Onshore

Chapter 1 | Introduction

1 Introduction

1.1 The Applicant

Centrica is proposing to develop three offshore wind farms within the Greater Wash Strategic Area, Lincs, Docking Shoal and Race Bank (applications will be made by Centrica (Lincs) Ltd, Centrica (DSW) Ltd and Centrica (RBW) Ltd). This follows a tender launched by the Crown Estate in July 2003 to bid for wind farm sites within three strategic offshore areas. Cables are required to connect each of these wind farms to an onshore substation located at Walpole Marsh, Norfolk. This Environmental Statement incorporates onshore works for all three wind farms.

1.1.1 Parent company, Centrica, has made an investment commitment of £750 million over the next few years to develop its own renewable generation assets. (It is perhaps better known through its market-leading British Gas operations.

1.1.2 Centrica currently owns and operates one onshore wind farm in Scotland. In October 2004, it acquired a 26 MW onshore wind farm, Glens of Foudland, which is now operational near Huntly (West of Aberdeen).

1.1.3 Centrica is a joint venture partner with Danish energy group DONG in the 90 MW Barrow Offshore Wind Farm. This 30-turbine wind farm became operational in June 2006 and is situated 7 km southwest of Walney Island, near Barrow-in-Furness.

1.1.4 In December 2003, Centrica also acquired two consented offshore wind farm sites, Lynn and Inner Dowsing, which will be built 5 km off the Lincolnshire coast, east of Skegness (with construction planned to commence in 2007). They are each 90 MW wind farms, and together will provide enough power for around 130,000 homes.

1.1.5 Centrica is currently seeking consent for the Lincs Offshore Wind Farm and will seek separate consents for the Docking Shoal and Race Bank projects off the Lincolnshire and North Norfolk coast in due course.

1.1.6 Details of Centrica's renewables investments can be found at www.centrica.com/renewables.

1.2 Background to the Development

1.2.1 In July 2003 the Crown Estate launched its Round 2 tender requesting that developers bid for rights to develop wind farm sites upon the seabed in three strategic areas both within and outside territorial waters. Centrica, with AMEC Wind Energy (AMEC) and Renewable Energy Systems (RES), successfully bid for the rights to develop Lincs, Docking Shoal and Race Bank within the Greater Wash Strategic Area. These rights are now wholly owned by Centrica and the sites are being developed in conjunction with RES and AMEC.

1.2.2 RES is a member of the Sir Robert McAlpine group of companies and is one of the leading and broadest-based companies in the wind energy industry worldwide. Since 1980, RES has played a central role in the development of the wind energy market in the UK and has also achieved significant success in the international market. In total, RES has installed more than 1 GW of wind generating capacity in the UK. RES is also working with Centrica in the development of the consented Round 1 Inner Dowsing and Lynn Offshore Wind Farms.

1.2.3 AMEC Wind Energy, a part of AMEC Project Investments Ltd and the wider AMEC plc, is a leading wind farm developer with technical excellence in project conception, engineering, management, operation and maintenance. AMEC has a wealth of wind energy development experience – both onshore and offshore – and has been developing wind farms for over ten years. AMEC is also working with Centrica in developing the consented Lynn and Inner Dowsing offshore wind farms in the Greater Wash.

1.2.4 Centrica received, and accepted, offers from National Grid to connect all three wind farms to the existing substation at Walpole Marsh in west Norfolk. It is proposed

that the connections for each of the three wind farms will follow a route to land via the Wash. From its landfall east of the mouth of the river Nene, the proposed onshore cable route passes through land within the local authority areas of both King's Lynn and West Norfolk Borough Council and South Holland District Council. The substation connection is located within the King's Lynn and West Norfolk Borough Council area.

1.2.5 A single application for planning permission will be made, to King's Lynn and West Norfolk Borough Council and South Holland District Council, under the Town and Country Planning Act 1990. The application will be subject to an Environmental Impact Assessment (EIA) and will be accompanied by an Environmental Statement. Deemed planning permission for the Lincs offshore and onshore works will be sought under Section 36 of the Electricity Act 1989, and is supported by this Environmental Statement. Two applications for planning permission will be made, to King's Lynn and West Norfolk Borough Council and South Holland District Council, under Section 57 of the Town and Country Planning Act 1990, for the onshore works associated with Docking Shoal and Race Bank. This application is supported by this Environmental Statement.

1.2.6 In addition, this Environmental Statement provides the background for the application by National Grid Company (National Grid) for enabling works required at the existing Walpole substation to accommodate the connections for the three wind farms.

1.2.7 National Grid Electricity Transmission plc (trading as National Grid) owns, maintains and operates the high voltage (275 kV and 400 kV) electricity transmission system throughout England and Wales. National Grid is also the system operator for the whole of the British transmission system, which includes that part of the system in Scotland (owned by the Scottish Transmission Owners). As such, National Grid has duties under the Electricity Act 1989 to develop and maintain an efficient, economic and coordinated system of electricity transmission.

1.2.8 The transmission system comprises approximately 7,200 route kilometres of overhead transmission lines and approximately 660 circuit kilometres of underground transmission cable. The system also has over 300 substations, at which the primary transmission voltage (400 kV or 275 kV) is transformed to a lower voltage (132 kV or less) and delivered as direct connections to the twelve distribution network operators (DNOs), who take supplies and distribute electricity at lower voltages to consumers.

1.2.9 National Grid is part of the National Grid Group (NG), one of the world's largest utilities, focused on delivering energy safely, reliably and efficiently. Through its subsidiary National Grid Gas, NG also owns and operates the high-pressure gas transmission system in Britain, and is the largest regional gas distribution company in the country. The company owns electricity transmission and distribution systems in the northeastern United States, and distributes gas in upstate New York. NG has a number of businesses operating in related areas, such as communications infrastructure, metering and interconnectors.

1.2.10 RPS Group plc (RPS) was appointed by Centrica to undertake an Environmental Impact Assessment and prepare this Environmental Statement for the onshore works.

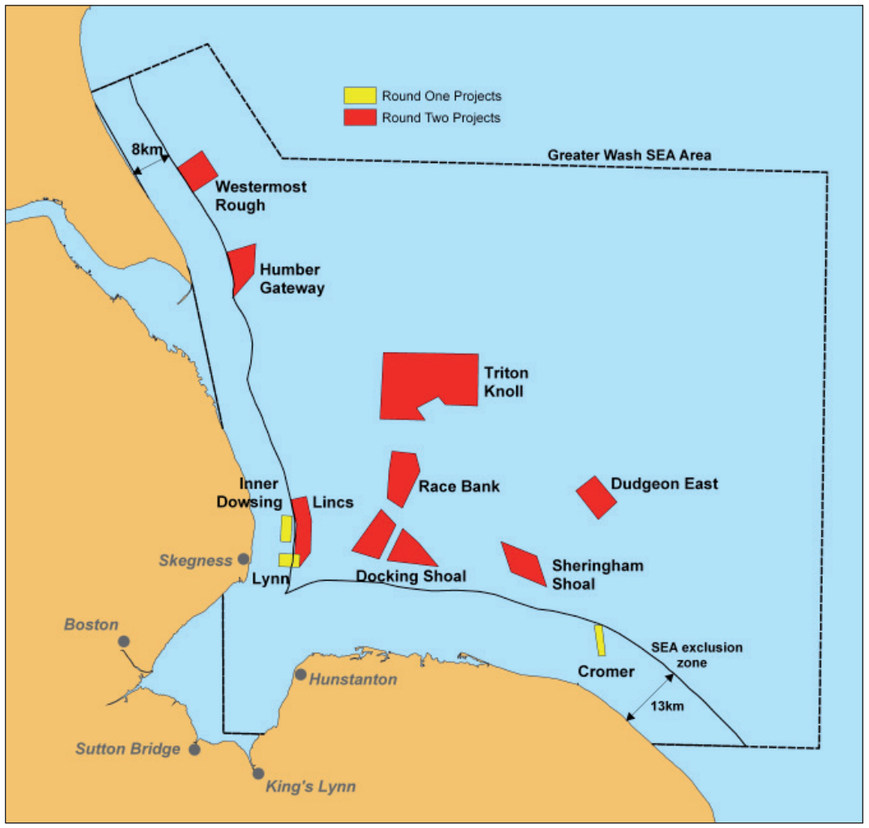

Figure 1.1 | Round 1 and 2 wind farm sites in the Greater Wash SEA area

1.3 Outline of the Works Proposed

1.3.1 This Environmental Statement documents the assessment of the environmental effects of the onshore components of all three wind farm projects. The assessment describes the works that are common to the three projects and those that are unique to any individual project.

1.3.2 These projects will share a landfall point, an onshore cable route and the site of a new 132 kV substation adjacent to the existing substation at Walpole Marsh. In the first year cable ducting for all three wind farm projects will be installed beneath the seawall at the point of landfall in a single operation. The offshore cables for the Lincs project will be inserted through these ducts and connected to onshore circuits in a jointing pit immediately behind the seawall. The onshore circuits will be laid underground for a distance of approximately 11 km to their connection point at the

existing Walpole Marsh substation. In subsequent years subject to consents being granted for Docking Shoal and Race Bank Offshore Wind Farms, circuits for these would be brought ashore and laid as separate operations, although they will follow the same onshore route.

1.3.3 To enable connection of the Lincs circuits to the national high voltage electricity transmission system a new 132/400 kV substation will be constructed adjacent to the Walpole Marsh substation. During the construction of the Lincs substation, site preparation works for the Docking Shoal and Race Bank substations will also be carried out. These will include site clearance, ground preparation, provision of access and security fencing. The electrical circuitry at the substations for Docking Shoal and Race Bank will be installed in subsequent years, at the same time as the cables for those projects are brought ashore and the onshore circuitry is laid.

1.3.4 In addition to these works National Grid will extend the existing 400 kV substation, in a single operation, to provide connection points for the Lincs, Docking Shoal and Race Bank circuits.

1.3.5 Details of the individual work items proposed are summarised in Table 1.1.

1.3.6 The assessment assumes that all three projects will be constructed and that, in all likelihood, this will take place over three consecutive years in the following order: Lincs, Docking Shoal and Race Bank. The assessment considers, therefore, the impact of:

- Lincs alone
- Docking Shoal in-combination with Lincs
- Race Bank in-combination with Lincs and Docking Shoal

1.3.7 The onshore works associated with Docking Shoal and Race Bank are sufficiently similar that the findings of this assessment would continue to apply even if one were substituted for the other. It would, for example, not affect the outcomes of this assessment if the locations of the substation components associated with these two wind farms were transposed.

1.3.8 National Grid also proposes to undertake works at the existing Walpole Marsh substation, the extension of the 400 kV substation to provide in addition to connections for all three wind farms. Details of the works associated with this extension (and other works proposed by National Grid at Walpole Marsh substation that are unrelated to the wind farm connections) and an assessment of their environmental effects are included as an appendix to this Environmental Statement.

Table 1.1 | **Summary of onshore work items**

Work item	Relevant to applications for	Responsibility for consent	Anticipated year of construction
ducting beneath seawall	Lincs Docking Shoal Race Bank	Centrica (Lincs) Ltd	year 1
installation of onshore circuits for Lincs	Lincs	Centrica (Lincs) Ltd	year 1
site preparation for wind farm substations (site clearance, ground works, access, fencing, etc.)	Lincs Docking Shoal Race Bank	Centrica (Lincs) Ltd	year 1
construction of Lincs 132/400 kV substation	Lincs	Centrica (Lincs) Ltd	year 1
extension of 400 kV substation at Walpole Marsh	Lincs Docking Shoal Race Bank	National Grid	year 1
installation of onshore circuits for Docking Shoal	Docking Shoal	Centrica (DSW) Ltd	year 2
construction of Docking Shoal 132/400 kV substation	Docking Shoal	Centrica (DSW) Ltd	year 2
installation of onshore circuits for Race Bank	Race Bank	Centrica (RBW) Ltd	year 3
construction of Race bank 132/400 kV substation	Race Bank	Centrica (RBW) Ltd	year 3

1.4 Structure of the Environmental Statement

1.4.1 The Environmental Statement for the proposed Lincs Offshore Wind Farm, covering the offshore turbines and foundations, interconnecting cables between turbines, the offshore substations and their foundations and the offshore section of the cables, is also available. Offshore ES documents for Docking Shoal and Race Bank are expected to be submitted during 2007. The Environmental Statement for the onshore and offshore components of the three wind farm developments is published as follows:

Volume 1: Offshore Works	A3 hard copy and DVD
Volume 1: Appendices	DVD only
Volume 2: Onshore Works	A3 hard copy and DVD
Volume 2: Appendices	DVD only
Non-Technical Summary	A5 hard copy, DVD and pdf available from website www.centrica.co.uk/renewables
Docking Shoal Offshore Wind Farm and Offshore Cabling	expected submission 2007
Race Bank Offshore Wind Farm and Offshore Cabling	expected submission 2007

Onshore

Chapter 2 | Policy Background

2 Policy Background

2.1 Introduction

2.1.1 This chapter describes the international, national, regional and local planning policy framework relevant to the construction of onshore infrastructure to support the Lincs, Docking Shoal and Race Bank Offshore Wind Farms. The overall development consists of the following:

- three offshore wind farms, located in the Greater Wash Area –
  - Lincs, with an expected output of 250 MW
  - Docking Shoal, with an expected output of 500 MW
  - Race Bank, with an expected output of 500 MW
  - two offshore cables for Lincs, up to four offshore cables for Docking Shoal and up to four offshore cables for Race Bank, connecting the wind farms to the proposed onshore landing point via a cable receiving pit, up to ten circuits (onshore cables for all three wind farms), buried underground, connecting the onshore landing point with the substations
  - two onshore circuits for Lincs, up to four circuits for Docking Shoal and up to four circuits for Race Bank, buried underground, connecting the onshore landing point to the substations and including construction compounds and access works

2.1.2 This volume of the ES addresses the Onshore components of this development. The purpose of this chapter is to outline the planning policy context proposals of the Onshore and to provide background to the consideration of potential environmental effects and other implications of the project set out in the Environmental Statement (ES).

2.2 International

Policy

2.2.1 In 1988 the United Nations adopted a resolution on the 'protection of global climate for present and future generations of mankind'. In the same year the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) established the Intergovernmental Panel on Climate Change (IPCC), in order to provide regular assessments of the state of knowledge on climate change.

2.2.2 The IPCC's initial Assessment Report in 1990 contributed to the development of The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC). This was adopted in 1992 and entered into force in 1994. The IPCC's second Assessment Report provided vital input to the process which ultimately led to the adoption of the UNFCCC in 1997.

2.2.3 Under the Kyoto Protocol, participating countries have agreed to limit or reduce their emission of greenhouse gases and have been assigned targets stipulating the maximum amount which they can emit per year over the Commitment Period (2008–12). Following Russia's ratification on 18 November 2004, the Kyoto Protocol entered into force on 16 February 2005.

Global Wind Energy

2.2.4 The global installed wind power capacity stood at 59,084 MW at the end of 2005, a 24 per cent increase on 2004 (Global Wind Energy Council press release, 17 February 2006). This capacity provides sufficient energy to supply the electricity needs of over 27 million average European households. The installation of 11,531 MW in 2005 represented an investment in generating equipment of €12 billion. Global employment in the industry is estimated to be between 90,000 and 100,000 people (Greenpeace 2005).

2.2.5 At the G8 summit held in 2005 the main topic of discussion was climate change. It was clearly stated that there is a global need to 'diversify our energy supply mix, including increased use of renewable fuels' (G8 2005).

2.3 European

European Policy

2.3.1 The European Council (2001) Directive 2001/77/EC relates to the promotion of electricity produced from renewable energy sources. Issued in September 2001, it commits Member States to setting national targets from renewable sources in terms of a proportion of total electricity consumption. The UK's target is set at 10 per cent.

Wind Energy in Europe

2.3.2 The European Union has set an overall target of generating 22 per cent of its electricity from renewable sources by 2010. This target will only be reached with a significant contribution from wind, which has the potential to meet up to 50 per cent of the target.

2.3.3 European cumulative wind power capacity increased by 18 per cent from 34,205 MW at the end of 2004 to 40,504 MW at the end of 2005. This capacity produces (in an average year) some 83 TWh of electricity, representing 2.8 per cent of EU electricity consumption in 2004 (TWh stands for Terawatt hours, 1 TWh = 10^{12} Watts). The 6,183 MW of wind power capacity installed in 2005 represents a wind turbine manufacturing turnover of some €6 billion (European Wind Energy Association press release, 1 February 2006). The top five European countries contributing to cumulative wind power capacity at the end of 2005 are Germany (18,428 MW), Spain (10,027 MW), Denmark (3,122 MW), Italy (1,717 MW) and the UK (1,353 MW) (European Wind Energy Association figures).

2.3.4 Climate change has been prioritised in the G8 by the UK Prime Minister Tony Blair. At the Davos World Economic Forum on 26 January 2005 he said that 'we need to work much harder to find ways to implement the vast range of low-carbon technologies that have already been developed'.

2.3.5 The Institute for Public Policy Research concluded that Canada, France, Germany, Japan, Italy, Russia, UK, and USA should 'generate at least 25% of electricity from renewable energy sources by 2025' (The Institute for Public Policy Research press release, 24 January 2005), established a series of measures to respond to the harmful effects of climate change, and prioritised several of those measures, including wind energy development.

2.4 National

UK Policy

2.4.1 As its contribution to the European Union commitment to the Framework Convention on Climate Change, the United Kingdom is committed to greenhouse gas emission reductions of 12.5 per cent from 1990 emission levels by a date in the period 2008–12. However, the UK Government has set itself a domestic target for reduction of CO_2 emissions beyond this commitment to the European Union. The domestic target is to reduce CO_2 emissions to 20 per cent below 1990 levels by 2010. In November 2000, the Government published the UK Climate Change Programme, which outlines the target areas and policies through which it aims to achieve these targets.

2.4.2 The Climate Change Programme further states that its main objective in the energy sector is to work towards the target of obtaining 10 per cent of the UK's electricity supply from renewable sources by 2010, with an extension of this target to 15 per cent by 2015.

2.4.3 The development of renewable energy is vital to the Government's CO_2 reduction targets, and provides benefits to the UK economy in terms of security of energy supply and economic development.

2.4.4 The Stern Review, 'The Economics of Climate Change', published in October 2006, was an independent review to assess the evidence and build understanding of economics of climate change. It was commissioned by the Chancellor of the Exchequer, reporting to both the Chancellor and the Prime Minister. The review concludes that the scientific evidence for climate change is now overwhelming: climate change presents very serious global risks, and it now demands an urgent global response. The economic costs of doing nothing about climate change will be equivalent to losing up to 20% of global GDP each year. All countries will be affected but the poorest countries will suffer earliest and most. The benefits of strong, early action will considerably outweigh the costs.

2.4.5 The report states that policy to reduce emissions should be based on three essential elements: carbon pricing, removal of barriers to behavioural change and, of most relevance to this project, supporting the development of a range of low-carbon and high-efficiency technologies on an urgent timescale.

Wind Energy in the UK

2.4.6 Renewable energy sources in the UK now provide just over 5 per cent of the total electricity supply, of which about half comes from wind (DTI 2006). In October 2006 the UK had an installed wind power capacity of 1,941 MW, representing enough power to supply about 1.09 million homes (www.bwea.com).

2.4.7 The recently completed Energy Review (DTI 2006) reaffirms the UK Government's commitment to renewable energy and the Renewables Obligation (RO). The RO is the Government's main policy instrument for encouraging the development of renewable energy generating capacity. It has provided an impetus to meet the UK's target of achieving 10 per cent of electricity production from renewable energy sources by 2010 and 15 per cent by 2015. The Energy Review expresses the Government's aspiration to strengthen the RO to give longer-term certainty, including extending obligation levels to 20 per cent. The Review gives particular support to offshore wind.

2.4.8 The development of offshore wind power is regulated through a series of Development Rounds administered by the Crown Estate, as landowner of the seabed to the territorial limit (12 nautical mile) and administrator beyond that limit.

2.4.9 Eleven Round 1 projects have been consented, totalling 1 GW of capacity. Of these, four are operational and one is being constructed. In December 2003 it was announced that 15 projects would be awarded Round 2 licences, with a combined potential capacity of 7.2 GW.

2.4.10 Wind turbines on average, generate electricity for between 80 and 85 per cent of the time. Turbines in the UK typically have a capacity factor in the order of 35 per cent (that is, over the course of a year a turbine would produce around 35 per cent of the amount it could theoretically have produced if working at full capacity all through the year). This is comparable with other methods of electricity production. For example, small-scale hydroelectric schemes have a capacity factor of around 25 per cent, while coal-fired power stations have a capacity factor in the region of 40 per cent.

2.5 The Development Plan

2.5.1 The onshore infrastructure described in the introduction falls within two local council boundaries (Kings Lynn and West Norfolk Borough Council and South Holland District Council), two county council boundaries (Lincolnshire and Norfolk), and two regions (East Midlands and the East of England).

2.5.2 Therefore, the Development Plan for the area in which the proposed development is located comprises:

- the existing Regional Spatial Strategy (RSS) for East of England, formed from Regional Planning Guidance RPG6 for East Anglia (2000), the Milton Keynes and South Midlands (MKSM) Sub-Regional Strategy (March 2005), and parts of RPG9 for the South East (2000) – of these RPG6 is the most relevant, as it guides development in East Anglia, which includes the county of Norfolk, to 2016
- the RSS for the East Midlands (RSS8), which was published in March 2005 and provides a regional policy framework to 2021
- the Lincolnshire Structure Plan, adopted on 27 September 2006, which provides a policy framework from 2001 to 2021
- the Norfolk Structure Plan, which was published in 1999 and projects policies forward to 2011
- the King's Lynn and West Norfolk Local Plan, which was published in 1998 and projects policies forward to 2011
- the South Holland Local Plan, which was adopted on 18 July 2006 and provides a policy framework guiding development to 2021

2.5.3 The Development Plan forms the statutory basis for the determination of planning applications. The Planning and Compulsory Purchase Act (2004) section 38 (6) provides that:

> *If regard is to be had to the development plan for the purpose of any determination to be made under the Planning Acts the determination must be made in accordance with the plan unless material considerations indicate otherwise.*

2.5.4 When considering the weight to be attached to policies contained in the Development Plan, section (5) of the Planning and Compulsory Purchase Act (2004) advises:

> *If to any extent a policy contained in a development plan for an area conflicts with another policy in the development plan, the conflict must be resolved in favour of the policy which is contained in the last document to be adopted, approved or published.*

Development Plan Policies

2.5.5 The onshore infrastructure detailed in the introduction is essential to support the proposed offshore wind farms at Lincs, Docking Shoal and Race Bank. The policies identified in this section take account of the potential effects of the onshore infrastructure and the benefits of renewable energy generation.

2.5.6 In view of the complexity of the Development Plan and the large number of policies relevant to onshore infrastructure and the purpose that it would serve, we have summarised regional, county, and local planning policies in six tables under the following headings: 'renewable energy', 'landscape', 'environmental', 'flooding', 'built heritage', and 'coastal'. Within each table, policies are grouped according to the Development Plan document from which they were taken. Appendix A2.17 contains a full list of adopted planning policies referred to in the summary tables.

2.5.7 In the tables below, there are three main headings ('Planning policy', 'Objectives' and Comments'), with sections of the table coming under subheadings ('RSS8 East Midlands', etc.).

Table 2.1 | **Renewable energy planning policies**

Planning policy	Objectives	Comments
RSS8 East Midlands		
Policy 41: Regional Priorities for Renewable Energy	Policy 41 requires Local Planning Authorities (LPAs) to promote and encourage renewable energy proposals where environmental, economic and social impacts can be addressed satisfactorily. It also suggests that when formulating Local Development Frameworks (LDFs) regard should be given to a number of criteria (listed in the policy) for onshore wind energy development and development required for other forms of renewable energy.	The RSS specifies a total regional renewable energy target of 2,495 GWh or 672 MW by 2010. Of this total, the offshore wind target is 1,056 GWh or 400 MW. RSS8 acknowledges that an area in the Wash has been identified by a Government consultation document as one of three national strategic areas for offshore wind generation. It states that when considering essential onshore infrastructure to support offshore wind farms, LPAs should have regard to environmental assets, but policies should not be so absolute as to prevent the development of onshore infrastructure, and should concentrate instead on mitigation of effects.
Policy 1: Regional Core Objectives	Policy 1 sets out 10 key objectives, which LPAs should consider in preparing LDFs, Local Transport Strategies, and other development strategies. Criterion 8 seeks to promote prudent use of natural resources, reduce overall energy use, and maximise the role of renewable energy generation.	Renewable energy generation is one of the key objectives of RSS8.
RPG6 East Anglia		
Policy 60: Renewable Energy	Policy 60 requires LPAs to include proposals for renewable energy generation in their plans, and sets out criteria against which applications for such schemes should be considered.	Policy 60 does not relate specifically to wind farms, but suggests that the environmental and sustainability implications of renewable energy schemes should be taken into account.
Norfolk Structure Plan		
Policy RC.9: Renewable Energy	Policy RC.9 encourages renewable energy developments that would not have any significant adverse environmental impact. It suggests that careful scrutiny should be given to designated sites, and states that where there is harm, the need to protect the county's assets will be weighed against the advantages of the proposed level of renewable energy generation.	
Lincolnshire Structure Plan		
Policy NE9: Renewable Energy	Policy NE9 encourages LDFs to promote a range of renewable energy sources having regard to: the sustainable benefits of using them; environmental impact including site, design and landscaping considerations; the effect on amenity, agriculture and the natural and built environment; traffic generation and vehicular access; proximity to the renewable energy source; the reuse of appropriate existing surplus industrial land; and benefits to the local community of small-scale schemes. It also requires local planning authorities in assessing proposals to consider the renewable energy targets contained in the RSS.	
Kings Lynn and West Norfolk Local Plan		
Policy SS4	Policy SS4 states that the council will encourage the conservation of energy and promote the use of renewable energy resources.	
Policy 9/27	Policy 9/27 requires applicants to demonstrate how the advantages of renewable energy schemes outweigh any potential environmental effects.	This ES contains an assessment of a range of potential environmental effects of the development.

Planning policy	Objectives	Comments
South Holland District Local Plan		
Policy EN3: Renewable Energy	Policy EN3 supports development of renewable energy schemes provided it can be shown that such development would not harm interests of acknowledged importance in the local environment.	This ES contains an assessment of a range of environmental effects of the development.

Table 2.2 | **Landscape planning policies**

Planning policy	Objectives	Comments
RSS8 East Midlands		
Policy 27: Protecting and Enhancing the Region's Natural and Cultural Assets	Policy 27 seeks to protect and enhance the region's natural and cultural assets through sustainable development.	Any impact of the onshore infrastructure on any natural or cultural asset should be balanced against the benefits of the renewable energy generation the onshore infrastructure will support. Impacts of the development on natural and cultural assets are assessed in Sections 7.6 and 7.2 respectively.
Policy 30: Priorities for the Management and Enhancement of the Region's Landscape	Policy 30 encourages LPAs to promote, among other things, the highest level of protection to the region's nationally designated landscapes.	Section 7.3 Landscape and Visual Assessment of the ES assesses the landscape impact of the proposed onshore infrastructure, and confirms that there are no nationally designated landscapes in the vicinity of the proposed onshore infrastructure.
RPG6 East Anglia		
Policy 38: Protection of Designated Sites	Policy 38 requests that development plans give priority to protecting and enhancing areas that are designated at international or national level.	The Wash is an area of international and national importance. Section 7.6 assesses potential impacts on sites of importance for nature conservation.
Norfolk Structure Plan		
Policy ENV2	Policy ENV2 will not permit development that is detrimental to any Area of Outstanding Natural Beauty (AONB), the Heritage Coast or the Broads, unless there is a proven national need for the development and there are no alternatives.	
Lincolnshire Structure Plan		
Policy NE1: Development in the Open Countryside	Resists development in the open countryside unless it is considered by the local planning authority to be essential in that location and therefore cannot be located at a settlement, or it is in accordance with other Structure Plan policies.	
Policy NE7: Protecting Historic Landscapes	Requires development to be appropriate to the character of the landscape in which it is situated and contribute to its conservation, enhancement or restoration. Proposals are assessed in relation to a number of factors, including: statutory and local designations of landscape features, biodiversity and ecological networks within the landscape, visual intrusion, and noise and light pollution.	
Kings Lynn and West Norfolk Local Plan		
Policy 4/5	Policy 4/5 protects AONBs and the Heritage Coast from any development that would be detrimental to their setting or character.	
Policy 4/6	Policy 4/6 resists development that would damage the character or appearance of certain specified 'Areas of Important Landscape Quality'.	Section 7.3 Landscape and Visual Assessment of the ES confirms that the onshore infrastructure proposed falls within an Area of Important Landscape Quality ('open landscape').
South Holland District Local Plan		
Policy SG4: Development in the Countryside	Policy SG4 seeks to protect the rural character of the countryside, and resists development in the open countryside unless it is essential in the proposed location, or would be inappropriate or cannot reasonably be accommodated within defined settlement limits.	

Planning policy	Objectives	Comments
Policy SG8: Landscaping of New Development	Policy SG8 seeks to require, where appropriate, landscaping proposals with new development. In reviewing development proposals, it pays particular regard to the protection of existing trees and hedgerows, provision of strategic tree planting to improve the setting of development within the wider landscape, and maintenance and establishment of wildlife habitats and corridors.	Section 7.3 identifies mitigation.

Table 2.3 | **Environmental planning policies**

Planning policy	Objectives	Comments
RSS8 East Midlands		
Policy 27: Protecting and Enhancing the Region's Natural and Cultural Assets	Policy 27 seeks to protect and enhance the region's natural and cultural assets through sustainable development.	The impact of the onshore infrastructure on any natural or cultural asset should be balanced against the benefits of the offshore renewable energy schemes.
Policy 33: A Regional Approach to the Water Environment	Policy 33 identifies a list of matters for LPAs and the Environment Agency to consider in a coordinated way. These include protecting and improving water quality, and reducing the risk of pollution, especially to vulnerable ground water.	The ES addresses this issue in Section 7.9 Hydrology, Hydrogeology, Geology and Soils.
Policy 34: Regional Priorities for Strategic River Corridors	Policy 34 seeks to encourage LPAs to protect and enhance the natural and cultural environment of the region's strategic river corridors, including the river Nene.	The onshore infrastructure proposed lies to the east of the river Nene corridor.
RPG6 East Anglia		
Policy 38: Protection of Designated Sites	Policy 38 requests that Development Plans give priority to protecting and enhancing areas that are designated at international or national level.	The ES considers the effect of the onshore infrastructure on a range of environmental receptors in Section 7.6 Ecology and Nature Conservation.
Norfolk Structure Plan		
Policy ENV.1	Policy ENV.1 seeks to protect the county's environmental assets, with special emphasis given to the protection, conservation and enhancement of areas of local landscape character or wildlife value, historic urban or rural environments, the settings of urban areas, towns and villages, and the environment generally.	The offshore cable route runs through the Wash, which is a designated Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR), Special Area for Conservation (SAC), Special Protection Area (SPA), and Ramsar Site. South of the Wash there are no other international or national designations in the vicinity of the proposed onshore infrastructure.
Policy ENV.6	Policy ENV.6 determines that development which adversely affects Ramsar Sites, SPAs, or Special Areas of Conservation (SACs) will not be permitted unless there is no alternative, overriding public interest, or an appropriate set of compensatory measures.	The offshore cable route runs through the Wash, which is a designated SSSI, NNR, SAC, SPA, and Ramsar Site. South of the Wash there are no other international or national designations in the vicinity of the proposed onshore infrastructure.
Lincolnshire Structure Plan		
Policy NE2: Sustaining Biodiversity	Policy NE2 resists development that would adversely affect the integrity or continuity of landscape features which are of major importance for wild flora and fauna identified in the UK or Lincolnshire Biodiversity Action Plans, unless there is an overriding need for development that outweighs the nature conservation value of the habitat or species.	Impacts of the development on biodiversity are assessed in Section 7.6, 'Ecology and Nature Conservation'.
Policy NE3: Sites of Nature Conservation Importance	Policy NE3 sets out a policy framework for the protection of sites of nature conservation importance. Different levels of protection are afforded to conservation sites, which range from European and RAMSAR sites to priority natural habitats, Sites of Special Scientific Interest and Locally and Regionally Important sites. In relation to locally and regionally important sites, this policy resists development that would have an adverse effect unless: it can be demonstrated that the need for it outweighs the nature conservation value of the site or it will result in a net gain over the existing situation in the area of habitat or nature conservation importance.	Impacts of the development on sites of nature conservation importance are addressed in Section 7.6.

Planning policy	Objectives	Comments
Policy NE4: Species Protection	Policy NE4 resists development of sites that would detrimentally affect species protected by law unless there is an overriding need, and in such circumstances mitigation measures will be required.	Impacts of the development on protected Species are assessed in Section 7.6.
Policy NE5: Trees, Woodlands and Hedgerows Protection	Policy NE5 seeks to retain and protect existing trees and woodland, and important hedgerows of amenity value and their associated habitats. Where a loss is unavoidable it requires replacement planting.	Impacts of the development on woodlands and hedgerows are assessed in Section 7.6. The impact on the landscape is addressed in Section 7.3, 'Landscape and Visual Assessment'.
Kings Lynn and West Norfolk Local Plan		
Policy 4/1	Policy 4/1 resists development that would harm the nature conservation interest of sites of national and international importance.	Impacts of the development on sites of national and international importance are assessed in Sections 7.3 and 7.6.
Policy 4/3	Policy 4/3 seeks to protect and improve the ecological interest of river corridors, and resists development that would adversely affect associated wildlife habitats, river flows and river water quality.	The development is located to the east of the River Nene. Section 7.9 considers potential impacts on water quality.
Policy 4/4	Policy 4/4 seeks to conserve the ecological value of sites of local wildlife interest. Seeks to refuse permission where the damage to local habitats outweighs the development benefits.	Impacts of the development on sites of local wildlife interest are assessed in Section 7.6.
Policy 9/31	Policy 9/31 resists development that would 'generate sufficient noise to adversely affect the reasonable occupation of noise-sensitive development or the quiet enjoyment of environmentally or ecologically sensitive areas'.	Impacts of the development with respect to noise pollution are assessed in Section 7.5, 'Noise'. Impacts on tourism and recreation are assessed in Section 7.4, 'Socioeconomics and Tourism'.
Policy 4/24	Policy 4/24 resists development that 'would pose an unacceptable risk to potable water sources, the quality and flows of aquifers and surface and coastal waters by waste water discharge or disturbing contaminated land'.	Impacts of the development on water are assessed in Section 7.9, 'Hydrology, Hydrogeology, Geology and Soils'.

Planning policy	Objectives	Comments
South Holland District Local Plan		
Policy SG10: Water Quality	Policy SG10 seeks to ensure that development does not degrade or threaten the quality of water and the water environment, by requiring development proposals to include measures necessary to ensure that both groundwater and surface water resources (on and off site) are protected.	Impacts of the development on water are assessed in Section 7.9.
Policy SG13: Pollution and Contamination	Policy SG13 resists development unless it can be demonstrated that it would not cause unacceptable levels of pollution, eg noise, light, odour or airborne pollutants, to the surrounding area, and it would provide as necessary the appropriate treatment of land to clean up pollution and contamination.	Impacts of the development on noise pollution are assessed in Section 7.5. Impacts on the soil are assessed in Section 7.9.
Policy EN1: Development and Sites of Nature Conservation Value	Policy EN1 seeks to conserve the critical nature conservation value of designated sites. Matters considered in relation to development proposals vary according to the level of protection. For example, for sites of local nature conservation importance there may be reasons for the development which are considered to outweigh the need to safeguard the nature conservation value of the site. With internationally designated sites considerations include: whether the proposal is likely to have a significant effect on the site and, if so, whether it would adversely affect its integrity; whether there are imperative reasons for the development on a European level; and whether there are alternative solutions available or ways in which the proposal could be modified to avoid an adverse effect on the integrity of the site.	Impacts of the development on sites of nature conservation value are assessed in Section 7.6.
Policy EN2: Wildlife Corridors and Other Areas	Policy EN2 resists development that may directly or indirectly have an adverse effect on the integrity of wildlife corridors and other areas of major importance to wild fauna and flora.	Impacts of the development on wildlife are assessed in Section 7.6.

Table 2.4 | **Flooding planning policies**

Planning policy	Objectives	Comments
RSS8 East Midlands		
Policy 36: A Regional Approach to Managing Flood Risk	Policy 36 resists development that, alone or in conjunction with other new development, would be at unacceptable risk from flooding or create such an unacceptable risk elsewhere. Proposals falling within this category may still be acceptable if appropriate mitigation measures can be implemented.	An assessment of flood risk is included in Section 7.8, 'Flood Risk and Coastal Defences'.
RPG6 East Anglia		
Policy 44: Development in Areas at Risk from Flooding	Policy 44 resists development proposals in floodplains and in areas at risk from flooding or coastal erosion.	See Section 7.8.
Norfolk Structure Plan		
Policy RC.3: Flood Risk	In areas at risk from flooding or in areas where it is likely to increase the risk of flooding elsewhere to an unacceptable level, development is only permitted where suitable mitigation measures have been agreed.	See Section 7.8.
Lincolnshire Structure Plan		
Policy NE13: Development and Flood Risk	Policy NE13 resists development that would be at unacceptable risk from flooding or create such a risk elsewhere, interfere with coastal processes, have a detrimental impact upon groundwater storage capacity, or recharge or impede the flow of floodwater.	See Section 7.8.
Kings Lynn and West Norfolk Local Plan		
Policy 9/21	Policy 9/21 states that development and the raising of the land levels in areas liable to flood will not be permitted. Development may be permitted where there is no loss of floodwater capacity or where provision for satisfactory floodplain restoration and adequate floodwater storage can be made.	See Section 7.8.
South Holland District Local Plan		
Policy SG9: Development and Flood Risk	Policy SG9 requires the submission of a flood risk assessment in areas of high flood risk and where necessary requires proposals to include details of measures designed to reduce the known risk of flooding. Where a strategic flood risk assessment and site-specific assessment is provided, this policy requires it to demonstrate how the proposed development will be defended from flooding for its proposed life. Policy SG9 resists built development in areas of high risk of flooding or those which may be subject to rapid inundation except where it is essential for operational reasons.	See Section 7.8.

Table 2.5 | **Built heritage planning policies**

Planning policy	Objectives	Comments
RSS8 East Midlands		
Policy 27: Protecting and Enhancing the Region's Natural and Cultural Assets	Policy 27 seeks to protect and enhance the region's natural and cultural assets through sustainable development.	The impact of the onshore infrastructure on any natural or cultural asset should be balanced against the benefits of renewable energy generated by the offshore wind farms.
Policy 31: Regional Priorities for the Historic Environment	Policy 31 seeks to conserve and enhance the historic environment of the East Midlands.	Section 7.2 Cultural Heritage assesses the impact of the proposal on features of historical importance, and confirms that there are no Scheduled Ancient Monuments (SAMs), designated Historic Parks or Gardens, or Conservation Areas that fall within the boundaries of any part of the development proposals.
RPG6 East Anglia		
Policy 40: Conservation of East Anglia's Built and Historic Environment	Policy 40 requires plans to ensure that new development respects and enhances local character.	See Section 7.2.
Lincolnshire Structure Plan		
Policy BE3: Conservation of the Historic Environment	Policy BE3 seeks to protect the character and appearance of the historic environment, with emphasis attached to listed buildings and conservation areas and their settings.	See Section 7.2.
Policy BE4: Archaeological Heritage	Policy BE4 requires the submission of an archaeological evaluation where proposals affect sites of archaeological significance or potential significance. Physical preservation *in situ* is the preferred option where development is likely to have an adverse effect on important archaeological remains or their settings. This policy resists development that would adversely affect archaeological remains or their settings where they are of national or international importance. It requires the excavation and recording of archaeological remains where physical preservation *in situ* is not warranted or desirable.	See Section 7.2.
Policy BE5: Historic Parks and Gardens	Policy BE5 resists development that would have a detrimental effect upon the character, appearance or setting of a historic park or garden.	See Section 7.2.
Norfolk Structure Plan		
Policy ENV.13: Historic Buildings, Archaeology, and the Historic Environment	Policy ENV.13 seeks to protect Listed Buildings, historic landscapes, sites of archaeological importance (whether scheduled or not), and their settings.	See Section 7.2.
Kings Lynn and West Norfolk Local Plan		
Policy 4/8	Policy 4/8 resists development that would be detrimental to Historic Parks or Gardens.	See Section 7.2.
Policy 4/9	Policy 4/9 resists development that would have an adverse effect on the setting or the site of an SAM or other nationally important monument.	See Section 7.2.

Planning policy	Objectives	Comments
Policy 4/10	Policy 4/10 identifies the need to consider the importance of archaeological remains and prepare archaeological assessments where proposals are likely to affect these interests.	See Section 7.2.
Policy 4/14	Policy 4/14 seeks to preserve or enhance Conservation Areas. Regard is given to proposals that affect views into and out of Conservation Areas.	See Section 7.2.
Policy 4/19	Policy 4/19 resists development that affects the setting of any Listed Building.	See Section 7.2.
South Holland District Local Plan		
Policy EN4: Development Affecting Listed Buildings	Policy EN4 resists development that may affect a listed building or its setting unless it preserves or enhances the character and appearance of the building and its setting.	See Section 7.2.
Policy EN7: Development Affecting Conservation Areas	Policy EN7 resists development within or affecting the setting of a conservation area unless it preserves or enhances the character and appearance of the area and its setting.	See Section 7.2.
Policy EN12: Ancient Monuments	Policy EN12 resists development that would adversely affect scheduled ancient monuments and other nationally important archaeological sites or their settings.	See Section 7.2.

Table 2.6 | **Coastal planning policies**

Planning policy	Objectives	Comments
RSS8 East Midlands		
Policy 35: Priorities for the Management of the Lincolnshire Coast	Policy 35 encourages local authorities to cooperate to manage the coast.	The ES assesses the impact of the proposals on the coast and countryside.
RPG6 East Anglia		
Policy 45: Development in Coastal Locations	Policy 45 seeks to protect the coast's biodiversity, natural character, recreational value and landscape quality.	See Section 7.3, 7.4 and 7.6.
Norfolk Structure Plan		
Policy ENV.4	Policy ENV.4 seeks to protect the coast and countryside from significant harm.	Assessment of the impacts can be found in Sections 7.3, 7.4 and 7.8.
Lincolnshire Structure Plan		
Policy NE14: Protection of the Waterside Environment	Policy NE14 seeks to protect from development the conservation or landscape value of river corridors, coastal margins or other waterside areas. It favours development where it will conserve, restore or enhance such areas.	See Section 7.3.
Policy T10: Coastal Conservation Areas	Development in coastal conservation areas is resisted where it would harm the amenity, landscape character, nature conservation and historic interest of such areas.	See Section 7.2, 7.3 and 7.6.
Kings Lynn and West Norfolk Local Plan		
Policy SS3	Policy SS3 states that the council will conserve the quality and character of the Borough's countryside and coast and the built environment of its towns and villages.	
Policy 9/19	Policy 9/19 states that development that would be detrimental to the integrity of tidal and fluvial defences will not be permitted.	See Section 7.8.
Policy 9/20	Policy 9/20 states that development in areas at risk from tidal flooding will not be permitted.	See Section 7.8.
South Holland District Local Plan		
(The Plan does not contain any policies that relate specifically to coastal planning.)		

2.6 Other Material Considerations

2.6.1 King's Lynn and West Norfolk Borough Council and South Holland District Council have prepared Local Development Schemes (LDSs) following changes to the planning system introduced through the Planning and Compulsory Purchase Act (2004). The purpose of an LDS is to prepare a timetable for the preparation of local planning policies in the Local Development Documents (LDDs), which make up the Local Development Framework (LDF), and to publicise which LDDs are to be produced over the next three years.

2.6.2 In response to changes to the planning system introduced through the Planning and Compulsory Purchase Act (2004), the King's Lynn and West Norfolk Local Plan is under review. In one of the first stages of the review an Issues and Options Paper for the Core Strategy Development Plan Document (DPD) was prepared in June 2005. The Core Strategy will set out the overarching strategy and objectives for the Borough.

2.6.3 Provisions in the Planning and Compulsory Purchase Act (2004) allow Plans that are at a sufficiently advanced stage to be adopted under the old planning regime and saved for three years. This is the case at South Holland District Council, where the South Holland Local Plan is under review. A Re-Deposit Plan was published in 2005 and is the subject of a Public Inquiry, which commenced on 5 January 2006. The Re-Deposit Plan, which has an end date of 2021, is a material consideration in the determination of planning applications. In response to the Planning and Compulsory Purchase Act (2004), South Holland District Council published an Issues and Options Core Strategy in September 2006, the first key stage in the production of an LDF.

2.6.4 There is a range of considerations material to the determination of planning applications. These include Government planning policy in the form of Planning Policy Guidance Notes (PPGs) and their successors Planning Policy Statements (PPSs), as well as, at the regional level, emerging Regional Spatial Strategies (RSSs), and Local Development Frameworks (LDFs) at the local level.

2.6.5 This section sets out Government planning policy, and identifies those draft policies contained in the emerging Development Plan that are relevant to the proposals.

The Kyoto Protocol

2.6.6 The Kyoto Protocol was drawn up in December 1997, ratified by the UK in 2002, and finally came into effect on 16 February 2005. The European Union is obliged to secure an 8 per cent reduction in greenhouse gas emissions from 1990 by 2012. The UK has committed to a reduction of greenhouse gases to 12.5 per cent below the 1990 levels by 2012.

Energy White Paper

2.6.7 The Energy White Paper (Our Energy Future - Creating a Low Carbon Economy) was published in February 2003. This document presents the Government's long-term strategy for shifting the UK decisively towards becoming a low-carbon economy' and to 'develop, apply and export leading-edge technologies, creating new businesses and jobs'. It also recognises that climate change is a real problem and that action is required to reduce greenhouse gas emissions.

2.6.8 The Energy White Paper has four goals for UK energy policy:

- to put ourselves on a path to cut the UK's CO_2 emissions – the contributor to global warming – by some 60 per cent by about 2050, with real progress by 2020
- to maintain reliable energy supplies
- to promote competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and improve our productivity
- to ensure that every home is adequately and affordably heated

2.6.9 The Energy White Paper goes on to state (in paragraph 1.23):

> *In reducing carbon dioxide emissions, our priority is to strengthen the contribution of energy efficiency and renewables.*

2.6.10 *The Energy Challenge*, the UK Government's report on the Energy Review, was released on 11 July 2006 and sets out the Government's key proposals for achieving clean, secure and sufficient energy supplies (DTI 2006).

2.6.11 It is the Government's intention that *The Energy Challenge* is seen as a statement of commitment to renewable generation and its supporting infrastructure. Consequently the Statement of Need included within the document clearly spells out the Government's commitment to the development of renewable energy as a source of low-carbon, indigenous electricity generation. It is noted that this statement is to be used as a material consideration alongside PPS22 (see Table 2.7) in England. The Statement of Need emphasises the importance that all participants in the planning process should place on the national social and economic benefits arising from low-carbon generation, particularly when balancing these against local issues. It emphasises, in addition, the need for expeditious decision-making.

The Stern Review

2.6.12 This year saw the publication of the Stern Review 'The Economics of Climate Change', an independent review to assess the evidence and build understanding of the economics of climate change. This was an independent review commissioned by the Chancellor of the Exchequer, reporting to both the Chancellor and the Prime Minister.

2.6.13 The review concludes that the scientific evidence for climate change is now overwhelming: climate change presents very serious global risks, and it now demands

an urgent global response. The economic costs of doing nothing about climate change will be equivalent to losing up to 20 per cent of global GDP each year. All countries will be affected, but the poorest countries will suffer earliest and most. The benefits of strong, early action will considerably outweigh the costs.

2.6.14 The report states that policy to reduce emissions should be based on three essential elements: carbon pricing, removal of barriers to behavioural change and, of most relevance to this project, supporting the development of a range of low-carbon and high-efficiency technologies on an urgent timescale.

Renewable Energy Targets

2.6.15 The current Government target for electricity generated within the UK by renewable sources is 10 per cent by 2010, recently extended to 15 per cent by 2015. There is also a recognised aspiration to double the 2010 figure to 20 per cent by 2020. These targets are supported by the Renewables Obligation, which obliges all licensed electricity suppliers to obtain certificates sufficient to cover a specified proportion of their supplies. This target increases incrementally from 3 per cent in 2003 to 15 per cent in 2015.

National Planning Policy

2.6.8 Government planning policy relevant to the proposals is summarised in Table 2.7.

Table 2.7 | **Relevance of renewable energy development in national planning policy**

National planning policy	Objectives	Comment
PPS1: Delivering Sustainable Development	To achieve more sustainable forms of development.	This policy is applicable to all development proposals, but its general nature makes it unlikely to prove a determining issue.
PPS7: Sustainable Development in Rural Areas	Key objectives include: raising the quality of life and the environment in rural areas; improving economic performance in the regions; the promotion of more sustainable, diverse and adaptable agricultural sectors; and the sensitive exploitation of renewable energy sources.	PPS7 is, in principle, supportive of renewable energy schemes.
PPS9: Biodiversity and Geological Conservation	PPS9 states that Development Plan policies and planning decisions should aim to maintain, and enhance, restore or add to biodiversity and geological conservation interests. In taking decisions, LPAs should ensure that appropriate weight is attached to designated sites of international, national and local importance, protected species, and biodiversity and geological interests within the wider environment.	These matters are fully considered in Section 7.6 Ecology and Nature Conservation.
PPG15: Planning and the Historic Environment	PPG15 provides a full statement of Government proposals for the identification and protection of historic buildings, conservation areas and other elements of the historic environment.	This issue is assessed in Section 7.2 Cultural Heritage.
PPG16: Archaeology and Planning	PPG16 sets out the Government's approach to archaeological remains on land and how they should be preserved or recorded both in an urban setting and in the countryside. It also gives advice on the handling of archaeological remains and discoveries through the Development Plan and development control systems, including the weight to be given to them in planning decisions and planning conditions.	The effect of the proposals on archaeology is assessed in Section 7.2 Cultural Heritage.
PPS22: Renewable Energy and companion guide	PPS22 sets out the Government's approach to renewable energy development. It states that 'renewable energy developments should be capable of being accommodated throughout England in locations where the technology is viable and the environmental, economic, and social effects can be addressed satisfactorily' (paragraph 1(i)).	PPS22 is an important policy statement, post-dating both of the adopted Local Plans. Thus its content should be accorded considerable weight in the decision-making process. The wider environmental, social, and economic effects of the onshore infrastructure are considered in Section 7.4 Socioeconomics and Tourism.

National planning policy	Objectives	Comment
PPS23: Planning and Pollution Control	PPS23 advises that any consideration of the quality of land, air or water, and potential effects arising from development, is capable of being a material planning consideration, in so far as it may arise from or may affect any land use.	These issues are considered in Section 7.9 Hydrology, Hydrogeology, Geology and Soils.
PPG24: Planning and Noise	PPG24 guides LPAs on the use of their planning powers to minimise the adverse impact of noise. It outlines the considerations to be taken into account in determining planning applications both for noise-sensitive developments and for those activities that generate noise.	Section 7.5 Noise assesses the effect of the onshore infrastructure on noise.

Emerging Regional Spatial Strategy

2.6.16 The RSS for the East of England and the RSS for East Midlands are under review. An Examination in Public was held between 1 November 2005 and 3 March 2006 to consider the draft East of England RSS. The Panel produced their report on 22 June 2006. Following a period of consultation and consideration of reports, it is expected that the new RSS should be published early in 2007 and will cover the period to 2021. Please refer to Table 2.8, which identifies those draft policies relevant to the proposals.

2.6.17 A draft East Midlands RSS was published for consultation on 28 September 2006. The consultation ends on 20 December 2006. An Examination in Public is due to commence in March 2007. The Panel's report is expected in mid-2007 and by the end of 2007 the Government should publish any changes. The final RSS is expected to be issued in early 2008 and will cover the period to 2026. Please refer to Table 2.9, which contains a summary of draft policies relevant to the proposals.

2.6.18 Please refer to Appendix A2.18 for full and complete copies of all draft policies referenced in relation to the draft East of England RSS and the draft East Midlands RSS.

Table 2.8 | **Draft Regional Spatial Strategy – East of England Plan**

Policy	Objectives	Comment
Policy SS14: Development and Flood Risk	Policy SS14's underlying objectives are to defend existing properties from flooding, and where possible to locate new development in places with little or no risk of flooding.	These issues are addressed in Section 7.8 Flood Risk and Coastal Defences.
Policy SS15: The Coast	Policy SS15 sets the strategy for the coast, which is to ensure a balanced policy that recognises the economic and social role of coastal ports and tourism areas, and the need for environmental protection and enhancement of the coast.	The impact of the proposals on the coast is addressed in Section 7.4 Socioeconomics and Tourism.
Policy KL1: King's Lynn Sub-Region	Policy KL1 states that LDDs should support the traditional and rural-based employment sectors, and attract investment in sectors of the economy that a have a particular scope for expansion, including renewable energy.	The proposals support renewable energy development.
Policy ENV2: Landscape Character	Policy ENV2 requires LPAs to provide the strongest levels of landscape character protection for the East of England's finest landscapes and areas of national importance.	This issue is considered in Section 7.3 Landscape and Visual Assessment.
Policy ENV3: Biodiversity and Earth Heritage	Policy ENV3 requires LPAs to ensure that internationally and nationally designated sites in the region are given the strongest level of protection.	This issue is considered in Section 7.6 Ecology and Nature Conservation.
Policy ENV5: The Historic Environment	Policy ENV5 requires LPAs to identify, protect, conserve and, where appropriate, enhance the historic environment of the region.	This issue is considered in Section 7.2 Cultural Heritage.
Policy ENV7: Air Quality	Policy ENV7 requires LPAs to have regard to the increased levels of development and associated infrastructure and seek to mitigate existing and potential air quality problems, paying particular attention to effects on wildlife in sensitive habitats such as SSSIs.	

Policy	Objectives	Comment
Policy ENV8: Renewable Energy and Energy Efficiency Policy	ENV8 sets renewable energy targets and encourages LPAs to promote energy efficiency and renewable energy. The targets are: 2010: 10 per cent (excluding offshore wind) 2010: 14 per cent (including offshore wind) 2020: 17 per cent (excluding offshore wind) 2020: 44 per cent (including offshore wind) Policy ENV8 requires LPAs to favourably consider the onshore developments associated with offshore energy generation and encourages the use of existing infrastructure and the undergrounding of cables connecting new plants to the grid, wherever possible.	This policy strongly supports renewable energy developments, a significant proportion of which are expected to be offshore wind schemes.
Policy ENV9: Water Supply, Management and Drainage	Policy ENV9 states that new development will be located and designed, and its implementation planned, so as to allow for sustainable provision of water supply and enable timely investment in sewage treatment and discharge systems, to maintain the required standard of water quality.	

Table 2.9 | **Draft Regional Spatial Strategy: East Midlands**

Policy	Objectives
Draft Policy 1: Regional Core Objectives	Objective (h) is one of the Core Objectives identified in Draft Policy 1. It seeks to reduce the causes of climate change by minimising emissions of CO_2 through maximising 'resource efficiency' and the level of renewable energy generation.
Draft Policy 6: Development in the Eastern Sub-Area	Among the requirements of Draft Policy 6 is one for development in the eastern sub-area to protect and enhance the natural and historic environment of the coastal margin, including the Wash Special Protection Area.
Draft Policy 26: Protecting and Enhancing the Region's Natural and Cultural Heritage	Draft Policy 26 sets out a list of principles to help in achieving sustainable development. These include: giving the highest level of protection to the region's internationally and nationally designated natural and historic assets; minimising unavoidable damage and clearly justifying any damage by showing a need for development in that location which outweighs it.
Draft Policy 27: Regional Priorities for Environmental and Green Infrastructure	Draft Policy 27 encourages local authorities and developers to work with the voluntary sector to ensure the delivery, protection and enhancement of environmental infrastructure across the region.
Draft Policy 28: Priorities for Enhancing the Region's Biodiversity	Draft Policy 28 encourages local authorities, local communities and developers to implement the Regional Biodiversity Strategy. Diagram 4 related to this draft policy indicates that the proposed site falls within the Wash Biodiversity Conservation Area. Draft Policy 29 seeks the establishment of large-scale habitat creation projects in such areas.
Draft Policy 29: Regional Priorities for Managing and Increasing Woodland Cover	Draft Policy 29 seeks to encourage the establishment of new woodland, and where woodland is unavoidably lost to development requires its replacement with woodland of equivalent value.
Draft Policy 30: Priorities for the Management and Enhancement of the Region's Landscape	Draft Policy 30 seeks to protect the region's natural and heritage landscapes, attaching priority to the Lincolnshire Wolds Area of Outstanding Natural Beauty (AONB). It also confirms that any local designations should be based on landscape character assessments and justified by exceptional local circumstances.
Draft Policy 31: Regional Priorities for the Historic Environment	Draft Policy 31 requires the historic environment to be understood, conserved and enhanced in recognition of its own intrinsic value and its contribution to the region's quality of life.
Draft Policy 32: A Regional Approach to Water Resources and Water Quality	Among the requirements of Draft Policy 32 is one for local authorities, developers and the Environment Agency to work together to protect and improve water quality and reduce the risk of pollution, especially to vulnerable groundwater.
Draft Policy 33: Regional Priorities for Strategic River Corridors	Draft Policy 33 seeks to protect and enhance the natural and cultural environment of Strategic River Corridors, including that of the river Nene.
Draft Policy 34: Priorities for the Management of the Lincolnshire Coast	Draft Policy 34 requires development along the Lincolnshire Coast to be located primarily in existing urban areas in ways that protect and enhance natural and cultural heritage.
Draft Policy 35: A Regional Approach to Managing Flood Risk	Draft Policy 35 resists certain kinds of development, for example any that would be at unacceptable risk from flooding or would create such an unacceptable risk elsewhere, or that would interfere with coastal processes or inhibit the capacity of the floodplain to store water. It does acknowledge, however, that development may still be acceptable where adequate mitigation measures can be employed.

Policy	Objectives
Draft Policy 38: Regional Priorities for Energy Reduction and Efficiency	Draft Policy 38 identifies a list of priorities to reduce energy usage. Associated paragraph 3.3.76 acknowledges that any infrastructure required for offshore developments would need to be accommodated in the Eastern Sub-Area. Paragraph 3.3.77 identifies the Wash as a national strategic area for offshore wind power and acknowledges that this has implications for design and location of onshore infrastructure. In this respect it requires Local Development Frameworks (LDFs) to include policies that concentrate on mitigating potentially adverse effects of onshore infrastructure and encouraging cooperative planning of infrastructure, for example cable sharing.
Draft Policy 39: Regional Priorities for Low Carbon Energy Development	Draft Policy 39 requires local authorities to promote, among other matters, the development of a distributed energy network using low carbon and renewable resources.

Local Development Framework

2.6.19 Following the introduction of the Planning and Compulsory Purchase Act (2004), King's Lynn and West Norfolk Borough Council and South Holland District Council have begun the process of reviewing their Local Plans to create Local Development Frameworks (LDFs). Although LDFs contain a portfolio of documents, it is the Development Plan Documents (DPDs) that have a statutory basis and when adopted will form part of the Development Plan together with the relevant RSS.

2.6.20 The King's Lynn and West Norfolk Local Plan has been saved under the provisions of the Planning and Compulsory Purchase Act (2004) until 2007. The process of preparing an LDF, which will guide growth and development in the Borough to 2021, has begun. An Issues and Options Paper for the Core Strategy DPD was published in June 2005. Subsequently a Core Strategy Preferred Options DPD was published on 9 October 2006 and is subject to public consultation until 20 November 2006.

2.6.21 The Core Strategy Preferred Options DPD sets out strategic approaches, in the form of 'preferred policy options', to key policy matters including renewable energy, coastal management, landscape, nature conservation and biodiversity. In respect of renewable energy the preferred policy option is to permit proposals for renewable energy development, subject to a number of provisions. These include a requirement that it should not cause severely adverse effects on, and conflicts with, landscape character, nature conservation or local amenity interests, which cannot be mitigated.

2.6.22 The preferred policy option for coastal management seeks to improve the mechanisms for coastal management and to move towards an integrated approach that manages the physical constraints of the coastline, while acknowledging the social, recreational, economic, physical and environmental issues. In relation to offshore wind farms it requires consideration of the impact of infrastructure coming onshore from such developments, which could for example require a breach of defence lines that could weaken them.

2.6.23 The South Holland Local Plan will be saved as part of the Development Plan for a period of three years from the date of its adoption, ie until 2009, or until it is replaced by an LDF. The development of an LDF has been delayed, and a new Local Development Scheme (LDS) was published in August 2006. It indicates that the first DPDs to be published for consultation will be a Core Strategy and Generic Development Control Policies in October 2006. The new LDF will provide a planning policy framework to 2021.

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Onshore

Chapter 3 | Approach to the Environmental Impact Assessment

3 Approach to the Environmental Impact Assessment

3.1 Introduction

3.1.1 This chapter describes the general approach taken to the provision of environmental information for the purposes of the Environmental Impact Assessment (EIA). Specific methodologies are described for each of the topics that are assessed in the relevant chapters.

3.2 Purpose of the EIA

The purpose of the EIA process is to provide adequate environmental information to enable decision-makers to understand the environmental effects of the project, in particular to provide:

> *… a means of drawing together, in a systematic way, an assessment of the project's likely significant environmental effects. This helps to ensure that the importance of the predicted effects, and the scope for reducing them, are properly understood by the public and the relevant competent authority before it makes its decision.*
>
> Department of the Environment, Transport and the Regions (DETR) Circular 02/99 *Environmental Impact Assessment*, paragraph 9

3.2.1 The purpose of this Environmental Statement (ES) is to report the findings of the EIA, which provides a systematic analysis of the proposed development in relation to the existing environment. This ES identifies and assesses potential impacts associated with the construction, operation and decommissioning of the onshore works for Lincs, Docking Shoal and Race Bank. Appropriate mitigation measures are also identified.

3.3 EIA Legislative Framework

European Directive 85/337/EEC as Amended by Directive 97/11/EC

3.3.1 The legislative framework for EIAs is set by European Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 97/11/EC.

3.3.2 The Environmental Impact Assessment Directive (97/11/EC) requires an EIA to be completed in support of an application for development consent for certain types of project. Offshore wind farms are listed in Annex II of the Directive, as 'installations for the harnessing of wind power for energy production (wind farms)', and these provisions have been transposed into UK legislation, as described below.

Section 36 of the Electricity Act 1989

3.3.3 Under Section 36 of the Electricity Act (1989), consent is required from the Secretary of State for Trade and Industry (SoS) to construct, extend or operate a generating station with a capacity of more than 50 MW, unless otherwise exempted. The requirement was extended on 1 December 2001 by means of a Statutory Order (SI2001/3642) to cover all offshore wind- and water-driven developments of above 1 MW capacity. The Electricity Act (1989) extends not only to UK territorial waters around England and Wales but also to the Renewable Energy Zone now designated by the UK Government outside territorial waters under the Energy Act (2004). The SoS has no power to vary the terms of a Section 36 consent once it has been granted, but does have power to attach conditions requiring further approvals.

3.3.4 The EIA Directive is applied to the Electricity Act through the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000 (SI 2000/1927). The Directive ensures that the consenting authority has sufficient information on which to base its decisions when considering applications for devel-

opments which may have a significant effect on the environment. In line with the requirements of the EIA Directive as enacted through the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000, there is a requirement to provide a full factual description of the development.

Town and Country Planning Act

3.3.5 The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI 1999 293) implement Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment (the EIA Directive), as amended by Council Directive 97/11/EC, in so far as it applies to development under the Town and Country Planning Act 1990.

3.4 The Conservation (Natural Habitats, etc.) Regulations 1994

3.4.1 The Conservation (Natural Habitats, etc.) Regulations 1994 transpose Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (EC Habitats Directive) into national law. The Regulations place a duty on the Secretary of State to propose to the European Commission a list of sites that are important for either habitats or species (listed in Annexes I and II, respectively, of the Habitats Directive). Once the Commission and UK Government have agreed that the sites submitted are worthy of designation, they are identified as Sites of Community Importance (SCIs). The UK Government must then designate these sites as Special Areas of Conservation (SACs) within six years. The Regulations also require the compilation and maintenance of a register of European sites, to include Special Protection Areas (SPAs) classified under Council Directive 79/409/EEC on the Conservation of Wild Birds (the Birds Directive) and SACs. These sites form a network termed Natura 2000.

3.4.2 The Habitats Regulations apply only as far as the limit of territorial waters (12 nautical miles from baseline).

3.4.3 The Regulations make it an offence (subject to exceptions) to deliberately capture, kill, disturb, or trade in the animals listed in Schedule 2, or pick, collect, cut, uproot, destroy, or trade in the plants listed in Schedule 4.

3.4.4 Where a plan or project is considered likely to have a significant effect on a Natura 2000 site, Regulation 48 sets out the requirements for an 'appropriate assessment' of the implications for the site in view of the site's conservation objectives.

3.5 Location of Information

3.5.1 The requirements for EIA arising from EIA Regulations, and the location of this information within this Environmental Statement, are listed in Table 3.1.

Table 3.1 | EIA Directive requirements and their locations within the ES

EIA requirements: Schedule 4, Parts I and II	Location within ES
(1) a description of the development proposed, comprising information about the site, design and size of the development	Section 5
(2) an outline of the main alternatives studied by the applicant or appellant, and an indication of the main reasons for their choice, taking environmental effects into account	Section 4
(3) the data required to identify and assess the main effects that the development is likely to have on the environment	Section 6
(4) a description of the likely significant effects of the project on human beings, flora, fauna, water, air, climate, material assets, cultural heritage, and the interaction between these	Section 7
(5) a description of the likely significant effects of the development on the environment, which should cover any effects of the development (direct and indirect, secondary, cumulative, short-, medium- and long-term, permanent and temporary, positive and negative) resulting from: • the existence of the development • the use of natural resources • the emission of pollutants • the creation of nuisance • the elimination of waste and a description by the applicant of the forecasting method used to assess the effects on the environment	Section 7
(6) a description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment	Section 7
(7) a description of measures to monitor these effects should the development proceed	Section 7
(8) an indication of any difficulties (technical deficiencies or lack of know-how) encountered by the applicant in compiling the required information	throughout, where applicable
(9) a 'Non-Technical Summary' of the above information	separate document

3.6 EIA Guidance

3.6.1 Guidance on implementing the UK's EIA Regulations is provided in DETR Circular 02/99 *Environmental Impact Assessment* and in the DETR's *Environmental Impact Assessment: A Guide to the Procedures*, 2000. This general guidance has been taken into account in undertaking the EIA. The DoE's guidance of 1995, *Preparation of Environmental Statements for Planning Projects that Require Environmental Assessment*, also includes guidance on specific topics, which has been used.

3.7 Identification of Key Impacts

3.7.1 This Environmental Statement includes a detailed explanation of the likely significant direct and indirect effects on the environment. Significant effects are defined under the European Directive as including secondary, cumulative, short-, medium- and long-term, permanent, temporary, positive and negative effects. A *significant* impact is one that is of sufficient importance that it must be considered by the competent authority, when determining whether consent should be issued. Determining whether the impact is significant or not requires consideration of several factors that may be different in different topic areas. In general, these factors include:

- the character of the receiving environment
- the number and sensitivity of people affected
- the nature, magnitude and duration of the impact
- the value and importance of resources (physical, natural, cultural and economic) affected by the operations
- the extent to which the achievement of legal standards, policy objectives or current standards of good environmental practice is compromised
- the views of statutory and non-statutory agencies and affected parties and the interests of the wider community
- cumulative impacts, including the cumulative impacts of: construction and operation of each of the three wind farm proposals; works undertaken by National Grid at Walpole Marsh substation; and, the proposed extension of Sutton Bridge power station

3.7.2. The assessment methodology for each topic is described within the relevant parts of Chapters 6 and 7 of this document. The ES also provides a description of the potential impacts, and identifies suitable mitigation measures to avoid, remedy or reduce these impacts as far as is practicable. The assessment of significance is therefore carried out on the residual impacts.

3.8 Strategic Environmental Assessment

3.8.1 In November 2002, the DTI published a consultation document, *Future Offshore*, which outlines a proposed strategic approach to the arrangements for site leasing for offshore renewable development. This report identified three areas – the Thames Estuary, the Greater Wash, and the North West – where potential for offshore wind development appeared most promising. The Strategic Environmental Assessment (SEA) of these areas, carried out on behalf of the DTI, was completed in June 2003.

3.8.2 The Lincs, Docking Shoal and Race Bank offshore wind farms fall within the Greater Wash SEA area. Centrica recognises the relevance of the SEA report to the implementation of this project, particularly with regard to cumulative environmental impact issues.

3.8.3 Following the process of SEA described above, the initial stage of the development process required an Agreement for Lease which, when converted into a Lease, would grant rights of occupation for placing structures or cables on the seabed. This process for the 'Round 2' offshore wind farms was completed in December 2003, resulting in the award of an Agreement for Lease by the Crown Estate for the Lincs, Docking Shoal and Race Bank offshore wind farm projects.

3.9 Scoping of the EIA

3.9.1 To assist in identifying the environmental effects on which to focus the ES, a formal scoping exercise was undertaken. This involved the preparation of a Scoping Report (Appendix A2.2) to address the onshore works, which was issued to statutory and non-statutory organisations in January 2006. The aims of this report were to:

- set out the overall approach to the EIA
- identify the main possible effects of the proposed development (at the stages of construction and operation) to be focussed on in the EIA
- identify the relevant study area, assessment methodology and potential mitigation measures to avoid, reduce or remedy any significant adverse effects on the environment, and to enhance any beneficial effects, for each of the relevant environmental topics
- indicate the proposed contents and structure of the report of the EIA, and the Environmental Statement
- invite comments

3.9.2 Over 70 statutory and non-statutory organisations were consulted. A summary of their responses can be found in Appendix A2.3.

3.10 Consultation Process

3.10.1 The Scoping and EIA process to date has been conducted with detailed and extensive consultation with statutory and non-statutory organisations, interested parties and the public.

Public Exhibitions

3.10.2 Exhibitions were publicised and held at King's Lynn, Hunstanton and Skegness in November and December 2005 to outline Centrica's proposed Round 2 projects in the Greater Wash. These allowed members of the public to meet members of the team to ask questions. Future public exhibitions are being scheduled following Centrica's consent submission and further details will be provided in the local press.

References

DoE (1995), Preparation of Environmental Statements for Planning Projects that Require Environmental Assessment (The Stationary Office, Norwich).

DTI (2002), Future Offshore: A Strategic Framework for the Offshore Wind Industry (Department of Trade and Industry, London).

Onshore

Chapter 4 | Site Selection and Consideration of Alternatives

4 Site Selection and Consideration of Alternatives

4.1 Introduction

4.1.1 The following chapter of the onshore ES presents an overview of the process followed by Centrica to identify and select the following key elements to the Lincs, Docking Shoal and Race Bank offshore wind farm projects:

1. The onshore National Grid connection point
2. The onshore landing point for the export power cable
3. The overland route for the export cable to reach the preferred grid connection point

4.1.2 It is important to note that the proposed grid connection point, onshore landing point and overland cable route for the Lincs project are also intended to be used for the proposed Docking Shoal and Race Bank projects (although the cables for these projects would be installed later than those for the Lincs project).

4.1.3 Detailed studies have been undertaken as part of the overall site selection process for all these project components, the findings of which have been used to inform the overall EIA process for this development.

4.1.4 The full list of studies/investigations undertaken with respect to the siting of onshore elements of this scheme are summarised below in Table 4.1.

4.1.5 Detailed studies and assessment have also been carried out with respect to the proposed offshore cable route. The reader is referred to the Offshore volume of this ES for further details about this process.

Table 4.1 | **Summary of key studies/investigations undertaken/reviewed as part of the site selection process for the onshore elements of the Lincs, Docking Shoal and Race Bank offshore wind farms (see Appendix contents list)**

Study/Investigation	Date	Undertaken by	Objectives
Study on the development of the offshore grid for connection of the Round 2 wind farms	January 2005	Econnect (on behalf of the DTI)	1. To undertake an assessment of the costs to connect the offshore wind farms which have been granted licences in the Round 2 offer from The Crown Estate, to the existing onshore national electricity transmission network. 2. To inform the debate on offshore transmission infrastructure development, licensing, charging, ownership and regulation.
Cable route alternatives study for Lincs, Docking Shoal and Race Bank offshore wind farm developments	August 2006	RPS Energy (on behalf of Centrica)	1. To undertake a technical, environmental and commercial desktop assessment of 11 potential grid connection cable route options in order to identify two preferred offshore and onshore cable routes. 2. To conduct a site visit in order to provide a detailed comparison of the landfall and onshore components of the two preferred options. 3. To provide information on a preferred offshore and onshore grid connection cable route for each of the Lincs, Docking Shoal and Race Bank offshore wind farm projects.
Application by Centrica to Central Networks East (CNE)	February 2005	Centrica	To investigate the possibility of connecting one or more of the Centrica Round 2 sites to the existing CNE grid at Skegness.

Study/Investigation	Date	Undertaken by	Objectives
Feasibility study for connection into CNE grid	2005	CNE	To explore the feasibility of connecting the three Centrica Round 2 sites to the CNE grid.
Application by Centrica to National Grid	July 2005	Centrica	To investigate the possibility of connecting one or more of the Centrica Round 2 sites to the existing National Grid at Skegness or Walpole.
Environmental Report for a proposed 400 kV substation extension and 132 kV substation replacement at Walpole Marsh, Norfolk	September 2006	National Grid	To assess the potential effects of the proposed National Grid's works at Walpole substation.

4.2 Selection of Grid Connection Point

4.2.1 Identification of a suitable grid connection for each of Centrica's Round 2 projects (Lincs, Docking Shoal, Race Bank) has been a key part of the development of all three wind farms.

4.2.2 A GB-wide grid connection option study for offshore wind farms was undertaken by Econnect on behalf of the DTI. Centrica commissioned further studies to consider the connection point options in more detail. These considerations are discussed in the Cable Route Alternatives Study for Lincs, Docking Shoal and Race Bank Offshore Wind Farm Developments, produced by RPS Energy on behalf of Centrica, RES and Amec Wind Energy (RPS 2006 and Appendix A2.22), and are summarised in Table 4.2.

4.2.3 A range of technical and commercial considerations were taken into account in determining the potential onshore grid connection points. These are discussed below.

The Availability of the Transmission Capacity at the Point of Connection

4.2.4 Available transmission capacity was a key determinant in considering the most appropriate point of connection for the three wind farms to the National Grid. A range of options were considered, including some that would allow multiple locations for connection points for the projects.

The Ability to Connect at 400 kV

4.2.5 The connection offers received from National Grid were based on direct connections to the grid at 400 kV as opposed to 132 kV, despite the wind farm export cables being rated at 132 kV. This was in part due to the size of the three projects (250 MW for Lincs, 500 MW for Docking Shoal and 500 MW for Race Bank). It was acknowledged, however, that a connection to an existing 132 kV substation would be acceptable, provided that the substation could be upgraded to 400 kV.

The Cost of the Connection

4.2.6 The total cost of connecting the three projects to the National Grid comprises the cost of the offshore and onshore cables, costs associated with the complexity of cable laying (particularly in very shallow offshore areas) and the cost of substation construction and any network reinforcement. The cost of network reinforcement is not necessarily solely attributable to the wind farm projects, but contributes to the wind farm project costs through the provision of security to National Grid.

The Timing of Connection

4.2.7 A key driver behind the construction of the offshore wind farms is the desire to meet the Government's 2010 targets for 10 per cent of electricity supplied in the UK to be provided from renewable sources. Where substantial transmission reinforcement is required, it is unlikely that connections can be provided prior to 2010.

The Length of Onshore and Offshore Cable

4.2.8 Cable length is a key constraint when selecting an appropriate cable route. Electrical transmission losses increase with increasing cable length to a point where projects are economically unviable. By determining the level of electrical loss that would be commercially acceptable, the maximum acceptable cable length was calculated to be 75 km, measured from offshore to onshore substation.

4.3 Connection Points Considered

4.3.1 The cable route selection study prepared by RPS considered the following potential grid connection points:

1. Bicker Fen (Lincolnshire)
2. Grimsby West (Humberside)
3. Sall (Norfolk)
4. Kings Lynn (Norfolk)
5. A new 400 kv substation between Walpole and Norwich Main (Norfolk)
6. Skegness (Lincolnshire)
7. Walpole (Norfolk)

4.3.2 An assessment of the environmental and planning constraints associated with each connection option was then undertaken as part of the cable route selection study. The key conclusions with respect to each option are summarised in Table 4.2.

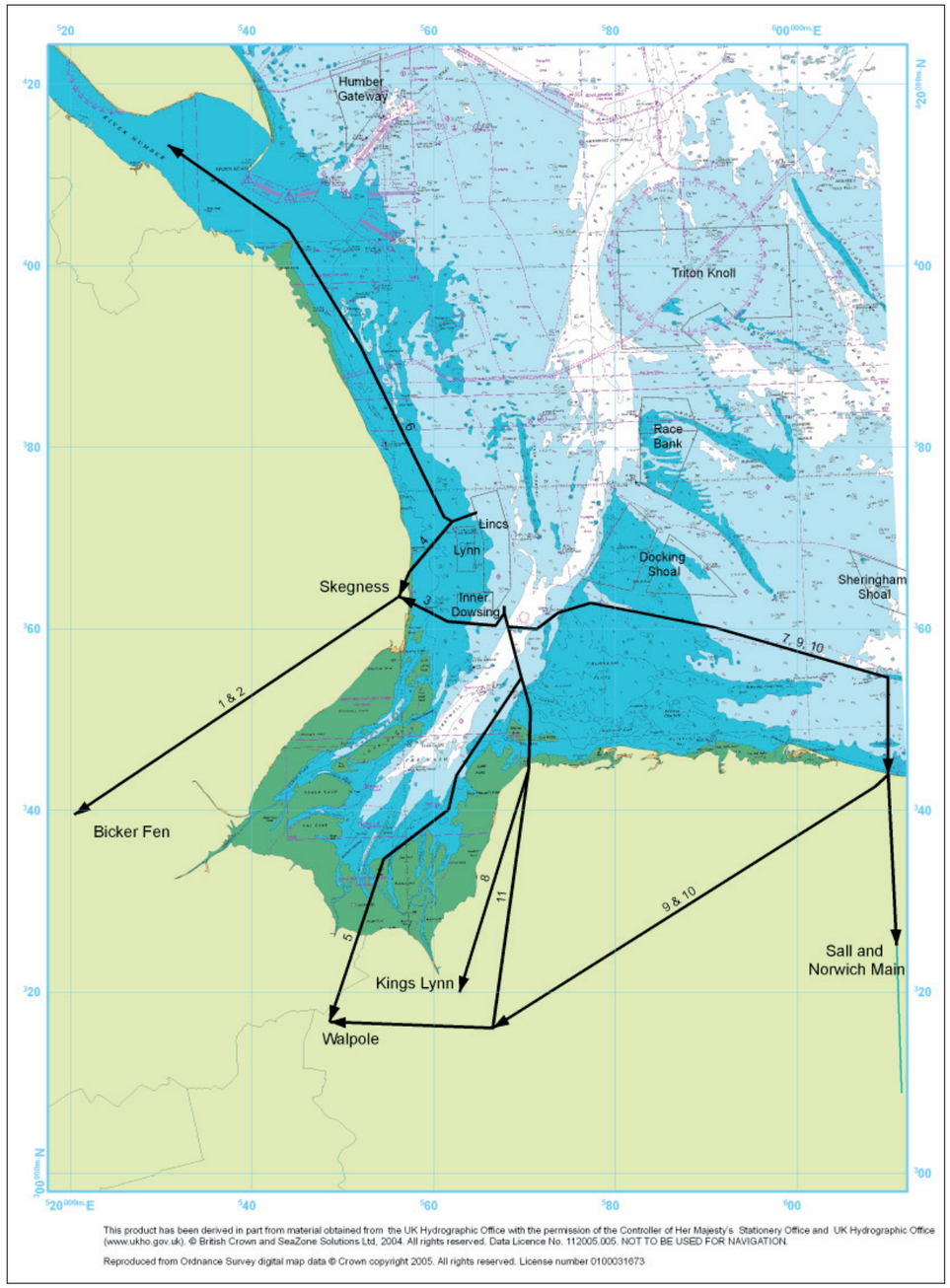


Figure 4.1 | Cable route options

Investigation of Each Option

4.3.3 As outlined above, initial investigations revealed seven possible grid connections: Bicker Fen, Grimsby West, Sall, Kings Lynn, Skegness and Walpole, plus a potential new 400 kv substation between Walpole and Norwich Main.

4.3.4 Potential cable routes into all of these connection points were investigated by RPS Energy (Appendix 2.22) as part of the cable route selection study. In total, eleven routes were assessed for connecting each of the three offshore wind farm developments to the National Grid. Details of each of these potential route options are discussed below.

4.3.5 When assessing the constraints, it was decided that Centrica-owned connections would be underground in order to minimise landscape and visual issues. National Grid-owned connections are necessarily overhead lines. This is because of regulatory constraints to minimise costs and technical limitations at higher voltages.

Table 4.2 | Summary of 11 connection points considered by Centrica

Option	Grid connection point	Name	Lincs cable distance (km)	Docking Shoal cable distance (km)	Race Bank cable distance (km)	Overview of key issues
1	Bicker Fen (Proposed new 400 kV National Grid connection)	via Bicker Fen Road	56.86	65.79	78.84	These options have been discounted for the following reasons: Upgrading of the transmission system is required at Bicker Fen to facilitate flows from the North of England and Scotland. These works could potentially result in long delays in receiving connection offers for this point, which are outside the timescales of these projects.
2	Bicker fen (Proposed new 400 kV National Grid connection)	via Bicker Fen Off Road	56.86	65.79	78.84	Cable laying would cause considerable traffic disruption for up to 6 months. This would be a significant issue as the A52 is the only route into the area and tourism plays a central role in the local economy (Option 1 only).
3	Skegness (Proposed new 400 kV National Grid connection with further 400 kV connection to National Grid at Bicker Fen)	via Skegness N	0.00	96.07	85.10	These options were initially considered a possibility due to the proximity of the offshore wind farms to the Skegness coastline. They were later discounted for the following reasons: CNE studies showed insufficient capacity in the local distribution network for the connection of any combination of Lincs, Docking Shoal and Race Bank.
4	Skegness (132 kV Central Network East connection) (Proposed new 400 kV National Grid connection with further 400 kV connection to National Grid at Bicker Fen)	via Skegness S	56.86	65.79	78.84	There is no existing connection to the transmission network (National Grid). Construction of a new 400 kV substation, probably adjacent to the existing 132 kV substation at Skegness, would be required to connect the wind farms and the local distribution network to the National Grid. A new 400 kV overhead line to take the power to a current interconnection point with the main transmission system, probably at Bicker Fen, would also be required. This is likely to cause major delays in the planning process, rendering the completion of this work unlikely within the desired timeframes for these projects. The 400 kV Bicker Fen substation would need to be extended in order to accept the 1.25 GW from the three wind farms. Centrica also discussed with Central Networks East (CNE) the possibility of connecting one or more of the wind farms to the local distribution network without the need to upgrade the transmission system. CNE carried out a feasibility study on behalf of Centrica and determined that, given the impending connection of the already consented Lynn and Inner Dowsing Wind Farms, the CNE network did not have sufficient capacity available to accommodate any of the Round 2 projects

Option	Grid connection point	Name	Lincs cable distance (km)	Docking Shoal cable distance (km)	Race Bank cable distance (km)	Overview of key issues
5	Walpole (132/400 kV National Grid connection)	via Walpole (through Wash Estuary)	50.48	52.72	71.29	In terms of technical and economic considerations, connection at Walpole was judged to be most viable for the following reasons: A connection offer was available immediately. There is approximately 1.3 GW of capacity available at Walpole and therefore there is no need for any reinforcement of the substation or associated overhead lines to connect the wind farms. A relatively small extension to the Walpole substation would be required. The cable length required falls within the limits of acceptable electrical losses. These factors would enable the projects to be completed within Centrica's requirements. A major disadvantage to this route, however, was that the cable lay was through an internationally designated marine conservation area. Detailed assessment work and consultation has been carried out to find a route that is environmentally acceptable and which complies with European legislation. The offshore route development process is detailed in the Offshore Volume of the ES.
6	Grimsby West (400 kV National Grid Connection)	via Humber	56.22	70.68	59.61	The option of taking the export cables to the north and into the Humber Estuary (to Grimsby West) was ruled out due to the following: Transmission capacity available for additional generation would be severely restricted by existing conventional power stations connecting into the same part of the network. Unacceptably high power loss associated with the cable lengths. The initial cable lay would be through an internationally designated nature conservation area. There would be issues associated with protecting the cable from shipping, particularly given the high level of activity in the Humber.
7	Sall (132 kV National Grid Connection) (Proposed new 400 kV National Grid connection)	via N Norfolk	75.73	49.5	71.99	This option was considered to be unacceptable due to the following: No existing connection to the transmission network (National Grid). The study by RPS Energy showed that, in order to achieve the required grid connection, a new 400 kV substation would be required and existing overhead lines would need upgrading. This was likely to cause major delays in the planning process, rendering the completion of these works unlikely within Centrica's requirements.

Option	Grid connection point	Name	Lincs cable distance (km)	Docking Shoal cable distance (km)	Race Bank cable distance (km)	Overview of key issues
8	Kings Lynn 300 MW (Proposed new 400 kV National Grid connection)	via N Norfolk	45.71	49.36	62.41	This option was discounted for the following reasons: No existing connection to the transmission network (National Grid). The study by RPS Energy showed that, in order to achieve the required grid connection, a new 400 kV substation would be required and existing overhead lines would need upgrading. This was likely to cause major delays in the planning process, rendering the completion of these works unlikely within Centrica's requirements.
9	Walpole (400/132 kV National Grid connection)	via N Norfolk (avoiding European Marine Sites)	126.65	100.42	122.91	This option was ruled out due to the following: Unacceptably high power loss associated with cable lengths. Numerous complex land ownership issues. High route complexity, ie crossing rivers, main drains, railways
10	New 400 kV substation between Walpole and Norwich main	via N Norfolk with new substation (avoiding European Marine Sites)	126.65	100.42	122.91	This option was not considered further due to the fact that a new 400 kV substation with associated overhead lines would be required. This was likely to cause major delays in the planning process, rendering the completion of these works unlikely within Centrica's requirements.
11	Walpole (132/400 kV National Grid connection)	via N Norfolk avoiding Wash Estuary	48.86	52.51	65.56	Although the cable lengths are on the limit of acceptable losses, this option was considered further as the best alternative to Route 5.

Summary of Findings

4.3.6 Based upon the initial desk-based assessment, Walpole (either via the Wash or via North Norfolk) was highlighted as the most likely location for connection. The substation at Walpole has sufficient capacity for connections up to 1.3 GW of new generation without the need to carry out major reinforcement works. This capacity is sufficient for all three of Centrica's Round 2 offshore wind farm projects and is available within Centrica and Government timescales.

4.3.7 Two options were feasible:

Option 5: Lincs, Docking Shoal and Race Bank to Walpole via the Wash

Option 11: Lincs, Docking Shoal and Race Bank to Walpole via the North Norfolk coast

4.3.8 It was clear at this stage, however, that both of these options would give rise to significant but not insurmountable challenges, the offshore routes passing through the Wash and north Norfolk environmentally designated sites. These challenges would be dealt with through mitigation.

4.4 Selection of Onshore Landing Point – Options 5 and 11

4.4.1 As a result of the review of potential grid connection points, and the identification of the two possible route options (5 and 11), further work was carried out to identify and assess potential cable-landing points.

4.4.2 The following factors were taken into consideration when examining the potential landing sites:

- Designated conservation areas
- Beach geomorphology
- Beach use
- Sediment movement
- Back beach environment (dunes, salt marsh etc.)
- Sea defences
- Access
- Land use

Option 5 – Walpole via the Wash

Landing Point Description

4.4.3 The selected landing point for this option is approximately 250 m east of the River Nene. The site was selected due to: a) the relatively short distance overland to Walpole; and b) the width of the salt marsh at this location (approximately 500 m), which would make it possible to insert ducts beneath the salt marsh and thus reduce environmental impact at this point.

4.4.4 Onshore, the cable would continue in a roughly southerly direction for approximately 11 km to the substation at Walpole. This relatively direct onshore route would result in the overall export cable length staying within the limits of acceptable electrical transmission losses, and would thus be economically acceptable.

4.4.5 The potential landing site comprises a mixture of mud flats and tidal salt marsh that extend to a major sea defence embankment. The salt marsh is well-established and falls within the Wash Site of Special Scientific Interest (SSSI). The area is made up of stable ground, interspersed with numerous gullies and channels. The vegetation is a mixture of coarse grass and marsh plants.

4.4.6 North of the salt marsh is an expanse of mudflats which extends beyond the 'Trial Bank' feature (a man-made circular reservoir) to the Old Lynn Road Channel. The inter-tidal mudflats and salt marsh represent one of Britain's most important winter feeding areas for waders and wildfowl.

4.4.7 To the landward side of the embankment is a major drainage system which is controlled via a number of sluice gates that allow the excess water to flow into the River Nene. This system comprises open fields with a series of interconnecting drainage channels and further earth embankments that formed part of earlier flood defence schemes.

Other Options Considered

4.4.8 Discussions with key consultees were held with regard to the potential for bringing the export cable ashore at a point west of the River Nene. However, this option was discounted due to the greater potential ecological impacts associated with it, including a badger sett, remnant hedges and semi-natural woodland, and because it would necessitate crossing the River Nene at some point inland to complete the connection at Walpole. In addition, access to the area west of the River Nene is severely limited, with no access roads capable of supporting the large-scale construction plant. New access roads would have been required to facilitate the works west of the river.

4.4.9 Initial discussions were also held about the possibility of the cable being laid up the channel of the River Nene itself. However, this option was rejected on engineering grounds plus navigational and dredging concerns. In addition, the disruption to local ports was considered too great.

Summary of Key Issues for Option 5

4.4.10 The key technical, environmental and commercial issues that are relevant to Option 5 are summarised below in Table 4.3.

Table 4.3 | **Summary of key technical, environmental and commercial issues relevant to Option 5**

Technical	The selected cable route would be the most direct to Walpole substation, whilst taking into consideration highly sensitive features within the Wash and also using the deeper water to avoid the mobile sandbanks and channels. Directional drilling under the salt marsh and coastal defences would need to be considered. Electrical losses through this length of cable would be acceptable. There is available transmission capacity at Walpole, sufficient to accommodate up to 1.3 GW of generation capacity.
Environmental	The cable route would pass through fish and shellfish areas. The route would pass directly through the Wash internationally designated areas. There is a good understanding of environmental conditions through the Wash and there are precedents of other wind farm projects that have laid cables through environmentally designated areas. Careful siting of cables would be needed to avoid key features of interest. Further details on the environmental issues faced by selecting a route through the Wash are provided in Volume 1 of the ES (offshore).
Commercial	A new 132 kV substation would be required adjacent to the existing substation. This would require an additional land area of approximately 150 m x 150 m. Connection offers have been received which are commercially acceptable in terms of cost and risk. Connection could be made within the necessary timescales.

Option 11 – Walpole via North Norfolk

Original Landing Point

4.4.11 Option 11 originally passed to the north of the Wash, with the cable landing point on the North Norfolk coast between Brancaster and North Hunstanton. The key advantage this potential landing site had over Option 5 was that the marine component of the route would have avoided the designated areas within the Wash Estuary marine SAC. However, the proposed route would still have passed through the North Norfolk SAC, and the cable length required would have exceeded the length of acceptable electrical losses and would therefore not have been economically viable.

4.4.12 The original technical, environmental and commercial issues associated with this option are summarised below in Table 4.4.

Table 4.4 | **Summary of the original technical, environmental and commercial issues associated with Option 11**

Technical	Directional drilling under the beach would have to be considered. Engineering issues may be considerable due to a high water table, shallow geology and multiple river crossings. The total distance for the cable would be greater than acceptable when electrical losses are considered. There is available transmission capacity at Walpole, sufficient to accommodate up to 1.3 GW of generation capacity.
Environmental	The marine cable would pass through internationally designated areas. The cable would pass through fishing and fish nursery areas. Beach landing would be perceived as an issue with local planning authorities due to beach use.
Commercial	Numerous land ownership issues to be resolved. New 132 kV substation required adjacent to existing substation in the order of 150 m x 150 m to be well screened and landscaped.

4.4.13 Further assessment of this proposed landing location also identified the fact that the majority of this section of the coast is a designated National Nature Reserve, due to the long, thin dune system known as 'Holme Dunes', and that the dunes in this area have rapidly been eroded over the past decade (as demonstrated by Environment Agency beach profile data). In addition, the inter-tidal beach and near shore area around Holme is eroding, unlike the rest of the North Norfolk Coast, which is accreting. Due to the environmental sensitivity of this part of the coastline and its eroding nature, in addition to the large mobile features on the foreshore, it was deemed that this area would be unsuitable for cable landing and burial.

Alternative Landing Point Considered

4.4.14 An alternative onshore landing point was identified and investigated between Hunstanton and Heacham. This section of coast was not within the area of erosion described above and, depending on the overland route chosen, cable losses associated with cable length could be acceptable. However, the offshore cable would now pass through part of the designated conservation areas of the Wash. An additional constraint was that the area around Hunstanton is of high importance to the tourism industry.

4.5 Selection of Overland Route

4.5.1 Once the two potential landings points had been identified (east of the River Nene and between Hunstanton/Heacham), further work was then undertaken to determine suitable overland routes from these landing sites to Walpole.

4.5.2 A site visit, incorporating landfall inspections and onshore route investigations, was undertaken on 11th and 12th January 2006 by RPS Energy Ltd. The purpose of this site visit was to investigate the overland routes for Options 5 and 11 in more detail.

4.5.3 The following technical and environmental factors were taken into consideration when examining the potential overland cable routes:

- Designated conservation areas
- Rivers, streams and drainage channels
- Land use
- Land ownership
- Historic and archaeological sites
- Transport infrastructure
- Suburban and rural development
- Proximity to National Grid
- Provision for a 50 m wide installation corridor

Option 5 – Walpole via the Wash

4.5.4 Walkover and access surveys were used to determine the most appropriate overland route. From the landing point to the east of the River Nene, the proposed route would traverse the main earth embankments and follow an almost straight course, south by southwest, to the Walpole substation.

4.5.5 The route would pass through agricultural land until it meets the A17. In doing so, it would pass through at least four farms. The majority of the fields have associated drainage ditches up to 2 m deep. At least two minor roads would have to be crossed before reaching the A17.

4.5.6 Beyond the A17, the route would continue in a straight line for approximately 4 km into the Walpole electrical substation. The route would cross the 'Old Enclosed Marsh' which, again, is agricultural land similar to that described above. Four minor roads would have to be crossed.

4.5.7 A Phase 1 Habitat Survey of the route following the standard method (NCC 1990, revised by JNCC in 2003) was undertaken between 7 and 9 December 2005 to check for environmental constraints. The survey was extended to include searches and mapping of potential habitat for:

- amphibians – including great crested newts
- reptiles
- mammals – including water voles, otters, brown hares, badgers and bats
- invertebrates

4.5.8 Further targeted ecological surveys were undertaken following the extended Phase 1 Habitat Survey. These are summarised below:

- A total of five winter farmland bird surveys, undertaken over the period November 2005 to March 2006, to identify the conservation significance of the proposed cable corridor route
- Bird surveys undertaken to record waterfowl using the farmland towards the coastal areas of the survey area at high tide
- Further surveys of amphibians, reptiles and mammals

4.5.9 The data from these surveys were used to determine the best route to Walpole from the landing site east of the River Nene. The proposed route was chosen in order to avoid potentially sensitive features, including a badger sett, remnant hedges and semi-natural woodland.

4.5.10 Overall, the onshore component of Option 5 presented no significant technical or environmental constraints. The route does not pass through any environmentally designated areas and land use is mainly agriculture (Grade 1 and 2). Standard procedures would need to be implemented for all road crossings. Further, with an overall distance of 11 km, there would be no transmission issues.

4.5.11 The key advantages to this route are presented below:

1. It is the most direct route to Walpole
2. It comes ashore at a point where it is possible to insert ducts beneath the salt marsh (ie the salt marsh strip is approximately 500 m wide)
3. There are few sensitive ecological features above the mean high water mark
4. There are fewer major features to cross (eg rivers, roads) than other route options
5. There are few residences along the route

Option 11 – Walpole via North Norfolk

4.5.12 With a landfall south of Hunstanton, there were two alternative overland routes: one to the west and one to the east. The west option would run parallel to the coastline, while the east option would be further inland.

West Route

4.5.13 A route was investigated following a disused railway line that exists between Hunstanton and Kings Lynn, forming part of the old Peterborough to Hunstanton line. This route represented a potential route for Option 11, either on the old track bed or beside it.

4.5.14 The suggested cable route would initially run adjacent to the old railway corridor, passing through freshwater grazing marshes but avoiding forested areas until Locke Farm near Snettisham. The land along this route is predominantly cereal crops (Grade 3 land), with some freshwater grazing marshes and associated extensive drainage channels.

4.5.15 From Snettisham, the route would pass directly south away from the old railway, which deviates east into Snettisham and Dersingham. The proposed cable route would then rejoin the old railway just below Wolferton, the site of the former Royal Station, and to the west of high value Scots Pine woodland.

East Route

4.5.16 From the proposed landing between Hunstanton and Heacham the route would cut across a golf course, over general agricultural land and pass under the A149. It would continue east for another 1.5 km and then turn due south and pass under the B1454 west of Sedgeford. The route would continue in this direction for approximately 10 km, covering predominantly good agricultural ground.

4.5.17 At the 10 km mark, the route would have to turn to the southeast for approximately 4 km to avoid the Sandringham Royal Estate and associated homesteads. This route would inevitably pass through a number of small plantations of well-managed mixed woodland.

4.5.18 After 4 km, the route would continue due south for a further 9 km, having bypassed the Hillington Hall Estate to the west. The route would then pass under the A148, the B1145 and three other minor roads. The intention would be to bury the cable on a parallel route to existing 400 kV power lines all the way to the Walpole substation. This would take the route south of Kings Lynn to the River Great Ouse, a distance of some 17 km. Once either over or under the Great Ouse, there would be a further 12 km to Walpole.

East vs West Routes – Potential Constraints on Overland Route

4.5.19 Assessment of the western route has shown that it had a number of major constraints:

- The protected status of the old railway line
- Engineering constraints associated with high water levels seaward of King's Lynn
- The potential for disturbance to tourism
- The presence of a number of terrestrial ecologically designated sites
- The requirement for a major river crossing

4.5.20 The eastern route had similar constraints, with the addition of greater land ownership and technical issues. The eastern route would be in excess of 56 km on land, which would require numerous landowner agreements. In addition, there were numerous road and rail crossings and one major river crossing, all of which would require complex engineering solutions and would have cable de-rating implications. The installation would also cause major traffic problems to the area. The route would also pass through known archaeological sites.

Comparison of Options 5 and 11

4.5.21 Both Options 5 and 11 require the addition of marine cables though the Wash. However, for Option 11 there are considerable issues, both at the landing point and along the overland cable route. Option 5, Walpole via the Wash, provides a suitable landing point east of the Nene and an overland route across primarily agricultural land, which will be reinstated post-construction.

4.6 Summary of Site Selection and Alternatives

4.6.1 The selection of the optimum location for grid connection, landing the marine export cable and overland route to the appropriate substation (Walpole) has been a complex, iterative process that has required a number of detailed studies to be undertaken by, and on behalf of, Centrica.

4.6.2 All aspects related to these elements of the project have been investigated in great detail. Through a process of elimination, it has become clear that the best possible option, based on a combination of technical, environmental and commercial grounds, is to land the marine export cable at a point approximately 250 m east of the River Nene and then continue onshore in a southerly direction for approximately 11 km to the substation at Walpole (Option 5).

4.6.3 The substation at Walpole has been selected as the proposed point for grid connection because: (a) it can accommodate the required 1.25 GW of capacity (total capacity from Lincs, Docking Shoal and Race Bank) after the addition of a 132 kV substation; and (b) the level of security required and date from which the connection will be available are acceptable and in line with Centrica's requirements and Government targets.

4.6.4 The landing point east of the River Nene has been selected because: (a) it represents the shortest direct overland route to Walpole; and (b) it comes ashore at a point where it is possible to insert ducts beneath the salt marsh (ie the salt marsh strip is approximately 500 m wide). Alternative sites to the west of the Nene, and also using the actual river channel to lay the cables, were discounted on environmental and technical grounds.

4.6.5 Finally, the overland route was selected because: (a) there are few sensitive ecological features above the mean high water mark; (b) there are fewer major features to cross (eg rivers, roads) than other route options; and (c) there are few residences along the route.

4.6.6 In summary, the proposed grid connection point, marine export cable landing site and overland route proposed by Centrica represent the best option when all technical, environmental and commercial issues are considered together. It is accepted that, due to the location of the offshore cable route through the Wash Estuary, these proposals still represent a considerable challenge to the developer. With the successful implementation of robust and well thought out mitigation measures, and continued consultation and liaison with key stakeholder groups, it is believed that the final option chosen can be successfully developed.

References

RPS Energy (2006). *Cable Route Alternatives Study for Lincs, Docking Shoal and Race Bank Offshore Wind Farm developments.* Report produced by RPS Energy on behalf of Centrica Renewable Energy Systems Ltd, Renewable Energy Systems Ltd and Amec Wind Energy, August 2006.

NCC (1990), *Phase 1 Habitat Survey of the route following the standard method* (revised by JNCC in 2003).

Onshore

Chapter 5 | Project Description

5 Project Description

5.1 Introduction

5.1.1 This chapter of the Environmental Statement describes the proposed onshore works associated with three offshore wind farm developments: Lincs, Docking Shoal and Race Bank. Although separate consent applications will be made for each of these projects, they share some common elements onshore, including the same landfall location and cable corridor. Each project will require its own 132 kV substation, but these will be constructed adjacent to one another and will share features such as access and fencing.

5.1.2 To connect the wind farm substations to the existing Walpole Marsh 400 kV substation, National Grid will construct an extension to the southeast on existing operational land. Details of the works associated with this extension (and other National Grid works unrelated to these proposals) and their likely environmental effects are described in a separate Environmental Report prepared by National Grid, which is included in its entirety in Appendix A2.14.

5.1.3 Information is provided in this chapter of the Environmental Statement on construction, operation and decommissioning of onshore works. Please refer to Chapter 4 of Volume 1 for details of the offshore works proposed for the Lincs offshore wind farm. Offshore details of Docking Shoal and Race Bank wind farm proposals are not yet available, but are scheduled to be submitted in 2007.

5.2 Objectives of the Developments

5.2.1 The construction of a 250 MW wind farm comprising up to 83 turbines at Lincs, and the two 500 MW wind farms at Docking Shoal and Race Bank (for which applications will be made in 2007), each comprising approximately 100 turbines, will make a significant contribution towards the Government's carbon dioxide (CO_2) reduction targets and provide economic benefits for the UK economy.

5.3 Project Description Drawings

5.3.1 The location of the proposed onshore cable routes and corridor boundaries from the seawall crossing to the existing substation at Walpole Marsh, and the location of the new substations for Lincs, Docking Shoal and Race Bank, are presented in Figure 5.1.

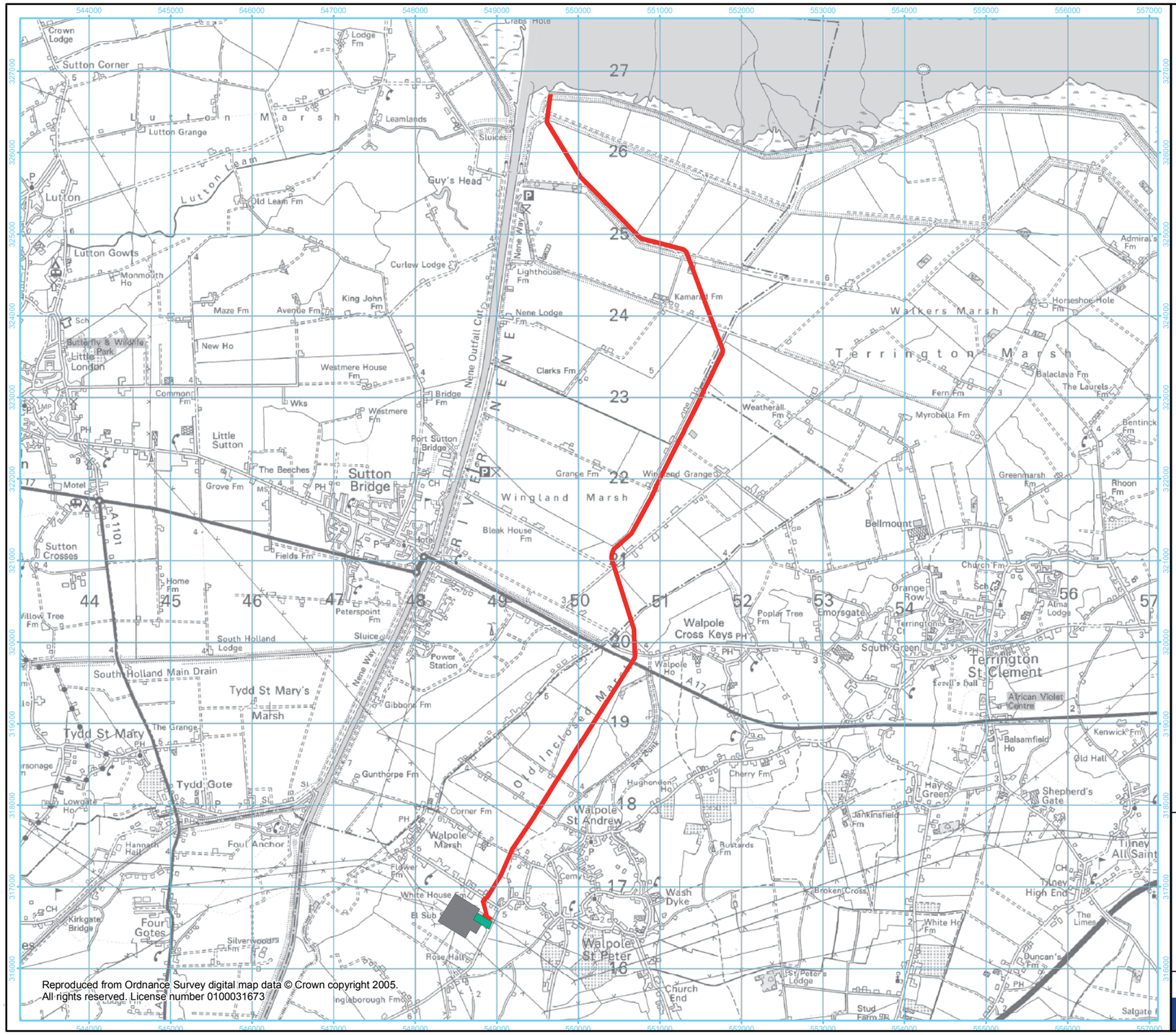
5.3.2 The layout of the substations in relation to the existing Walpole substation and additional works required by the National Grid, in order to accommodate the connections for Lincs, Docking Shoal and Race Bank, are illustrated in Figure 5.2. Elevations of these works are shown in Figures 5.3 and 5.4.

5.4 Onshore Site Location

5.4.1 This assessment addresses the onshore cable route from mean high water spring (MHWS) to its connection at Walpole substation. The assessment also addresses works required at Walpole to connect the cables to the existing substation.

5.4.2 The export cables for Lincs, Docking Shoal and Race Bank will come to shore at the same point, approximately 250 m east of the mouth of the river Nene and approximately 6 km north-northeast of Sutton Bridge. The cables run together in a roughly southerly direction to their connection point at the existing Walpole substation. The approximate length of the onshore section of cable is 11 km. The proposed alignment of the onshore connection and substation is shown in Figure 5.1.

5.4.3 The proposed cable route is located principally within a highly intensive agricultural area, with numerous maintained drainage ditches. There are numerous individual farm buildings and some residential properties associated with the minor road corridors.



Key

- Onshore Cable Route for Lincs, Docking Shoal and Race Bank Offshore Wind Farms
- Existing Walpole Substation
- Location of Proposed Substations for Lincs, Docking Shoal and Race Bank Offshore Wind Farms

0 1 2 3 km

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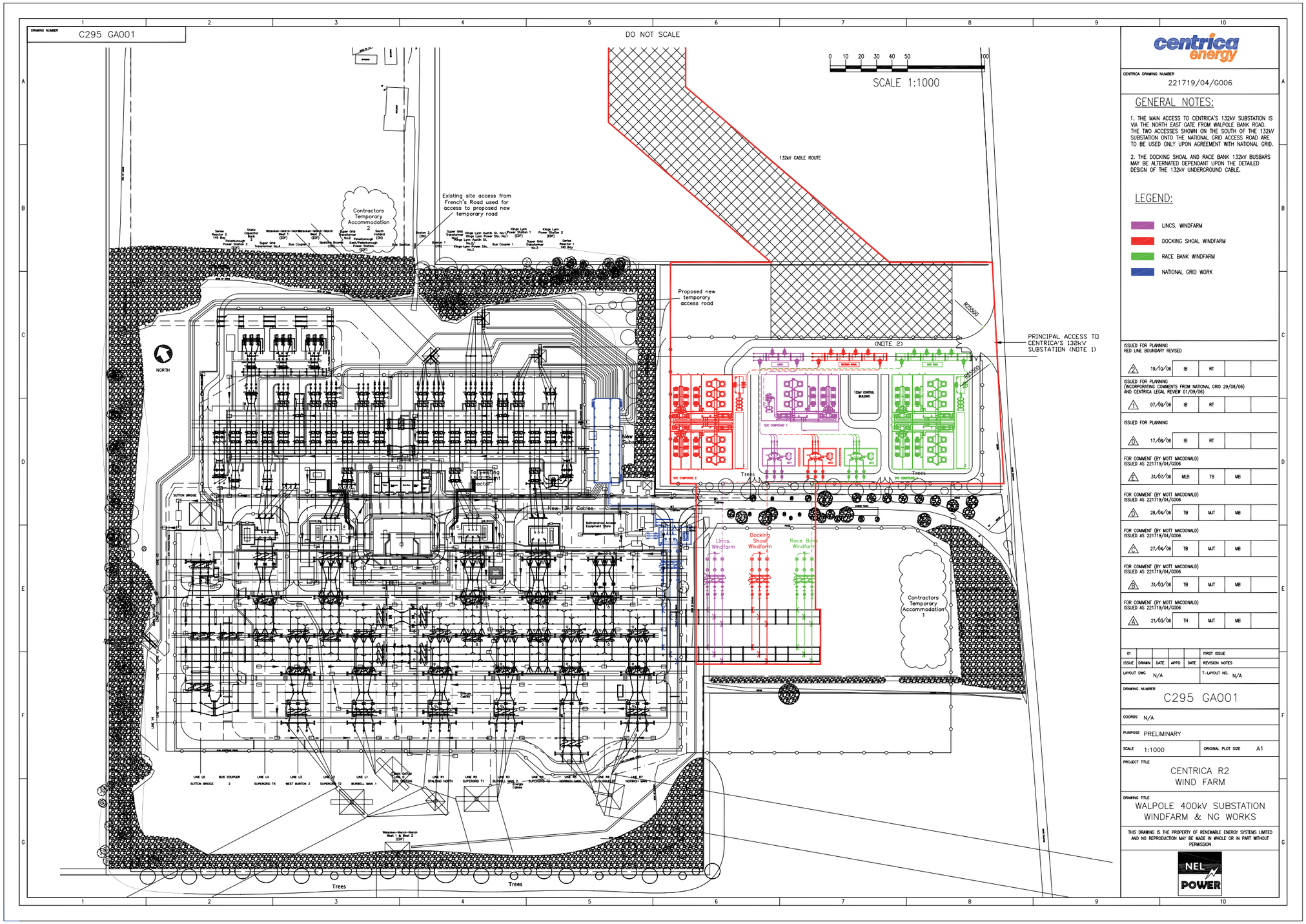
Client:	Centrica Renewable Energy Limited
Project:	Lincs, Docking Shoal and Race Bank Offshore Wind Farms - Onshore Connection
Title:	Location of the Onshore Cable Route and Substations
Date:	Nov 2006
Scale:	1:45,000 @A3
Drawn:	KM
Checked:	TN
Drawing based upon:	British National Grid
Job:	JPP1131
Figure No:	
Rev:	B

www.rpsgroup.com

Figure 5.1 | Location of the onshore cable route and substations



CENTRICA DRAWING NUMBER
221719/04/G006

GENERAL NOTES:

1. THE MAIN ACCESS TO CENTRICA'S 132kV SUBSTATION IS VIA THE NORTH EAST GATE FROM WALPOLE BANK ROAD. THE TWO ACCESSES SHOWN ON THE SOUTH OF THE 132kV SUBSTATION ONTO THE NATIONAL GRID ACCESS ROAD ARE TO BE USED ONLY UPON AGREEMENT WITH NATIONAL GRID.

2. THE DOCKING SHOAL AND RACE BANK 132kV BUSBARS MAY BE ALTERNATED DEPENDANT UPON THE DETAILED DESIGN OF THE 132kV UNDERGROUND CABLE.

LEGEND:

- LINCS. WINDFARM
- DOCKING SHOAL WINDFARM
- RACE BANK WINDFARM
- NATIONAL GRID WORK

ISSUED FOR PLANNING RED LINE BOUNDARY REVISED					
4	19/10/06	IB	RT		
ISSUED FOR PLANNING (INCORPORATING COMMENTS FROM NATIONAL GRID 29/08/06) AND CENTRICA LEGAL REVIEW 01/09/06)					
3	07/09/06	IB	RT		
ISSUED FOR PLANNING					
2	17/08/06	IB	RT		
FOR COMMENT (BY MOTT MACDONALD) ISSUED AS 221719/04/G006					
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01					FIRST ISSUE

ISSUE	DRAWN	DATE	APPD	DATE	REVISION NOTES

LAYOUT DWG N/A — T-LAYOUT NO. N/A

DRAWING NUMBER C295 GA001

COORDS N/A

PURPOSE PRELIMINARY

SCALE 1:1000 — ORIGINAL PLOT SIZE A1

PROJECT TITLE
CENTRICA R2 WIND FARM

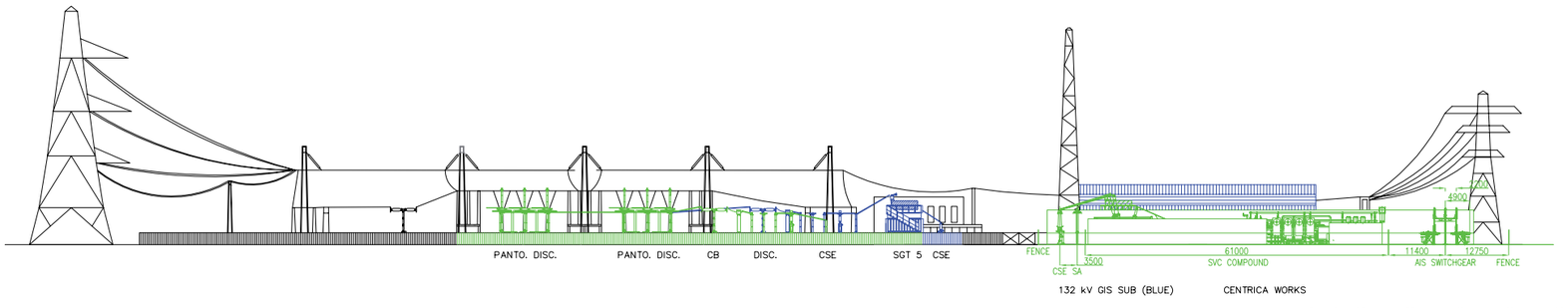
DRAWING TITLE
WALPOLE 400kV SUBSTATION WINDFARM & NG WORKS

NEL POWER

Figure 5.2 | Layout of the substations for Lincs, Docking Shoal and Race Bank in relation to the existing substation at Walpole Marsh

DRAWING NUMBER C295 GA002

DO NOT SCALE



SECTION A–A

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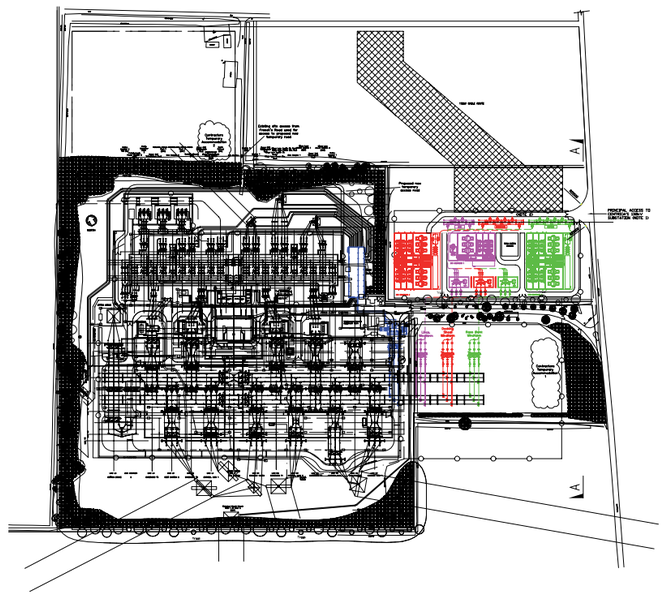


PLAN VIEW (NOT TO SCALE)

centrica energy

CENTRICA DRAWING NUMBER 221719/01E/E011

GENERAL NOTES:

1. THE MAIN ACCESS TO CENTRICA'S 132kV SUBSTATION IS VIA THE NORTH EAST GATE FROM WALPOLE BANK ROAD. THE TWO ACCESSES SHOWN ON THE SOUTH OF THE 132kV SUBSTATION ONTO THE NATIONAL GRID ACCESS ROAD ARE TO BE USED ONLY UPON AGREEMENT WITH NATIONAL GRID.

2. THE DOCKING SHOAL AND RACE BANK 132kV SWITCHGEAR MAY BE ALTERNATELY ORIENTATED DUE TO THE DETAILED DESIGN OF THE 132kV UNDERGROUND CABLE.

LEGEND:

- LINCS. WINDFARM
- DOCKING SHOAL WINDFARM
- RACE BANK WINDFARM
- NATIONAL GRID WORK

ISSUED FOR PLANNING (INCORPORATING COMMENTS FROM NATIONAL GRID 29/08/06) AND CENTRICA LEGAL REVIEW 01/09/06)
07/09/06 | IB | RT

ISSUED FOR PLANNING
17/08/06 | IB | RT

ISSUED FOR CLIENT COMMENT (BY MOTT MACDONALD) ISSUED AS 221719/01E/011
10/07/06 | DMC

ISSUED FOR CLIENT COMMENT (BY MOTT MACDONALD) ISSUED AS 221719/01E/011
07/07/06 | DMC

ISSUED FOR CLIENT COMMENT (BY MOTT MACDONALD) ISSUED AS 221719/01E/011
03/07/06 | DMC

ISSUE	DRAWN	DATE	APPD	DATE	REVISION NOTES
01					FIRST ISSUE

LAYOUT DWG N/A | T-LAYOUT NO. N/A

DRAWING NUMBER C295 GA002

COORDS N/A

PURPOSE PRELIMINARY

SCALE 1:500 | ORIGINAL PLOT SIZE A1

PROJECT TITLE
CENTRICA R2
OFFSHORE WINDFARMS

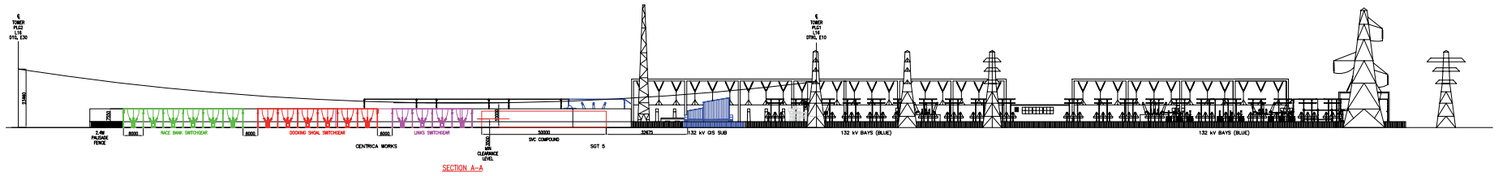
DRAWING TITLE
WALPOLE 400kV SUBSTATION WINDFARM & NG WORKS
SWITCHYARD ELEVATIONS SECTION A–A

NEL POWER

Figure 5.3 | Layout of the substations for Lincs, Docking Shoal and Race Bank in relation to the existing substation at Walpole Marsh - Section A-A

DRAWING NUMBER C295 GA003

DO NOT SCALE



SECTION B-B

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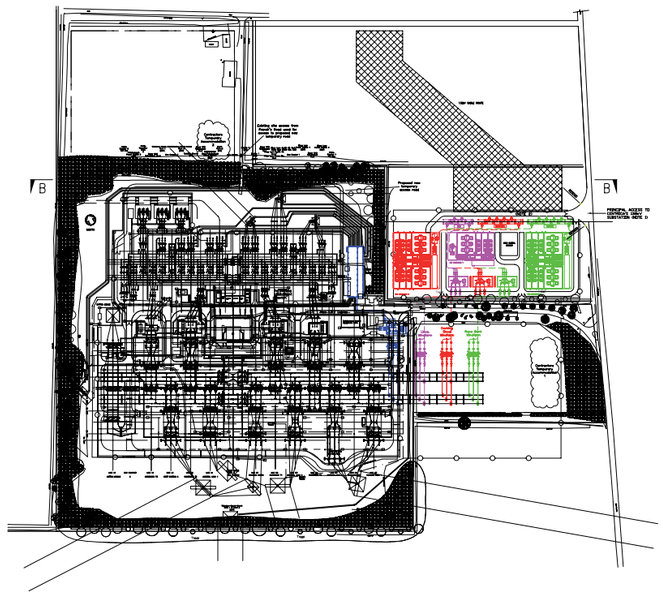

PLAN VIEW (NOT TO SCALE)

centrica energy

CENTRICA DRAWING NUMBER 221719/01E/E012

GENERAL NOTES:

1. THE MAIN ACCESS TO CENTRICA'S 132kV SUBSTATION IS VIA THE NORTH EAST GATE FROM WALPOLE BANK ROAD. THE TWO ACCESSES SHOWN ON THE SOUTH OF THE 132kV SUBSTATION ONTO THE NATIONAL GRID ACCESS ROAD ARE TO BE USED ONLY UPON AGREEMENT WITH NATIONAL GRID.

2. THE EXACT LOCATION AND DEPTH OF THE 132kV CABLES MAY BE ALTERED DEPENDANT UPON THE ULTIMATE DESIGN OF THE 132kV UNDERGROUND CABLES.

LEGEND:

- LINCS. WINDFARM
- DOCKING SHOAL WINDFARM
- RACE BANK WINDFARM
- NATIONAL GRID WORK

ISSUE	DRAWN	DATE	APPD	DATE	REVISION NOTES
07	IB	07/09/06	RT		ISSUED FOR PLANNING (INCORPORATING COMMENTS FROM NATIONAL GRID 29/08/06) AND CENTRICA LEGAL REVIEW 01/09/06
06	IB	17/08/06	RT		ISSUED FOR PLANNING
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04	DMC	07/07/06			ISSUED FOR CLIENT COMMENT (BY MOTT MACDONALD) ISSUED AS 221719/01E/012
03	DMC	04/07/06			ISSUED FOR CLIENT COMMENT (BY MOTT MACDONALD) ISSUED AS 221719/01E/012
01					FIRST ISSUE

LAYOUT DWG N/A

T-LAYOUT NO. N/A

DRAWING NUMBER C295 GA003

COORDS N/A

PURPOSE PRELIMINARY

SCALE 1:1000

ORIGINAL PLOT SIZE A1

PROJECT TITLE
CENTRICA R2
WIND FARM

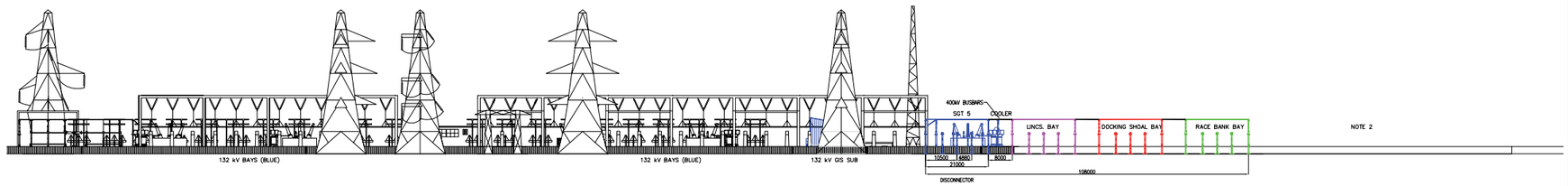
DRAWING TITLE
WALPOLE 400kV SUBSTATION WINDFARM & NG WORKS
SWITCHYARD ELEVATIONS SECTION B-B

NEL POWER

Figure 5.4 | Layout of the substations for Lincs, Docking Shoal and Race Bank in relation to the existing substation at Walpole Marsh - Section B-B

DRAWING NUMBER C295 GA004

DO NOT SCALE



SECTION C–C

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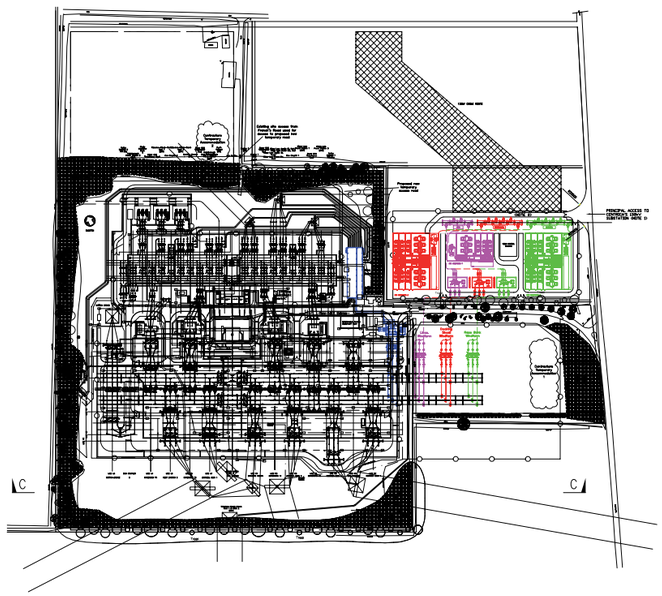

PLAN VIEW (NOT TO SCALE)

centrica energy

CENTRICA DRAWING NUMBER 221719/01E/E013

GENERAL NOTES:

1. THE MAIN ACCESS TO CENTRICA'S 132kV SUBSTATION IS VIA THE NORTH EAST GATE FROM WALPOLE BANK ROAD. THE TWO ACCESSES SHOWN ON THE SOUTH OF THE 132kV SUBSTATION ONTO THE NATIONAL GRID ACCESS ROAD ARE TO BE USED ONLY UPON AGREEMENT WITH NATIONAL GRID.
2. FOR CENTRICA WORKS REFER TO C295 GA003.
3. THE DOCKING SHOAL AND RACE BANK 132kV BUSBARS MAY BE ALTERNATELY DESIGNED UPON THE DETAILED DESIGN OF THE 132kV UNDERGROUND CABLE.

LEGEND:

- LINCS. WINDFARM
- DOCKING SHOAL WINDFARM
- RACE BANK WINDFARM
- NATIONAL GRID WORK

ISSUED FOR PLANNING (INCORPORATING COMMENTS FROM NATIONAL GRID 29/08/06) AND CENTRICA LEGAL REVIEW 01/09/06)				
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ISSUED FOR PLANNING ISSUED AS 221719/01E/013				
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ISSUE	DRAWN	DATE	APPD	DATE	REVISION NOTES
01					FIRST ISSUE

LAYOUT DWG N/A — T-LAYOUT NO. N/A

DRAWING NUMBER C295 GA004

COORDS N/A

PURPOSE PRELIMINARY

SCALE 1:750 — ORIGINAL PLOT SIZE A1

PROJECT TITLE
CENTRICA R2
WIND FARM

DRAWING TITLE
WALPOLE 400kV SUBSTATION WINDFARM & NG WORKS
SWITCHYARD ELEVATIONS SECTION C–C

NEL POWER

Figure 5.5 | Layout of the substations for Lincs, Docking Shoal and Race Bank in relation to the existing substation at Walpole Marsh - Section C-C

5.4.4 The parts of the wind farm projects described in this chapter include:

- The proposed onshore landing points, including the method for crossing the seawall and jointing of the cables from the wind farms to the onshore cables
- Laying the onshore cables – across mostly agricultural land – to the substation, crossing ditches and roads
- Onshore electrical substations for each of the wind farms, into which the cables would be connected
- Associated works by the National Grid at Walpole substation

5.4.5 All of the works described in this chapter lie within the application site boundaries and are within the jurisdiction of local planning authorities. The cable landfall site and approximately 7 km of the cable route lie within the jurisdiction of South Holland District Council. The remainder of the cable route and the substation connection lie within the jurisdiction of King's Lynn and West Norfolk Borough Council.

5.5 Cable Characteristics and Configuration

Sub-sea Cables

5.5.1 Sub-sea cables will be used to connect the offshore wind farms to the onshore section of the cable route at a point immediately onshore of the existing seawall. Please refer to Volume 1 of this Environmental Statement for details of offshore works relating to the Lincs Offshore Wind Farm. Details of the offshore works associated with Docking Shoal and Race Bank Offshore Wind Farms are not yet available but are scheduled to be submitted in 2007.

Onshore Cables

5.5.2 Once the 132 kV sub-sea cables come ashore, they will join onto 132 kV land cables. Each three-core sub-sea cable will connect to an onshore circuit comprising three single-core cables.

5.5.3 The size of the cable and the number of circuits to be installed depends on the cable conductor cross-sectional area selected. At this stage, two 132 kV options are considered:

- 500 mm^2 cross sectional area copper
- 800 mm^2 cross sectional area copper

5.5.4 The decision of which rating to use will be determined by site conditions, including the thermal properties of the substrate within which cables are laid. As with the sub-sea cables, the appropriate rating to use will be determined during detailed preconstruction site investigations.

5.5.5 It is anticipated that Lincs will require two circuits comprising the smaller (500 mm^2) cables. Docking Shoal and Race Bank will each require either:

- four circuits comprising 500 mm^2 cables or,
- three circuits comprising 800 mm^2 cables

5.5.6 The maximum number of circuits would be ten, where all circuits are composed of 500 mm^2 cables.

5.6 Onshore Cable Route

5.6.1 This section describes the onshore cable route from the mean high water spring (MHWS) mark, otherwise taken as the seaward toe of the seawall, to the point at which it joins the onshore substation. It includes the proposals for crossing the seawall. Activities in the inter-tidal and sub-tidal areas are addressed in Volume 1 of the Environmental Statement. The preliminary surveys suggest access to the majority of the cable route can be achieved by using the existing road network.

Cable Landfall and Seawall Crossing Methodology

5.6.2 The seawall will be crossed using horizontal directional drilling (HDD). This method will prevent direct disturbance to salt marsh habitats and eliminate the need for seawall breach. The technique involves drilling in an arc between two points, passing beneath any obstacle. A small pilot hole is created to set the path of the arc, and then a larger backreamer is pulled back through the duct to widen it to the necessary diameter for the cables to pass through. HDD will be used to insert ducts beneath the seawall and salt marsh. Electrical cables will be brought ashore via these ducts.

5.6.3 The number of ducts will depend on the rating of the sub-sea cables used (either 500 mm^2 or 800 mm^2 132 kV copper conductor). The implications of these two options are indicated in Table 5.1.

Table 5.1 | **Number and spacing of ducts passing under the sea defences**

Cable option	Number of cables	Spacing between ducts	Width of ducting corridor
500 mm^2	10	5 m	50 m
800 mm^2	8	5 m	40 m

5.6.4 The ducts associated with all three wind farms will be installed in advance of cable laying. In the first year, the onshore export cables for the Lincs Offshore Wind Farm will also be installed. The remaining ducts will be sealed in anticipation of the installation of the export cables for Docking Shoal and Race Bank in subsequent years. The width of the ducting corridor will depend on the rating of the cables used as indicated in Table 5.1.

5.6.5 Installation of the cable ducts involves the following key tasks:

- Locate directional drilling rig and associated plant on land adjacent to the sea-wall
- Drill outwards under the salt marsh and out into the inter-tidal region for a total distance of approximately 500 m
- Construct temporary offshore scaffolding or work platforms at the duct surfacing positions
- Assemble and weld polyethylene duct sections on land to produce appropriate, manageable lengths up to 500 metres long and float out to the offshore work platforms
- Pull the ducts into the bores from offshore towards the seawall, using the directional drill rig
- Install a suitably rated pulling bond into each duct in order to perform the cable pull-through operation

5.6.6 Figure 5.6 shows a drill rig typical of the size of rig that would be required for the HDD operation under the sea defences and salt marsh. The operational weight of this rig is 63 tonnes. It is transported in modules and assembled on site.

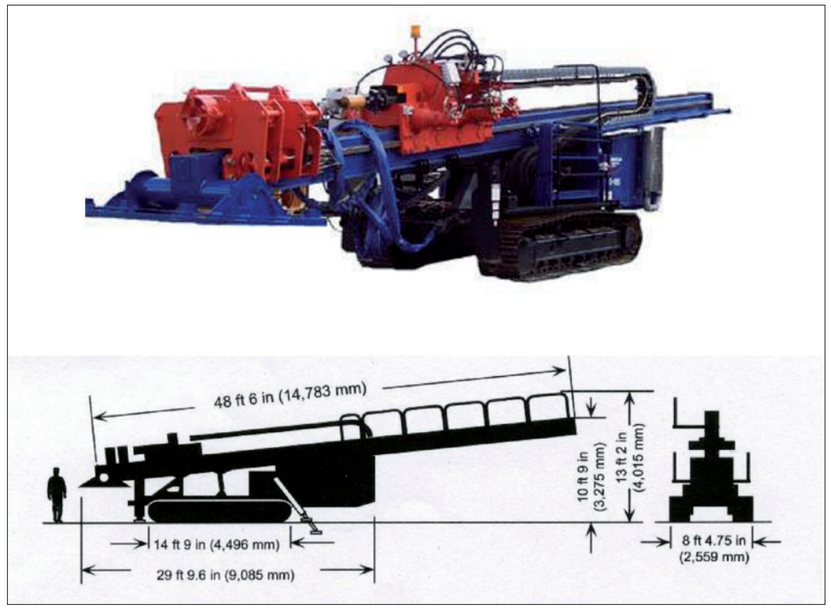


Figure 5.6 | The dimensions and appearance of a horizontal directional drilling (HDD) rig similar to that which would be used to drill under the coastal defences (photograph copyright © LongboreTT Ltd)

5.6.7 The HDD rig, along with its associated support plant, will be sited to the east of the River Nene. Figure 5.7 shows the estimated surface area required to site the HDD plant, and the likely arrangement of the equipment shoreward of the sea defences.

The drilling rig is sited 50–90 m behind the seawall in order to achieve a target bore depth before it passes under the sea defences.

5.6.8 Directional drilling requires the use of a drilling mud such as bentonite, which is a naturally occurring alkaline substance. Bentonite is used as a drilling mud to assist drilling operations. It is pumped to the cutting head and circulated back through the bore, recovered, filtered and reused. The filtered aggregate will be disposed of at a suitable location. During drilling operations, steps would be taken to ensure drilling was halted before breakout of the drill head, in order to allow the bentonite mud to be extracted and properly disposed of. It is possible that installed ducts may be filled with grout once the cable pull-through operation is complete, in order to ensure predicted cable rating.

5.6.9 Figure 5.8 shows a schematic of the installation of ducts under the salt marsh and first part of the inter-tidal region.

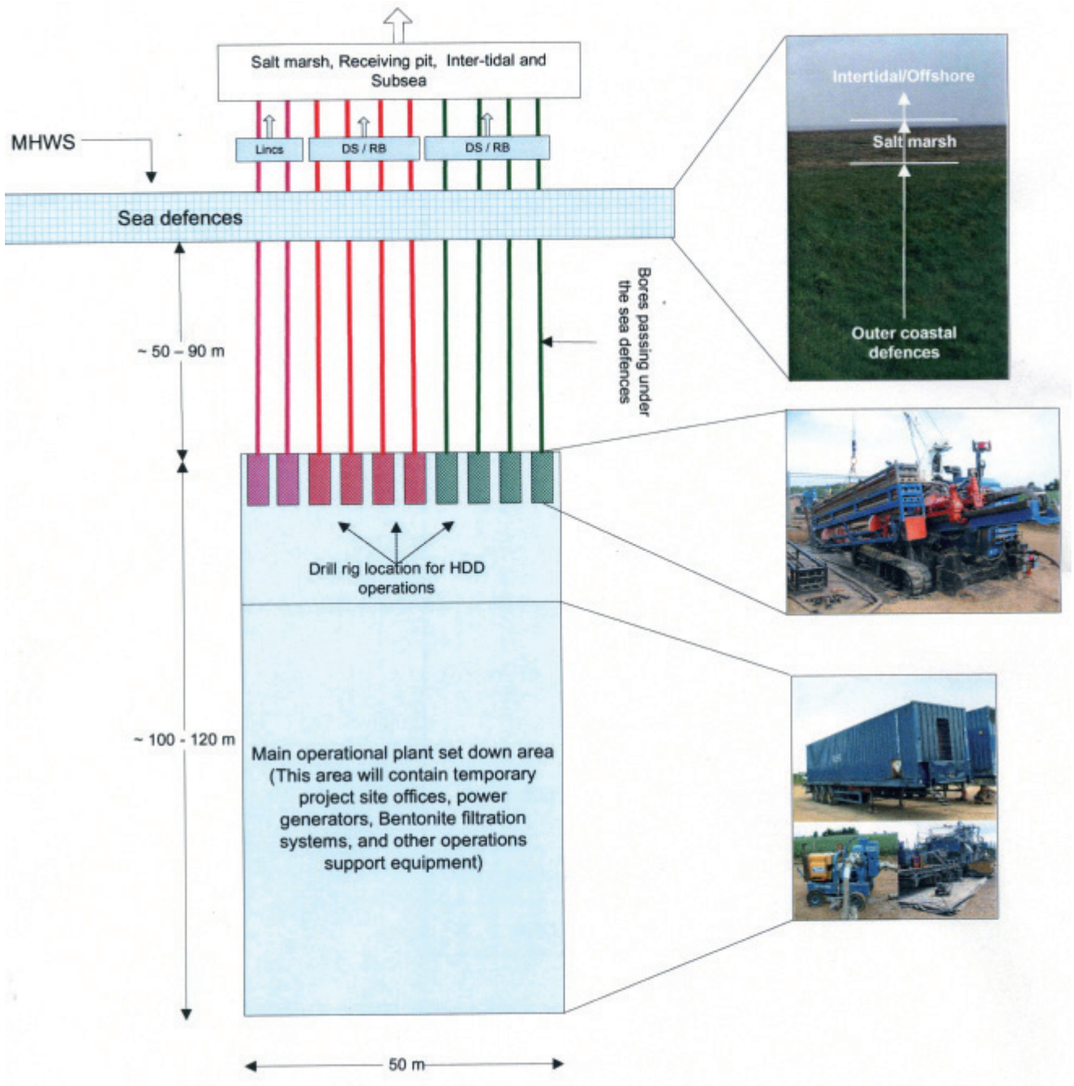
5.6.10 Once ducts are installed the cable installation will take place. Details of the offshore component are included in Volume 1 of the Environmental Statement. In summary it will involve the following tasks:

- Positioning a dumb barge carrying up to 5 km of cable as close as possible to the duct entry site
- Floating the cable from the barge towards the conduit entrance (receiving pit, if required) and then placing it on rollers for the remaining distance if the water depth is insufficient for effective floating
- Pulling the cable into the duct
- Burying the cable from the duct entrance to the barge
- Laying and burying the cable from the barge position to the end of the inter-tidal region

5.6.11 It is possible that the offshore cable could be installed without the requirement for jointing. This will be further examined in the detailed design phase.

Connection Chamber

5.6.12 Connection chambers will be required a short distance behind the sea defences and will house the offshore to onshore cable joint. Connection chambers will be required for all three wind farms. The decision as to whether these will be constructed together in the first year, or during the installation of the cables for each wind farm separately (ie over three separate years), will be made at the detailed design stage. Each chamber will comprise a shallow concrete-lined structure, with access provided by a manhole cover or several pre-cast concrete trenches capped and reinstated. The purpose of the chamber is to provide a housing for the joint between the heavily armoured three-core marine cables and the single-core land-buried cables. It is not anticipated that periodic access to the actual joint between the marine and land cable will be required, as these are generally regarded as maintenance-



centrica energy amec

PROJECT TITLE
CENTRICA ROUND 2
OFFSHORE WIND FARMS

DRAWING TITLE
LINCS, DOCKING SHOAL & RACE BANK
Indicative construction horizontal directional drilling operation underneath the outer coastal defences

LEGEND

- Lincs Cables
- Docking Shoal (DS) / Race Bank (RB) Cables

Date	Paper	By / Ckd	Rev
12/10/06	A3	GE/RS	C

DRAWING NUMBER
6217_6218_970_02

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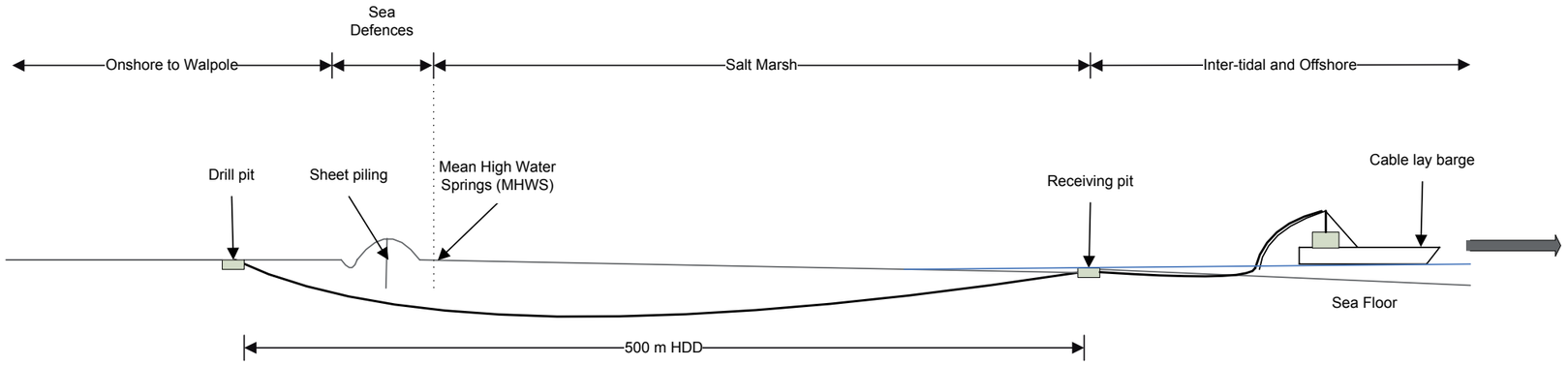
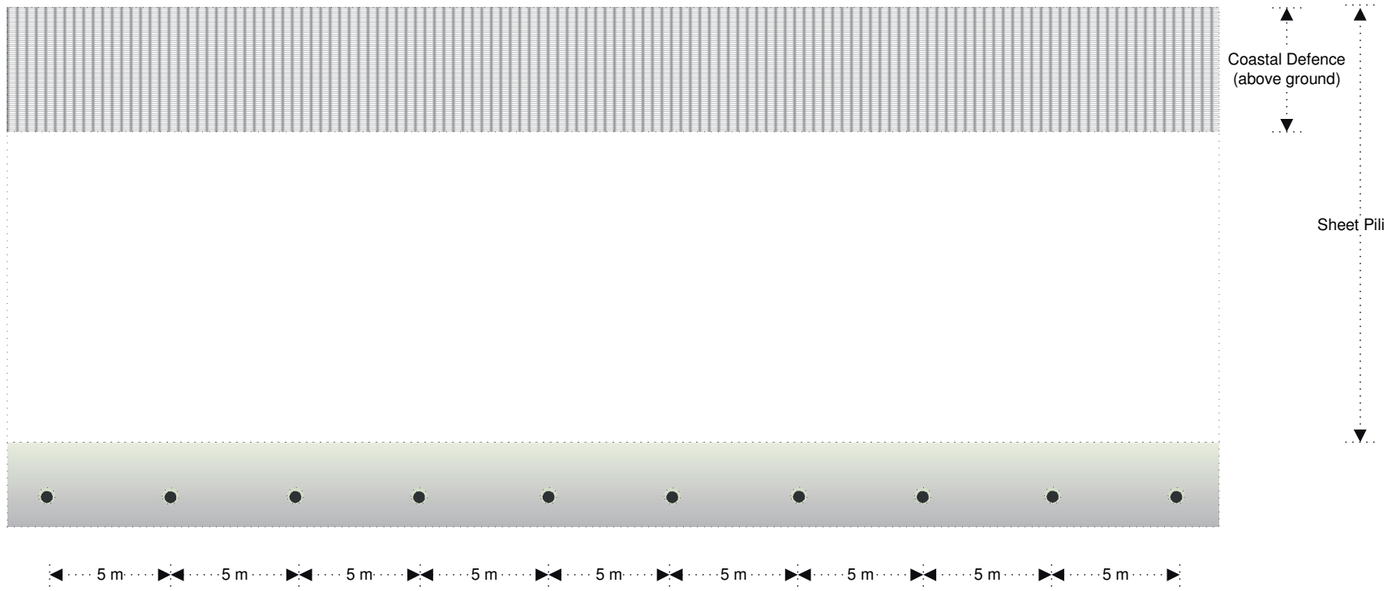
Figure 5.7 | Plan view of the drill site operational area immediately shoreward of the sea defences





centrica energy amec

PROJECT TITLE
CENTRICA ROUND 2
OFFSHORE WIND FARMS

DRAWING TITLE
LINCS, DOCKING SHOAL & RACE BANK
Indicative longitudinal section (top) and cross section (bottom) of directional drilling operations under the coastal defences

LEGEND

Date	Paper	By / Ckd	Rev
27/10/06	A3	GE/RS	F

DRAWING NUMBER

6217_6218_970_05

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Figure 5.8 | Installation of ducts under salt marsh and inter-tidal region

free. The sheath bonding equipment, which may be located above or below ground, as shown in Figure 5.13, must be easily accessible as annual inspections will be required.

Installation of Onshore Cable Circuits

5.6.13 Cables are traditionally laid in open trenches which are excavated by using a standard mechanical excavator or specific trenching machine. Once trench preparation has taken place, the cables are laid and the trench is back-filled with the original material. It is likely that alternative material will be required to surround the cables, as detailed in paragraph 5.6.22, if the original material is not deemed to have suitable thermal dissipaton and physical characteristics.

If mechanical excavators are used, they will be similar to those indicated in Figure 5.9 The vehicle will be tracked to spread its weight as evenly as possible.

Figure 5.9 | Tracked mechanical excavator

5.6.14 A recently developed and possibly alternative methodology for laying the cables is to plough the cables into the ground. This is a simultaneous lay-and-bury operation, during which one circuit (three cables) would be reeled off their respective cable drums and buried into the ground to the required depth in one operation, negating the need to construct an open trench. Additional materials, such as thermally resistive material and warning tape, can also be fed in during this single-pass operation. This methodology has recently been employed to lay cable up to 33 kV during the construction of Onshore wind energy projects. Construction plant required to deal with the larger 132 kV cable is currently under development and the possibility of its utilisation during the construction phase will be further considered during the detailed design phase. In keeping with the Rochdale Envelope approach, the open trenching method for cable installation represents the worst case scenario and is detailed further in the following sections.

5.6.15 This recently developed method is presently only available for laying cable of up to 33 kV, and therefore this method is not included within the assessment. 132 kV cable-laying capabilities are anticipated in the near future and will be considered further once available.

5.6.16 It is anticipated, therefore, that the majority of the remaining onshore cable length will be installed within an open trench. The exception will be where the cable crosses further inland (historical) seawalls, walls, large drains and major roads, where HDD will be employed.

5.6.17 Irrespective of the installation method used, the cable route will be surveyed and suitable measures taken to protect any services and drainage channels that might be affected during cable installation. Where necessary, land drains will be reinstated after cable installation.

5.6.18 Figure 5.10 shows a typical trench containing three cables (one circuit). The wooden shuttering in the trench may be required to prevent the trench walls from collapsing. For wider trenches, battered walls (ie sloping walls) could be considered in order to obviate the need for shuttering.

Figure 5.10 | Typical 132 kV cable trench

5.6.19 The layout of the works corridor for an open trench is illustrated in Figure 5.11.

5.6.20 It is assumed for the purposes of this assessment that a corridor width for installation of up to ten circuits (including working areas) will be no greater than 50 m.

5.6.21 Site clearing and preparation (establishing vehicle access) will be required prior to the commencement of cable laying. Once the cables have been laid, the land will be returned to its previous condition, leaving no lasting impact. Where necessary, reinstatement of internal drainage networks will be necessary for each installation method. Appropriate planning will be required in order to ensure that disturbance to hedgerows and other habitat features is avoided or minimised during critical times, eg nesting.

5.6.22 As part of a detailed route survey, the soil will be analysed for its thermal properties. If it is suitable (ie its thermal resistivity is consistent and in line with the design parameters that have been used to calculate the cable ratings), it can be used to back-fill the trenches after installation. If it is not suitable, it will be disposed of at a suitable facility and replaced with a selected sand that does possess the required thermal properties. The soil would be checked to ensure it is free from sharp stones that could cause cable damage. It is expected that some selected sand will be necessary.

5.6.23 The onshore cable would be laid in sections, with the section length dependent on the feasibility of handling the cable drums and cable route design (an average section length would be approximately 500 m). Laying cables in an open trench involves pulling the cables off their drum via a winch positioned at the end of a section.

5.6.24 For cable laying through farmland, the cable must be laid sufficiently deep to prevent any interference from ploughing. A trench depth of 1,250 mm is the UK standard.

5.6.25 The cables for each circuit will be flat spaced, and the cable sheaths will be cross-bonded (ie interconnected) at each joint position.

5.6.26 Removed soil will be stored at the side of each trench. The approximate volumes of soil to be removed are presented in Table 5.2.

Table 5.2 | **Estimated volume of soil to be excavated**

	Lincs	Docking Shoal	Race Bank
Volume of soil to be excavated over 11 km route	41,250 m^3	68,750 m^3	68,750 m^3

5.6.27 While the cable trenches are open, they will be fenced off for health and safety reasons, and security firms will be employed as required.

5.6.28 After the cables have been pulled into the trenches, the trenches will be back-filled.

5.6.29 The sheath bonding equipment, which may be located above underground or below ground, must be easily accessible, as annual inspections will be required. Depending on the location, joint bonding areas may require a small wooden fence for protection from farm machinery.

Seawalls

5.6.30 Moving southwards there are several seawalls, which were constructed during earlier reclamation works, that need to be negotiated. The cables would be installed either by open trenching or by pulling into ducts, which would be pre-installed under the seawalls using an HDD method similar to that described for the landfall.

Drains

5.6.31 For small land drains, defined as less than 1 m wide and 1 m deep, open trenching is the preferred method. Using sheet piling or sandbags to dam the drain tempo-

Figure 5.11 | Onshore cable spacing parameters

rarily, a water pump can be used to divert flow across the sectioned work area. A trench depth of between 1,000–1,500 mm below the bottom of the drain is necessary to allow for any future maintenance requirements of the drain.

5.6.32 Open-cut trenching on medium and large (greater than 1 m × 1 m) may require different methodologies – see below.

5.6.33 There are two options for crossing medium and large drains (greater than 1 m × 1 m):

- Drain culverts – placing culverts into drains (as indicated in Figure 5.12) will allow cables to be installed without the need to bury them at depth. A portion of the drain will be sectioned using sandbags and a diverting water pump if required. An appropriately sized culvert for the drain and necessary support and reinforcement will be installed into the drain if required. The cables will be laid across the top at a minimum depth of approximately 1,500 mm and the remainder backfilled with suitable material. Attention will, at all times, be paid to the ecological value of the drains before culverts are installed. This configuration is shown in Figure 5.12.
- HDD – ducts will be installed under drains to an agreed depth below the bottom of the ditch (to allow for future ditch maintenance). See methodology for crossing larger drainage ditches and major roads below.

5.6.34 The method to be used at each ditch crossing will be determined at the detailed design stage.

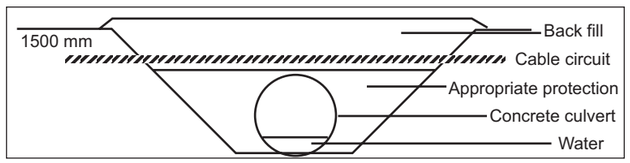


Figure 5.12 | Cross-section of a culverted drain crossing

Roads

5.6.35 Cables passing under roads are not required to be buried to the same depth as those under farmland. A burial depth of 1,100 mm is standard. Due to the high level of surface activity associated with trenching, it is expected that the open trench approach will only be taken with small or lightly used roads, to minimise disturbance.

5.6.36 Drilling under medium to large roads (including the A17) is preferred over trench cable-laying methods, to allow the road to be used as normal by traffic while the work is carried out. A duct would be sunk to an agreed depth below the road, depending on the road construction and location of other services. See methodology for crossing larger drainage ditches and major roads below.

Methodology for Crossing Larger Drainage Ditches and Major Roads

5.6.37 Where it would be impractical to trench through obstacles such as large drains or major roads, it would be necessary to use a trenchless cable-laying technique, such as HDD, using a methodology similar to that described for the landfall.

5.6.38 In order that the target depth under the obstacle be achieved using Horizontal Directional Drilling, the entry and exit pit will be located some distance from either side of the obstacle. The distance at which the pits will be located will be dependent on the target depth at which the conduit must pass under the obstacle.

5.6.39 There are other methods of trenchless cable laying, namely guided augers and micro-tunnelling. These, however, require drilling and reception pits to be sunk either side of the obstacle, and then a duct is drilled between the two. Although there is no need for a separation distance between the drilling site and obstacle boundary, these methods take longer to complete because of the need to excavate and shore up the drill and reception pits.

Onshore Cable Jointing

5.6.40 At the cable section joints, it is possible that the trench would have to be widened to allow more room for the cable joint. The joint bays for all ten circuits can be accommodated within the 50 m corridor by ensuring that the joints are staggered.

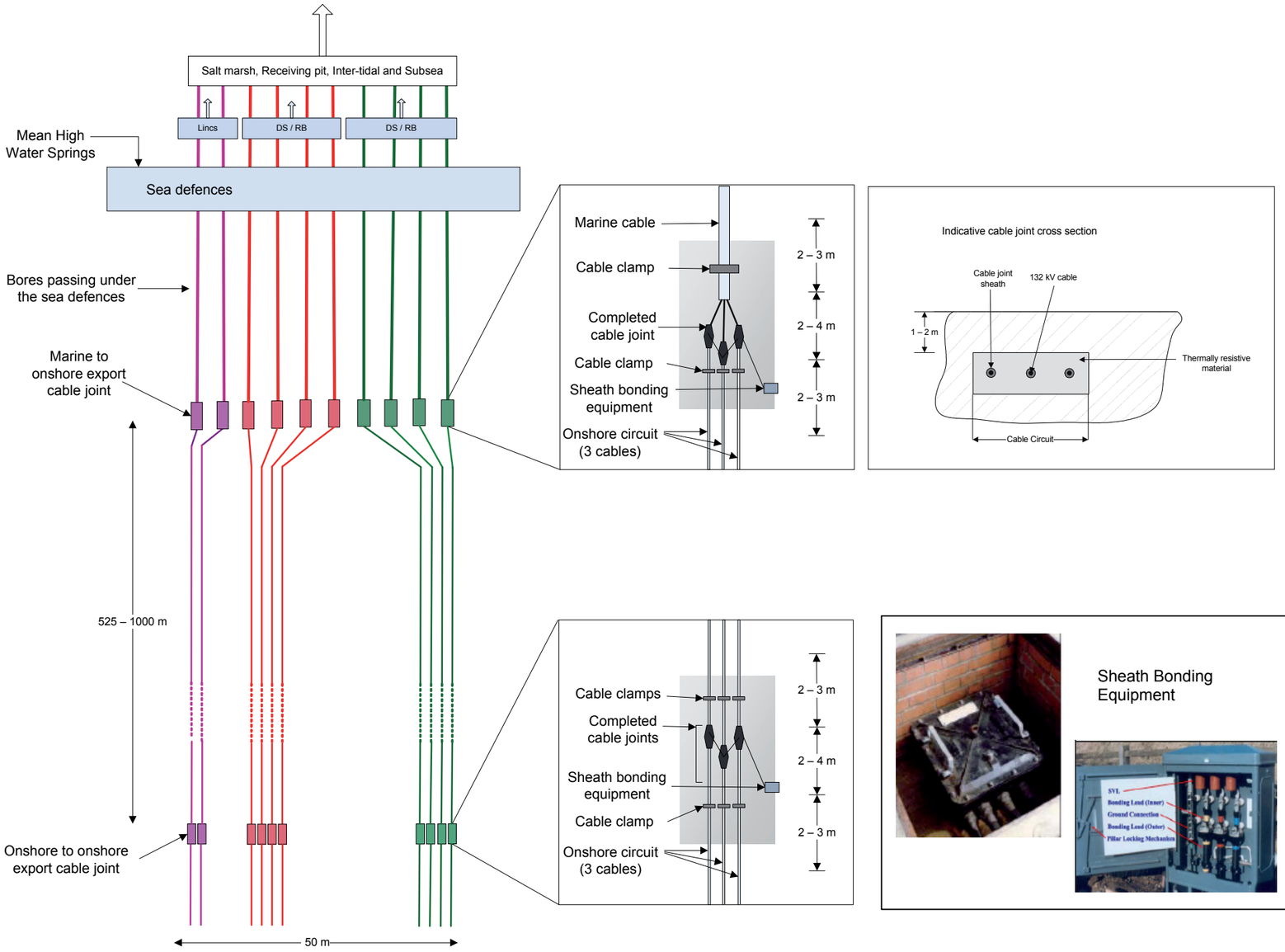
5.6.41 Depending on the stability of the ground at the bottom of the trench, it may be necessary to line the trench with a geotextile such as ‘Terram’. This material geotextile serves to increase the load-bearing capacity of the ground, increasing the stability of the cable jointing box. It can comprise a plastic grid system or a woven glass fibre mat. The need for and specification of such reinforcements will be determined during the detailed design phase.

5.6.42 On completion of cable jointing, the joint bays would be back-filled with either the original soil, selected sand or, if necessary for thermal reasons, a sand and cement mix. For three cables, a typical joint bay would be 2.5 m wide × 7 m long.

5.6.43 At each joint bay, specialist cable sheath bonding equipment would be necessary. This could be housed in a pit below ground level or in a kiosk above ground, as shown in Figure 5.13.

5.6.44 The excavation that would be necessary to house the underground sheath bonding equipment would be approximately 1.5 m square with a depth of 1 m. An above-ground kiosk is approximately 1.2 m high × 1.5 m wide × 0.4 m deep.

5.6.45 One set of bonding equipment is necessary for every circuit. The equipment must be located within 10 m of each joint location. The equipment requires annual maintenance inspection, so it must be accessible.



PROJECT TITLE

CENTRICA ROUND 2
OFFSHORE WIND FARMS

DRAWING TITLE

LINCS, DOCKING SHOAL & RACE BANK
Indicative jointing area parameters for marine to onshore and onshore to onshore circuits.

LEGEND

- Lincs Circuits
- Docking Shoal (DS) / Race Bank (RB) Circuits

Note: this diagram illustrates the use of 132kv 500 mm^2 (conductor cross-sectional area) cables. With 500 mm^2 cable, four circuits each would be needed for Docking Shoal and Race Bank. Alternatively, three circuits using 800 mm^2 cables may be used. The diagram illustrates cabling using 500 mm^2 cable and this represents the worst case scenario in terms of the number of cables.

Cable section lengths will be variable and will range from 500 m to 1000 m along the onshore cable route. Exact cable lengths will be determined during detailed design to ensure optimum cable usage and the siting of cable ioints.

Date	Paper	By / Ckd	Rev
17/10/06	A3	GE / RS	G

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Figure 5.13 | Details of cable jointing

5.6.46 The number of jointing bays required depends on the lengths of the cables used, and this is yet to be decided. Where possible, jointing bays would be located adjacent to field boundaries or roads.

5.6.47 If the sheath bonding equipment is housed in an underground pit, a small area surrounding the pit may be fenced off in order to protect it from agricultural activities.

Transport

5.6.48 The cable drums will be transported via a low-loader articulated truck. Assuming that cables are supplied in 525 m lengths, the number of cables that are required, the combined drum and low loader weights are shown in Table 5.3. A typical low-loader is 18 m long and 2.5 m wide. The typical weight of a low-loader without a payload is 28 tonnes and the ground clearance is about 550 mm. A detailed transportation and access plan will be produced in order to keep local disturbance to a minimum.

Table 5.3 | **Typical cable parameters**

	Lincs	Docking Shoal	Race Bank
Number of cable drums	126	252	252
Weight of each 525 m drum of cable	14 tonne	14 tonne	14 tonne
Weight of low-loader with 525 m drum of cable	42 tonne	42 tonne	42 tonne

Temporary Cable Route Construction Areas

5.6.49 Temporary construction laydown/compound areas will be established at suitable locations along the length of the proposed cable route and substations, as indicated in Figure 5.14.

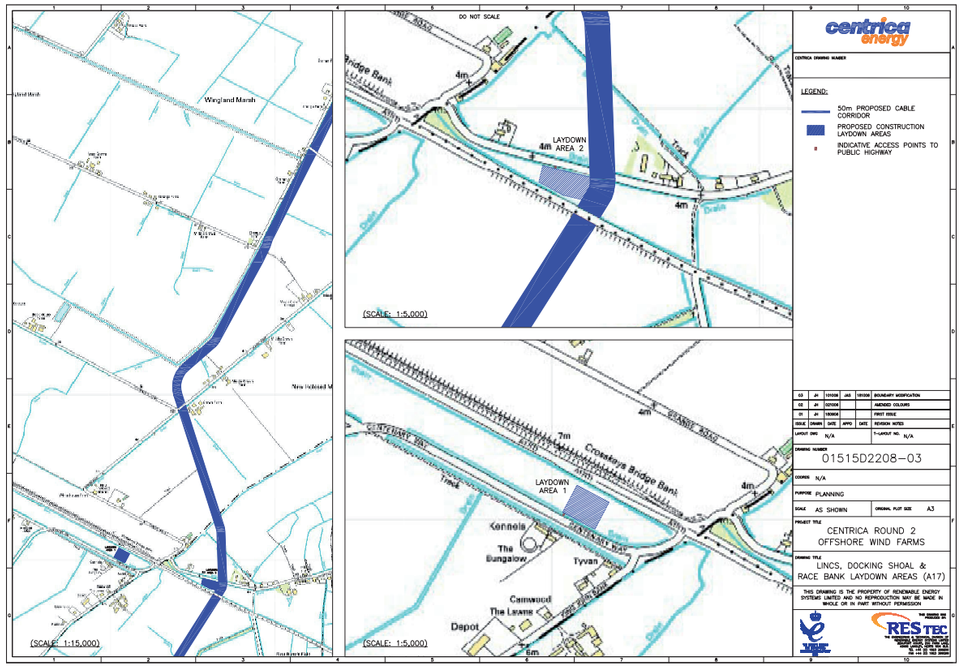


Figure 5.14 | Details of construction laydown areas adjacent to the A17

5.6.50 Cables will be delivered to site as required. Cranes will offload the cables from low-loaders onto specially prepared hard-standings. Hard-standings will be capable of supporting at least three cable drums, one low-loader and a mobile crane. The standing would have a footprint of some 10 m × 30 m and be capable of supporting around 175 tonnes.

5.6.51 During the construction period, temporary construction tracks will be installed across farmland. These construction tracks will be installed within the 50 m cable corridor boundary where possible, negating the requirement for further land take.

5.7 Onshore Substation

5.7.1 The Lincs, Docking Shoal, and Race Bank wind farms will connect to the UK electricity supply network through an extension to the existing National Grid (NG) substation at Walpole.

5.7.2 The equipment installed at the substation will be of a similar type as the existing equipment, with a view to minimising the environmental impact of the development.

5.7.3 The extension of the existing 400 kV bus-bars and for the new 132 kV switchgear at Walpole, required to complete the interface connection between the cabling to

shore and the grid connection point, has been developed using AIS (air insulated switchgear) (see Figure 5.2).

5.7.4 The substation layout was developed using AIS in a single bus-bar arrangement. The AIS equipment used (ABB PASS switchgear) results in a smaller footprint than a conventional AIS arrangement.

Layout of Substations for Lincs, Docking Shoal and Race Bank Offshore Wind Farms

5.7.5 In order to connect the three wind farms, Centrica proposes to construct three new 132 kV/400 kV substations at Walpole. To accommodate this connection, National Grid will construct an extension to the 400 kV bus-bars at the eastern side of the existing substation. This bus-bar extension also includes works associated with National Grid's 132 kV asset replacement scheme (details of National Grid's proposed works are included in Appendix A2.14).

New 132/400 kV Substations for Lincs, Docking Shoal and Race Bank Offshore Wind Farms

5.7.6 The new substations for Lincs, Docking Shoal and Race Bank would together occupy an area of approximately 200 m × 95 m, including access tracks, control building and landscaping areas. The proposed substations will enable connection of the eight to ten circuits associated with the Lincs, Docking Shoal, and Race Bank offshore wind farms to the existing Walpole substation.

5.7.7 The new 132/400 kV substation would occupy approximately 2 ha of land to the east of the existing substation and would comprise connections to the offshore wind farm circuits. The circuits associated with each of the three wind farms would be connected via bus-bars and switchgear to individual 132 kV to 400 kV step-up transformers. In addition to the bus-bars, switchgear and transformer, each circuit would include ancillary equipment such as coolers, protection, controls and Static Var Compensation (SVC) equipment, required to enable the wind farms to satisfy the requirements of the Grid Code (National Grid Electricity Transmission Ltd (2006). The Grid Code, Issue 3, Revision 17, September 2006)

5.7.8 Although the execution strategy for the works is to be finalised, the current accepted connection offers with National Grid provide for connections to the wind farms to be made in 2008 for Lincs, 2009 for Docking Shoal and 2010 for Race Bank, subject to review. It is envisaged, however, that National Grid will install all four bays of the 400 kV bus-bar extension as part of the works for the Lincs connection, in order to avoid multiple 400 kV power outages / system shutdowns. Similarly, Centrica may install the foundation works and common drainage for all three wind farms during the execution of the Lincs project in order to save multiple construction mobilisation costs and local disturbance. The electrical plant, however, such as the bus-bars, transformers and SVCs, would be installed to meet the individual connection dates with National Grid.

5.7.9 The maximum height of equipment installed in the new substations will be approximately 12 m.

5.7.10 The land surrounding the Centrica substation (included within the planning application boundary) would be used for tree and shrub planting and nature conservation purposes. It is anticipated that the extension will be constructed at approximately existing ground levels and that no significantly large export or import of fill materials will be required. The topsoil would be stripped and used within the proposed landscaped area.

5.7.11 To provide access to the site, a new access point would be established, opening on to Walpole Bank road. Use of the existing access point was discussed with NG but refused. Within the substation application area, perimeter roads would be established to provide access to major components.

5.7.12 The areas within the Centrica substation not covered by hard-standing would be surfaced with free-draining stone chippings and would be passively drained to adjacent ditches. Impermeable hard-surfaced areas, including access roads, would drain through oil interceptors before passing into existing drainage ditches to the north and west of the site. Each of the three transformers, and any other oil-filled equipment, would include full self-containment through a system of bunding to prevent accidental spillages causing damage to groundwater or adjacent watercourses. The Environment Agency has previously indicated that nearby watercourses are of low sensitivity. It is proposed, however, that drainage measures would be discussed and agreed with the Environment Agency and Internal Drainage Board (IDB) in advance of construction and any necessary discharge consents obtained.

5.7.13 Floodlights may be installed in the Centrica substation area to facilitate work if required during the hours of darkness and for added security. It is not intended that the substation be permanently lit.

5.7.14 The transformers for each wind farm will be enclosed within concrete blast walls of between 5–7 m height for safety and noise insulation purposes. Further noise attenuation would be provided as necessary around noise-producing equipment, to meet the consented noise levels measured at the agreed receptor points.

5.7.15 For security reasons, the site would be bounded by a 2.4 m high palisade fence.

National Grid 400 kV Substation Extension

5.7.16 The connection of Lincs, Docking Shoal and Race Bank wind farms to the national high voltage electricity transmission system requires an extension to National Grid's existing 400 kV substation at Walpole Marsh. These works, which are on existing operational land, are considered to be permitted development (under Schedule 2, Part 17, Class G(a) of the Town and Country (General Permitted Development Order) 1995), and would be undertaken by National Grid.

5.7.17 The Walpole extension will also provide a 400 kV bay for the connection of an additional 132/400 kV supergrid transformer (SGT5), which is being installed as part of works National Grid is also undertaking to replace the existing 132 kV substation. The works associated with the replacement of the existing 132 kV substation are unrelated to the connection of the wind farms. Details of all the works that National Grid will be undertaking at Walpole Marsh substation are summarised in Table 5.4 and are described in detail in Appendix A2.14. Although some of the works being undertaken by National Gird are unrelated to the connection of the wind farms, they are relevant for considerations of potential cumulative impacts.

Table 5.4 | **Key elements of the works proposed by National Grid at Walpole Marsh substation**

Work item	Planning or consent requirement	Responsibility for consent	Required for connection to wind farms?
Three-bay extension to existing 400 kV substation	Permitted development under Schedule 2, Part 17, Class G(a) of the Town and Country Planning (General Permitted Development) Order 1995	National Grid	Yes, required to connect three wind farms
Replacement of existing National Grid 132 kV substation and addition of Supergrid Transformer 5 to existing 400 kV substation	Permitted development under Schedule 2, Part 17, Class G(a) of the Town and Country Planning (General Permitted Development) Order 1995	National Grid	No, required to be replaced for reasons of safety and reliability. SGT 5 required to facilitate replacement of existing National Grid 132 kV substation
Further extension to south to accommodate access road, extended fence line and landscaping	Requires planning permission under the Town and Country Planning Act 1990	National Grid	No, but would facilitate maintenance and provide for screening through tree planting

5.7.18 In order to connect the wind farms, National Grid is required to extend the 400 kV bus-bars from their current alignment. The bus-bars (which carry the electricity circuits overhead) will be supported on the ground by insulated columns. Their maximum height would be 12 metres, which is significantly lower than the equipment within the existing 400 kV substation, which is up to 22 metres in height (excluding towers).

5.7.19 All structures would be constructed in galvanised lattice steelwork, either unfinished or painted in a dark grey colour. The bus-bars would be mounted on an area surfaced in stone chippings; the supergrid transformer would be mounted on an area of impermeable hard surfacing. An access road would be constructed within the fence line. It is anticipated that the extension would be constructed at approximately existing ground levels, and only limited quantities of fill material would be required to be imported to make up a level platform for the siting of the equipment. The topsoil would be stripped, stored and if appropriate, used within the proposed landscaped area.

5.7.20 The proposed bus-bars would be connected to the proposed Lincs, Docking Shoal and Race Bank substations by underground cables.

5.7.21 The works undertaken by National Grid to connect the wind farms will require the extension of the existing substation to the southeast to create an extension area of 160 by 100 metres. The existing belt of trees along Walpole Bank road would not fall within the substation extension area and will be retained. The land required for this part of the extension is operational land owned by National Grid. This extension would be sufficient to accommodate all the equipment required to connect the wind farms, and would satisfy the connection agreements that are in place with Centrica (Lincs) Ltd, Centrica (DSW) Ltd and Centrica (RBW) Ltd.

5.7.22 National Grid has guidelines to assist in the siting and design of substations to mitigate their environmental effects. These guidelines have been taken into account in the design of the proposed substation extension.

Civil Engineering arrangements for Wind Farm Substations

5.7.23 The civil requirements associated with the onshore substation will reflect standard utility practices and methods. Civil designs will take into account both the static and active loads associated with the equipment. Site conditions are not presently known and, therefore, the extent of piling requirements for the site cannot be quantified.

5.7.24 The 132/400 kV transformer foundations and oil containment arrangements will represent the major civil installations for the substation development. The design will have to allow for the provision of blast walls for oil containment in the event of a transformer rupture.

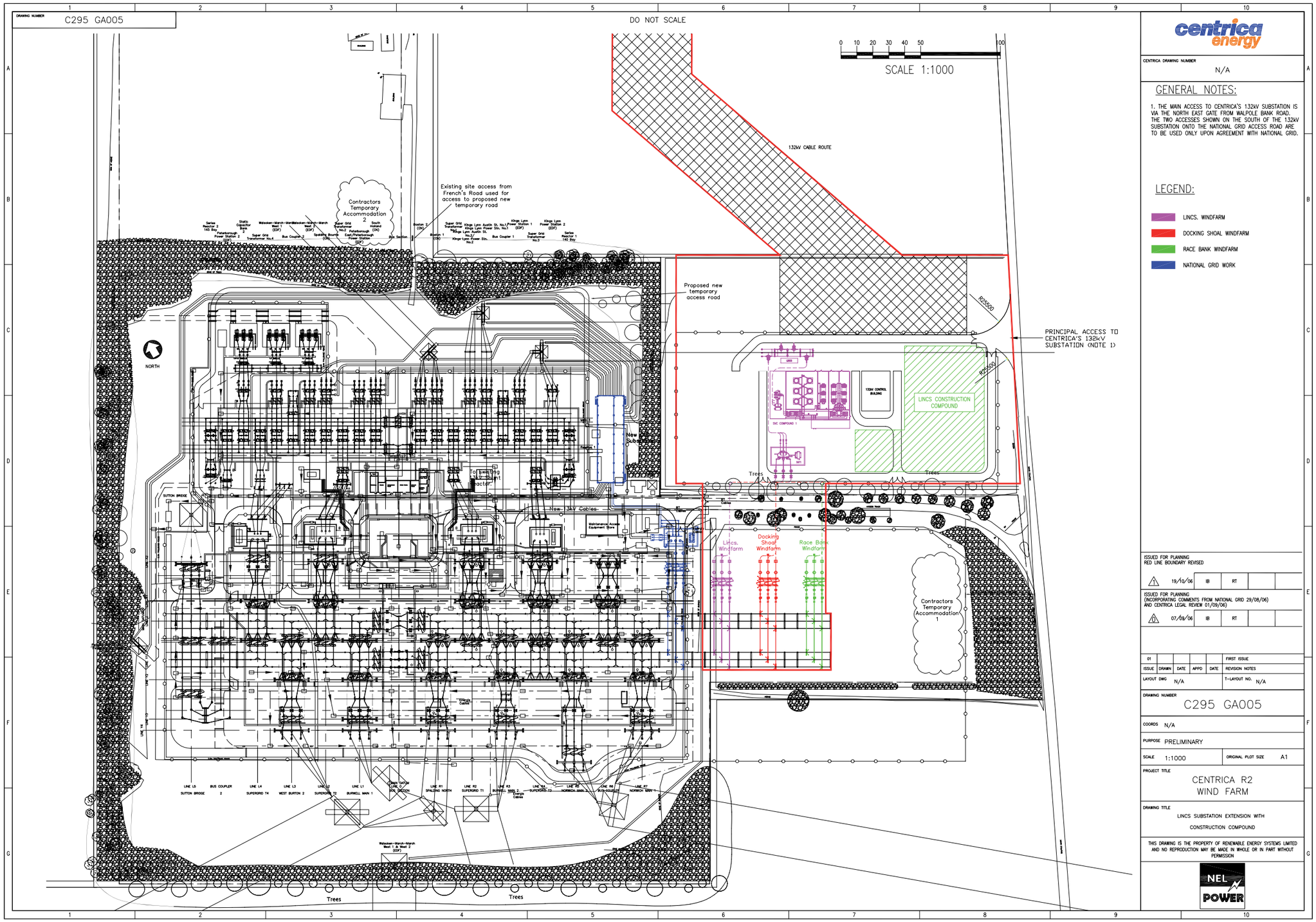


Figure 5.15 | Location of Lincs construction compound

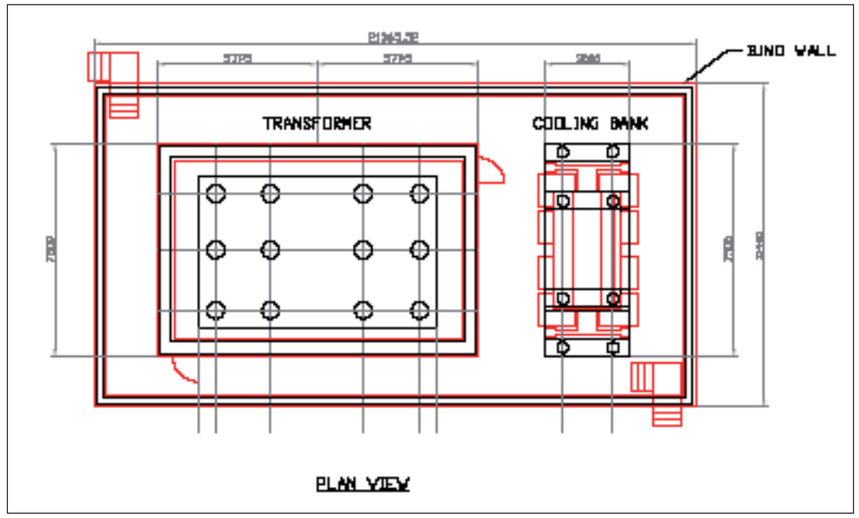


Figure 5.16 | Transformer base arrangement

Construction of Wind Farm Substations

5.7.25 The substation equipment for Lincs, Docking Shoal and Race Bank wind farms will be constructed adjacent to one another as indicated in Figure 5.2. The substation for Lincs will be constructed first, followed by Docking Shoal and Race Bank in subsequent years. Site preparation works for all three sites will be undertaken prior to the construction of the Lincs substation. This will involve the construction of site access, ground works and security fencing. It should be noted that the bus-bar arrangement for Docking Shoal and Race Bank may be alternated, dependent on the detailed design of the 132 kV underground cable.

Temporary Construction Facilities

5.7.26 During the construction of the Lincs substation, a construction compound will be established immediately to the east in approximately the location of the proposed Race Bank substation (Figure 5.15). An indicative layout for this construction compound is illustrated in Figure 5.17.

5.7.27 In subsequent years, when the Docking Shoal and Race Bank substations are constructed, the temporary construction area will be relocated on land to the northeast of the construction area as shown in Figure 5.19 to allow site access. A typical arrangement for this construction compound is indicated in Figure 5.18.

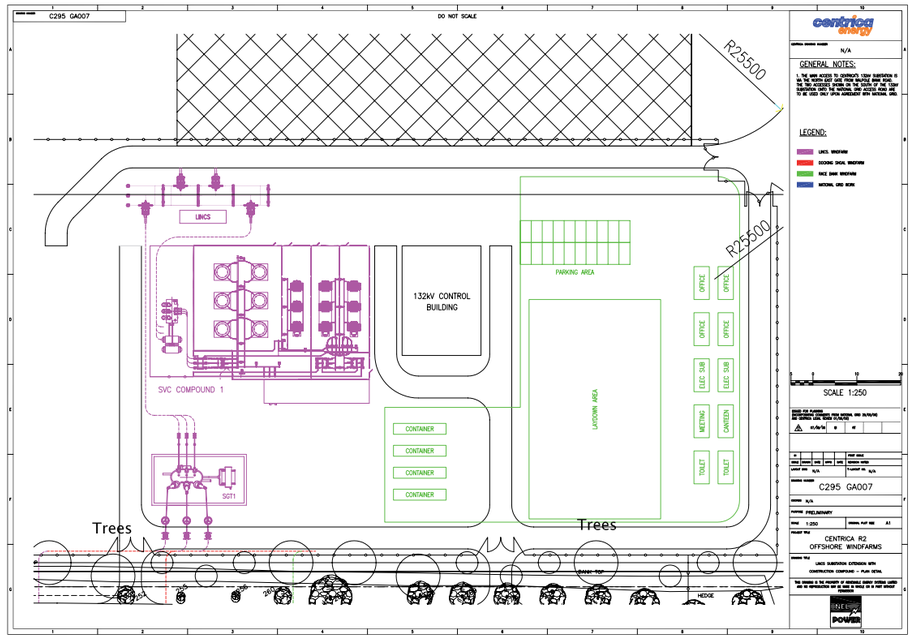


Figure 5.17 | Details of Lincs construction compound

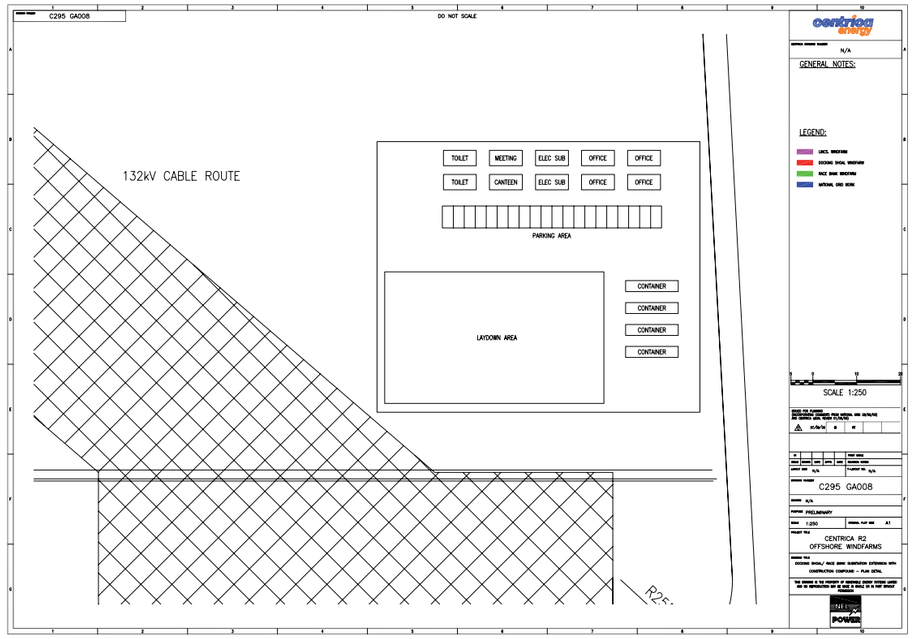


Figure 5.18 | Details of Docking Shoal and Race Bank construction compound

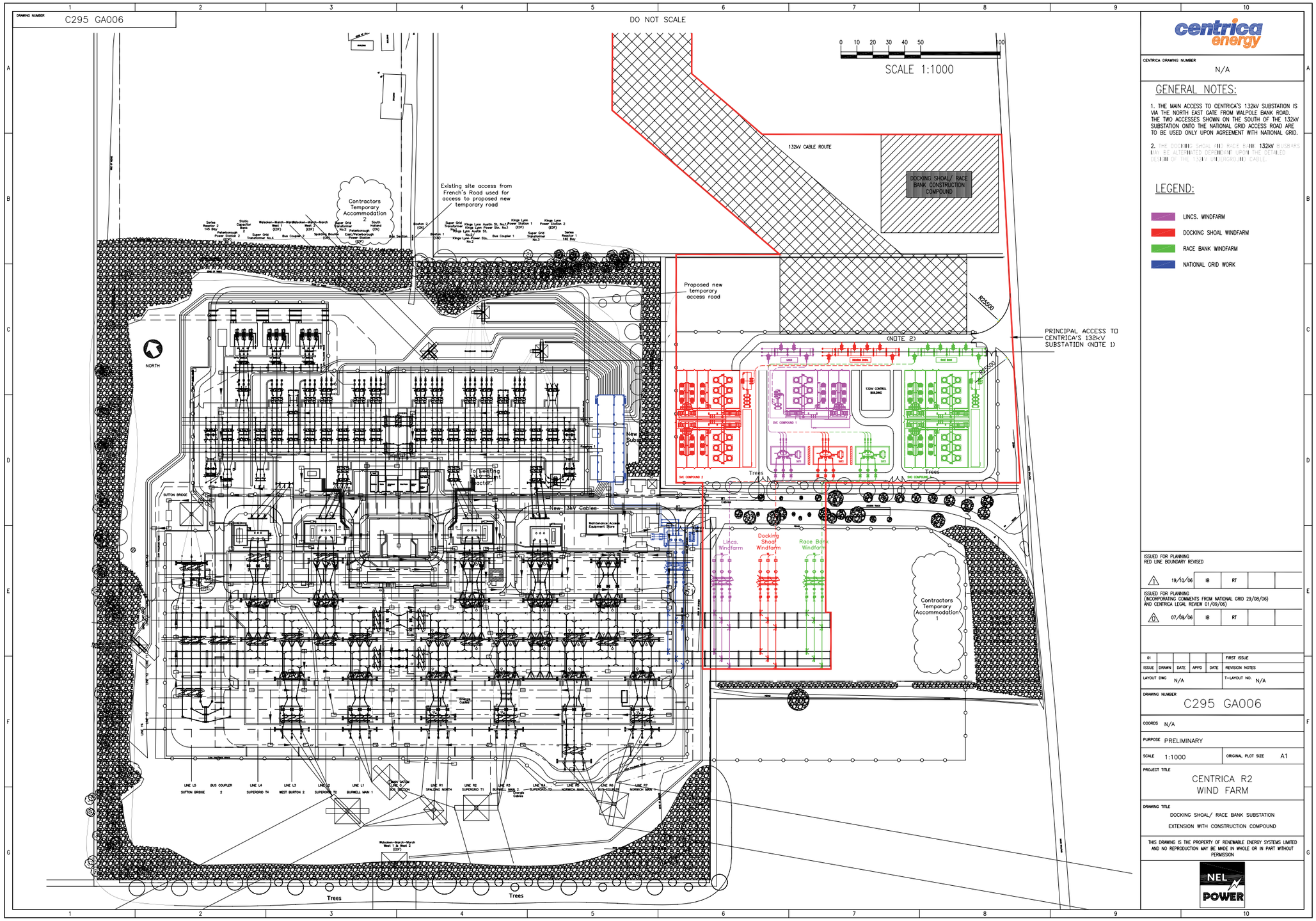


Figure 5.19 | Location of Docking Shoal and Race Bank construction compound

5.7.28 Temporary construction compounds will be used for plant and equipment storage and a centre for operations management. The construction programme will require the establishment of site access tracks or haul roads (requiring the input of suitable materials). Land used for this will be reinstated at the end of the construction period.

Installation Access

5.7.29 The major items of plant requiring consideration in terms of access are the 400/132 kV transformers, which are estimated to weigh about 150 tonnes for Lincs and up to 275 tonnes each for Docking Shoal and Race Bank. The transportation of these units requires specialist transportation equipment, clearly defined access routes and facilities for offloading and installation of the units. Further details on access arrangements are addressed in Section 6.7 Transport and Traffic.

Environmental Considerations

Transformer Oil

5.7.30 Mineral oil is used for insulation and cooling purposes in transformers. In the event of a failure or rupture, the leaked oil could cause considerable environmental damage. Standard practice for containment of oil within substations will be adhered to in the development of the site for the new 400/132 kV transformers. The basic transformer design arrangement will reflect standard practice for transformer oil containment.

Noise Levels from Onshore Substation

Transformer

5.7.31 Each of the transformers for the wind farms will comply with International Electrotechnical Commission (IEC) publication 60076-10 on noise levels as presented in Table 5.5. The potential noise effects of transformers required for the three wind farms are considered alone and, where relevant, cumulatively in Section 6.5.

Table 5.5 | **Maximum sound power levels for transformers**

Equivalent double-wound rated power (MVA)	Maximum sound power level of main unit dB(A)	Maximum sound power level of cooler dB(A)
100–199	90	84
200–350	91	87

Electric and magnetic fields

5.7.32 All mains-powered electrical equipment produces electric and magnetic fields (EMF). The magnitude of EMF depends on the operating voltage of the equipment. Both electric and magnetic fields diminish rapidly with distance. It is relatively easy to shield electric fields, whereas magnetic fields are not normally affected by most common materials.

5.7.33 Underground cables generate no electric fields that are detectable at the surface, and the magnetic fields they generate are significantly weaker, at distances greater than a few metres from the cable, than those generated by overhead lines.

5.7.34 The electric and magnetic fields generated by substations are complex, but are also typically less than those generated by overhead lines, and they decrease with distance at a faster rate. National Grid has assessed the effects of its proposed substation works and has concluded that they will not significantly change existing fields in publicly accessible areas. Likewise, the proposed wind farm substations are not expected to significantly increase fields within neighbouring properties.

5.8 Timing and Duration of Cable-Laying and Construction Activities

5.8.1 It is assumed, for the purpose of this assessment, that construction activities will involve separate mobilisation for Lincs, Docking Shoal and Race Bank projects, and that the works for the three wind farms will be completed over three consecutive years. Certain works, including the insertion of ducts for all three projects beneath the seawall and salt marsh habitats, and the installation of the Lincs Offshore Wind Farm onshore cable and substation works, will be completed within the first year. The installation of the cables and substations for Docking Shoal and Race Bank Offshore Wind Farms is expected to take place in years 2 and 3.

Cable Landfall and Seawall Crossing

5.8.2 The duration of activities associated with HDD operations are summarised in Table 5.6. These estimates take account only for the time which HDD plant is on site and exclude time required for site preparation (if required) and subsequent reinstatement (if required).

Table 5.6 | **Typical installation times for horizontal direction drilling operations**

Operation	Duration
Rig up (initial rig establishment and erection)	2 days
Relocation for each further installation on site	1 day
Drilling activity	100 m/day
Conduit pull or push through	1 day
Rig down (for entire plant)	2 days

5.8.3 Based on durations shown in Table 5.6, it is assumed that each conduit will require a total of 7 days, and that eight conduits can be installed in 60 days and ten conduits in 74 days, including two days rig up and two days rig down time.

Construction programme

Lincs

5.8.4 The installation of onshore cables for the Lincs Offshore Wind Farm will take approximately 6–9 months, based on typical cable installation times presented in Table 5.7. Alterations in the cable-laying method and the length of the cable sections have the potential to decrease this timescale.

Table 5.7 | **Typical installation times. It should be noted that times vary with section length. Typical times for a section of double circuit (ie two groups of three cables) are presented here.**

Operation	Duration
Trench excavation and close timbering	2–3 weeks
Cable pulling	1–1½ weeks
Cable jointing and bonding connections (per bay)	3–4 weeks
Backfilling and reinstatement	In parallel with jointing

5.8.5 The construction programme for Lincs is shown in Figure 5.20.

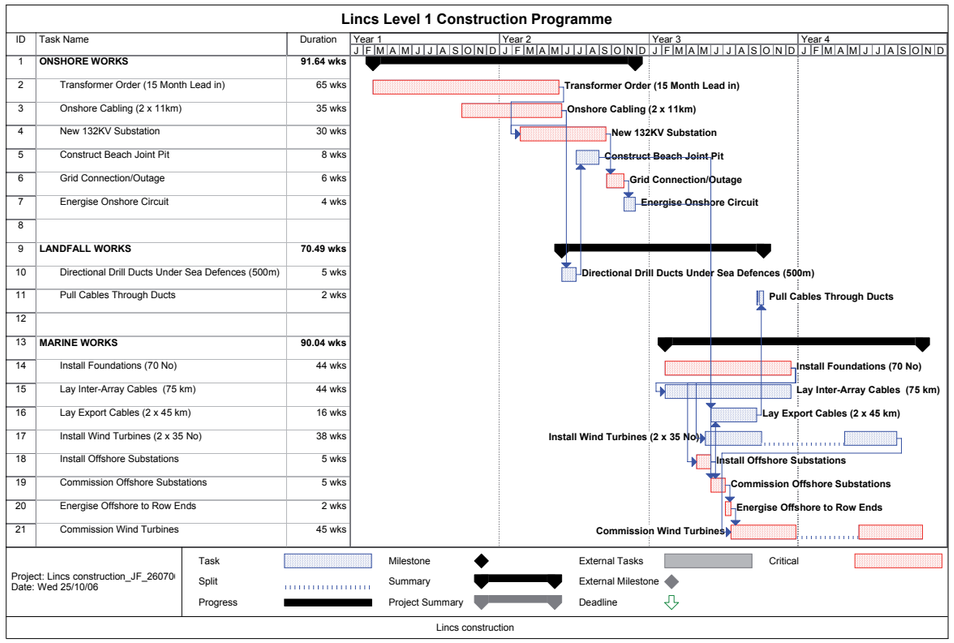


Figure 5.20 | Lincs Onshore Works construction programme

Docking Shoal and Race Bank

5.8.6 It is anticipated that the subsequent installation of cables for the Docking Shoal and Race Bank offshore wind farms will be of similar duration.

5.8.7 The construction programme for Docking Shoal and Race Bank are shown in Figure 5.21.

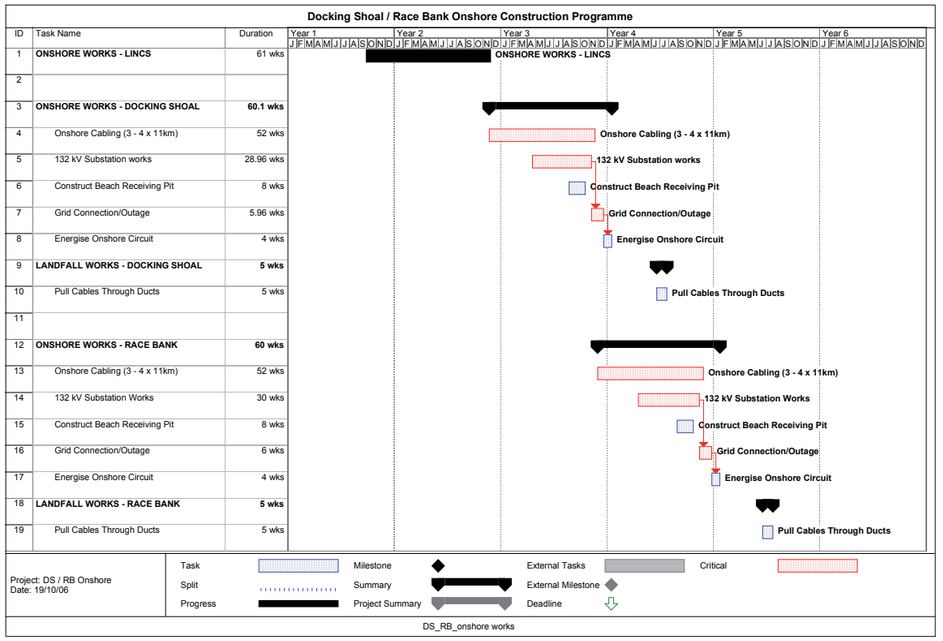


Figure 5.21 | Docking Shoal and Race Bank Onshore Works construction programme

5.9 Decommissioning

Project Lifetime

5.9.1 The offshore components of the Lincs projects are planned to last for 40 years (the term of the Crown Estate lease). The Crown Estate leases for Docking Shoal and Race Bank are for 50 years. Re-powering may be required during this period after approximately 20 years, the design life of the wind turbines, and will be subject to further environmental studies.

Onshore Substation

5.9.2 The onshore substation may continue to be used as a substation site after the original offshore wind farm has been decommissioned. It is possible that the substation could be upgraded for use by future developments.

5.9.3 In the event of decommissioning of the onshore works, the effects of decommissioning would be generally similar to those of construction.

Onshore Cable Removal

5.9.4 Onshore cables will be left buried in situ, unless lifted to be replaced by new cable to be run along the same route as part of future developments or wind farm re-powering.

References

National Grid Electricity Transmission Ltd (2006), *The Grid Code*, Issue 3, Revision 17, September 2006.

Onshore

Chapter 6 | Description of the Environment

6 Description of the Environment

6.1 Introduction

6.1.1 This chapter of the Environmental Statement presents the baseline conditions of the physical, biological and human environment. The chapters within it deal with the following aspects in turn:

- cultural heritage
- landscape and visual assessment
- socioeconomics and tourism
- noise
- ecology and nature conservation
- transport and traffic

- flood risk and coastal defences
- hydrology, hydrogeology, geology and soils

6.1.2 Each chapter contains an introduction, a description of relevant planning policy and guidance, an outline of consultations undertaken, and a description of relevant baseline conditions.

6.1.3 The impacts of the proposed development are addressed in Chapter 7.

6.2 Cultural Heritage

Introduction

6.2.1 This chapter describes the known and potential historic environment of the area potentially affected by the construction, operation and decommissioning of the onshore components of Lincs, Docking Shoal and Race Bank offshore wind farms. The historic environment comprises buried and upstanding archaeological remains, the buildings and structures that make up the 'built heritage', and the wider-ranging concept of the 'historic landscape'. The elements of the proposed onshore works that may have a potential effect on the existing historic environment and their potential impacts are addressed in Chapter 7.2. That chapter contains an assessment of the significance of potential impacts arising from the construction, operation and decommissioning of onshore cables and substations and identifies appropriate mitigation.

Approach to the Assessment

6.2.2 The principal aim of this chapter is to identify historic environment resources that may be affected, either directly or indirectly, during construction and operation of the proposed development.

6.2.3 The resources under consideration include internationally designated sites such as World Heritage Sites, nationally designated sites such as Scheduled Ancient Monuments (SAMs), Listed Buildings (LBs), Registered Parks and Gardens of Special Historic Interest (RPaGs), and Registered Battlefields (RBs). Regionally and locally designated sites would include Conservation Areas, Areas of Archaeological Importance (or similar) and locally listed buildings, as set out in District-Wide Local Plans.

6.2.4 Figure 6.1 shows the location of the identified resources. Within the text, and on the figures and tables in this chapter, a unique RPS prefixed reference number is provided for each identified site or feature. A gazetteer of identified resources is presented as Appendix A2.19, 'Gazetter of Identified Sites and Features'.

Sources of Information

Legislation, Guidance and Policies

6.2.5 The assessment has been prepared taking into account the following legislation and guidance:

- Legislation:
  - Ancient Monuments and Archaeological Areas Act 1979
  - National Heritage Act 1983
  - Town and Country Planning Act 1990
  - Planning (Listed Buildings and Conservation Areas) Act 1990
  - Hedgerow Regulations 1997
  - Protection of Military Remains Act 1986
- Guidance:
  - Planning Policy Guidance Note 15 (PPG15): Planning and the Historic Environment (DoE 1994)
  - Planning Policy Guidance Note 16 (PPG16): Archaeology and Planning (DoE 1990b)

6.2.6 The following standards and guidance were also considered:

- *Standards and Guidance for Archaeological Desk-Based Assessments*, Institute of Field Archaeologists (Revised Edition 1999)
- *Environmental Impact Assessment: A Guide to Procedures*, DETR (2000)

6.2.7 Statutory protection for archaeological remains is principally enshrined in the Ancient Monuments and Archaeological Areas Act 1979, as amended by the National Heritage Acts (1983 and subsequent). Nationally important sites are listed in a Schedule of Monuments and are accorded statutory protection. Details of scheduling are held on the list maintained by the Department for Culture, Media and Sport (DCMS). Works affecting a Scheduled Monument require Scheduled Monument Consent. The law provides for some activities to be subject to class consents, but these are principally agricultural in nature. Historic Parks and Gardens, and Historic Battlefields, have received recognition under the National Heritage Act. Such sites are described on a register maintained by English Heritage for DCMS, but such designation does not afford statutory protection.

6.2.8 For other components of the historic environment, the Planning (Listed Buildings and Conservation Areas) Act 1990 provides statutory protection for Listed Buildings and Conservation Areas, and for the setting of Listed Buildings.

6.2.9 The Hedgerow Regulations 1997 include guidelines that aim to protect hedgerows that have been assessed as 'important' in terms of criteria that include historical elements. Developments that would require the removal of any part of an 'important' hedgerow require a consent from the Local Planning Authority.

6.2.10 PPG16 (1990) provides advice concerning the safeguarding of archaeological remains within the planning process. It recognises that archaeological remains are an irreplaceable and finite resource that should be preserved, along with their settings. In situations where remains are threatened by development and where preservation *in situ* is not justified, the developer should make provision for appropriate investigation and recording of the remains.

6.2.11 PPG15 (1994) provides advice on dealing with Conservation Areas, Listed Buildings, World Heritage Sites, Historic Parks and Gardens, Historic Battlefields and the wider historic landscape within the planning process.

Local and Regional Policy

6.2.12 Objectives of local and regional planning policies relating to cultural heritage are detailed in Table 2.5 in Chapter 2 of this ES. Key policies include:

- RSS8 East Midlands:
  - Policy 27
  - Policy 31
- RPG6 East Anglia:
  - Policy 40
- Lincolnshire Structure Plan:
  - Policy BE3
  - Policy BE4
- Norfolk Structure Plan:
  - Policy ENV13
- King's Lynn and West Norfolk Local Plan:
  - Policy 4/9
  - Policy 4/10
  - Policy 4/19
- South Holland District Local Plan:
  - Policy EN4
  - Policy EN12

Consultation

6.2.13 Initial consultation was sought by inviting comment from Statutory and Non-Statutory consultants on a Scoping Report issued in January 2006. This document

detailed the scope of works to be undertaken and final content of the assessment presented here.

6.2.14 English Heritage in a letter of 31 January 2006 expressed a general level of satisfaction with the scope of the assessment that was proposed. They highlighted the need to consult with local conservation offices as part of the consideration of effects on the settings of listed buildings or locally designated historic buildings. English Heritage also highlighted the need for consideration of how best to identify possible archaeological assets within the cable route, drawing attention to the potential impacts on archaeological remains that may exist at depth within the cable corridor.

6.2.15 The principal archaeologist at Lincolnshire County Council responded in an email dated 16 February 2006. She stated that there was little current evidence for the presence of underlying archaeological remains within the study area due to the depth of overlying silts, and identified that little purposive archaeological work has been undertaken here. She also suggested that some form of archaeological evaluation would be required if foundations and cabling runs required deep excavation.

6.2.16 The planning advisory archaeologist at Norfolk Landscape Archaeology responded in a letter of 9 January 2006. He expressed approval with the proposed extent of data-gathering across the area of the scheme proposal.

Baseline Studies

6.2.17 The collection of baseline data was undertaken in accordance with current guidance for desk-based archaeological assessments. All relevant primary and secondary documents, maps and aerial photographs have been examined in order to collate data regarding the known and potential historic environment. This process included consultations of the National Monuments Record, the Lincolnshire Historic Environment Record and Norfolk Environment Record, Lincolnshire County Record Office and Local Studies Library and the Archive Centre in Norwich. Use was also made of the websites of the British Geological Survey, Countryside Agency and selected UK and Ireland Genealogy sites.

6.2.18 The study area regarding direct impacts comprised a 500 m wide strip centred on the cable route. However, data requests regarding Scheduled Monuments and Listed Buildings were extended to a wider 4–5 km zone in order to fully assess indirect impacts on the settings of these features.

6.2.19 A site walkover was undertaken by a qualified archaeologist. The purpose of this visit was to establish whether topographic or other evidence survived to indicate the presence of previously unrecorded archaeological sites, and also to assess potential effects on the setting of historic environment features. The character of the wider historic landscape was also taken into consideration in order to assess as fully as possible the potential impacts upon the character of this landscape.

6.2.20 A geophysical survey of the Walpole substation area has been undertaken to identify the extent of probable salterns. The details of this survey are included at Appendix A2.20.

Assessment of Importance

6.2.21 In assessing the effects of the proposed development on the historic environment resource base, it is necessary to consider the importance of the individual elements of that resource base as well as the magnitude of impact. This is in line with the publication *Environmental Impact Assessment: A Guide to Procedures* (DETR 2000). Professional judgement and a degree of flexibility are relevant to the assessment process. There are occasions when information is insufficient for the formulation of well-informed judgements and an assessment of risk is all that can be offered.

6.2.22 Annex 4 of PPG16 sets out the Secretary of State's non-statutory criteria for scheduling ancient monuments, and these can be used as a basis for the assessment of the importance of historic remains and archaeological sites. They include period, rarity, documentation, group value, survival and condition, fragility and vulnerability, diversity, and potential.

6.2.23 The categories of local and regional importance are less clearly established than those of national importance, and implicitly relate to local and regional priorities which themselves will vary within and between regions. Local and regional research agendas may be available, and local or structure plans may offer assistance.

6.2.24 The criteria set out in Annex 4 of PPG16 can be used as a guide for judgements of importance augmented with an additional category of 'International', as listed below:

- *International*: World Heritage Sites
- *National*: high-status sites including Scheduled Monuments, Listed Buildings (Grade I and II*), well-preserved historic landscapes, registered Historic Battlefields, and registered Historic Parks and Gardens (Grade I and II*)
- *Regional*: the bulk of archaeological sites with reasonable evidence of occupation, ritual, industry etc., Conservation Areas, Listed Buildings (Grade II), reasonably preserved historic landscapes, and registered Historic Parks and Gardens (Grade II)
- *Local*: sites with some evidence of human activity, but in a fragmentary or poor state, buildings of local importance, and dispersed elements of historic landscapes
- *Unimportant*: destroyed sites, random stray finds, and buildings of no architectural merit
- *Uncertain*: insufficient evidence to judge importance
  (English Heritage indicate that listed buildings are graded to show their relative importance:
  - Grade I buildings are these of exceptional interest
  - Grade II* buildings are particularly important buildings of more than special interest
  - Grade II are of special interest, warranting every effort to preserve them.)

Baseline Description

Topography and Geology

6.2.25 The site is within an area of low-lying agricultural land at approximately 4–8 m above Ordnance Datum (aOD). The cable route connects to the offshore cable 250 m to the east of the Nene Outfall and lies entirely within land reclaimed since the Roman period (*c.* AD 45–410).

6.2.26 The geology of the region is a combination of post-glacial alluvium and freshwater clays, and post-Roman marine clays (see Section 6.9 for detailed discussion of the drift geology). However, there has been considerable sediment accretion in the region, particularly within the Wash area, which has produced a complex stratigraphic sequence that may involve alluvial deposits overlying soil horizons.

6.2.27 In general, the landscape within the study area consists of low-lying arable land of the Lincolnshire and Norfolk Fens, characterised by large and medium-sized rectangular fields bounded by ditches and drains.

Palaeoenvironmental Background

6.2.28 The site is situated wholly within reclaimed land which once formed part of the Wash, a tidal estuary which in medieval times extended south, funnelling into a point now 20 km inland from the present coastline.

6.2.29 The palaeoenvironmental potential of the former Wash estuary is limited, and differs from that of the Fens which surrounds it, which has been well documented through the extensive Fenland Survey (1982–89). One of the transects studied as part of the Fenland Survey was just to the east of the study area, along the A17 corridor between Walpole Cross Keys and Tilney All Saints. Unfortunately this transect is outside the area of documented post-Roman reclamation and cannot therefore be directly correlated with the land within the study area. However, it demonstrated the presence at Walpole Cross Keys of a 7–8 m thick layer of silts and phragmites at a level approximately 9 m below ground level (*c.* –5 m aOD) overlain by a sequence of sands, silts and disturbed ground. To the east this phragmites layer became thinner and was recorded at levels closer to the surface. No obvious peat deposits were recorded, and no former land surfaces were identified.

6.2.30 Within the study area a series of six boreholes was sunk in 1971 along the line of the 1951 bank drain. These identified surface deposits of clay merging into sand and sandy silt. However, one borehole also recorded some ‘soft black organic silty clay’ between 1.32 m and 2.29 m below ground level.

6.2.31 Two boreholes were sunk in 1973: at Gibbon’s Farm, north of Walpole Marsh, and approximately 2.3 km west of the proposed cable route. These identified soft, dark grey, sandy silt at between 1.3 m and 2.7 m below ground level, sealed by soft, light brown sandy silt between 0.3 m and 1.3 m below ground level.

6.2.32 The results of available geotechnical investigations suggest a broad sequence consisting primarily of silts, some with phragmites inclusions. This is typical of an area that was formerly part of a tidal estuary. No true peats have been identified within the study area, and no former land surfaces could be identified; the peatland of the area is situated to the south and west of the study area.

Historic Environment Resource Base

6.2.33 A gazetteer of identified sites and features is provided as appendix A2.19, and locations are shown on Figure 6.1.

Designated Sites and Features

6.2.34 There are no Scheduled Ancient Monuments within the site or the extended study area. No part of the site or the extended study area falls within a World Heritage Site, Conservation Area, Registered Park or Garden of Special Historic Interest, or Registered Battlefield.

6.2.35 There are two Listed Buildings within 500 m of the site: the East and West Bank Lighthouses (sites 1 and 2 respectively) are both Grade II*. There are a further 15 Listed Buildings within 2 km of the site: St Andrew’s Church in Walpole St Andrew (site 3) and St Peter’s Church in Walpole St Peter (site 31) are both Grade I; the Old Manor in Walpole St Andrew (site 5) is Grade II*; all of the remaining structures are Grade II and include the Princess Victoria Public House in Walpole St Andrew (site 4), Greens Cottage on Folgate Lane (site 6), and Nene Lodge (site 7) and Curlew Lodge (site 8) on the eastern and western sides respectively of the Nene Outfall.

6.2.36 The Cross Keys Bridge over the Nene Outfall at Sutton Bridge, approximately 3 km west of the site, is Grade II* listed (site 9). There is a group of Listed Buildings at Sutton Bridge, including the Grade II* listed Hydraulic Engine House (site 10) and a Grade II listed K6 telephone kiosk on the eastern side of the Nene Outfall (site 11). Several other Grade II Listed Buildings are present within the village of Sutton Bridge.

Archaeology and Historic Development

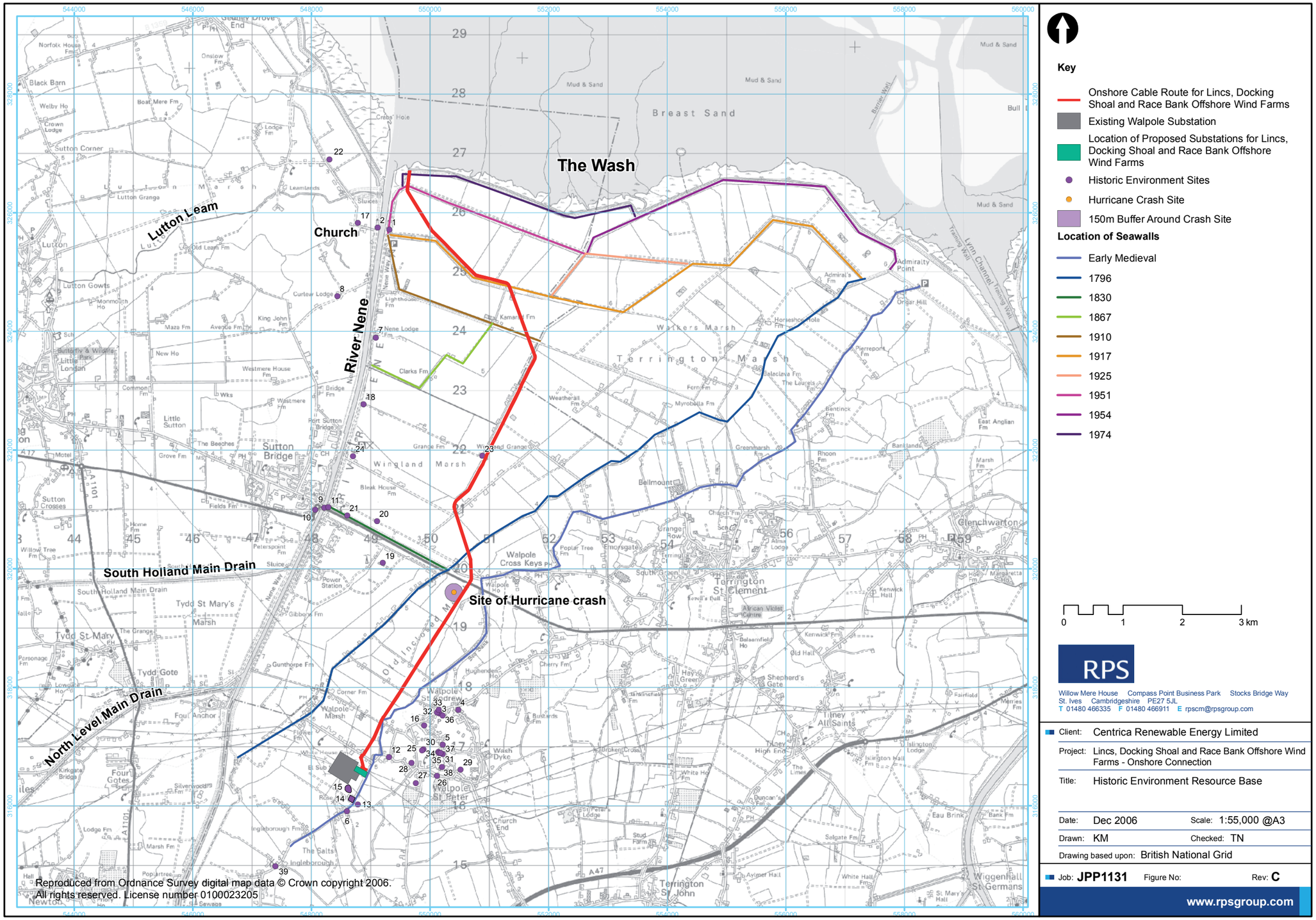
6.2.37 There has been no previous purposive archaeological work undertaken within the study area.

Prehistoric Activity

6.2.38 There is no direct evidence for prehistoric activity within the study area. No records held in either Lincolnshire or Norfolk Historic Environment Records relate to prehistoric activity in the study area.

Roman and Early Medieval Activity

6.2.39 There is limited direct evidence for Roman-period activity (*c.* AD 43–410) within the study area. Antiquarians have referred to the earliest (easternmost) sea bank as ‘Roman’, and it is noted on modern Ordnance Survey maps as ‘New Roman Bank’. However, this term was not used earlier than the seventeenth century; there is no evidence of its Roman origin and it most likely dates from the eighth or ninth



Key

- Onshore Cable Route for Lincs, Docking Shoal and Race Bank Offshore Wind Farms
- Existing Walpole Substation
- Location of Proposed Substations for Lincs, Docking Shoal and Race Bank Offshore Wind Farms
- Historic Environment Sites
- Hurricane Crash Site
- 150m Buffer Around Crash Site

Location of Seawalls

- Early Medieval
- 1796
- 1830
- 1867
- 1910
- 1917
- 1925
- 1951
- 1954
- 1974

0 1 2 3 km

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Project: Lincs, Docking Shoal and Race Bank Offshore Wind Farms - Onshore Connection

Title: Historic Environment Resource Base

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Drawn: KM Checked: TN

Drawing based upon: British National Grid

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Figure: 6.1 | The historic environment resource base

century AD (Hall and Coles 1994). This Middle Saxon date is derived from pottery finds at Tilney, disturbed during the construction of the bank, and the presence of occupation debris of Mid-Saxon date (*c.* AD 651–850) which runs up to the sea bank and may continue beneath it (Silvester 1988). The substation is located within land that lies to the west of this early sea bank at Walpole and it is likely that this area was part of the Wash estuary in Roman times.

6.2.40 On the west bank of the Wash a second embankment is shown on the 1843 Sutton Tithe map marked as 'Roman Sea Wall', and the former coastline can be traced along the line of this former sea bank running from Lutton in the north to Tydd St Mary. The place name Tydd (tide) at Tydd St Mary, Tydd Gote and Tydd St Giles, strongly indicates the line of the tidal Wash in former times (Summers 1976).

6.2.41 An extensive programme of fieldwalking has been undertaken in and around Walpole St Peter, all of which has been on land to the east of (i.e. behind) the 'Roman' sea wall. The results indicate the presence of settlement activity from the Roman period onwards, but with increasing density from the Mid-Saxon period. Roman material was limited to small scatters of pot sherds. A whole Roman greyware vessel has been recovered from within the alluvial silts at Oak Tree Farm, not far from the substation site (site 12), but this seemed to have been repaired with a shellac-based substance indicating a modern attempt at conservation and thus suggesting that the vessel had been re-deposited.

6.2.42 The fieldwalking programme recovered pottery of Early, Mid- and Late Saxon date (*c.* AD 851–1065) from a number of locations in and around Walpole. One location to the southeast of the substation (site 13) was subject to limited excavation, revealing the presence of a number of ditches and pits of Mid-Saxon date along with a considerable quantity of artefacts. Some of the pits were filled with animal bones.

6.2.43 Settlement during the early medieval period (and also subsequently) appears to have been concentrated along roddens. These are former river channels that became silted up during episodes of marine transgression and were subsequently abandoned as the rivers created new courses. When sea levels fell or when the land was deliberately drained, the land adjacent to the silt-filled channels contracted more than the silts, leaving behind the roddens as raised meandering lines in an otherwise flat landscape. These raised areas acted as linear nodes for settlement activity.

6.2.44 Salterns are another type of archaeological site that may be contemporary with the Mid- to Late Saxon settlement in the area. It is thought that the majority of these features date from the tenth to fifteenth centuries, after which the salt industry in this area declined. Salterns are mounds of waste material resulting from a process known as sand-washing. Brine-impregnated sand and silt was gathered at the high-tide line and then washed through a filter of peat or turf. Once the water had the correct salinity it was taken to a salt-house and boiled in lead or earthen vessels. The brine eventually evaporated, leaving only the salt and the remaining sandy material which was thrown onto a waste heap. These large mounds of waste can be up to 5 m in height and over 200 m in length. Salterns often lie directly adjacent to the coastline, and as this changed due to sea bank construction and land reclamation, the older salterns went out of use and new ones were established closer to the new coastal strip.

6.2.45 Two possible salterns represented by extensive mounds or raised areas of land are located close to the substation (sites 14 and 15), and there is potentially another example just to the northeast of site 15 (and due east of the substation). These sites lie on the seaward side of the 'Roman' sea bank.

Medieval and Post-Medieval Activity

6.2.46 There is no direct evidence for any medieval activity within the site or its immediate environs. Fieldwalking in the fields east of the sea bank at Walpole, however, has produced a quantity of medieval pottery associated with the settlement of Walpole. This is referred to in the Domesday Book and the place name is derived from the 'wall' (the 'Roman' sea bank) and a pool. The entry mentions: 'John, nephew of Waleran, held in Walpola half a carucate of land, which was possessed by a freeman in the Confessor's time' (Parkin 1808).

6.2.47 St Andrew's Church (site 3), from which Walpole St Andrew derives its present name, was originally built in the fifteenth century, with a bequest of 1443 for building the nave and another in 1463 for a porch (Pevsner and Wilson 1994). St Peter's Church in Walpole St Peter also originated in the fifteenth century, and has been described as 'one of the handsomest parish churches in England' (White 1883).

6.2.48 A gold coin of Edward III, minted in London in the period 1361–69, has been found at Walpole St Andrew (site 16).

6.2.49 During the medieval period the land in the vicinity of the site would have been marginal and was used as inter-common land by the surrounding townships, including Walpole, Terrington and Tilney. The medieval settlement of Walpole is unlikely to have extended west beyond the 'Roman' sea bank.

6.2.50 The area within which the site is located has been progressively reclaimed since the seventeenth and eighteenth centuries, and previously formed part of the Cross Keys Wash. This name applies to the marine environment present beyond the 'Roman' sea bank.

6.2.51 In a map of Sir Cornelius Vermuyden's 'Great Level' of 1642, the area was part of the Nene estuary, an area of sand and marsh (Harris 1953). In 1788 2,500 acres of Long Sutton Common were enclosed by an Act of Parliament, and in 1796 the South Holland Main Drain was constructed.

The Eighteenth Century to Today

6.2.52 An Act of Parliament in 1796 led to the enclosure of a further strip of land west of the 'Roman' sea bank (Figure 6.1). This land is still shown on the modern Ordnance Survey maps as 'Old Inclosed Marsh' in the vicinity of the substation, and the 1796 bank is referred to as the King John Bank. Further to the northeast it is shown as the Old Common Bank, as it enclosed parts of the inter-common land.

6.2.53 In 1830 the Nene Outfall cut was constructed (Wills 1984); this straightened the river and stopped its course from shifting. Prior to the 1830 works, attempts to control the outflow within the Wash estuary had failed to resist the channelling effect of the Wash and tidal surges (Hall and Coles 1994). A pair of lighthouses was built on the edge of the new cut near the outfall; these had become disused by the 1880s and have since been converted to houses; one was occupied by the naturalist Sir Peter Scott in the 1930s. Both are Grade II* Listed Buildings (sites 1 and 2).

6.2.54 As part of these works the Sutton Wash embankment was built, extending for 1.5 miles in length across the estuary from Sutton Bridge to Walpole Cross Keys, and now carrying the modern A17(T) road (Hall and Coles 1994; Allen 1834). Previously the embankment and bridge also carried a railway linking Sutton Bridge to King's Lynn. The current hydraulic swing bridge over the Nene Outfall (Cross Keys Bridge, built 1897) is a Grade II* Listed Building (site 9), as is the adjacent hydraulic engine house (site 10).

6.2.55 A plan of 1836 shows the South Holland Main Drain and the North Level Main Drain. The area south of the 1830 Sutton Wash embankment is shown as enclosed and owned by the Crown, Guy's Hospital, the Commissioners of the Nene Outfall and the Lords and Commoners of Walpole.

6.2.56 The land to the north of the Sutton Wash embankment was enclosed and brought into cultivation on a gradual basis by the construction of a series of embankments including ones constructed in 1867, 1910, 1917, 1925, 1951, 1954 and 1974 (Figure 6.1).

6.2.57 The Ordnance Survey first edition map of 1890 shows St Philip's Church close to Guy's Head (site 17). This church is not recorded on the Sutton Tithe Map of 1843 and no trace of the structure exists today. The place name 'Guy's Head' alludes to the ownership of the land by Guy's Hospital in London in the mid-to-late nineteenth century. Similarly, the Wisbech Port Sanitary Authority Hospital is shown on the OS first edition map at Hospital Road (site 18), but little evidence of the building has survived.

6.2.58 Second-World-War remains within the study area include three pillboxes close to the modern A17(T) (sites 19–21), one to the north of Guy's Head (site 22) and another at the junction of Hospital Road and Cocklehole Road (site 23). One of the pillboxes (site 19) lies within the former RAF Sutton Bridge airfield. This was opened in 1926 as a gunnery training camp, and closed in 1958, although it had been inactive since 1946 (Osborne 1977). The airfield was active as a fighter base during the Second World War, and a possible crash site of a Hawker Hurricane is recorded just to the south of the A17(T) road (Figure 6.1). A gun emplacement of this period is also recorded close to East Bank Farm (site 24).

6.2.59 To the east of the cable route and substation there is a cluster of features in the vicinity of Walpole St Peter that are identified on the Norfolk Historic Environment Record. This includes two undated mounds (sites 25 and 26), one of which is known to have been used for a windmill, two undated former watercourses (roddens) recorded as cropmarks (sites 27 and 28), a trackway of possible medieval date (site 29) and the site of a post-medieval building (site 30).

Historic Landscape

6.2.60 No detailed historic environment characterisation study has been completed for this area. A county-wide study of Norfolk is underway, and a further study of this specific area is being undertaken by the Wash Estuary Strategy Group.

6.2.61 Within the study area for the cable route and substation the historic environment is predominantly one of recently and progressively reclaimed land. The eastern edge of this is marked by the 'Roman' sea bank, a boundary, probably of early medieval date, beyond which are a number of dispersed settlements that have medieval and possibly earlier origins. The western boundary is marked by the engineered channel of the Nene Outfall Cut, adjacent to which is the post-medieval port of Sutton Bridge.

6.2.62 The reclaimed land is divided into regular fields separated by parallel, straight drainage ditches eventually feeding into the Nene Outfall. A number of nineteenth- and twentieth-century sea banks are present, increasing in frequency closer to the coast.

Site Visit

6.2.63 A site visit was undertaken by a qualified archaeologist on 13 December 2005. The site and most of the study area consisted of recently ploughed arable fields, with some grass. These fields were bounded by drainage ditches, the pattern of which appears to have changed at the south of the site from the original enclosure pattern shown on the Ordnance Survey first edition map of 1890.

6.2.64 No evidence of St Philip's Church (site 17) could be identified on the ground. A small group of red-brick farm outbuildings on the site of the former Wisbech Port Sanitary Authority Hospital (site 18) may be remnants of the hospital complex, and the broader location is preserved in the modern road name 'Hospital Road'.

6.2.65 Most of the farm buildings adjacent to the site were constructed from red brick and appeared to be from the later part of the twentieth century.

6.2.66 The weather conditions at the time of the survey were dry and slightly overcast with good visibility. No previously unrecorded historic environment sites were observed within the site or its immediate environs.

Statement of Importance (Significance) of Remains

6.2.67 No Scheduled Monuments were identified within 2 km of the site, and no part of the site or study area lies within a designated Conservation Area, Registered Park or Garden of Special Historic Interest or Registered Battlefield.

6.2.68 Seventeen Listed Buildings were identified within 2 km of the site, including two Grade I listed churches and a pair of Grade II* listed lighthouses. Two other Grade II* Listed Buildings (a swing bridge and associated hydraulic engine house) are just over 2 km

from the site. All of the grade I and II* Listed Buildings should be regarded as being of National significance. The Grade II Listed Buildings should be regarded as being of Regional significance.

6.2.69 A total of five Second World War pillboxes are present along with a gun emplacement site of the same period. The pillboxes are in reasonable condition and should be regarded as being of Regional (medium/moderate) importance.

6.2.70 The study area includes a progressive sequence of sea banks, the earliest of which is likely to be of early medieval date (ninth to tenth century) and the remainder of eighteenth- to twentieth-century date. The earliest sea bank should be regarded as of Regional (medium/moderate) importance, the remainder as Local (low) importance.

6.2.71 Settlement remains from the Roman period onwards are located behind the earliest sea bank. The assessment has identified no known buried settlement remains within the site, and overall a very low potential for the presence of such remains. At least two probable salterns are present close to the substation. These should be regarded as of Local (low) importance.

6.2.72 One site of potential Regional (medium/moderate) importance was identified within 500 m of the proposed cable route: the site of a Hawker Hurricane aircraft that crashed during the Second World War.

6.2.73 The sequence of sediment accretion within this area of the Wash, through frequent flooding episodes and post-medieval land reclamation, means there may be potential for alluvial deposits to mask former land surfaces, particularly those relating to the prehistoric period. However, the available palaeoenvironmental evidence suggests the area consists of silts with phragmites inclusions typical of a former tidal estuary, with no evidence for the presence of peats or former land surfaces within the upper 2 m of the deposit sequence.

Summary

6.2.74 The baseline cultural heritage assessment has identified that the proposed development (cable route and substation extension) lies within an area of land that has been progressively reclaimed since the Roman period. The probability that significant archaeological remains of pre-Roman and Roman date are present within the development area is considered to be very low. There is a possibility that palaeo-environmental remains may be present. A number of probable salterns have been identified close to the current substation, and these may be of mid to late Saxon date. There are remains of Second World War date close to the proposed cable route. These include pillboxes, a gun emplacement and the recorded crash site of a Hawker Hurricane. Assessment of potential impacts on remains and identification of appropriate mitigation is addressed in Section 7.2.

6.3 Landscape and Visual Baseline

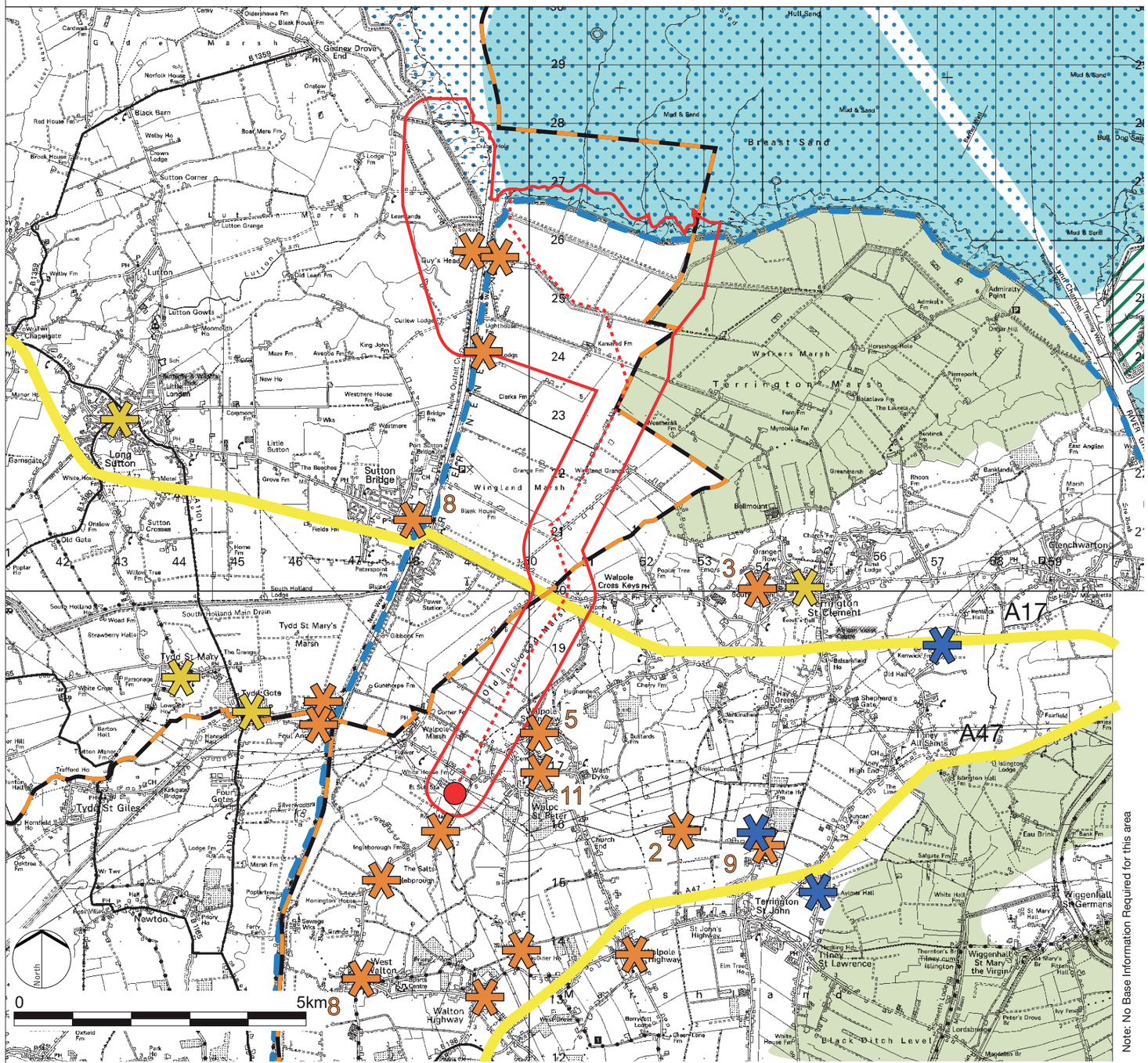
Introduction

6.3.1 This chapter of the Environmental Statement (together with Section 7.3) considers the effect the onshore elements of the grid connection for the proposed Lincs, Docking Shoal and Race Bank Offshore Wind Farms will have on the existing landscape environment, its characteristic features and the people who view it. This chapter identifies the existing baseline environment, against which the magnitude and significance of any change to the character of the landscape as well as the potential effect upon views, visual amenity and receptor groups within the visual envelope can be assessed. Details of the onshore proposals for the three separate but related developments appear in Section 7.3, together with a description of the nature and extent of the likely landscape and visual effects for both the cable corridors and the substation extensions.

Approach to the Assessment

Introduction

6.3.2 The methodology for the landscape and visual assessment of the onshore elements follows relevant standards and guidance principally set out in the Countryside Agency's *Landscape Character Assessment Guidance* (2002) and other recognised guidelines, in particular the Institute of Environmental Management and Assessment/Landscape Institute's *Guidelines for Landscape and Visual Impact Assessment*, second edition (2002) and the *Companion Guide to PPS22* (ODPM 2004b). For further detailed information on the methodology guidance, refer to Appendix A2.15.



Key

- Substation Site and Route of On Shore Connection
- Boundary of Proposed Works
- County Boundary
- District/Borough Boundary
- A17 and A47
- Important Landscape Quality - Open Landscape Kings Lynn and West Norfolk Local Plan
- Area of Outstanding Natural Beauty
- Scheduled Ancient Monuments
- Conservation Area
- Listed Buildings and Structures
- Multiple Listed Buildings and Structures
- Area including: Sites of Special Scientific Interest, Special Areas of Conservation, Ramsar Site, Special Protection Area
- Nene Way/Peter Scott Walk Recreational Trail
- National Nature Reserve

Note: No Base Information Required for this area

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LINCS, DOCKING SHOAL AND RACE BANK OFFSHORE WIND FARMS - ONSHORE CONNECTION

SITE LOCATION AND LANDSCAPE POLICY CONTEXT

DRAWN	SG	DATE	October 2006
CHECKED	AJ	SCALE	NTS
APPROVED	WW	STATUS	Final

DRAWING NO. **2115.1LO/01**

Figure 6.2 | Site location and landscape policy context

Scope of Work

6.3.3 In order to undertake the full impact assessment, several clear stages were identified and addressed in accordance with the prescribed methodology, including:

- a desktop review of current statutory and non-statutory documents
- a desktop review of existing landscape characterisation material
- establishment of a visual envelope of the substation extension works
- identification of a range of visual receptor groups within the study area
- the production of four representative photomontages from agreed viewpoints (within King's Lynn and West Norfolk District) showing the anticipated view following construction of the three separate but related extensions to the proposed substation
- a description of the proposed onshore elements
- an assessment of the magnitude and significance of effects upon the landscape, its character and the visual environment during the separate construction stages of the three wind farm connections and the identified, progressive operational stages of the proposed development
- an assessment of any mitigation measures that may be incorporated within the proposals to help reduce identified potential landscape and visual impacts

6.3.4 This chapter describes the baseline. Chapter 7.3 identifies and assesses potential impacts and identifies appropriate mitigation.

Sources of Information

Existing Published Landscape Assessment Work

6.3.5 A variety of landscape character assessment work relevant to the wider study area of the proposed offshore wind farm development has previously been carried out by different agencies. These include the Countryside Agency's *Character of England Map* (1999) and English Nature's equivalent *Natural Areas Map* (1999) and *Wind Turbine Development – Landscape Assessment, Evaluation and Guidance* undertaken by Land Use Consultants (LUC) on behalf of Breckland Council and King's Lynn and West Norfolk Borough Council (LUC 2003).

6.3.6 Reference should be made to Appendix A2.16, which gives a more detailed summary of key aspects of the *Character of England Map* areas.

Source documents

6.3.7 In defining the existing baseline environment, the following documents have been reviewed. For further details refer to Appendices A2.15 and A2.16:

Landscape Policy

- *Lincolnshire Structure Plan* Deposit Version (Lincolnshire County Council 1998)
- *Lincolnshire Structure Plan*: Deposit Draft (Lincolnshire County Council 2004 and 2005) including proposed changes February 2005
- *Norfolk Adopted Structure Plan* (Norfolk County Council 1999)
- *King's Lynn and West Norfolk Local Plan* (King's Lynn and West Norfolk County Council 1998)
- *South Holland District Re-deposit Local Plan* (South Holland District Council 2005)
- *Planning Policy Guidance 20: Coastal Planning* (DoE 1992)
- *Planning Policy Statement 22: Renewable Energy* (ODPM 2004a)
- *Planning for Renewable Energy: A companion Guide to PPS22* (ODPM 2004b)

Landscape Assessment

- the Countryside Agency's Character of England Map (1999) (Character Area 46)
- *Guidelines for Landscape and Visual Impact Assessment* (Institute of Environmental Management and Assessment/Landscape Institute 2002)
- *Landscape Character Assessment Guidance* (Countryside Agency/Scottish Natural Heritage 2002)
- *Wind Turbine Development: Landscape Assessment, Evaluation and Guidance,* Breckland Council and King's Lynn and West Norfolk Borough Council (LUC 2003)

The Study Area

6.3.8 It is accepted practice in landscape and visual assessment work that the extent of the study area is broadly defined by the visual envelope arising from the development site (the area of land or sea within which it may be possible to see any part of the proposed development). This depends upon a variety of factors including the scale of development, the relationship between the viewpoint and the development itself, and the context within which the development is seen.

6.3.9 As the extent of the onshore infrastructure is restricted to an underground cable route and an extension to the existing electricity substation (albeit as three separate but related developments), the extent of visibility and effect upon the landscape is fairly limited. The visibility of the substation extension will be at its greatest towards the end of the progressive construction phases and in the short term during operation, before the proposed landscape mitigation measures mature. It is likely to be visible from nearby local roads and isolated, scattered residential properties in the immediate vicinity.

6.3.10 The overall extent of visibility of the onshore connection is defined in Figure 6.3, which illustrates the visual envelope of the proposed development. This has been defined in accordance with the *Guidelines for Landscape and Visual Impact Assessment* (Institute of Environmental Management and Assessment/Landscape Institute 2002). The illustrated visual envelope for the underground cable route to the north of the A17 uses the existing boundary of the proposed works to identify the extent of areas with significant visual exposure. This extends to a 500 m offset from the proposed cable route. Where works are proposed to the substation extension the visual envelope is slightly more extensive but still restricted to the immediate area surrounding the existing substation. For a full assessment of the effects on the landscape and visual baseline resource, refer to Chapter 7.3.

Policy Background

Introduction

6.3.11 The national and Development Plan policy framework recognises the importance of renewable energy, but also requires that there is due consideration given to areas of recognised landscape value.

6.3.12 As part of establishing the existing baseline environment, the assessment reviewed and considered a range of relevant policies from the structure plans covering Norfolk and Lincolnshire, the King's Lynn and West Norfolk Local Plan and South Holland Local Plan. Details of the relevant objectives of these plans are included in Chapter 2; however, the key plans and objectives relevant to the landscape environment include:

- Lincolnshire Structure Plan policies relating to:
  - natural environment, landscape and countryside (Policies NE2, NE6, NE8 and NE12)
  - built environment and countryside (Policies BE3, BE5 and BE6)
  - tourism, leisure and the coast (Policies T1, T9 and T10)
- Norfolk Structure Plan policies relating to:
  - county strategy (Policy CS7)
  - the environment (Policies ENV1, ENV2, ENV3, ENV4, ENV6, ENV7, ENV8, ENV9, ENV11, ENV12 and ENV13)
  - resource conservation and management (Policies RC4 and RC9)
- King's Lynn and West Norfolk Local Plan policies relating to:
  - strategic statement (Policies SS1, SS3, SS4)
  - conserving environmental resources (Policies 4/1, 4/5, 4/6, 4/8, 4/9 and 4/14)
  - the rural area (Policies 8/13 and 8/14)
- South Holland Local Plan policies relating to:
  - core strategic and general policies (Policy SG1)
  - conservation and enhancement of the environment (Policies EN1, EN2, EN3, EN4, EN7 and EN12)

Landscape Designations

6.3.13 The King's Lynn and West Norfolk Local Plan (Borough Council of King's Lynn and West Norfolk 1998) recognises that the coastal landscapes and coastal margins enhance the value of the borough's landscape. This is recognised, in part, by the designation of an Area of Important Landscape Quality which includes the Terrington Marsh and Walkers Marsh areas to the west of the river Great Ouse Lynn Channel. This area is valued for the open character of its landscape. As illustrated on Figure 6.2, this Area of Important Landscape Quality extends within and beyond the northeastern boundary of proposed works of the cable corridor for the onshore connection. The likely short-term effects on this area during the construction phase of the cable corridor are considered in Chapter 7.3.

6.3.14 Other designated landscapes within the Borough of King's Lynn and West Norfolk include the western portion of the Norfolk Coast Area of Outstanding Natural Beauty (AONB) lying to the east of the river Great Ouse Lynn Channel (located approximately 8 km east of the proposed boundary of works), and a further Area of Important Landscape Quality, valued for its open character, located approximately 6.5 km southeast of the existing substation. Both these designated landscapes lie beyond the anticipated visual envelope of the development as illustrated in Figure 6.2. Potential short-term effects on these areas during construction of the onshore connection are considered in Chapter 7.3.

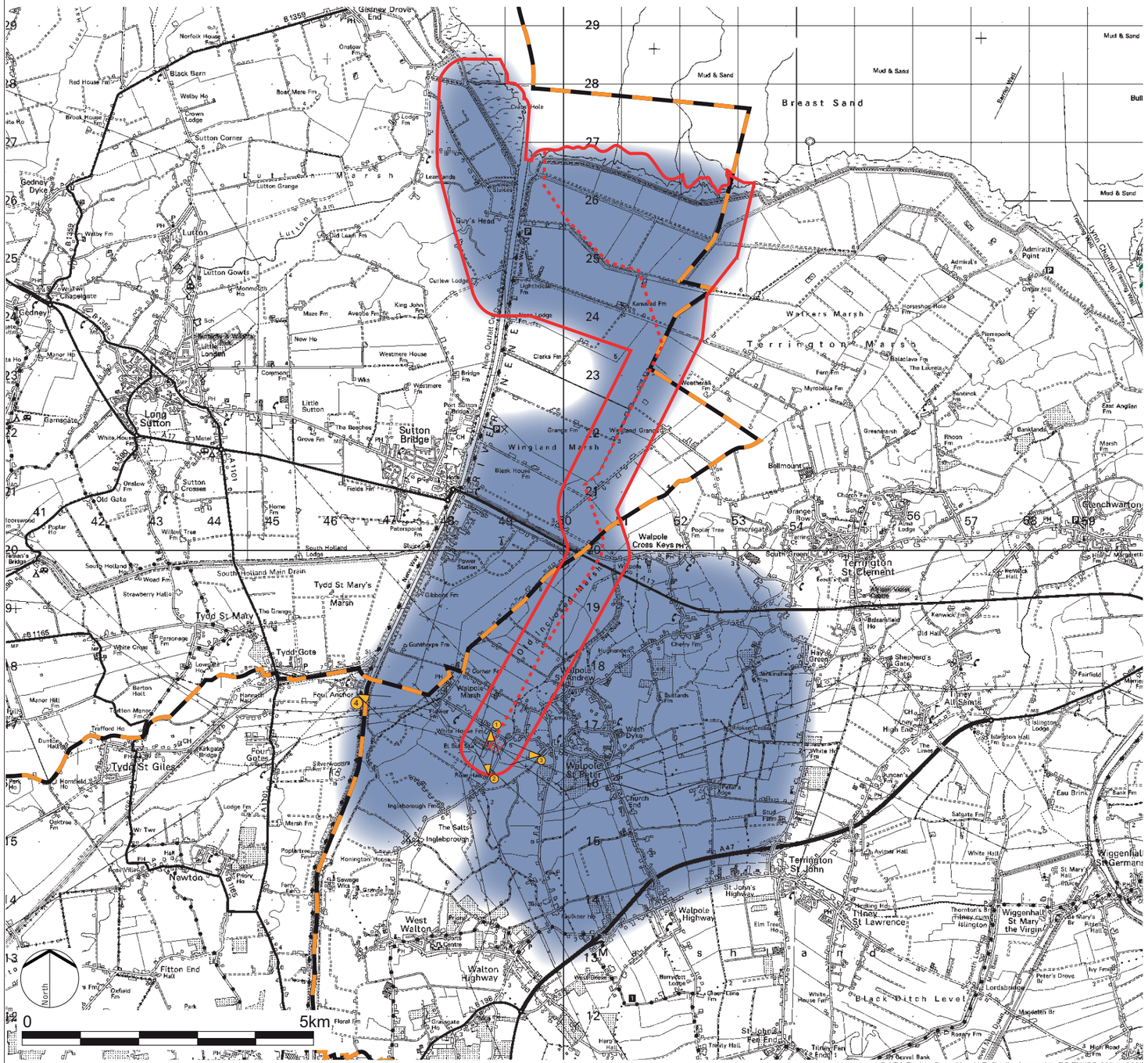
6.3.15 The District of South Holland does not have any landscape designations of local or national significance either within or immediately adjacent to the boundary of proposed works for the onshore connection.

Scheduled Ancient Monuments

6.3.16 There are no Scheduled Ancient Monuments (SAMs) lying within the boundary of proposed works for the onshore connection. The nearest SAM to the proposed works comprises a moated site and medieval field system in a church field (approximately 5 km east of the existing substation) and a moated site and formal garden remains at Aylmer Hall (approximately 6 km east of the substation). The distribution of SAMs within the study area is illustrated on Figure 6.2. They lie outside the visual envelope of the development, as illustrated on Figure 6.3.

Conservation Areas

6.3.17 There are no conservation areas within the boundary of the proposed works for the onshore connection. In the wider landscape, there are several conservation areas including Tydd Gote (approximately 3.5 km west of the substation), Tydd St Mary (approximately 5 km west of the substation), Long Sutton (approximately 1 km west of the proposed boundary of works) and Terrington St Clement (approximately 3.25 km east of the proposed boundary of works). The locations of these conservation areas are illustrated on Figure 6.2. All of these conservation areas lie beyond the visual envelope of the proposed development, which is illustrated on Figure 6.3.



No dimensions are to be scaled from this drawing. All dimensions are to be checked on site. Area measurements for indicative purposes only.
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Key

- Boundary of proposed work
- Approximate extent of Visual Envelope of the Cable Corridor and Substation Extension
- Cable Corridor
- District/Borough Boundary
- County Boundary
- Representative Viewpoints
- Extention to the Walpole Substation

Notes:
The Visual Envelope is based upon field work visibility mapping of the substation and is supplemented by a computer generated Zone of Visual Influence (ZVI) for the substation.

The model for this took into account the immediate localised screening features surrounding the substation, such as hedgerows, groups of trees and buildings, and thus provided an exaggerated impression of the extent of visibility. The actual level of visibility on the ground is likely to be noticeably less than that suggested by this plan and there will be some areas within the Visual Envelope where there is no visibility. The area shown is therefore the maximum area of theoretical visibility.

To the north of the A17 the extent of the Visual Envelope of the cable route has been determined by field work visibility mapping to assess the area of significant visibility. This includes a minimum 500m offset from the cable corridor and associated construction activity. Beyond this distance views may still be available but it is considered that they will not be significant for the purposes of the assessment.

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REPRESENTATIVE VIEWPOINT LOCATIONS AND VISUAL ENVELOPE

DRAWN	JGP	DATE	October 2006
CHECKED	RF	SCALE	NTS
APPROVED	WW	STATUS	Final

DRAWING NO. **2115.1LO/05**

Figure 6.3 | Representative viewpoint locations and visual envelope

Listed Buildings

6.3.18 There are several listed buildings and structures in the study area. The east and west lighthouses on the banks of the River Nene (Grade II* listed) and Nene Lodge (Grade II listed) lie within the boundary of proposed works near the mouth of the River Nene. Within the visual envelope of the development, there are a further five listed buildings and structures associated with the settlement of Walpole St Andrew (lying adjacent to the eastern boundary of proposed works), a further 11 listed buildings and structures associated with the settlement of Walpole St Peter (located approximately 1 km east of the existing substation) and Faulkner House (Grade II listed) located approximately 3 km southeast of the existing substation. Refer to Figure 6.2 for the location of the listed buildings within the study area. Although they are located within the overall visual envelope the setting is generally contained within the enclosed settlement or landscape pattern and therefore restricted to the immediate environment with limited views to the development. For a further discussion of other likely effects on listed buildings, refer to Chapter 7.2.

Ecological Designations

6.3.19 The entire coastline of the Wash is also recognised, both nationally and internationally, for its nature conservation and scientific value. Areas designated for their nature conservation importance have been included here to the extent that these areas are also relevant to the existing landscape or seascape character and visual amenity baseline. They are illustrated on Figure 6.2. The anticipated ecological effects on the Wash are discussed in Chapter 7.6.

The Existing Landscape Environment

Landscape Character Context

6.3.20 The landscape character context is identified at different levels, with the Countryside Character Initiative (CCI) and English Nature's *Natural Areas Map* (1999) providing the broader framework to determine the character of the British countryside at a national level. Within the CCI character map, the study area lies within character area 46, 'The Fens', the key characteristics of which are detailed in Appendix A2.16.

Local Landscape Character Assessment

6.3.21 The character of the local landscape within the Borough of King's Lynn and West Norfolk has been assessed as part of *Wind Turbine Development: Landscape Assessment, Evaluation and Guidance* (LUC 2003), completed on behalf of Breckland Council and King's Lynn and West Norfolk Borough Council. This assessment has identified five landscape character types at the local level to assist with the detailed landscape policy for the Borough. They are:

- open coastal marshes
- drained coastal marshes
- the Fens – settled inland marshes
- the Fens – open inland marshes
- wooded slopes with estate land

6.3.22 The study area for onshore elements straddles the first three of these character areas, as illustrated on Figure 6.4. For further information on the key characteristics of these, refer to Appendix A2.16.

6.3.23 At the time of writing, no published local landscape character assessments were available for the District of South Holland. This assessment therefore utilises the national character assessment work undertaken by the Countryside Agency, supplemented by the local landscape character assessment work and additional field work to define the character of the study area. Refer to Appendix A2.16 for further details.

The Landscape Character of the Study Area

6.3.24 The identified study area (as defined earlier) embraces a short stretch of low-lying, undeveloped coast at the southern extent of the Wash, which is indented by the mouth of the Nene Outfall. The study area then extends from the Wash southwards along the Nene Outfall for up to 11 km to Walpole and then to the northern peripheries of Wisbech.

Landscape Character to the North of the A17

6.3.25 The landscape and seascape context to the north of the A17 is characterised by a distinctively open, flat and low-lying landscape with extensive vistas to level horizons, and a uniform and simple landscape. Within the northern half of the study area a hierarchy of rivers, drains and ditches provides a strong influence throughout the area with sea defence embankments providing local enclosure and elevation. Large rectilinear fields, divided by ditches and isolated vegetated features, add to the exceptionally open aspect which is broken only by the series of seawalls and associated river outfall structures. Settlement and other built structures are largely absent with the exception of occasional isolated farms and the Sutton Bridge power station. A consistent simple character with a sense of remoteness and wildness presents a medium quality landscape which lies at the edge of a small area of locally important (open) landscape quality on the eastern peripheries. The open and exposed scale is also considered to be of low to medium sensitivity to change due to the cable route construction.

Landscape Character to the South of the A17

6.3.26 To the south of the A17, the landscape surrounding the substation is slightly more enclosed. While it retains some of the open characteristics described above, a few subtle variants are interspersed, which to a large extent relate to a more concentrated settlement pattern of scattered farmsteads and ribbon settlements. The landscape exhibits a more irregular field pattern with local enclosure and a varied field boundary definition of deciduous and strong evergreen vegetated screens. Fruit orchards are also a common feature. They provide further enclosure and diversity to the character of this area as well as limiting wider views to the surrounding landscape. A number of varied built structures are also present providing a strong built

influence and contrasting sense of scale. These include the Sutton Bridge power station and lines of pylons, which are dominant features slicing diagonally across the field system, fragmenting the view and the unity of the landscape. Although more diversity is found to the south of the A17, the landscape quality is generally considered to be low within the open landscape, in light of the dominant built influence, and medium within the intricate settlement pattern. The sensitivity to change due to the substation extension is also considered to be low in light of the high number of existing built features including the existing substation.

Landscape Features

The Substation Site

6.3.27 The site of the proposed substation extension encompasses a flat, medium-scale arable field which is located adjacent to the southeast boundary of the existing substation. The site is bounded to the southeast by a low clipped hedgerow, extending between the site and the Walpole Bank road. The site is bounded to the southwest by deciduous scrub vegetation and semi-mature trees lining the main entrance to the substation. The vegetation varies in height between 5 m and 10 m, with ash, rowan, cherry, hawthorn and willow being the predominant tree species. The boundary vegetation limits views to the wider landscape further west of the site. The site is bounded to the northwest by a belt of mature deciduous hedgerow vegetation, 5–15 m in height. This feature screens views to the base of the substation structures as seen from the east. A ditch aligns with the northeastern boundary and is open to the adjacent arable field to the northeast of the site. There are views across this arable field towards deciduous boundary vegetation along French's Road. Evergreen boundary vegetation, which screens the residential property on the intersection between French's Road and Walpole Bank, is also visible across the open northeast boundary of the site. The quality of these varied landscape features is considered to be low to medium given the varied and intermittent coverage, and the sensitivity to the proposed change is also considered to be low to medium given the varied character and location along the site peripheries.

6.3.28 The existing substation site itself occupies an area of approximately 21 acres. Within this fenced and well screened area several existing bus-bars, transformers and other associated infrastructure are present, with access tracks and operational buildings. The height of the infrastructure and the substation is typically between 19 m and 22 m with taller pylons and overhead cables also present. It forms a significant industrialised feature. The proposed substation extension site lies immediately to the east of this area.

The Area Surrounding the Substation – South of the A17

6.3.29 In the wider landscape surrounding the substation site, a flat, medium-scale arable landscape dominates. Within this landscape distinct vertical elements, such as rows of Lombardy poplars and evergreen shelter belts, provide notable intermittent features in the middle to far distance, towards the flat horizon line. Mature hedgerows frequently enclose local roads between settlements. In addition to these vegetated features a variety of built and industrial features including numerous pylons and telegraph poles are prominent within the landscape, providing orientation and a consistent built form across the flat horizon line.

6.3.30 Local roads and embankments also form prominent elements in the immediate landscape. They combine with the overhead cabling associated with the pylons and telegraph poles to provide a network of strong linear industrial features. Other notable linear features within the wider landscape include the A17, located at a minimum distance of approximately 3.5 km north of the substation site, and the River Nene and its associated flood defence embankments, located at a minimum distance of approximately 2.2 km west of the substation site.

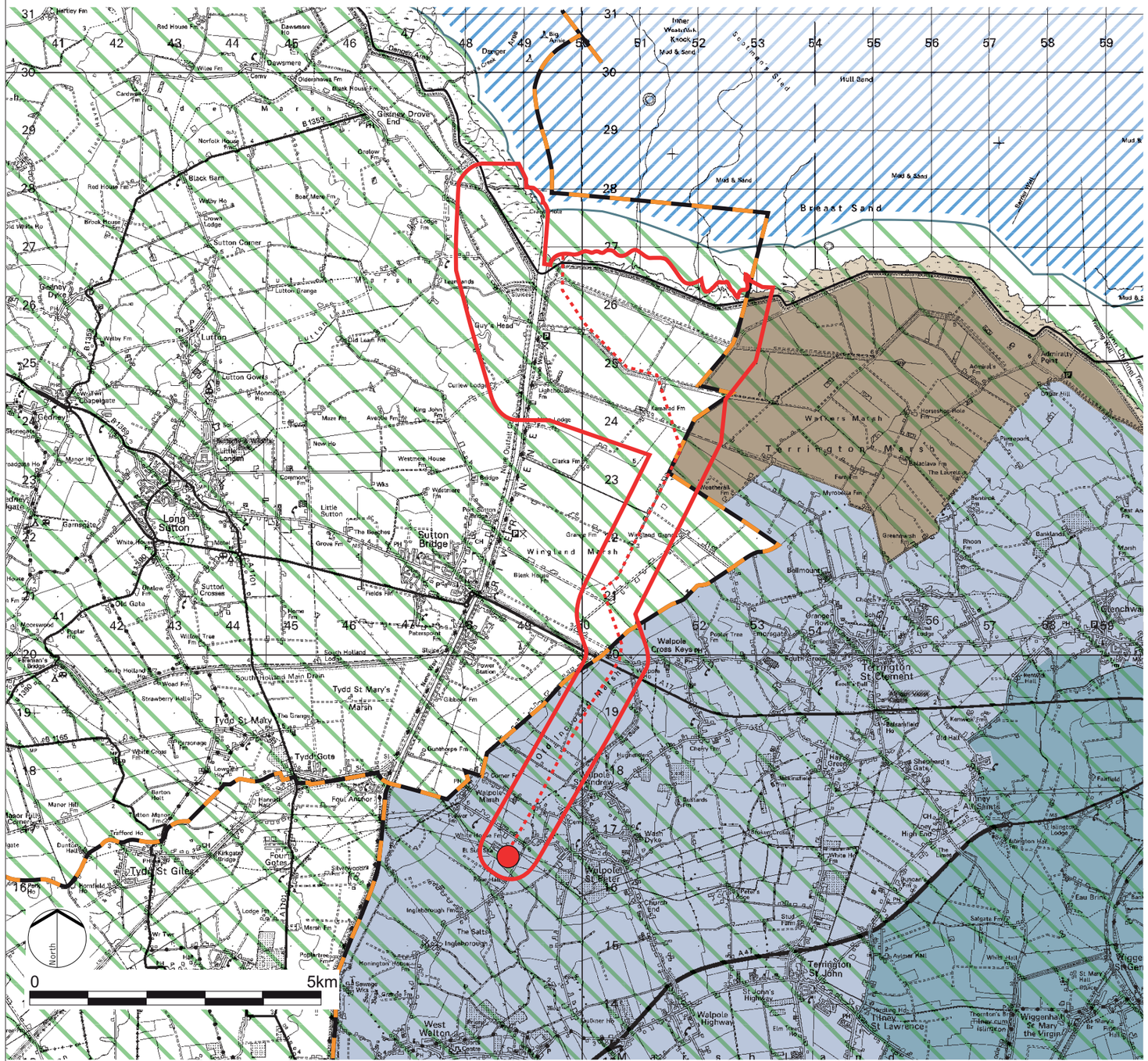
6.3.31 In the immediate vicinity of the substation, settlement generally consists of sprawling linear development and scattered isolated farmsteads along a local network of roads. Notable localised settlement in close proximity to the site includes Walpole Marsh, located approximately 1 km northeast of the site; Walpole St Peter, approximately 1.5 km to the east; and Walpole St Andrew, approximately 1.2 km northeast of the site. There is generally a medium-to-small-scale field pattern on the outskirts of these settlements and there tends to be more vegetation in proximity to settlements, with scrubby pasture, orchards, Lombardy poplars and outgrown field boundaries often providing a greater degree of enclosure. Evergreen shelter belts are also common, and assist with providing a greater sense of perspective in views towards the flat horizon. The quality of this varied and somewhat fragmented coverage of vegetated features is generally medium and the sensitivity to the proposed development is generally considered to be low given the intermittent nature of the features.

6.3.32 Sutton Bridge power station, located approximately 3 km to the north of the existing substation, is generally very prominent in views from the surrounding landscape, with its two white chimneys and main cantilevered building forming a particularly strong vertical feature.

The Cable Corridor North of the A17

6.3.33 Within the cable corridor landscape to the north of the A17, raised flood defence embankments associated with the River Nene and the Wash become significant linear elements. Connected with these features, the lighthouses on the east and west banks at the mouth of the River Nene also form prominent features. The coastline of the Wash itself is simple and open in its form but dynamic and varied in its habitat, being characterised by estuarine marshes, extensive areas of mudflats and flat coastal lowlands. With a very infrequent vegetation cover and a large exposed scale the quality is generally medium and the sensitivity to the proposed change is considered to be low.

6.3.34 Communication routes crossing the cable corridor include the A17 and a limited number of local roads. Roads are broadly straight and commonly aligned with watercourses and ditches. Settlement is generally limited to isolated residential properties and scattered farms along local roads. Recreational opportunities in close proximity to the cable corridor include the Nene Way national trail and a picnic area south of the west bank lighthouse adjacent to the River Nene.



No dimensions are to be scaled from this drawing. All dimensions are to be checked on site. Area measurements for indicative purposes only.
Based upon Ordnance Survey map with the permission of the controller of H.M.S.O. © Crown copyright Reproduced under licence No. 189189

Figure 6.4 | Landscape character

Summary

6.3.35 The majority of the study area associated with the cable route corridor lies within a low-lying, relatively undeveloped open and simple coastal landscape, the character of which is exposed and fairly remote. Further inland and to the south of the major A17 road corridor the landscape is more varied and enclosed and includes several contrasting built and natural elements, which make for a discordant landscape with a dominant built influence and a strong sense of enclosure and screening to settlements.

6.3.36 The landscape of the Walpole substation area comprises a flat, medium-scale arable field system with a varying degree of enclosure from mature overgrown hedgerows, which enclose and limit views in some areas. Elsewhere, low-clipped hedgerows to the east side and open field boundaries allow more open views across the wider landscape. Nearby residential properties are commonly bounded by evergreen shelter belts and views towards the existing substation from the surrounding area are partially screened by characteristic semi-mature boundary vegetation.

The Existing Visual Environment

Introduction

6.3.37 The purpose of the Visual Assessment is first to determine the extent of the visual envelope of the development (ie the area within which it may be possible to see any part of the construction or operational elements of the development), and then to determine how visible the proposals would be from a number of agreed sensitive viewpoints and receptors within the visual envelope. This approach is based on recommendations set out within the *Guidelines for Landscape and Visual Impact Assessment* (Institute of Environmental Management and Assessment / Landscape Institute 2002).

Visual Envelope

6.3.38 The flat topography with prominent sea defence embankments and varied vegetation pattern are the main features of the local landscape that will determine visibility of the development. It should be noted that the screening effect of vegetation will vary seasonally with visibility influenced by tree leaf and arable crop rotation.

6.3.39 The extent of onshore activity arising from the proposed development is effectively restricted to underground cabling works in the Wingland Marsh and Old Inclosed Marsh areas and a small extension to the existing Walpole substation. The extent of significant visual exposure of the cabling work during construction will be largely confined to the immediate area comprising local roads and neighbouring roadside properties, and partially to within 500 m of the cabling trench (where no other work is anticipated), as shown on Figure 6.3. Although more distant views will be available from the open remote landscape to the north towards the construction of the cabling trench, they will be relatively minor and will be viewed as part of the wider landscape with a mixture of built and natural elements present.

6.3.40 The visibility of the substation extension in the area immediately surrounding the site will vary according to the presence of localised blocks of screening vegetation. Several local roads to the north, south and east of the site are lined by mature hedgerow vegetation which limits views towards the site. Similarly, evergreen boundary vegetation and linear tree belts commonly associated with settlements will screen most views towards the substation from nearby residential properties. Occasional isolated transient views towards the substation can be seen from the wider landscape to the east. Views from the southeast are generally screened by strong field patterns and associated boundary vegetation and most properties close to the site have their own boundary vegetation that restricts views. Views towards the substation from the wider landscape to the west of the River Nene are largely limited by the flood embankments along the river.

Key Visual Receptors

6.3.41 A variety of visual receptors can be expected to be affected by the onshore proposals connected with the wind farm development. The views available to receptors will vary depending on the intricacies of the roadside vegetation and industrial built form. The visual receptors will include not only local people, but also those travelling through the area and those visiting the area for recreational and amenity purposes. The three main receptor groups are local residents, the travelling public and visitors to the area. Refer to Appendix A2.15 for details of the methodology for assessing the visual receptors' sensitivity to change.

Residents

6.3.42 Local residents are judged to have generally higher levels of sensitivity to changes in their landscape and visual environment than those of visitors. Their levels generally range from high to medium, given the generally exposed scale and industrialised context. Residents who may potentially be affected by the construction and operational phases of the substation extension include those living in properties on French's Road and Walpole Bank, residents living on the western outskirts of Walpole St Andrew and Walpole St Peter, and residents living in Walpole Marsh. Residents who may potentially be affected by the construction phase of the cable corridor include those living in isolated scattered dwellings along Anchor Road, Cocklehole Road, Chalklene, Grange Road, Hospital Road and Garners Road. The actual effect on residents will depend on the orientation of their dwellings, the extent of boundary vegetation associated with their properties and the presence of intervening hedgerow vegetation and trees. For details of the assessment of effects on these receptors, refer to Chapter 7.3.

Travelling Public

6.3.43 This category of visual receptor groups embraces both residents and those who travel to or through the area. The group includes travellers along the main roads the A17 and A47 – as well as those on adjacent minor roads. This group is considered to have a low to medium sensitivity to the proposed change on account of the transitory nature of views in any one direction and general context. The locations of these receptors are illustrated on Figure 6.2 and the assessment of effects is detailed in Chapter 7.3.

Visitors and the Tourism or Amenity Resource

6.3.44 This visual receptor category embraces a wide variety of individual visual receptor groups, whose principal preoccupation is with the enjoyment of the outdoor environment, the open countryside and the tourism or amenity resource. These receptor groups include visitors to the picnic area associated with the west bank lighthouse, birdwatchers in the coastal areas of the Wash, and users of the Nene Way and Peter Scott Walk recreational trails and other public rights of way. It is expected that those receptor groups who are using the landscape resource for the enjoyment of the outdoor environment and the open countryside will be more sensitive than others to visual changes. Visitors and users of the amenity resource of the study area are, therefore, generally considered to have a medium to high sensitivity. Refer to Section 7.3 for details of the assessment of effects.

Viewpoint Baseline

6.3.45 To help define the existing visual baseline environment, it is accepted practice to select and agree upon a number of representative viewpoints within the visual envelope of the development. These ideally include a range of sensitive viewpoints and visual receptor groups, from which both the existing baseline conditions and the effects arising from the proposed development will be assessed to determine how visible the proposed development will be from specific locations and to gauge the anticipated effects on visual amenity. The four identified representative viewpoints were agreed with King's Lynn and West Norfolk District Council. They are illustrated in Figures 6.5–6.6 and the baseline visual environment is described below. The assessment of effects is detailed in Section 7.3.

Viewpoint 1

6.3.46 Viewpoint 1 is the entrance to a farm off French's Road, between Walpole St Peter and Walpole Marsh, at grid reference 48133 16948. It is approximately 130 m north of the substation.

6.3.47 This viewpoint illustrates the view available primarily to travellers along French's Road. As illustrated in Figure 6.5, the existing view comprises a small-scale enclosed landscape, which is visible through an isolated break in the mature boundary vegetation along French's Road. The view is also well contained by existing roadside vegetation to the northwest and southeast of the isolated viewpoint. Within the view, the foreground comprises a cluster of agricultural buildings, an access track and an open arable field. The view is then contained in the near distance by mature deciduous field boundary trees which form a linear screen belt to the existing substation. Other significant vegetation in the view includes field boundary vegetation on the distant horizon, enclosing views to the southeast. The foreground horizon is flat and vegetated, interspersed with significant industrial features throughout, including the existing substation, pylons and associated overhead cable, and is typical of views to the horizon in the area.

6.3.48 The existing industrial elements within the view combine with the significant areas of mature vegetation to give an overall existing quality that is judged to be low to medium.

6.3.49 This viewpoint can also be taken to represent those views that are available to receptors other than travellers, including residents and agricultural workers who are using the local road. The visual sensitivity to the proposed change, however, from the primary receptor group of travellers on French's Road is considered to be low due to the number of existing built elements and the containment within the view.

Viewpoint 2

6.3.50 Viewpoint 2 is on Walpole Bank, adjacent to Rose Hall Farm, at grid reference 48115 16209. It is approximately 400 m south of the substation.

6.3.51 Located to the south of the substation, this viewpoint illustrates the view available primarily to travellers along Walpole Bank. Figure 6.5 illustrates a 90-degree section of a wider 270-degree view available from this viewpoint. The view comprises a flat, large-scale arable landscape in the foreground with views extending to the west, across flat, open farmland towards a low, flat distant horizon interspersed with pylons, tree belts and other industrial elements. The pylons and overhead cables extend into the foreground and dominate the view. To the south of the viewpoint, a deciduous tree belt surrounds Rose Hall Farm, the nearest residential property to the south of the site. From the viewpoint, there are proximate views to the existing substation which are partially screened by a prominent deciduous tree belt. This deciduous tree belt also continues to screen views towards the north from this viewpoint. To either side of the existing substation there are open views to the south and east comprising further expanses of flat, open farmland, also interspersed with pylons and occasional tree belts. Beyond the illustrated 90-degree view, there is evidence of settlement to the east beyond the open arable farmland, with the church tower of Walpole St Peter visible in the distance.

6.3.52 The predominance of industrial elements in the view results in an overall existing quality that is judged to be low.

6.3.53 Additional receptors represented by this viewpoint include residents of Rose Hall Farm and local road users. The visual sensitivity to change, however, from the primary receptor group of travellers along Walpole Bank is considered to be low to medium given the existing composition with the substation forming a prominent industrialised feature across the majority of the view.

Viewpoint 3

6.3.54 Viewpoint 3 is on Police Road, on the eastern edge of Walpole St Peter, at grid reference 49619 16480. It is approximately 610 m east of the substation.

6.3.55 This viewpoint is located on land adjacent to a residential property on Folgate Lane on the eastern edge of Walpole St Peter, and is illustrative of the view available primarily to the residential receptor group. As illustrated in Figure 6.6, an open view is available to the west of this viewpoint. The view looks across a flat, medium-scale arable landscape towards a flat horizon in the middle distance comprising a mixture of mature deciduous vegetation, evergreen vegetation and the industrial structures of the existing substation. The horizon is also interspersed with pylons and associ-

ated overhead cables which extend into the foreground and across the majority of the view, breaking up the skyline and giving a sense of linear structure and built form. Sutton Bridge power station is also visible (though not part of the panorama) in views to the north and there are intermittent views towards Walpole St Peter to the east and towards Walpole St Andrews to the north. Vegetation in the wider landscape includes numerous shelter belts of varied structure, associated with scattered farms and nearby villages.

6.3.56 The medium-scale enclosure of the landscape within the view combines with a lack of more distant views available from the viewpoint to intensify the dominance of the pylons and overhead cables within the view. The overall quality of the view is, therefore, judged to be low.

6.3.57 The view can also be taken to be representative of those available to additional receptors including local road users and people living at other isolated residential properties on the eastern edge of Walpole St Peter. The visual sensitivity to change from the primary receptor group of residents is considered to be medium to high due to the perceived existing concentration and dominance of industrial elements within the uniformly enclosed view, with limited potential or capacity to absorb further change of this nature within the view.

Viewpoint 4

6.3.58 Viewpoint 4 is on the Nene Way, at the southeast edge of Foul Anchor, at grid reference 46602 11145. It is approximately 2.3 km from the substation.

6.3.59 This viewpoint illustrates the view available primarily to the footpath users on the Nene Way, which lies approximately 2.3 km to the west of the proposed substation. As Figure 6.6 illustrates, the foreground of the view is open, flat and dominated by the outfall of the River Nene. Beyond the River Nene lies a large-scale open, arable landscape, which is uniformly defined in the middle to long distance by a flat vegetated horizon. The horizon is interspersed and dominated by pylons and overhead cables, which extend across the breadth of the view and into the foreground to the south of the viewpoint. The view focuses on the Walpole substation where there is a slight concentration of pylons and overhead cables. Elsewhere in the view, its character is dictated by the pylons and cables which fragment the skyline. Sutton Bridge power station is also partially visible in views to the north of the viewpoint, adding another significant industrialised feature to the view.

6.3.60 The River Nene outfall and associated flood banks provide a strong linear feature in the foreground of the view, which provides focus and distracts from the other significant industrial elements in the view. The overall quality of the view is, therefore, judged to be low.

6.3.61 Additional receptors represented by the viewpoint include residents of Foul Anchor, local road users and other users of the Nene Way. The large-scale landscape combines with the existing diversity of significant industrialised elements and potentially allows the view to absorb further change of this nature. The sensitivity of the view to change from the primary receptor group of footpath users on the Nene Way is, therefore, judged to be low.

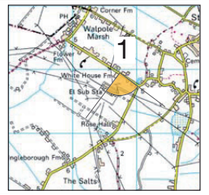
Summary

6.3.62 The low-lying, relatively undeveloped open and simple coastal landscape to the north of the A17 road corridor will permit an extensive zone of visibility during construction of the cable corridor. However, at the same time, its remote, undeveloped character will reduce the number of visual receptors that would potentially be affected by the proposals. Further inland and to the south of the major A17 road corridor the landscape is more varied and enclosed and, although more visual receptors are present, views to the wider landscape are generally screened to a degree. Where views are available, several contrasting built and natural elements are present, providing a landscape with a dominant industrial character and influence which will reduce the sensitivity of general visual amenity to the proposed change.

6.3.63 Key receptor groups identified within the study area include not only local residents in the immediate vicinity but also those travelling through the area on local roads and those visiting the area for recreational and amenity purposes such as recreational route users and birdwatchers in the coastal areas of the Wash.

Viewpoint 1: Existing View

Grid reference:	548733E, 316948N
Elevation AOD:	3.00m
Height of camera above ground:	c. 1.6 m
Lens focal length (35mm format):	50 mm
Date:	13/03/06
Time:	12.15
Weather:	Overcast



Viewpoint 2: Existing View

Grid reference:	548775E, 316209N
Elevation AOD:	3.00m
Height of camera above ground:	c. 1.6 m
Lens focal length (35mm format):	50 mm
Date:	13/03/06
Time:	12.45
Weather:	Overcast

DATE	**December 2006**	DRAWN	**RC**
SCALE	**NTS**	CHECKED	**SD**
STATUS	**Final**	APPROVED	**WW**

LINCS, DOCKING SHOAL AND RACE BANK OFFSHORE WIND FARMS
ONSHORE CONNECTION

VIEWPOINT 1: VEHICULAR ENTRANCE TO FARM YARD OFF FRENCH'S ROAD
VIEWPOINT 2: WALPOLE BANK, ADJACENT TO ROSE HALL FARM

Oxford
T 01865 887050

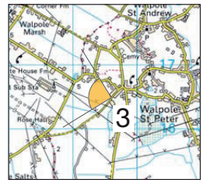
LDADESIGN

DRAWING NO. **2115.1LO/PMBASE**

Figure 6.5 | Viewpoint 1 and 2: existing substation views

Viewpoint 3: Existing View

Grid reference:	549619E, 316480N
Elevation AOD:	3.00m
Height of camera above ground:	c. 1.6 m
Lens focal length (35mm format):	50 mm
Date:	13/03/06
Time:	11.45
Weather:	Overcast



Viewpoint 4: Existing View

Grid reference:	546602E, 317745N
Elevation AOD:	0.96m
Height of camera above ground:	c. 1.5 m
Lens focal length (35mm format):	50 mm
Date:	13/03/06
Time:	13.45
Weather:	Overcast

DATE	**December 2006**	DRAWN	**RC**
SCALE	**NTS**	CHECKED	**SD**
STATUS	**Final**	APPROVED	**WW**

LINCS, DOCKING SHOAL AND RACE BANK OFFSHORE WIND FARMS
ONSHORE CONNECTION

VIEWPOINT 3: POLICE ROAD, EASTERN EDGE OF WALPOLE ST PETER
VIEWPOINT 4: NENE WAY, SOUTHEAST EDGE OF FOUL ANCHOR

Oxford
T 01865 887050

LDADESIGN

DRAWING NO. **2115.1LO/PMBASE**

Figure 6.6 | Viewpoint 3 and 4: existing substation views

6.4 Socioeconomics and Tourism

Introduction

6.4.1 This chapter describes the socio-economic, tourism and recreational characteristics of the area potentially affected by the construction, operation and decommissioning of the onshore components of Lincs, Docking Shoal and Race Bank offshore wind farms.

6.4.2 The baseline conditions have been established through desktop studies and consultation. The potential effects of the wind farm have been identified and assessed and, where relevant, mitigation measures have been identified.

Consultation

6.4.3 As part of the scoping exercise several national and local organisations were consulted, as listed in Chapter 3. Table 6.1 summarises the responses received.

Table 6.1 | **Scoping responses received with respect to socioeconomic, tourism and recreation matters**

Organisation	Response
East of England Development Agency	Asked that the ES include information on the need for the development and the wider socioeconomic benefits and costs, and an analysis of alternative options. Considered these issues particularly important: provision for businesses; improving the region's skills base and human capital; tackling deprivation and social exclusion; equality and diversity; improving provision of port, airport and transport infrastructure so as to enable corridors of economic activity; promotion of sustainable development, urban renaissance and rural vitality; managing growth and development sensitively and effectively; complementing and enhancing the position of London as a world city; and protecting and enhancing the region's landscapes and environmental assets.
Norfolk County Council	Asked that the ES provide accurate figures for the likely number of people to be employed, both during construction and once the three wind farms are operational.
Norfolk Coast Partnership	Was satisfied that the onshore cable route proposed would not have an impact on the Norfolk Coast Area of Outstanding Natural Beauty (AONB).
Wash Estuary Strategy Group	Indicated that the Wash Estuary Management Plan and the European Marine Site Management Scheme should be considered.
Sustrans	Expressed concerns over the potential impact of construction traffic on cyclists using minor roads and questioned whether there would be improvements to crossings on the A47.
Sport England	Recommended assessing potential effects on air sports (eg sky diving and gliding) and water sports such as sailing and canoeing.
Ramblers' Association: King's Lynn Group	Expressed no objection to buried cables in the area. Suggested burying the cables under the bed of the river Welland to join up with the National Grid at the existing power station at Sutton Bridge.

Table 6.2 | **Examples of the sensitivity of receptors**

Receptor sensitivity	Description
high	Assisted Areas tourist attractions of regional or natural importance national trails/footpaths
medium	surrounding settlement regional footpaths and recreational routes commercial or other businesses, including shops and services local tourist attractions areas of particular value for rural amenity
low	local footpaths rural agricultural areas

Baseline Description

Sources of Information

6.4.4 Information sources used to establish the baseline for this assessment include:

- Regional Spatial Strategy (RSS) documents for the East of England (East of England Regional Assembly 2004) and the East Midlands (East Midlands Regional Assembly 2005)
- Local Plans for King's Lynn and West Norfolk (Borough Council of King's Lynn and West Norfolk 1998) and for South Holland (South Holland District Council 2005)
- labour market profile data for King's Lynn and West Norfolk from Nomis (www.nomisweb.co.uk)

- 2001 Census data (Office of National Statistics (www.statistics.gov.uk))
- Lincolnshire County Council's *Census Atlas* (Lincolnshire County Council 2005)
- Regional Economic Strategy documents for the East of England (East of England Development Agency 2004) and the East Midlands (East Midlands Development Agency 2006)
- figures on the economic impact of tourism from Lincolnshire County Council (2005b and 2005c), the East of England Tourist Board (2003) and East of England Tourist Board Research Services (2003)

Regional Overview

6.4.5 For each of the two regions being considered, a description of key socioeconomic indicators and features of their economy is given in comparison to national statistics. These data have been obtained from *Regions in Figures for 2004–05* (Office of National Statistics (www.statistics.gov.uk)).

East Midlands

6.4.6 The East Midlands region covers an area of 15,607 km^2, making it the fourth largest region in England in terms of area. It comprises the counties of Derbyshire, Leicestershire, Nottinghamshire, Northamptonshire, Lincolnshire, and Rutland. The region has a population of 4.2 million (7 per cent of the UK total), making it the second smallest region in England in terms of population. One in three of the population live in rural areas, 11 per cent higher than the national average. The region's main population centres are the cities of Derby, Nottingham, Leicester, and Lincoln, and the town of Northampton.

6.4.7 The region has no commercial construction ports but the coastal ports of Boston, Fosdyke, and Sutton Bridge account for a small proportion of total UK sea-borne freight and may offer opportunities for operation and maintenance support.

East of England

6.4.8 The East of England region covers an area of 19,120 km^2 and consists of the counties of Bedfordshire, Essex, Cambridgeshire, Hertfordshire, Norfolk, and Suffolk. The majority of its land is less than 60 m above ordnance datum with much of the fens and central lowlands being at or below sea level.

6.4.9 The region's population is approaching 5.5 million. The main population centres are Peterborough, Norwich, and Cambridge.

6.4.10 The eastern seaboard hosts seven major seaports such as Felixstowe, Harwich, and Tilbury, which combined handle more than half of the UK's containerised traffic. The main options for established construction ports potentially suitable for supporting offshore wind construction are seen as Great Yarmouth, King's Lynn, and Harwich/Felixstowe (DTI 2003). Great Yarmouth is the principal UK base for the offshore oil and gas industry in the southern North Sea and was used for the construction phase of the Scroby Sands offshore wind farm.

Population

6.4.11 The Borough of King's Lynn and West Norfolk is the tenth largest district council area in England and Wales (Borough Council of King's Lynn and West Norfolk 1998), covering an area of 1,429 km^2. The 2001 Census measured the population at 135,345 Nomis (www.nomisweb.co.uk), so population density is just below one person per hectare.

6.4.12 South Holland District covers an area of 742 km^2 (South Holland District Council 2005), with a population of 76,552, as measured in the 2001 Census (Office of National Statistics (www.statistics.gov.uk)). Population density in South Holland is one person per hectare.

6.4.13 Table 6.3 highlights the age structure of the East of England, Norfolk, and King's Lynn and West Norfolk, and of the East Midlands, Lincolnshire, and South Holland (Office of National Statistics (www.statistics.gov.uk)).

Table 6.3 | **Age structure of the East of England, Norfolk, and King's Lynn and West Norfolk; and the East Midlands, Lincolnshire, and South Holland**

	East of England	Norfolk	King's Lynn and West Norfolk	East Midlands	Lincolnshire	South Holland
0–15	1,082,761	144,796	24,448	836,823	123,969	13,676
	20.1 %	18.2 %	18.1 %	20.1 %	19.2 %	17.9 %
16–31	1,044,324	143,057	22,387	826,984	112,486	12,089
	19.4 %	18.0 %	16.5 %	19.8 %	17.4 %	15.8 %
32–47	1,262,165	171,874	28,927	973,437	143,537	16,269
	23.4 %	21.6 %	21.4 %	23.3 %	22.2 %	21.3 %
48–63	1,005,695	168,585	29,090	782,228	137,693	16,920
	18.7 %	21.2 %	21.5 %	18.7 %	21.3 %	22.1 %
64+	993,195	168,736	30,493	752,702	128,960	17,568
	18.4 %	21.2 %	22.5 %	18.0 %	19.9 %	23.0 %
Total population	5,388,140	796,728	135,345	4,172,174	646,645	76,522

6.4.14 Table 6.3 shows that the age structure both of King's Lynn and West Norfolk and of South Holland is skewed towards an older population, an effect that can be attributed to the out-migration of the young and in-migration of people of retirement age (South Holland District Council 2005).

6.4.15 The 2001 Census showed that of all the potentially economically active people (aged 16–74 years) in Norfolk, 60.5 per cent were employed, 5.0 per cent were unemployed and 34.3 per cent were economically inactive. For comparison, of all the potentially economically active people (aged 16–74 years) in King's Lynn and West Norfolk, 60.1 per cent were employed, 4.4 per cent were unemployed and 35.6 per cent were economically inactive.

6.4.16 A breakdown of the employees within nine broad employment sectors shows that wholesale and retail trade, repairs, manufacturing, and health and social work are the three largest employers both in Norfolk generally and in King's Lynn and West Norfolk Borough (Office of National Statistics (www.statistics.gov.uk)).

6.4.17 For Lincolnshire the 2001 Census showed that of all the potentially economically active people (aged 16–74 years), 60.6 per cent were employed, 4.9 per cent were unemployed and 34.4 per cent were economically inactive. For comparison, of all potentially economically active people (aged 16–74 years) in South Holland, 61.7 per cent were employed, 3.6 per cent were unemployed and 34.5 per cent were economically inactive.

6.4.18 In Lincolnshire and in South Holland District wholesale and retail trade, repairs, and manufacturing are the largest employers. Real estate, renting and business activities are the third largest employer in South Holland District (Office of National Statistics (www.statistics.gov.uk)).

6.4.19 The Government's standard measure for deprivation is called the Index of Multiple Deprivation (IMD), which covers several causes of deprivation (income, employment, health and disability, education, housing and access, etc.). The 354 local authority districts in England are each given a score devised from several different statistical sources, and a rank, where a rank of 1 indicates the most deprived.

6.4.20 This index approach yields a score for spatial areas called Super Output Areas (SOAs). The Office for National Statistics developed the SOAs. SOAs are geographical units that aggregate census output areas and are considered at three levels. The lowest level, containing an average of 15,000 people, is the level used in the 2004 Index of Multiple Deprivation (ODPM 2004).

6.4.21 From the 2004 Index of Multiple Deprivation it is evident that deprivation is not a major problem in King's Lynn and West Norfolk, as the district is ranked 150th out of the 354 districts in England. This places King's Lynn and West Norfolk approximately half way down the list (Office of National Statistics (www.statistics.gov.uk)).

6.4.22 South Holland District is ranked 210th out of the 354 districts in England; from the 2004 Index of Multiple Deprivation it is evident that deprivation is not a major problem in South Holland District (Office of National Statistics (www.statistics.gov.uk)).

6.4.23 The proposed development will not affect any Assisted Areas, or any qualifying for support under European Structural Funds.

Economic Activity and Wealth Creation

Regional Overview

6.4.24 Table 6.4 presents key economic statistics for each of the regions being considered. Gross Value Added (GVA) is 'a measure of productivity in an area and shows how much an area contributes to the UK economy. The term GVA is used to denote estimates that were previously known as gross domestic product (GDP) at basic prices. The term GDP denotes GVA plus taxes (less subsidies) on products, ie at market prices. Regional accounts are currently only published at basic prices, so the figures are now referred to as GVA rather than GDP as in previous publications' (Lincolnshire Enterprise 2005).

6.4.25 Per head GVA can be indexed to that of the UK, which illustrates whether an area is contributing more or less to the UK economy than the UK average. On the index the UK is 100; scores above this highlight productivity that is greater than the UK average, and scores below show that productivity is less than the UK average.

Table 6.4 | **Key regional economic statistics**

	East Midlands	East England	UK
Gross value added, 2003 £ Millions	61,681	83,043	951,692
Gross Value Added, 2003 (£ per head)	14,505	15,201	15,980
GVA £ per head, 2003 (UK=100)	91	95	100
Expenditure on Research and Development, 2002 (£ Millions)	1,362	3,429	19,275

East Midlands

6.4.26 The economy of the East Midlands has a value of more than £61 billion and has been growing quicker than the UK average for the last 20 years with lower unemployment than the national or European averages.

6.4.27 The level of GVA per head (91 per cent) is, however, below the average levels in the UK and the EU. There are also wide disparities within the region with some areas performing well while others, more reliant on primary industries such as agriculture, textiles, and mining, are performing significantly worse than the region as a whole. These areas include the Nottinghamshire/Derbyshire former coalfields, some urban areas of Nottingham, Leicester, and Derby, the Lincolnshire coastal resorts and some rural areas. These areas as a result also experience higher than average unemployment, social exclusion, and deprivation issues.

6.4.28 The region is influenced at its western edges by Manchester and Sheffield. The south of the region is more prosperous due to close links with the South East but there are parts of the region affected by rural deprivation and isolation.

East of England

6.4.29 In 2003 the economy of the East of England has a value of £83 billion, which is approximately 8.5 per cent of that of the UK. The region's GVA per head (and hence productivity) is just below the UK average at 95 per cent.

6.4.30 The region's economy is interlinked with and dependent upon the London economy. However, the region also has links to the East Midlands and South East through infrastructure, cross-boundary business sectors, clusters (eg public and private environmental organisations in Peterborough) and supply chains.

6.4.31 In the UK, the East of England has one of the highest expenditures on research and development at just under £3.5 billion, representing more than 4 per cent of regional GVA. There are eight universities and three higher education colleges in the region including the world-renowned University of Cambridge. Together these attract 65,100 full-time and 38,700 part-time students.

6.4.32 Renewable East and the East of England Development Agency are keen to attract offshore wind energy developers in the region. The strength factors that the region has to offer to this sector are:

- port infrastructure – the port of Great Yarmouth has a track record of wind farm developments (ie Scroby Sands)
- prime expertise in the offshore sector associated with the oil and gas operations and transferable to wind energy – including offshore installation, commissioning operation, and maintenance
- expertise in onshore installations, which is relevant for connection of the wind farm to the public grid

Local Overview

6.4.33 The economies of Lincolnshire and Norfolk reflect their highly rural character.

6.4.34 Two-thirds of Lincolnshire comprises agricultural tilled land (about three times the national average) and this is reflected in the workforce, of which 5.1 per cent are engaged in employment described as 'agriculture, hunting and forestry' (Lincolnshire County Council 2005). Agricultural land quality in the county is very good and the proportions of the 'best and most versatile' grades are also significantly higher than the national average. As a result of the high quality of the land much agriculture in the county is intensive, with vegetable and arable farming dominant and a considerable decline in pasture over the last 50 years.

6.4.35 The local authority areas of South Holland District and King's Lynn and West Norfolk Borough are also both considered to be predominantly rural (Defra 2005), the main land-use along the proposed cable route being agricultural tilled land. In its Regional Economic Strategy (RES) the East of England Development Agency (2004) notes that the King's Lynn sub-region, which includes the towns of Long Sutton and Sutton Bridge, is a priority regeneration area with high levels of deprivation and low economic performance. The East Midlands Development Agency (2006) in its RES also identifies the Lincolnshire coast as a relatively deprived part of the East Midlands.

Tourism and Recreation

6.4.36 The key tourism and recreation interests relate to the presence of significant habitats for wetland bird species and other wildlife.

Table 6.5 | **Regional tourism statistics**

	Lincolnshire[1]	Norfolk[2]
staying visitors (per annum)	3,058,800	4,914,000
staying visitor spend (£ per annum)	412,091,000	737,307,000
day visitors (per annum)	18,856,746	46,324,853
day visitor spend (£ per annum)	549,692,457	1,240, 515,441
Supported by tourism total business turnover (£ per annum)	1,145,030,500	2,825,863,000
Supported by tourism total full-time equivalent jobs	15,576	28,894
Supported by tourism total actual jobs	22,978	not available

[1] Lincolnshire County Council (2005b)
[2] East of England Tourist Board (2003)

6.4.37 Lincolnshire is bounded to the east by the North Sea and the western and southern parts of the Wash. The region is valued for its landscape, habitat and wildlife which are of local, national and international importance. Important areas include parts of the Lincolnshire coast around Gibraltar Point and the Wash which form an Area of Outstanding Natural Beauty (AONB) and are designated under the European Habitats Directive (as a Special Area of Conservation and Special Protection Area) and internationally as a Ramsar Site.

6.4.38 The coastlines of both Lincolnshire and Norfolk are renowned tourist locations. The beaches at Skegness, Sutton-on-Sea and Mablethorpe, for example, have been awarded the EnCams Seaside Award 2006, which recognises well-managed beaches that are clean and safe. The North Norfolk coast attracts visitors from all over the country and is designated as an Area of Outstanding Natural Beauty (AONB).

6.4.39 Table 6.5 summarises the economic value of tourism in Lincolnshire and Norfolk.

6.4.40 The Wash National Nature Reserve (NNR) is described by English Nature as one of the most outstanding coastal wetlands in Europe. Incorporating a mix of open deep water, permanent shallow water, mudflat, and salt marsh, the reserve is of considerable importance for migrating and wintering waders and wildfowl. Salt marsh areas are botanically diverse and also support important breeding bird populations. Sandbanks within the reserve are used by pupping Common Seals. The Peter Scott Walk (see below) provides the primary means by which most visitors are able to visit the NNR and view its features of interest. English Nature discourages access to the NNR, beyond that afforded by public rights of way, without appropriate guidance.

6.4.41 The natural environments of South Holland and of King's Lynn and West Norfolk vary from fenlands to coastal areas with sand dunes, salt marshes and mudflats (South Holland District Council 2005). Certain areas of these two districts are designated AONB, although no land within 4 km of the proposed cable route is designated in this way; the nearest such location is the Norfolk coast east of the river Great Ouse.

6.4.42 There are no National Trails affected by the proposed cable route, although the Nene Way follows the River Nene, located to the west of the proposed cable route. The Peter Scott Walk follows the seawall along the coast from the mouth of the River Nene to the ferry crossing at King's Lynn. There are several Public Rights of Way (footpaths and bridleways) in the vicinity of the proposed cable routes and substation (Ordnance Survey 1998 and 1996).

6.4.43 National Cycle Route 1: Coasts and Castles passes to the southwest of the substation and proposed cable routes. The Norfolk Coast Cycleway is a 95 km cycle route from King's Lynn to Cromer. At its closest point it passes 0.38 km from the proposed development.

6.4.44 There are no other formal recreational resources that are likely to be affected by the proposed development.

Summary

6.4.45 The socio-economic, tourism and recreational character of the area potentially affected by the onshore works for the three wind farms reflects the rural setting of the Lincolnshire and Norfolk coast. The primary economic activities of the area are rural, particularly agriculture. Tourism is also important to the region with visitors drawn to the open coastal landscape, extensive clean beaches and abundant wildlife. While no National Trails are directly affected by the proposed works, there are important walkways (including the Peter Scott Walk) and National Cycle Routes nearby.

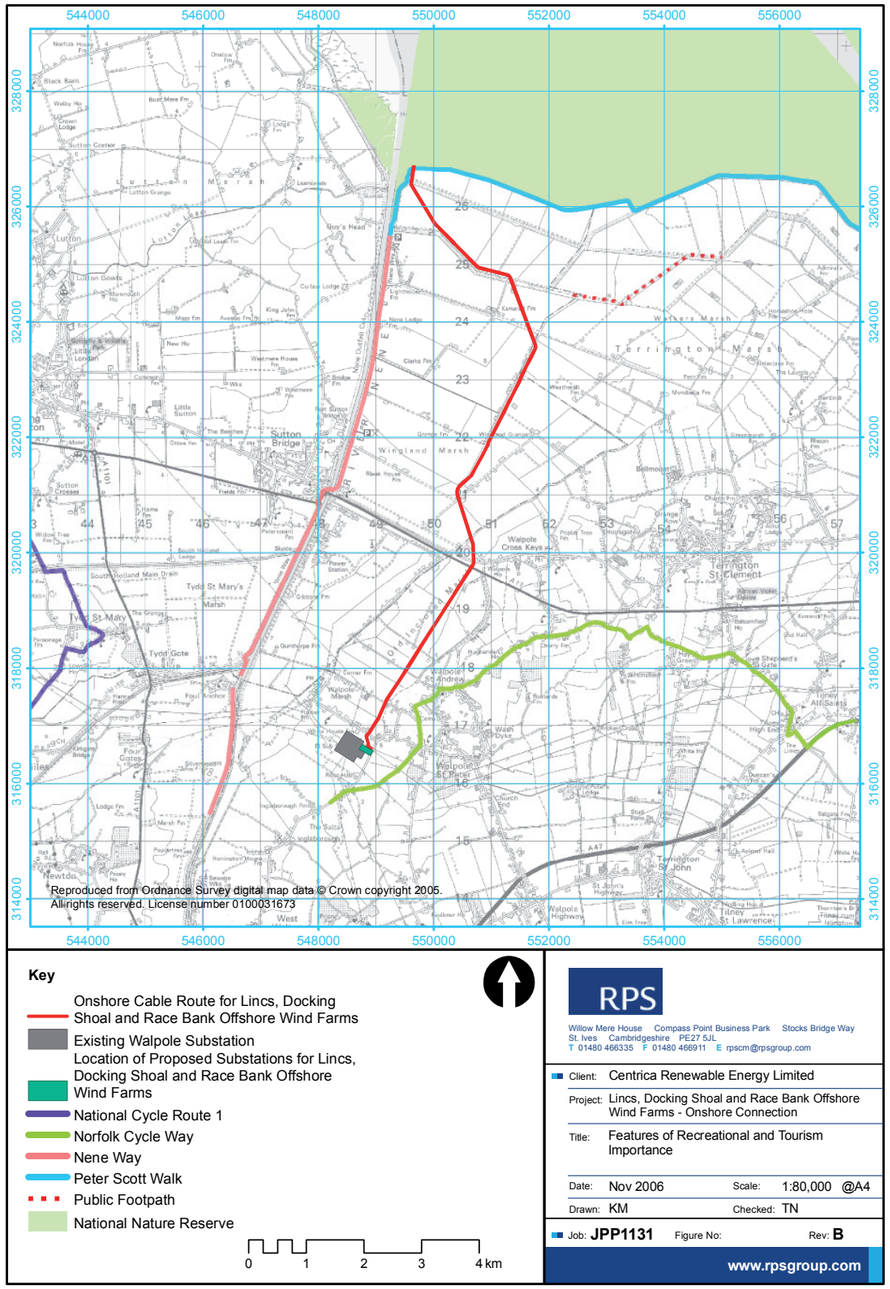


Figure 6.7 | Features of recreational and tourism importance

6.5 Noise

Introduction

6.5.1 This chapter of the Environmental Statement (together with Section 7.5) considers the potential effect of the onshore elements of the grid connection for the proposed Lincs, Docking Shoal and Race Bank Offshore Wind Farms on the existing noise environment of the proposed cable route and the area of Walpole Marsh substation. In this chapter the approach to the assessment is outlined and the baseline noise environment is described. Section 7.5 identifies those aspects of the proposed developments that may cause noise impacts, assesses the significance of potential impacts and identifies appropriate mitigation.

6.5.2 Noise levels are typically referred to using a logarithmic ratio scale called the decibel (dB). This measure of noise can be defined in terms of sound power levels (Lw), which is used in this assessment to indicate the strength of a noise source, or sound pressure levels (Lp), used to indicate exposure to noise at a specific location.

6.5.3 As noise levels can vary with time, statistical indices can be applied to the Lp parameter as follows:

- L_{eq} is the sound level that, if maintained continuously for a stated period of time, would give the equivalent amount of noise energy as the varying levels would over the same period
- L_{90} those levels that are exceeded for 90 per cent of each sample period (often used to describe background levels)

6.5.4 As only some frequencies of noise are audible to the human ear, the term dB(A) is used to represent the weighting applied to the decibel unit to represent the frequency response of the human ear. In this assessment the terms L_{Aeq} and L_{A90} are, therefore, used to describe noise levels over time.

Approach to the Assessment

Scope of Work

6.5.5 The assessment involved the following key tasks:

- identification of appropriate standards and guidance for use in the baseline of noise impacts
- collection of daytime and night-time ambient noise level data in order to determine the existing baseline noise climate at potentially sensitive properties in the vicinity of the site
- quantitative and qualitative assessment of noise levels at potentially sensitive local receptors during the construction phase of the development
- quantitative and qualitative prediction and assessment of noise levels at a selection of receiving properties, which have the potential to be affected by a change in noise level in future years as a result of the development
- determination of the significance of the impacts associated with both the construction and operation of the development
- provision of proposals for mitigation measures, where appropriate, in order to minimise any potential negative impacts arising from the development and prediction of any residual effects that may remain following implementation of said mitigation measures

Relevant Planning Policy and Guidance

6.5.6 Various guidance documents and assessment methodologies have been adopted to determine whether any adverse noise impact is likely to occur as a result of the onshore elements of the project during both the construction and operational phases.

6.5.7 The current Government guidance about noise within the planning system is contained in *Planning Policy Guidance Note 24: (PPG24) Planning and Noise*. With regard to the specifics of renewable energy there is further limited guidance about noise in *Planning Policy Statement 22 (PPS22): Renewable Energy.*

6.5.8 These planning policy guidance documents are discussed in further detail in Table 2.7 of Chapter 2.

6.5.9 With regard to the assessment of noise from industrial facilities of this sort, PPG24 refers to the following methodologies:

British Standard BS 4142:1997

6.5.10 BS 4142:1997 (BSI 1997a) assesses the likelihood of complaints arising from an industrial facility by comparing noise from the specific source being considered and the background noise level (measured as an L_{A90}), in the absence of the specific source.

6.5.11 If appropriate a character correction of +5 dB(A) can be added to the specific noise level where the source has any distinctive characteristics (tones or impulses, such as whines, hums or bangs) or if it is irregular enough to attract attention. This is termed the rating level.

6.5.12 This rating level is directly compared to the background noise level (L_{A90}) of the locality in the absence of the process under consideration, in order to conclude an assessment level. With regard to this assessment level the standard states that a rating level of around 10 dB or higher above the background indicates that complaints are likely to occur. A difference of around +5 dB above the background is considered to be of marginal significance. These descriptions are summarised in Table 6.6 below.

Table 6.6 | **BS 4142 significance criteria**

Assessment level, dB(A) (rating level relative to background level)	Description
<–10	'If the rating level is more than 10 dB below the measured background level then this is a positive indication that complaints are unlikely' (negligible significance)
–10 to +5	The more negative the difference, the less the likelihood of complaints (minor significance)
+5	'A difference of around +5 dB is of marginal significance' (minor–moderate significance)
+5 to +10	But the more positive the difference the greater the likelihood of complaints (moderate significance)
>+10	'A difference of around 10 dB or more indicates that complaints are likely' (major significance)

6.5.13 Since background noise levels vary throughout a 24-hour period it is necessary to assess the acceptability of noise levels for separate periods (eg day and night) chosen to suit the hours of operation of the project.

6.5.14 In situations where the L_{A90} background and the rating levels are both considered to be 'low' (background of less than 30 dB(A) and a rating level of less than 35 dB(A)), the British Standard states that the presented methodology is not applicable. In these circumstances, it is usually more appropriate to assess the noise impact by considering sleep disturbance criteria and other aspects such as noise change. It should be noted that this is not a BS 4142, or British Standards Institute recommendation (there is no advice given as to an acceptable approach in these circumstances), but it is accepted practice for situations of this type.

BS 8233: 1999

6.5.15 BS 8233 (BSI 1999b) defines a range of ambient noise levels for several design criteria for good or reasonable conditions in certain habitable rooms. Table 6.7 presents a summary of the levels recommended in BS 8233 for habitable rooms within residential dwellings.

Table 6.7 | **BS 8233 design range for habitable rooms**

Criterion	Typical situation	Design range dB $L_{Aeq,T}$	
		good	reasonable
reasonable resting or sleeping conditions	living rooms	30	40
	bedrooms*	30	35

* For a reasonable standard in bedrooms at night, the standard states that individual noise events should not normally exceed 45 dB L_{Amax}

World Health Organization

6.5.16 Guidance on desirable levels of environmental noise is also given by the World Health Organization (WHO) within the document *Guidelines for Community Noise* (WHO 2000).

6.5.17 In the guidelines document, it is considered that the sleep disturbance criteria should be taken as internal noise levels of 30 dB L_{Aeq} and 45 dB L_{Amax}, or external levels of 45 dB L_{Aeq} and 60 dB L_{Amax} with windows open.

6.5.18 With regard to external daytime levels, the WHO document states that 'To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level should not exceed 55 dB L_{Aeq}. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB L_{Aeq}.'

Construction Noise and Vibration

6.5.19 *BS 5228: Noise Control on Construction and Open Sites, Parts 1, 2 and 4* (BSI 1999a; BSI 1997b; BSI 1992a) provides information and procedures for the control of noise and vibration from activities on construction sites, including piling. BS 5228 does not promote specific noise limits for construction noise and vibration but does provide guidance on predicting and measuring noise.

6.5.20 With respect to hours of work, BS 5228 makes reference to the fact that noise levels generated during the evening (19.00–23.00 hours) may need to be lower than the daytime (07.00–19.00 hours) period (a difference of 10 dB is quoted) and also that for any night-time operations (23.00–07.00 hours) levels should be quieter still. The standard does not, however, offer guidelines with respect to acceptable levels.

6.5.21 The Department of the Environment (DoE) (now Defra) *Advisory Leaflet 72* (DoE 1976) suggests that 70 dB L_{Aeq} should be applied as an acceptable guideline level at the façade of residential properties. This is equivalent to a free field noise level of 67 dB L_{Aeq}.

6.5.22 Ground-borne vibration from construction sources, due mainly to operations such as impact piling, can be a source of concern for occupants of buildings in the vicinity. The concerns can be that the building may suffer some form of cosmetic or structural damage or that ground settlement may arise that could subsequently lead to damage. It should be noted that there is a major difference between the sensitivity of people feeling vibration and the onset of levels of vibration that damage a structure. Table 6.8 presents the thresholds for the evaluation of the onset of risk of minor cosmetic damage to buildings (ie levels below which minor or cosmetic damage is unlikely). The levels are described in terms of peak particle velocity (PPV) for both intermittent and continuous vibration and are drawn from the guidance given in BS 5228 Part 4 (BSI 1992a) and BS 7385 Parts 1 and 2 (BSI 1990; BSI 1993).

Table 6.8 | **Evaluation of building damage due to vibration (threshold values)**

Building classification	Peak particle velocity (mm s^{-1})	
	intermittent	continuous
residential in generally good repair	10	5
residential where preliminary survey reveals significant defects	5	2.5
industrial or commercial – light and flexible structure	20	10
industrial or commercial – heavy and stiff structure	30	15

6.5.23 With regard to vibration and its effects on the human body, the level that is perceivable by humans is much lower than that required to cause building damage. The human body is most sensitive to vibration in the vertical direction (foot to head). The effect of vibration on humans is guided by British Standard 6472 (BSI 1992b). This standard does not give guidance on the limit of perceptibility, but it is generally accepted that vibration becomes perceptible at levels of approximately 0.15–0.30 mms^{-1}.

6.5.24 BS 6472 defines base curves, in terms of root mean square (rms) acceleration, which are used to assess continuous vibration. The standard states that in residential buildings, the base curve should be multiplied by 1.4 at night and by 2–4 during the daytime to provide magnitudes at which the probability of adverse comment is low. In order to assess human exposure to vibration, measurements ideally need to be undertaken at the point at which the vibration enters the body, ie measurements would need to be taken inside properties. However, various conversion factors have been established to convert vibration levels measured at a foundation to levels inside buildings, depending on the structure of the building.

Local and Regional Policies

6.5.25 Objectives of local and regional planning policies relating to noise are detailed in Table 2.3 in Chapter 2. Key policies are Policy 9/31 of the King's Lynn and West Norfolk Local Plan and Policy SG13 of the South Holland Local Plan.

6.5.26 Where vibration is intermittent or occurs as a series of events, the use of vibration dose values (VDVs) is recommended in BS 6472 for the assessment of subjective response to vibration. The VDVs at which it is considered there will be a low probability of adverse comment are drawn from BS 6472 and presented in Table 6.9.

Table 6.9 | **Evaluation of human disturbance due to vibration (threshold values)**

Place	Daytime 16-hour VDV ($ms^{-1.75}$)	Night-time 8-hour VDV ($ms^{-1.75}$)
critical working areas	0.11	0.09
residential	0.22–0.43	0.13
office	0.43	0.36*
workshops	0.87	0.73

*These VDV thresholds would not apply unless night-time work was a regular activity at the premises.

Consultations

6.5.27 The location of the substation and the route of the onshore cable comes under the jurisdiction of two local planning authorities, namely, King's Lynn and West Norfolk Borough Council (KLWNBC) and South Holland District Council (SHDC).

6.5.28 An assessment procedure was agreed with the environmental health officers from each of the local authorities (telephone conversations and subsequent emails between J. Joynt (RPS) and D. Clack (KLWNBC) and S. Branson (SHDC) during February and March 2006). It was confirmed that the assessment of the operational phase of the development would be undertaken in line with the guidance of BS 4142. Both councils confirmed that a rating level of a maximum of 5 dB above the existing background would be acceptable. However, more preferably the difference would be between 0–3 dB. The agreed assessment for the construction and operational phases are detailed below.

Transportation

6.5.29 Transportation noise has been discussed separately as part of Section 6.7. It is predicted that the impacts on the local traffic flows will not be sufficient to significantly effect noise levels in the area.

Baseline Description

Existing Situation and Proposals

6.5.30 The development proposals are described in Chapter5 .

6.5.31 The closest residential properties to the proposed site of the substation are Holmleigh House and White House Farm, which are approximately 300 m and 240 m from the substation location respectively. Both of these properties are to the north, accessed off French's Road.

6.5.32 Along the proposed route of the onshore cable an additional five locations, as detailed within Table 6.10, would be subject to noise generated during the construction phase of the cable installation.

6.5.33 The seven receptors that have been identified as the most sensitive with regard to noise from the proposed development are detailed in Table 6.10, and shown in Figure 6.8.

Table 6.10 | **Sensitive receptors – separation distances**

Receptor number	Address	Distance from Substation (m)	Distance from cable route (m)
1	Holmleigh House, French's Road	165	170
2	White House Farm, French's Road	190	77
3	Nursery Farm, Marsh Road	N/A	30
4	The Rosary, Goose Lane	N/A	266
5	2 Grange Road	N/A	183
6	The Gables, Cockhole Road	N/A	40
7	5 Kamarad Cottages	N/A	300

N/A – location at a distance in excess of 300 m from the proposed substation location.

6.5.34 Table 6.11 below details the noise-monitoring schedule agreed with both KLWNBC and SHBC at each of the 7 receptors. Figure 6.8 above illustrates the relative location of the sensitive receptors to both the construction and operational phases of the development.

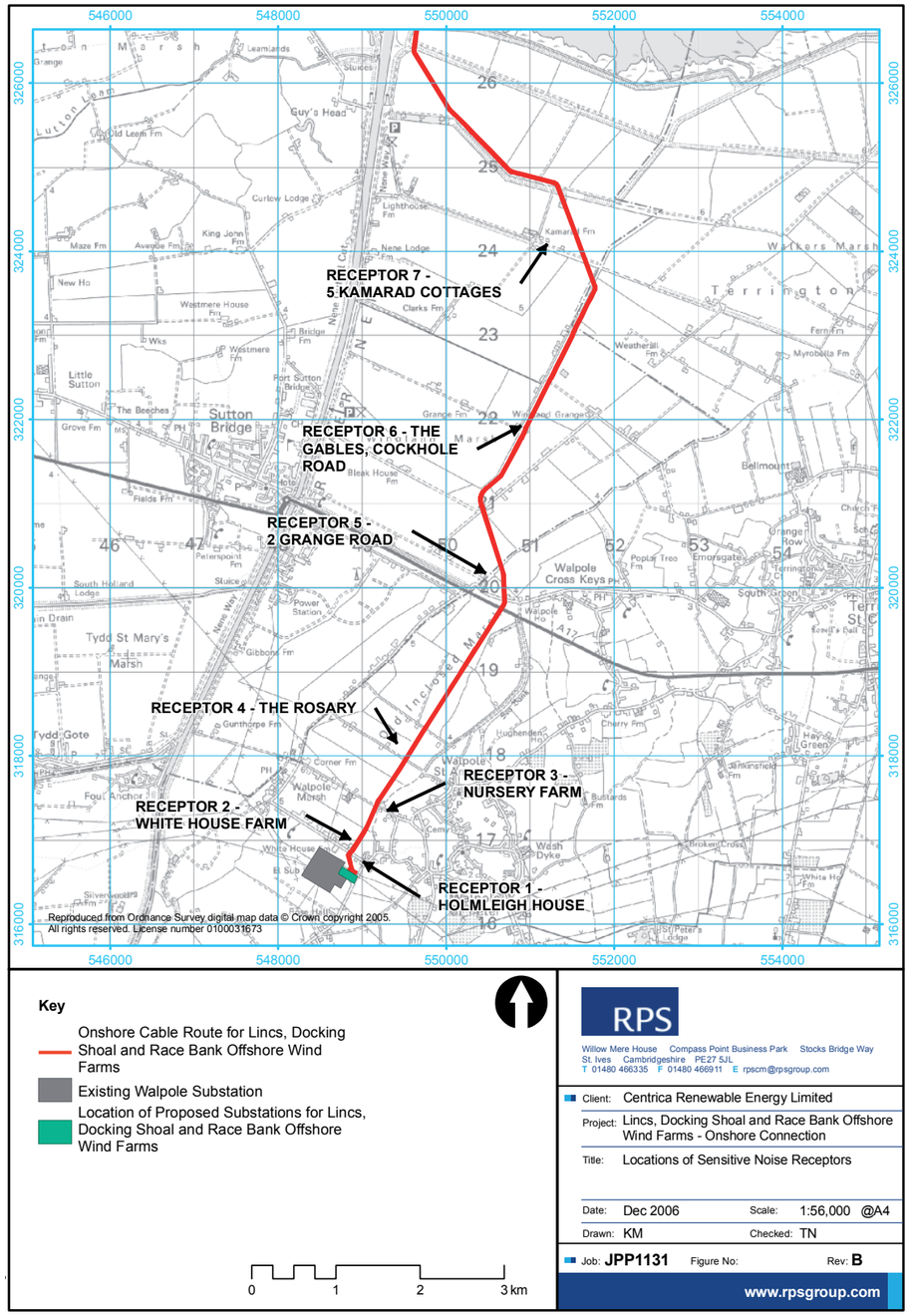


Figure 6.8 Locations of sensitive noise receptors

Table 6.11 | **Sensitive receptors – noise monitoring information**

Receptor number	Measurement duration	Noise monitoring location	Main noise sources
1	24 h continuous	free-field location at the rear of the property, 34 m from Walpole Bank Road, 22.2 m from house and 2.1 m from the boundary hedge	low flying military aircraft, HGV on Walpole Bank and French's Road, telephone bell, low-frequency tone from the existing substation
2	2 h daytime, 15 min night-time	free-field location approximately 15 m from the edge of Wisbech Road on land adjacent to the property. There is a direct line of sight with the existing substation, 15 m to the south of the property	day – vehicles accessing the property, planes overhead and HGVs on Wisbech road (2–4 per hour)
			night – occasional vehicles on Wisbech Road
3	2 h daytime, 15 min night-time	free-field location approximately 10 m from Marsh Road on the driveway to the property	day – plane overhead, car accessing drive and car alarm (5 sec)
			night – cockerel cry and car passing, continuous running water in neighbour's garden
4	2 h daytime, 15 min night-time	free-field location approximately 6 m from Goose's Lane on the outside of the property boundary	day – wind in the trees, van running engine near meter, dogs barking, cars on nearby road, military plane overhead
			night – car on quiet single carriageway
5	2 h daytime, 15 min night-time	free-field location approximately 6 m from the edge of Grange Road on land in front of the properties on the other side of the road	day – traffic noise from the A17, and occasional traffic on Grange Road (3–5 cars/h)
			night – traffic noise from the A17
6	2 h daytime, 15 min night-time	free-field location approximately 3 m from the edge of Hospital Road and Cockhole Road on land in front of the properties on the opposite side of the road	day – plane overhead and traffic on quiet single-track road (3–5 cars/h)
			night – distant road noise
7	2 h daytime, 15 min night-time	free-field location approximately 3 m from the edge of the single-track access road to the field and barns	day – dog barking, farm vehicle activity in last hour
			night – occasional dog barking

6.5.35 Noise monitoring was undertaken initially between the 13–14 March 2006 and for a 24-hour period between the 28–29 March 2006. All monitoring, with the exception of the continuous 24-hour period, was undertaken fully attended by competently trained RPS acoustic technicians. The 24-hour monitoring period was undertaken unattended, but was instigated and periodically monitored by competently trained RPS acoustic technicians.

6.5.36 During the noise monitoring, detailed notes of the weather conditions and the existing noise climate of the locality were recorded. The weather conditions are as noted below.

13 March 2006 (receptors 2–5)

6.5.37 The weather conditions dry (approximately 5°C) with the wind ranging between 1–3 ms^{-1}, with occasional gusts of up to 6 ms^{-1}.

14 March 2006 (receptors 6–7)

6.5.38 The weather conditions varied, with surface water affecting the road surfaces during the monitoring, wind speeds ranged between 1–3 ms^{-1} throughout the monitoring. The ground-level temperature during the day was a maximum of 5°C, and 1°C during the night-time period.

28–29 March 2006 (receptor 1)

6.5.39 At start of the monitoring the weather conditions dry (12°C), with occasional blustery winds. As the survey progressed the weather remained dry with broken cloud cover.

6.5.40 The noise monitoring was undertaken using a Norsonic 188, Rion NL-32 and a Bruel and Kjaer 2260, the noise meters were calibrated before and after each survey period with a Rion NC-74 acoustic calibrator, and no significant fluctuations were noted.

6.5.41 Calibration certificates and a full output of the noise-monitoring data can be seen in Appendixes (A2.4) respectively. A summary of the noise-monitoring data is presented below in Table 6.12, for the following metrics: L_{A90}, L_{Aeq} and L_{Amax}.

Table 6.12 | Monitored existing external free field noise levels

Receptor	Address	Daytime			Night-time		
		L_{A90}	L_{Aeq}	L_{Amax}	L_{A90}	L_{Aeq}	L_{Amax}
1	Holmleigh House	40.7	55.1	93.7	34.0	43.3	76.6
2	White House Farm	42.4	55.6	80.8	31.2	51.1	73.6
3	Nursery Farm	43.1	54.0	84.6	33.6	48.2	75.7
4	The Rosary	44.1	57.3	81.6	31.9	36.5	46.8
5	2 Grange Road	52.2	59.7	79.0	32.9	46.7	61.6
6	The Gables	39.7	50.1	77.3	29.3	35.3	56.1
7	5 Kamarad Cottages	37.8	51.3	79.6	29.7	36.6	56.3

Summary

6.5.42 Existing noise levels along the cable route and in the area of the Walpole Marsh substation have been measured and characterised. The surveys undertaken indicate that the key existing daytime noise sources include road traffic, the existing substation at Walpole Marsh, low-flying aircraft and adjacent farming agricultural activities. During the overnight period night noise levels are measured to be at a lower level, with road traffic and the sounds of dogs barking being among the key contributing sources.

6.5.43 These noise data form the basis of the noise impact assessment contained within Chapter 7.5. The assessment considers sources of noise potentially arising from the construction, operation and decommissioning of the onshore cables and the substations for elements of the Lincs, Docking Shoal and Race Bank Offshore Wind Farms.

6.6 Ecology and Nature Conservation

Introduction

6.6.1 This chapter, together with Chapter 7.6, considers the potential effect that the onshore elements of the grid connection for the proposed Lincs, Docking Shoal and Race Bank Offshore Wind Farms may have on ecology and features of importance for nature conservation within the area of the proposed cable route and Walpole Marsh substation. In this chapter the approach to the assessment is outlined and the baseline environment with respect to ecology and nature conservation is described. Chapter 7.6 identifies those aspects of the proposed developments that may cause impacts on ecology and nature conservation, assesses the significance of potential impacts and identifies appropriate mitigation.

Approach to the Assessment

Study Area

6.6.2 The study area includes the proposed route of the cables above MHWS (See Offshore volume 1 for assessment of ecology and nature conservation below MHWS.). It is anticipated that cables for all three wind farms will follow the same route and occupy a total corridor of up to 50 m. The study area also includes the areas adjacent to the existing substation at Walpole that will be affected by the installation of new infrastructure, including 132/400 kV transformer equipment with associated switchgear and busbars; cooling equipment and cabling; access routes; and temporary working and storage areas associated with all three wind farms. An extended Phase I habitat survey; wintering and breeding bird surveys; and, where required, targeted surveys for other groups and species have been conducted within an area 500 m either side of the central point of the proposed cable route and 500 m around the substation extension works.

6.6.3 Surveys undertaken below Mean High Water Spring (MHWS). (equivalent to the seaward toe of the current sea wall) and assessment of these ecological features are addressed in the Offshore Environmental Statement (ES). The height of mean high water springs is the average throughout the year of two successive high waters during those periods of 24 hours when the range of the tide is at its greatest.

Sources of Information

Legislation, Guidance and Policies

6.6.4 This assessment has been prepared taking account of the following legislation, guidance and policies:

- the Conservation (Natural Habitats andc) Regulations 1994
- the Wildlife and Countryside Act 1981 (as amended)
- Planning Policy Statement 9: Biodiversity and Geological Conservation
- the Protection of Badgers Act 1992
- relevant regional and local plans
- the UK Biodiversity Action Plan

The Conservation (Natural Habitats etc.) Regulations

6.6.5 The Conservation (Natural Habitats etc.) Regulations 1994 ('Habitats Regulations') transpose Council Directive 79/409/EEC on the conservation of wild birds ('Birds Directive') and Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ('Habitats Directive') into national law (in conjunction with the Wildlife and Countryside Act, see below).

6.6.6 Regulation 48(1) states: 'A competent authority, before deciding to undertake, or give consent, permission or other authorisation for a plan or project which (a) is likely to have a significant effect on a European site in Great Britain (either alone or in a combination of projects), and (b) is not directly connected with or necessary to the management of the site, shall make an appropriate assessment of the site in view of the site's conservation objectives.' It should be noted that the onshore components of the proposed development are unlikely to require consideration in terms of Regulation 48.

6.6.7 Regulation 39 of the Habitats Regulations makes it an offence (subject to exceptions) to deliberately capture, kill, disturb, or trade in the animals listed in Schedule 2 (European protected species of animals), or pick, collect, cut, uproot, destroy, or trade in the plants listed in Schedule 4 (European protected species of plant). New developments for which development works would contravene the protection afforded to European protected species require a derogation (in the form of a licence) from the provisions of the Habitats Directive.

The Wildlife and Countryside Act 1981 (as Amended)

6.6.8 The Wildlife and Countryside Act 1981 (as amended) is the principle mechanism for the legislative protection of wildlife in Great Britain. This legislation is the means by

which the Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention') and the European Union Directives on the Conservation of Wild Birds (79/409/EEC) and Natural Habitats and Wild Fauna and Flora (92/43/FFC) are implemented in Great Britain.

6.6.9 Planning authorities are required to consult English Nature before granting planning permission for the development of land in a Site of Special Scientific Interest (SSSI), or within the consultation area around an SSSI as defined by English Nature. The planning authority is also required to consult English Nature if the development is considered likely to affect an SSSI, even if the application site falls outside the SSSI and surrounding consultation area.

Planning Policy Statement 9: Biodiversity and Geological Conservation

6.6.10 PPS 9 sets out planning policies on protection of biodiversity and geological conservation through the planning system. These policies complement, but do not replace or override, other national planning policies and should be read in conjunction with other relevant statements of national planning policy.

6.6.11 In establishing the existing baseline environment a range of relevant policies from the structure plans covering Norfolk and Lincolnshire and the local government areas of King's Lynn and West Norfolk and South Holland were reviewed. Details of the relevant objectives of these plans are included in Table 2.3, Chapter 2. Key policies include:

- Norfolk Structure Plan:
  - Policies ENV1, ENV4 and ENV6
- Lincolnshire Structure Plan:
  - Policies NE2, NE3, NE4 and NE5
- Kings Lynn and West Norfolk Local Plan:
  - Policies 4/1, 4/3, 4/4 and 9/31
- South Holland Local Plan:
  - Policies EN1 and EN2

Consultation

6.6.12 Initial consultation was sought by inviting comment from statutory and non-statutory consultees upon a scoping report issued in January 2006. That document detailed the scope of works to be undertaken and the final content of the assessment presented here. Consultees included English Nature, the RSPB, the Lincolnshire Wildlife Trust and the Norfolk Wildlife Trust.

6.6.13 In addition, specific additional consultations were undertaken with English Nature and the RSPB regarding survey methods for birds.

Assessment Methods

6.6.14 The assessment method for this ecological assessment is based on guidance issued by the Institute of Ecology and Environmental Management (IEEM 2006).

6.6.15 The method involves four key stages:

- baseline studies
- identification of valued ecological receptors
- identification and characterisation of potential impacts
- assessment of impact significance

Baseline Studies

6.6.16 Baseline studies are conducted within the identified zone of influence of the proposed development.

6.6.17 Baseline information about ecological features, including sites of importance for nature conservation, species populations, species assemblages and habitats, is obtained from several key sources including:

- existing data and information relevant to the site, from published sources, data bases and local recorders
- consultation
- ecological surveys

Identification of valued ecological receptors

6.6.18 It is impractical and inappropriate for an assessment of the ecological effects of a development to consider every species and habitat that may be affected. Instead, it should focus on 'valued ecological receptors'. Valued ecological receptors are species and habitats present within the zone of influence of the proposed development that are of sufficiently high value that an effect upon them as a result of the proposed development could be considered to be significant.

6.6.19 The value of sites, populations of species, species assemblages and habitats is evaluated with reference to:

- their importance in terms of 'biodiversity conservation' value (which relates to the need to conserve representative areas of different habitats and the genetic diversity of species populations)
- any social benefits that species and habitats deliver (eg relating to enjoyment of flora and fauna by the public)
- any economic benefits that they provide

6.6.20 For the purposes of this assessment, sites, species populations, species assemblages and habitats have been valued on the following scale:

- international
- national (UK)
- county
- district
- parish or local
- less than local

6.6.21 The valuation of sites makes use of established value systems (eg SSSIs are all of national importance, County Wildlife Sites are of county importance), although judgement is required for the valuation of sites of less than district value.

6.6.22 The valuation of populations of species, assemblages of species and habitats uses accepted criteria, examples include:

Species Populations

6.6.23 The importance of populations is evaluated on the basis of their size, recognised status (eg published lists of species of conservation concern, Biodiversity Action Plan status) and legal protection status. Bird populations, for example, exceeding one per cent of published biogeographic populations are considered to be of international importance, those exceeding one per cent of published national populations are considered to be of national importance, and so forth.

Species Assemblages

6.6.24 In some instances, it is the species assemblage that is important. Criteria used to evaluate the importance of assemblages include Site of Special Scientific Interest (SSSI) selection criteria and frameworks such as that of Fuller (1980), which provides guidance for evaluating the relative importance of bird assemblages.

Habitats

6.6.25 Criteria for the evaluation of habitats and plant communities include Annex III of the EC Habitats Directive, guidelines for the selection of biological SSSIs and, where available, local authority and wildlife trust criteria for the selection of local sites (eg County Wildlife Sites). Legal protection status is also a consideration for certain habitats.

6.6.26 Institute of Ecology and Environmental Management (IEEM) guidelines on ecological impact assessment (IEEM 2006) notes the difficulty of devising valuation criteria that can be consistently applied to designated sites, habitats and species in the same way in all parts of the country, and recommends an approach to valuation that involves teasing apart the different values that can be attached to the ecological receptors under consideration. However, it is beneficial to give examples of the sorts of criteria used in the valuation process, summarised in Table 6.13, which has been adapted from a similar table included in several of the earlier drafts of the IEEM guidelines.

Table 6.13 | **Examples of criteria used to evaluate ecology receptors**

Level of value	Examples of definitions
international	an internationally important site, eg SPA, SAC or Ramsar (or a site considered worthy of such designation); a regularly occurring population of an internationally important species (listed on Annex IV of the Habitats Directive)
national (UK)	a nationally designated site, eg SSSI, or a site considered worthy of such designation; a viable area of a habitat type listed in Annex 1 of the Habitats Directive, or smaller areas of such habitat which are essential to maintain the viability of a larger whole; any regularly occurring population of a nationally important species, eg listed on Schedules 5 and 8 of the Wildlife and Countryside Act 1981; a feature identified as of priority in the UK BAP
county (Norfolk, Lincolnshire)	areas of internationally or nationally important habitats which are degraded but are considered readily restored; viable areas of key habitat identified in Local BAPs, or smaller areas of such habitat which are essential to maintain the viability of a larger whole; a site designated as a Wildlife Site or Site of Nature Conservation Interest (SNCI); a regularly occurring, locally significant number of a nationally important species
district	areas of habitat identified in a sub-county (district/borough) or in the relevant Natural Area profile; district sites that the designating authority has determined meet the published ecological selection criteria for designation, including Local Nature Reserves; sites or features that are scarce within the district or borough or which appreciably enrich the district or borough habitat resource; a diverse or ecologically valuable hedgerow network
parish or local (site and its vicinity, including areas of habitats contiguous with or linked to those on site)	areas of internationally or nationally important habitats which are degraded and have little or no potential for restoration; a good example of a common or widespread habitat in the local area
less than local	areas of heavily modified or managed vegetation of low species diversity or low value as habitat to species of nature conservation interest; common and widespread species

6.6.27 In this assessment, sites, species populations, species assemblages and habitats are considered to be Valued Ecological Receptors (VER) if they meet the following minimum level of importance:

- *sites* – district importance
- *species populations and assemblages* – district importance
- *habitats* – district importance

6.6.28 It is considered that no significant effect can occur to features of lesser importance than those listed, except where a feature has high social or economic value.

6.6.29 The description and valuation of ecological features will take account of any likely changes, including, for example, trends in the population size or distribution of species; likely changes to the extent of habitats; and the effects of other proposed developments or land-use changes.

Baseline Studies

Overview

6.6.30 The following information presents the results of the studies undertaken to determine the value of ecological receptors within the study area, and the subsequent identification of those receptors for which an assessment of the potential impacts of the development proposals was required.

6.6.31 An initial appraisal of the site identified the following survey requirements:

- a desk study of existing information, including records held by relevant biological records centres
- an extended Phase I habitat survey together with scoping for additional species-specific survey requirements
- winter farmland bird surveys
- winter high tide waterbird surveys

Desk Study

6.6.32 A desk study was conducted that involved contacting a number of statutory and non-statutory nature conservation bodies for information on species and sites of nature conservation interest. The purpose of collecting this information was to supplement the site assessment and identify records of any species that may not be recorded during the survey.

6.6.33 Covering an area of at least 2 km either side of a central point along the proposed cable corridor and substation (see Figure 6.9), the desk-study search area included a review of existing statutory sites of nature conservation interest.

6.6.34 Information on the location of Ramsar Sites, Special Protection Areas (SPAs), Special Area of Conservation (SACs), Sites of Special Scientific Interest (SSSIs) and National Nature Reserves (NNRs) was obtained from www.magic.gov.uk.

6.6.35 Information about the interest features and conservation objectives of these sites was obtained from the Ramsar Bureau and relevant agencies (JNCC and English Nature).

6.6.36 The Lincolnshire and Norfolk Wildlife Trusts were contacted for information on non-statutory County Wildlife Sites (CWS).

6.6.37 Organisations contacted for information about habitats and species were:

- British Trust for Ornithology (BTO)
- Centre for Ecology and Hydrology (CEH)
- English Nature
- Norfolk Biological Records Centre
- Norfolk Wildlife Trust
- Lincolnshire Badger Group
- Lincolnshire Bat Group
- Lincolnshire Wildlife Trust
- RSPB
- Wash Wader Ringing Group (WWRG)
- National Biodiversity Network ‘NBN Gateway’ (www.nbn.org.uk)

Site Surveys

6.6.38 A Phase 1 survey following the standard method (NCC, 1990, revised by JNCC in 2003) was undertaken between 7 and 9 December 2005. The survey was extended to include searches for, and mapping of potential habitat for:

- amphibians – including great crested newts
- reptiles
- mammals – including water voles, otters, brown hares, badgers and bats
- invertebrates

6.6.39 In addition, the presence of lower plants or protected or notable plants was recorded. Winter bird surveys were undertaken concurrently and are described below.

6.6.40 Areas of similar habitat were mapped as accurately as possible using the JNCC Phase 1 habitat categories. Typical plant species assemblages were recorded for each category of habitat, and species names used follow Stace (1997). Target notes were made on any habitat features of particular ecological interest. Hedges or ditches, features associated with boundaries on site, were also recorded.

6.6.41 Further maps were produced to indicate the broad location and extent of habitats that were thought to have potential to support protected species (eg whole sections of ditch).

6.6.42 Presence, or potential presence, of species of importance for conservation (including protected species) was determined on the basis of opportunistic observations, the presence of characteristic signs, tracks or marks, or the presence of key habitats.

6.6.43 For amphibians, this included the presence of standing (open) water, particularly ponds with shallow edges and marginal vegetation. Reptile habitat is less clearly

defined, but slow worms tend to be found in areas of scrub, rough grassland (particularly with areas of rubble, hard standing or log piles present), thick ground vegetation (they bask less often than other British reptiles) and some habitats influenced by man (such as railway cuttings and gardens). Potential habitat for the common lizard includes areas of vegetation with open patches to bask in, especially piles of rubble and wood in sunny areas, ground cover of ivy is especially good for lizards to feed and avoid predators, dense but short vegetation, open to the sun and scrub. Potential habitat for grass snakes includes water bodies or damp habitat surrounded by long grass, scrub or woodland. Suitable habitat for adders, smooth snakes and sand lizards is not present within the survey area.

6.6.44 Evidence of badgers, water voles and otters usually takes the form of distinctive foot markings or the obvious presence of setts, holts, burrows, latrines, or evidence of foraging (eg snuffle holes).

6.6.45 No attempt was made to locate bat roosts, but an assessment was made of the potential for built structures and trees to support roosts. Trees observed during the extended Phase I survey were assessed and their potential to support bat roosts categorised as follows.

- *High potential* – trees with definite signs of roosting bats, such as droppings, scratch marks or staining
- *Medium potential* – trees with holes, cracks or crevices that appear to provide potential roosting sites, but no evidence located
- *Low potential* – trees with small cracks, peeling bark or holes, but which are considered unlikely to provide roost habitat, often because the tree is too small

6.6.46 Although the surveys were undertaken in December it is considered, in light of the nature of the habitats present (primarily those associated with highly intensive agriculture), that major habitat features of interest and potential for the presence of protected species will have been adequately identified.

6.6.47 Further targeted surveys were undertaken for key species groups for which potential habitat was identified as follows.

Birds

6.6.48 A winter farmland bird survey was undertaken to identify the conservation significance of the proposed cable corridor route.

6.6.49 Consultation was undertaken with English Nature and the RSPB to ensure that the farmland bird survey methods were appropriate.

6.6.50 The survey area covered the entire length of the proposed cable route together with a 500 m buffer zone to either side (1 km in total, illustrated in Figure 6.10).

6.6.51 The winter farmland bird survey methods were adapted around the territory (registration) mapping methods outlined in Bibby *et al.* (2000). While this methodology was designed for undertaking breeding bird censuses it is also suitable as a methodology for recording bird species and activities at other times of year.

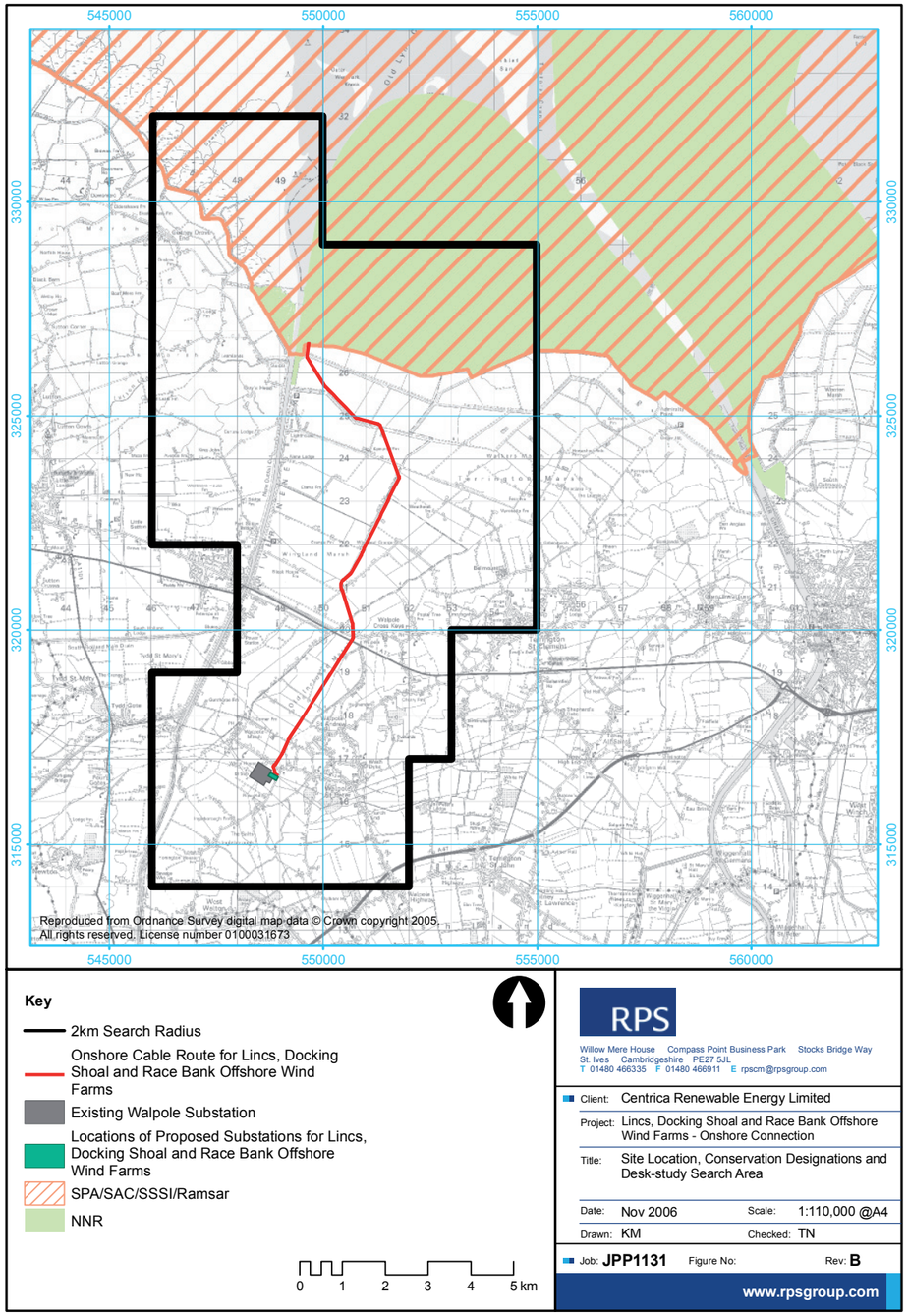


Figure 6.9 | Site location, conservation designations and desk-study search area

6.6.52 The survey area was surveyed on foot by an experienced ornithologist walking at an even pace, and observations made in all areas. Suitable optical equipment (binoculars, telescope) was used to observe bird behaviour, numbers and species. All bird species seen and numbers counted were recorded on site visit maps (1:10,000). The registration mapping used standard British Trust for Ornithology (BTO) notation for species and behaviour, thus incorporating notes on bird activity (eg roosting and feeding).

6.6.53 The survey area was divided into 11 separate sections identified as Ornithological Survey Sections A–K (Figure 6.10). The sections were divided using land features such as the seawalls, roads, and areas of distinct habitat, etc. This was to aid in identifying if any particular areas of the survey site were of particular ecological significance to wintering farmland birds and to aid in presenting the results of the survey, as identification of territories was clearly not appropriate for the winter period.

6.6.54 A total of five winter farmland bird survey visits were undertaken from November 2005–March 2006.

6.6.55 In addition to the surveys of winter farmland birds, studies were undertaken to assess inter-tidal bird populations occurring in the onshore habitats (above mean high water spring) within the study area.

6.6.56 A desk study was conducted that involved contacting a number of statutory and non-statutory nature conservation bodies for information on ornithological data relating to the inter-tidal areas and high-tide onshore roosting areas of the Wash. The organisations contacted were:

- English Nature
- British Trust for Ornithology (BTO) including Wetland Bird Survey data (WeBS)
- the Wash Wader Ringing Group (WWRG)
- Centre for Ecology and Hydrology (CEH)
- RSPB

6.6.57 In addition to the desk study, field surveys were undertaken to provide up-to-date baseline data for inter-tidal birds within the study area. Full details of the inter-tidal bird survey methods are provided in the Offshore ES.

6.6.58 Survey methods were based on those outlined for low- and high-tide estuarine bird surveys in *Bird Monitoring Methods: A Manual of Techniques for Key UK Species* (Gilbert *et al*. 1998). Techniques used to estimate numbers followed those given in Bibby *et al*. (2000).

6.6.59 Surveys took place from November 2005 until October 2006. Two surveys were conducted each month to coincide with periods of low and high water between November 2005 and June 2006. Between July 2006 and October 2006, two low-tide surveys and one high-tide survey were undertaken each month, together with a 'through tide' survey in August 2006 as agreed with English Nature.

6.6.60 The survey area was divided into logical compartments based on those used for established Wetland Bird Survey (WeBS) counts and, within near-shore areas, field boundaries.

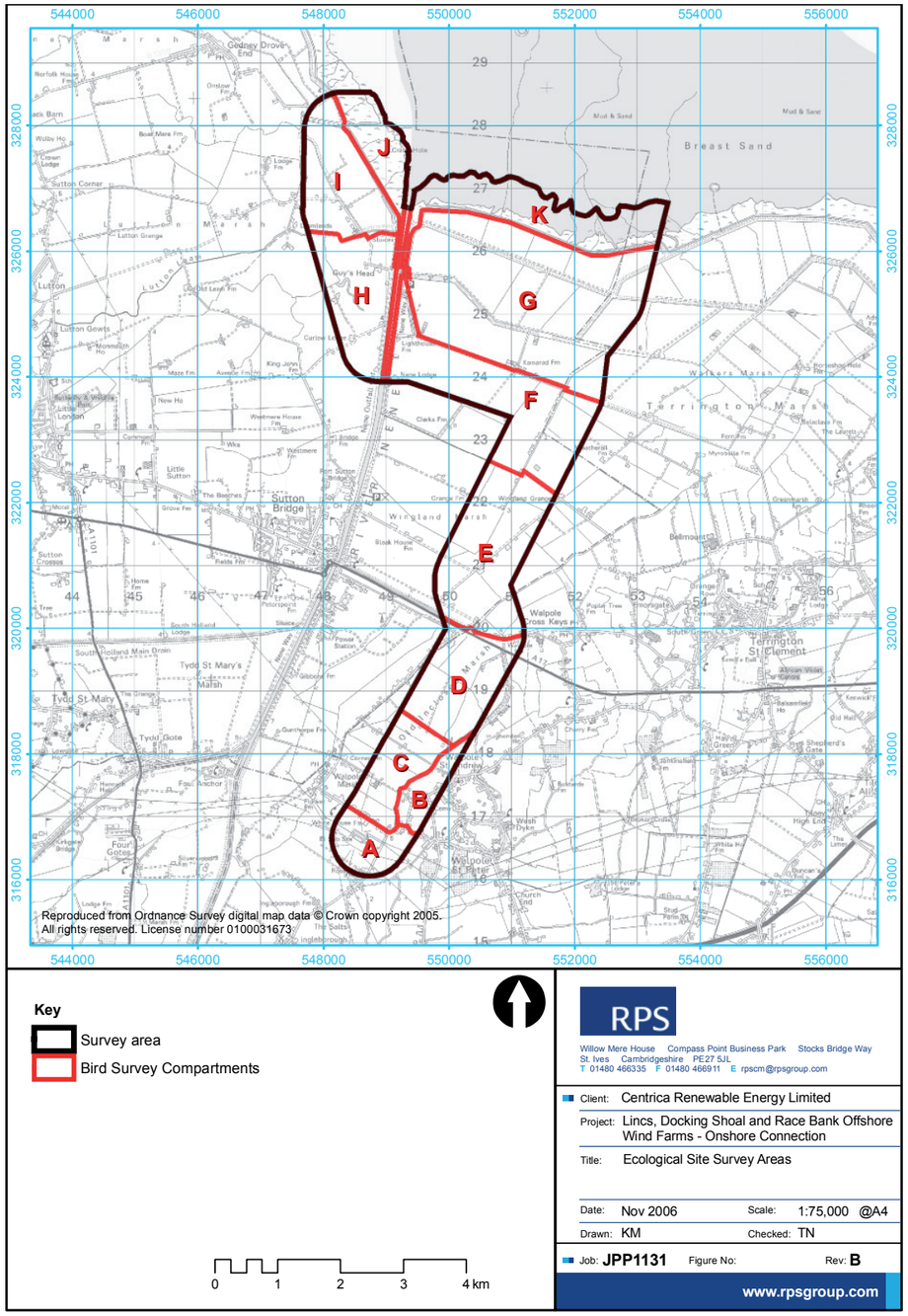


Figure 6.10 | Ecological site survey areas

Other habitats and species

6.6.61 During the extended Phase I survey an assessment was made of the potential for habitats to support species of importance for conservation, including birds and protected species. Where habitats with the potential to support such species were identified, further targeted surveys were undertaken to determine their presence or absence and the extent of usage. The extended Phase I Habitat Survey and desk study identified that the following specific ecology surveys were required for a full assessment of the conservation significance of the study area:

- hedgerows
- amphibians (including great crested newt)
- reptiles
- breeding farmland birds
- mammals (including badger, water vole, otter and bats)

6.6.62 The methodologies for these surveys were based on appropriate best practice and established techniques. Full details of the methods are presented in a supplementary report, included in Appendix A2.21.

Existing Environment

Statutory Sites of Conservation Interest

6.6.63 The desk study revealed that there are no onshore sites of international, national or local importance within 2 km of the substation or potential route alignments (Figure 6.9).

6.6.64 Substantial parts of the Wash below the high water mark are, however, protected by multiple designations. Summary details of this site and its designations are provided in Table 6.14.

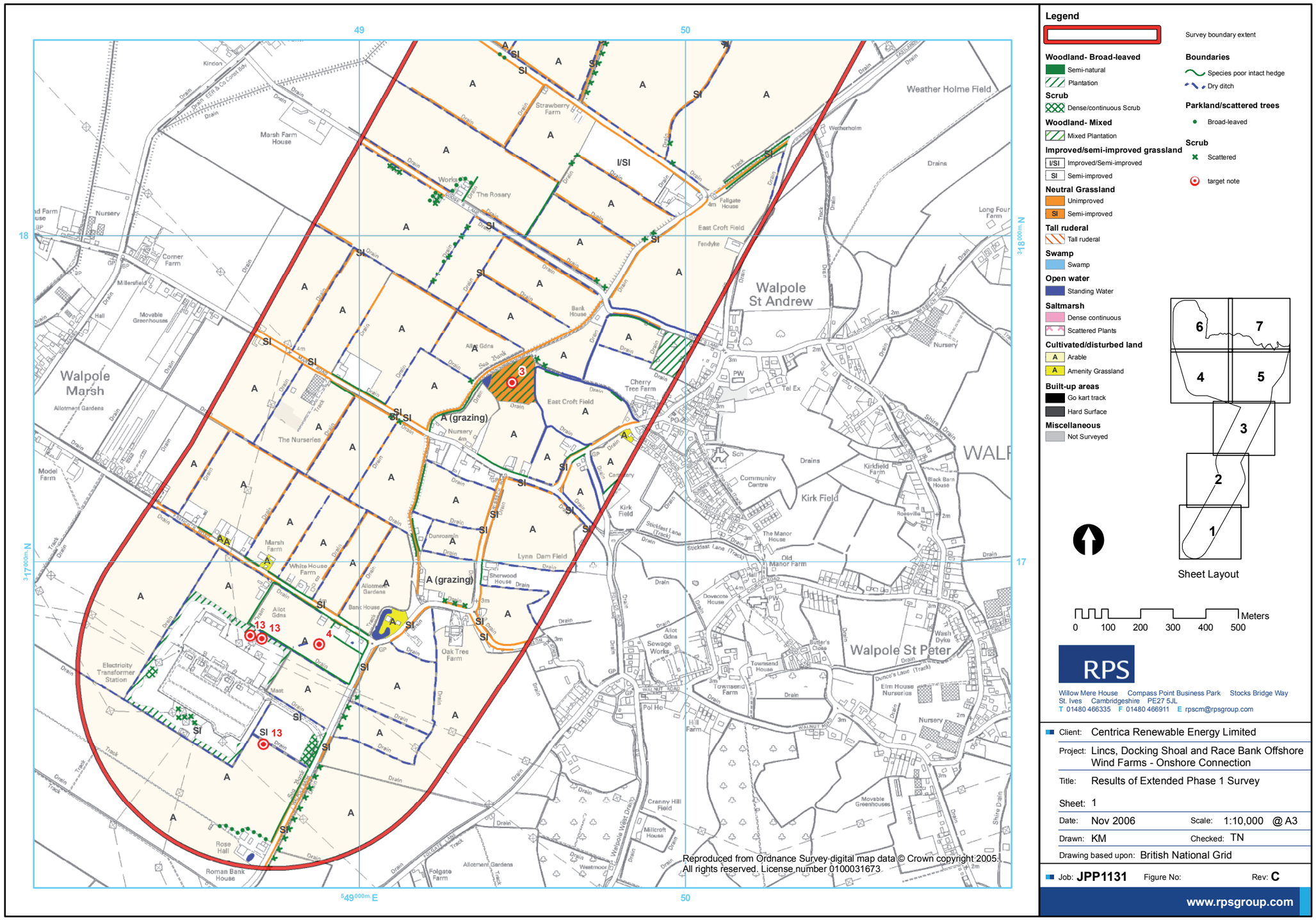
Habitat Surveys

6.6.65 The proposed site is located principally within a highly intensive agricultural area with numerous intensively maintained drainage ditches. There are a number of individual farm buildings and some residential properties associated with the minor road corridors. The habitats present reflect the primary land use of the survey area, with arable habitats dominating. Habitats associated with field boundaries include ditches, hedges and unimproved grassland. The River Nene bisects the western part of the survey area as it flows northwards to the Wash. Other wetland habitats present include small areas of standing water (ponds) constructed for agricultural purposes, associated with houses or constructed as game flights. Some of the ditches and small area of standing water were classified as salt marsh under Phase I terminology due to the presence of characteristic salt marsh species.

6.6.66 The Phase 1 survey results are presented in Figures 6.11–6.17 in the form of a series of maps. Each map provides details of habitat types, boundary features and includes the location of target notes.

Table 6.14 | **Statutory Sites of Conservation Interest identified within 2 km of the proposed development area**

Site name	Approximate area (ha)	Features of interest	Importance	Approximate distance from proposed development
the Wash Ramsar Site	62,212	Internationally important wetland supporting internationally and nationally important populations of birds. Large common seal, *Phoca vitulina,* colony. Nursery ground for plaice, *Pleuronectes platessa*, cod, *Gadus morhua,* and sole, *Solea solea.*	international	within 2 km of onshore works
the Wash and North Norfolk Coast Special Area of Conservation (SAC)	107,761	Marine areas, sea inlets, tidal rivers, estuaries, mud flats, sand flats, lagoons, salt marshes, salt pastures, salt steppes.	European	Within 2 km of onshore works
the Wash Special Protection Area (SPA)	62,212	Regularly occurring bird populations of European importance, including nationally important populations of breeding, passage and wintering Annex I species and internationally important populations of breeding, passage and wintering migratory species. Supports a waterfowl assemblage of over 20,000 individuals.	European	Within 2 km of onshore works
the Wash Site of Special Scientific Interest (SSSI)	63,135	Inter-tidal mudflats and salt marshes representing one of Britain's most important winter feeding areas for waders and wildfowl. Migratory birds of international significance. Salt marsh and shingle communities of considerable botanical interest. Mature salt marsh of importance for breeding birds. Important breeding ground for common seals.	national	within 2 km of onshore works
the Wash National Nature Reserve (NNR)	9,899	Breeding, passage and wintering birds. Common seals. Salt marsh and inter-tidal mudflats.	national	within 2 km of onshore works



Legend

Survey boundary extent

Woodland- Broad-leaved
- Semi-natural
- Plantation

Scrub
- Dense/continuous Scrub

Woodland- Mixed
- Mixed Plantation

Improved/semi-improved grassland
- I/SI Improved/Semi-improved
- SI Semi-improved

Neutral Grassland
- Unimproved
- SI Semi-improved

Tall ruderal
- Tall ruderal

Swamp
- Swamp

Open water
- Standing Water

Saltmarsh
- Dense continuous
- Scattered Plants

Cultivated/disturbed land
- A Arable
- A Amenity Grassland

Built-up areas
- Go kart track
- Hard Surface

Miscellaneous
- Not Surveyed

Boundaries
- Species poor intact hedge
- Dry ditch

Parkland/scattered trees
- Broad-leaved

Scrub
- Scattered

target note

Sheet Layout

0 100 200 300 400 500 Meters

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Client:	Centrica Renewable Energy Limited
Project:	Lincs, Docking Shoal and Race Bank Offshore Wind Farms - Onshore Connection
Title:	Results of Extended Phase 1 Survey
Sheet:	1
Date:	Nov 2006
Scale:	1:10,000 @ A3
Drawn:	KM
Checked:	TN
Drawing based upon:	British National Grid
Job:	JPP1131
Figure No:	
Rev:	C

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Figure 6.11 | Results of extended phase 1 survey

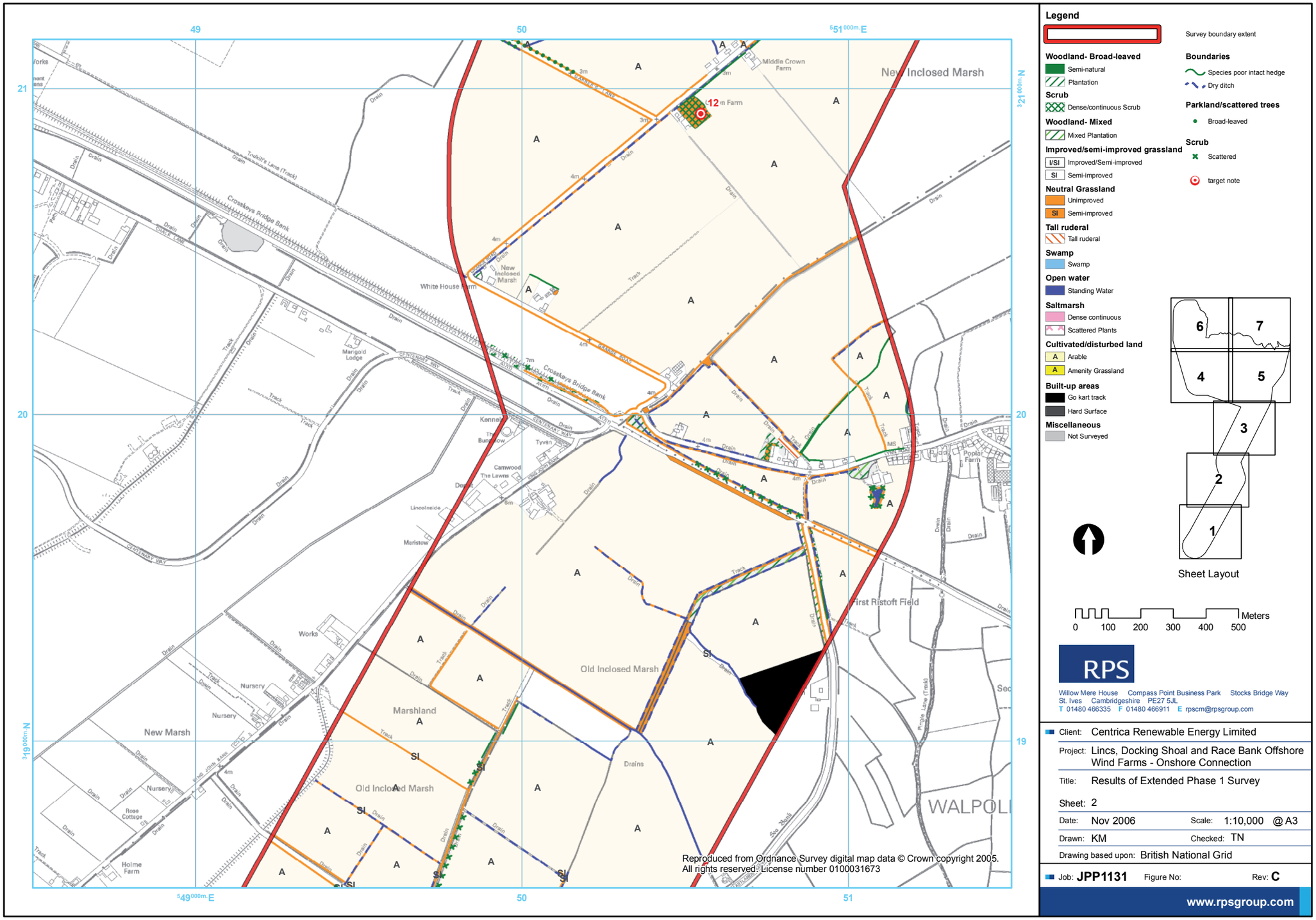

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Figure 6.12 | Results of extended phase 1 survey

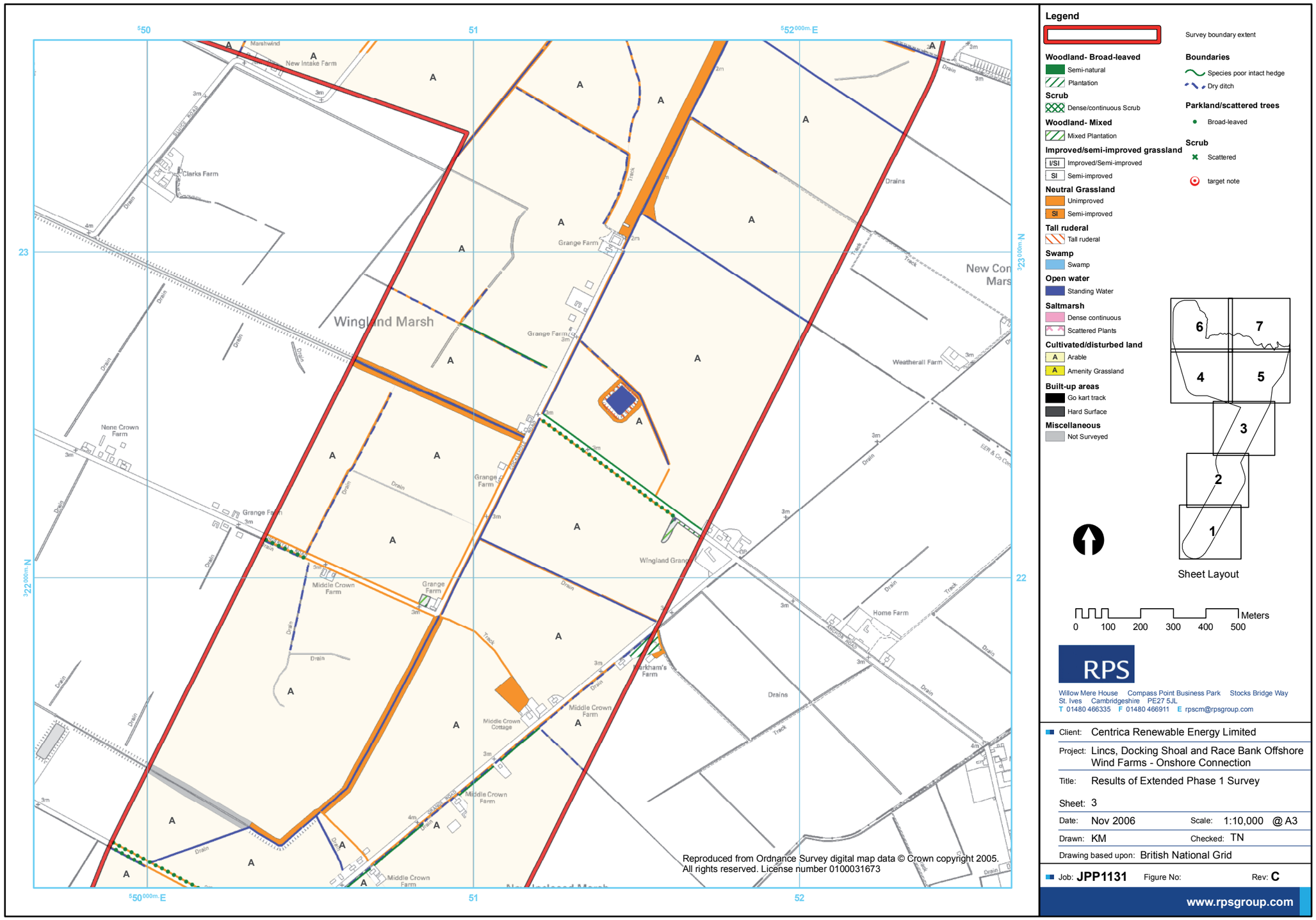
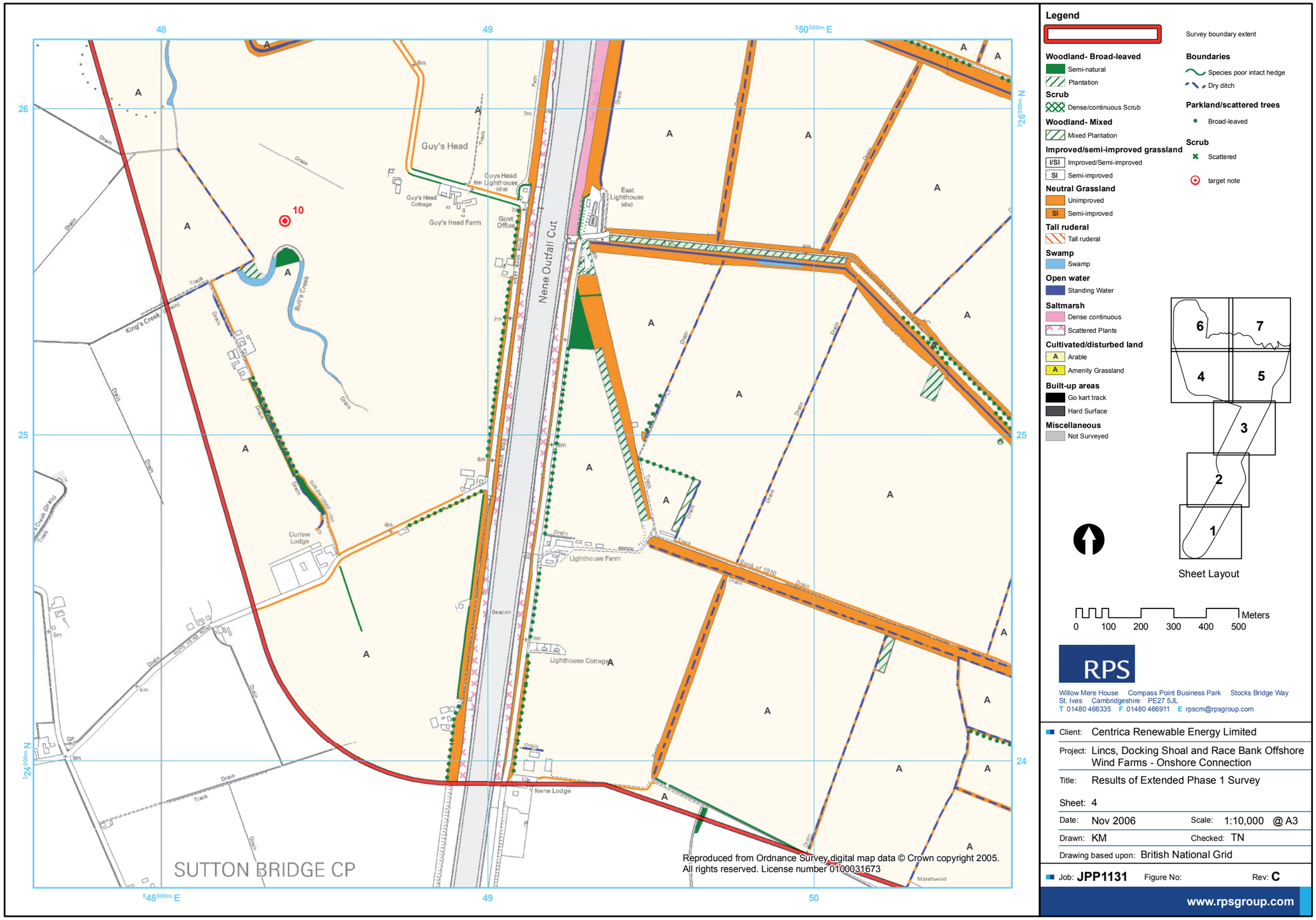


Figure 6.13 | Results of extended phase 1 survey



Legend

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Woodland- Mixed
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Neutral Grassland
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Tall ruderal
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Swamp
- Swamp

Open water
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- A Arable
- A Amenity Grassland

Built-up areas
- Go kart track
- Hard Surface

Miscellaneous
- Not Surveyed

Boundaries
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- Dry ditch

Parkland/scattered trees
- Broad-leaved

Scrub
- Scattered
- target note

Sheet Layout

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Drawing based upon: British National Grid
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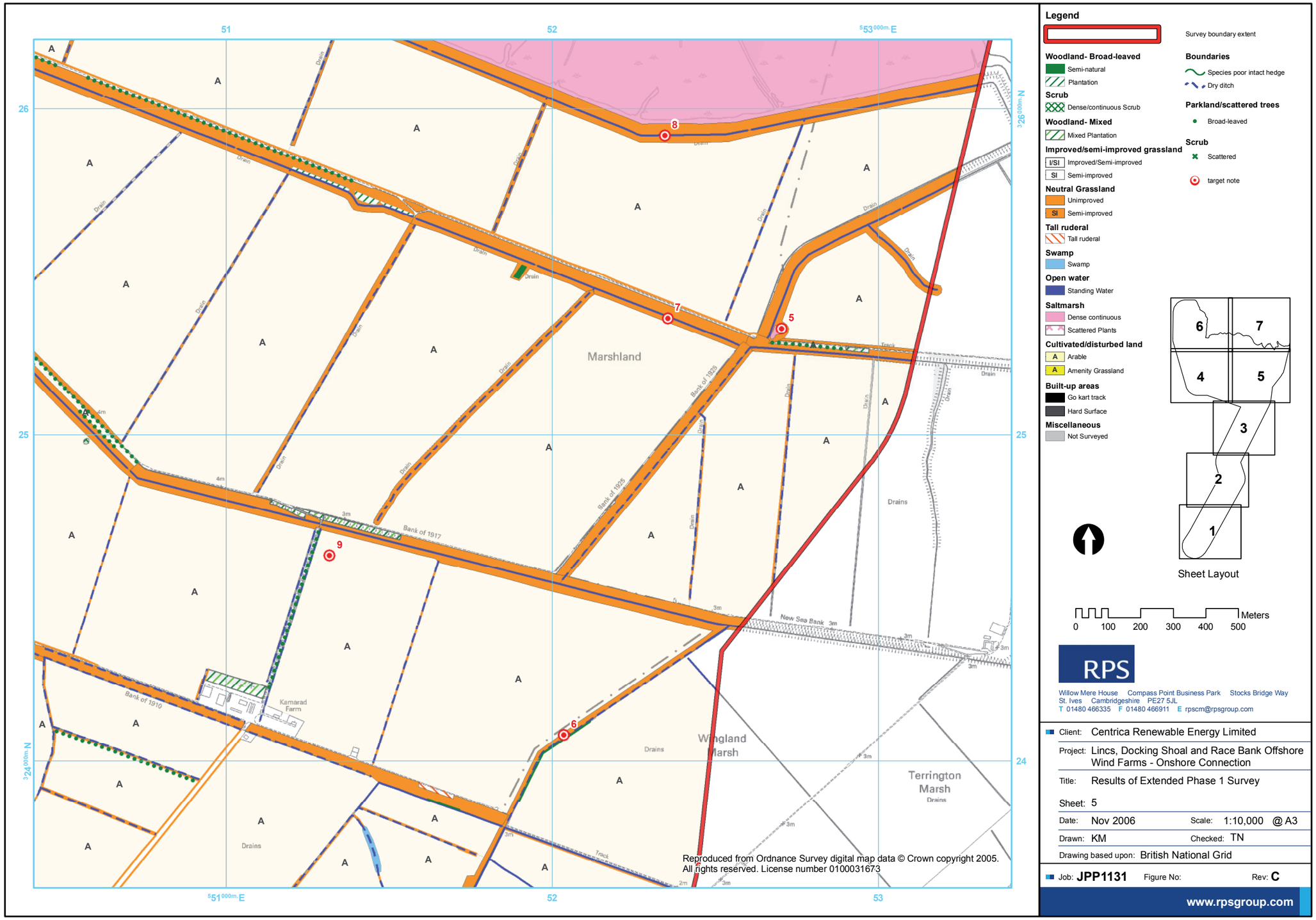
Figure 6.14 | Results of extended phase 1 survey



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Woodland- Mixed
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- SI Semi-improved

Neutral Grassland
- Unimproved
- SI Semi-improved

Tall ruderal
- Tall ruderal

Swamp
- Swamp

Open water
- Standing Water

Saltmarsh
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Title: Results of Extended Phase 1 Survey
Sheet: 5
Date: Nov 2006 Scale: 1:10,000 @ A3
Drawn: KM Checked: TN
Drawing based upon: British National Grid
Job: JPP1131 Figure No: Rev: C
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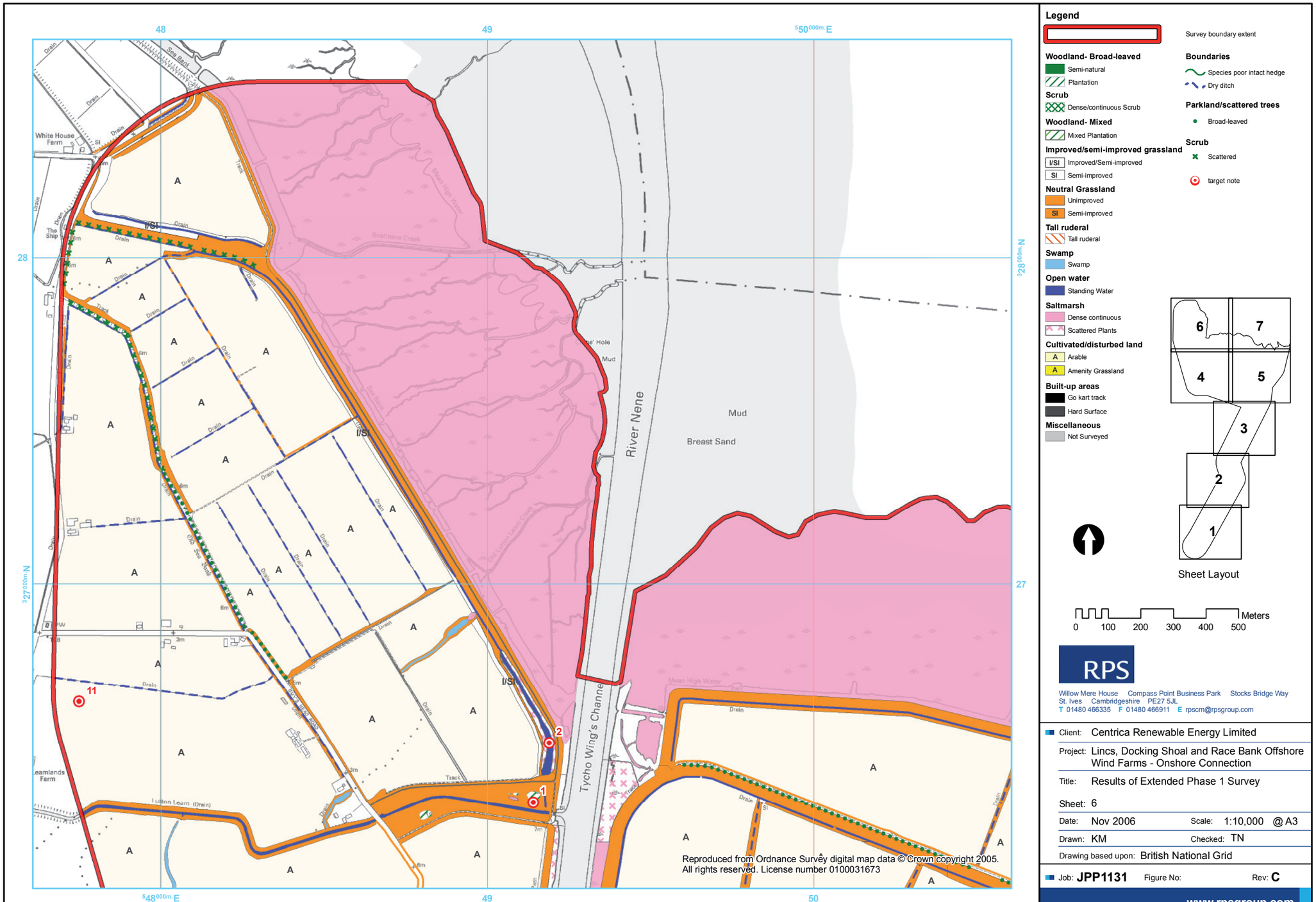
Figure 6.15 | Results of extended phase 1 survey



Legend

Survey boundary extent

Woodland- Broad-leaved
- Semi-natural
- Plantation

Scrub
- Dense/continuous Scrub

Woodland- Mixed
- Mixed Plantation

Improved/semi-improved grassland
- I/SI Improved/Semi-improved
- SI Semi-improved

Neutral Grassland
- Unimproved
- SI Semi-improved

Tall ruderal
- Tall ruderal

Swamp
- Swamp

Open water
- Standing Water

Saltmarsh
- Dense continuous
- Scattered Plants

Cultivated/disturbed land
- A Arable
- A Amenity Grassland

Built-up areas
- Go kart track
- Hard Surface

Miscellaneous
- Not Surveyed

Boundaries
- Species poor intact hedge
- Dry ditch

Parkland/scattered trees
- Broad-leaved

Scrub
- Scattered
- target note

Sheet Layout

0 100 200 300 400 500 Meters

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Client: Centrica Renewable Energy Limited
Project: Lincs, Docking Shoal and Race Bank Offshore Wind Farms - Onshore Connection
Title: Results of Extended Phase 1 Survey
Sheet: 6
Date: Nov 2006 Scale: 1:10,000 @ A3
Drawn: KM Checked: TN
Drawing based upon: British National Grid
Job: JPP1131 Figure No: Rev: C
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Figure 6.16 | Results of extended phase 1 survey

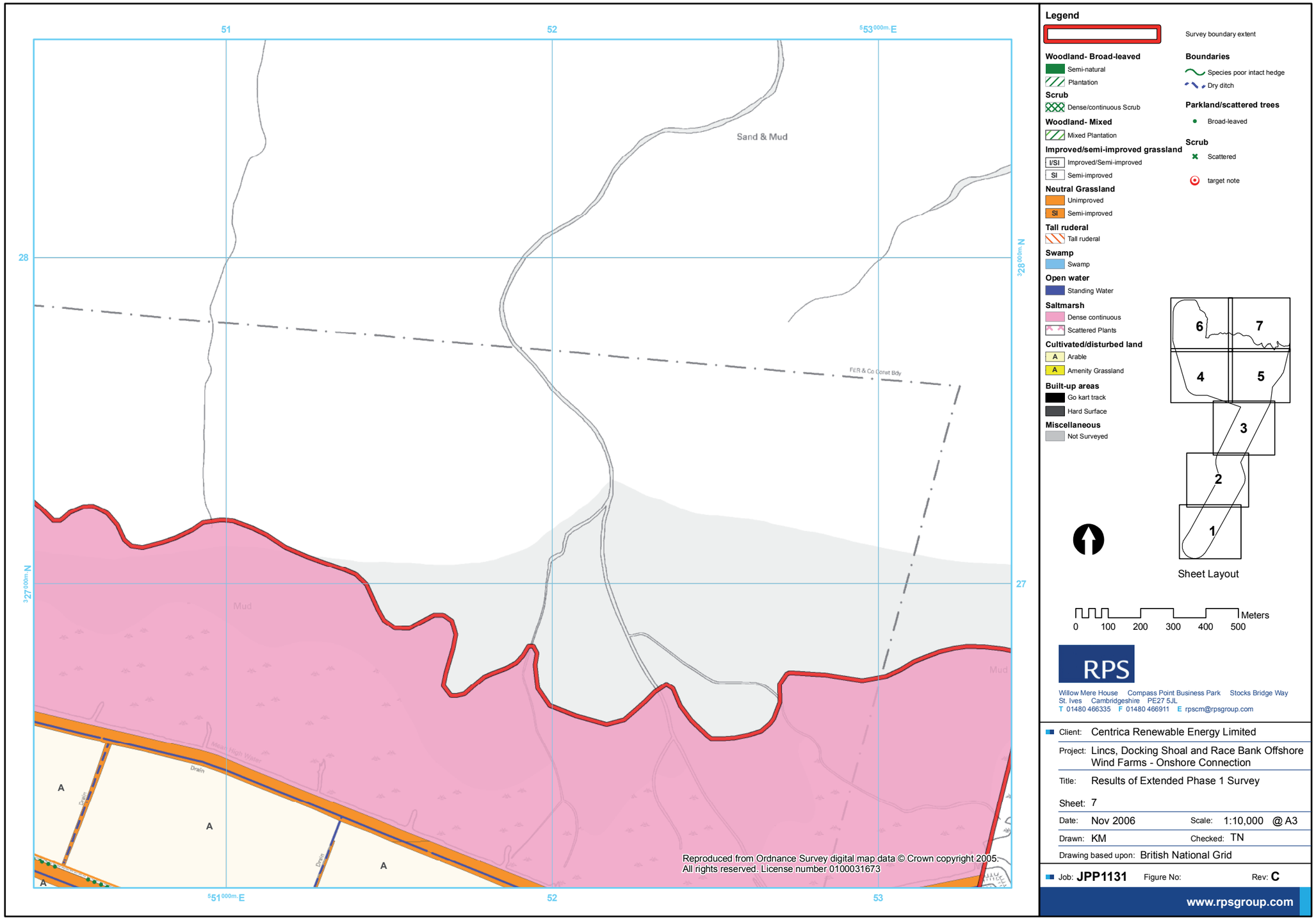

Figure 6.17 | Results of extended phase 1 survey

6.6.67 In addition, National Grid has undertaken some ecological surveys in connection with its applications at Walpole Marsh substation. These are described in Appendix A2.14.

6.6.68 The following Phase I habitats were recorded within the survey area.

- Agricultural land-use:
  - arable
- Grassland and ruderal habitats:
  - unimproved neutral grassland
  - semi-improved neutral grassland
  - improved or semi-improved species-poor grassland
  - semi-improved species-poor grassland
  - amenity grassland
  - tall ruderal
- Woody habitats:
  - dense or continuous scrub
  - scattered scrub
  - semi-natural broad-leaved woodland
  - plantation broad-leaved woodland
  - mixed plantation
  - hedges
- Wetland habitats:
  - salt marsh
  - swamp
  - wet and dry ditches
  - ponds
- Built-up areas:
  - built structures
  - go-kart track
  - hard surface

6.6.69 Each habitat recorded is summarised in the following paragraphs with an indication of the plant communities associated with them.

Arable

6.6.70 The majority of the survey area consisted of intensive arable agriculture. Discussions with some tenants indicated that crops commonly grown include winter cereals, spring cereals, potatoes, sugar beet and vining peas. West of the River Nene areas of under-sown crops were also observed.

6.6.71 The highly intensive management of these habitats is expected to preclude the presence of plant species of importance for conservation. These habitats may, however, be used for foraging and roosting by wildfowl (including populations associated with the Wash), particularly at high tide. In addition, it is known that marsh harriers (an interest feature of the Wash SPA) and Montagu's harriers will breed in fields containing arable crops.

Grassland and Ruderal Habitats

6.6.72 Areas of grassland were mapped in the survey area, particularly along the sides and tops of ditches, the sections of banks associated with the ditches, and strips along roadsides. The majority of grassland appeared to be unimproved, species poor and dominated by grasses such as common couch, *Elytrigia repens*, cock's-foot, *Dactylis glomerata*, false oat-grass, *Arrhenatherum elatius* and red fescue, *Festuca rubra*. Forbs present at this time of year included hogweed, *Heracleum sphondylium*, cow parsley, *Anthriscus sylvestris* and ribwort plantain, *Plantago lanceolata*. Patches of common reed, *Phragmites australis,* was present in the grassland along ditch sides and also in an area of grassland by the coast (Target Note 1). A broomrape species, most likely one of the subspecies of common broomrape, *Orobanche minor*, which is rare in Lincolnshire (JNCC 2005), was also noted in the grassland and in the adjacent salt marsh stand (Target Note 5). Some areas along the banks next to the salt marsh also had sea couch, *Elytrigia atherica*, suggesting transitions to salt marsh.

6.6.73 Some of the grassland on site also had perennial rye-grass, *Lolium perenne*, and appeared to be semi-improved grassland. However, it was not possible to assess species richness at the time of the survey. Forbs that were present included ribwort plantain, common cat's-ear, *Hypochoeris radicata*, and wild carrot, *Daucus carota*.

6.6.74 In addition, there were also strips of grassland that were clearly species-poor and dominated by grasses such as perennial rye-grass. The vegetation was mapped as improved / species-poor semi-improved neutral grassland.

6.6.75 Amenity grassland was identified, primarily associated with dwellings. These were predominantly grass dominated, species-poor and regularly mown grasslands.

6.6.76 The majority of ditch sides, tops and banks appeared unmanaged, although a number had been cut. Some of the road verges had also been cut.

6.6.77 Areas and patches of ruderal vegetation were present within the survey area. Species included nettles, *Urtica dioica*, creeping thistle, *Cirsium arvense,* and bristly oxtongue, *Picris echioides*.

Woody Habitats

6.6.78 Occasional areas of woody vegetation are present although these are scattered in the form of scrub (often associated with historic seawall alignments) and, in the southern part of the survey area, in the form of plantation and semi-natural woodland.

6.6.79 The main area of scrub recorded was associated with the existing substation at Walpole. In addition, there is a smaller area adjacent to Crown Farm (Target Note 12). Small areas of scrub are also scattered throughout the survey area, associated with properties and some field boundaries. Scrub species recorded during surveys included brambles, *Rubus fruticosus* agg., hawthorn, *Crataegus monogyna*, blackthorn, *Prunus spinosa*, gorse, *Ulex europaeus*, willow species, *Salix* spp., and rose, *Rosa* sp.

6.6.80 Semi-natural broad-leaved woodland, broad-leaved and mixed plantations of varying ages were present on site. The largest area of semi-natural woodland is located south of East Lighthouse adjacent to the River Nene. Trees and shrubs present included oak, *Quercus* sp., ash, *Fraxinus excelsior*, poplar, *Populus* sp., alder, *Alnus glutinosa*, field maple, *Acer campestre*, cherry, *Prunus* sp., elm, *Ulmus* sp., willow species, *Salix* spp., pine, *Pinus* sp., and hazel, *Corylus avellana*.

6.6.81 An old orchard with mature trees was present in the south of the site (Target Note 3). A range of mosses and lichens was found on the trees. One area to the east and adjacent to the River Nene near the coast had stands of sea-buckthorn, *Hippophae rhamnoides*, planted along with hawthorn, goat willow, *Salix caprea,* and oak, *Quercus* sp.

6.6.82 Hedges and lines of planted trees were also present throughout the survey area, including species such as ash, whitebeam, *Sorbus aria* and poplar. Individual trees were also present, some of which were mature and included species such as ash, sycamore, *Acer pseudoplatanus*, and willow.

6.6.83 Eleven hedgerows were identified as being of potential conservation importance and surveyed accordingly to determine if they were of UK Biodiversity importance or of importance under the terms of the Hedgerow Regulations (HR), by determining the diversity of native woody species as defined by the HR. Hedgerows around farms, houses and gardens were not included. The surveys identified that none of the hedgerows reached the threshold for habitat importance.

Wetland Habitats

6.6.84 Wetland habitats recorded include rivers, ditches, swamp, open (standing) water and salt marsh.

6.6.85 The River Nene, which flows almost due north to the Wash, bisects the western part of the survey area. The river itself was not surveyed, but riparian and exposed intertidal habitats were mapped along the river channel where possible.

6.6.86 Wet and dry ditches occurred throughout the site. Patches, and stands (forming reedbeds), of common reed and patches of bulrush, *Typha latifolia*, were present in most of the ditches, both wet and dry. The larger stands were mapped as swamp, the smaller stands were not mapped. A number of the ditches showed signs of management, with emergent vegetation having been cut and evidence of dredging activity. Wet ditches immediately adjacent to the coast appeared to be brackish.

6.6.87 Areas of swamp and open (standing) water were recorded infrequently throughout the site. One of the stands near to the coast, to the west of the River Nene, appeared to be brackish (Target Note 2). Emergent vegetation such as common reed and bulrush were present in a number of the ponds, the larger stands were mapped as swamp. The smaller stands were not mapped. Submerged species, where visible, were recorded, although the timing of the surveys for these species was not ideal.

6.6.88 Salt marsh to the seaward side of the seawall is addressed in the Offshore ES. Landward of the seawall, patches of vegetation classified as salt marsh were recorded in wet and dry ditches immediately adjacent to the coast and associated with the banks of the River Nene. In addition, a small area of swamp in the north-eastern part of the survey area was classified as salt marsh on the basis of the plant species it supported.

6.6.89 A stand and patches were found in the adjacent grassland of what appeared to be transitional vegetation between grassland and salt marsh, where sea couch and wild carrot were present in the sward. The stand was mapped as salt marsh. A broomrape species, most likely one of the subspecies of common broomrape, *Orobanche minor*, which is rare in Lincolnshire (JNCC 2005) was noted in this stand (Target Note 5).

6.6.90 The area of standing water (Target Note 2) next to the coast had salt marsh species, such as salt marsh rush, *Juncus gerardii*, along the muddy margins. This was mapped as salt marsh scattered plants.

Built-up Areas

6.6.91 The remaining habitats recorded during the Phase I survey were: buildings, roads, hard standing, allotments (Target Note 4) and an area of go-kart track. The plant and animal communities associated with these habitats are impoverished and comprise common and widespread species.

Birds

Breeding

6.6.92 Breeding bird surveys were undertaken within onshore areas between May and July 2006, and identified a total of 77 species occurring within the area surveyed. Of these 49 species were identified as breeding. Of the 49 species confirmed to be breeding within the study area, twelve were identified as species of importance for conservation and are listed in Table 6.15.

Table 6.15 | **Breeding bird species of importance for conservation recorded in the survey area during the period July 2006**

Species	WandCA Schedule 1 (a)	EU Annex 1 (b)	UK BAP (c)	BoCC Red List (d)
marsh harrier	■	■		
turtle dove			■	■
skylark			■	■
song thrush			■	■
spotted flycatcher			■	■
starling				■
tree sparrow			■	■
house sparrow				■
linnet			■	■
yellowhammer			■	■
reed bunting			■	■
corn bunting			■	■

(a) Schedule 1 of the Wildlife and Countryside Act 1981
(b) Annex 1 of the EU Wild Birds Directive
(c) List of Priority Species on the UK Biodiversity Action Plan (BAP)
(d) Red List of the Birds of Conservation Concern (BoCC) (Gregory *et al.* 2002)

6.6.93 In addition to the 49 species identified as breeding within the study area, a further nine species were observed that were not confirmed to be breeding, although their presence at this time of year suggests that they may possibly be breeding within close proximity to the study area. Of these nine species, three were identified as species of importance for conservation:

- Montagu's harrier
- hobby
- barn owl

Non-Breeding

6.6.94 The results of the farmland winter bird survey of November 2005 to March 2006 along the proposed cable route corridor are presented in Appendix A2.8 and A2.9 together with a full species list in Appendix A2.8 and A2.9. Data are presented by sector for all species recorded as the mean number and maximum number of birds during the survey period. A total of 88 bird species were recorded during the five visits of the survey.

6.6.95 Of the 88 species recorded during the survey period, the 25 listed in Table 6.16 have some designation or conservation status based on their inclusion in:

(a) Schedule 1 of the Wildlife and Countryside Act 1981

(b) Annex 1 of the EU Wild Birds Directive

(c) List of Priority Species on the UK Biodiversity Action Plan (BAP)

(d) Red List of the Birds of Conservation Concern (BoCC) (Gregory *et al.* 2002)

Table 6.16 | **Bird species of conservation significance recorded in the cable construction corridor, November 2005 to March 2006**

Species	WandCA Schedule 1 (a)	EU Annex 1 (b)	UK BAP (c)	BoCC Red List (d)
little egret		■		
marsh harrier	■	■		
hen harrier	■	■		■
merlin	■	■		
peregrine falcon	■	■		
grey partridge			■	■
golden plover		■		
green sandpiper	■			
barn owl	■			
short-eared owl		■		
skylark			■	■
fieldfare	■			
song thrush			■	■
redwing	■			
starling				■
house sparrow				■
tree sparrow			■	■

Species	WandCA Schedule 1 (a)	EU Annex 1 (b)	UK BAP (c)	BoCC Red List (d)
linnet			■	■
twite				■
bullfinch			■	■
Lapland bunting	■			
snow bunting	■			
reed bunting			■	■
yellowhammer				■
corn bunting			■	■

6.6.96 Ten species recorded (marsh harrier, hen harrier, merlin, peregrine falcon, green sandpiper, barn owl, fieldfare, redwing, Lapland bunting and snow bunting) are listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended).

6.6.97 An additional three species to those listed on Schedule 1 recorded within the survey area are listed under Annex 1 of the EU Birds Directive (79/409/EEC). These are little egret, golden plover and short-eared owl.

6.6.98 It should be noted that species listed on Annex 1 of the EU Wild Birds Directive and Schedule 1 of the Wildlife and Countryside Act are included primarily to protect and conserve breeding populations of the species. As such, their occurrence on sites in winter is of somewhat lesser importance unless significant proportions of the population are recorded using the site.

6.6.99 Eight species recorded during the surveys (grey partridge, skylark, song thrush, tree sparrow, linnet, bullfinch, reed bunting and corn bunting) are listed as UK BAP priority species. Grey partridge and skylark are specifically listed on the Norfolk Local Biodiversity Action Plan (LBAP) and song thrush is listed on both the Norfolk and Lincolnshire LBAP plans.

6.6.100 Fourteen species encountered (hen harrier, grey partridge, black-tailed godwit, skylark, song thrush, starling, house sparrow, tree sparrow, linnet, twite, bullfinch, yellowhammer, reed bunting and corn bunting) are listed on the BoCC Red List (Anon, 1996). These are species for which there has been a significant decrease in population or range in recent years.

Onshore Inter-tidal Birds

6.6.101 The results of the desk study and field surveys identified the following inter-tidal bird species as regularly occurring on the onshore habitats in close proximity to the seawall.

- golden plover
- grey plover
- knot
- dunlin
- curlew

6.6.102 All of these species are included on the SPA citation for the Wash, either for their individual populations or as a component of the waterfowl assemblage.

6.6.103 Existing information for the following species groups were sought to identify species whose populations may require specific consideration due to their inclusion on; Schedules 5 of the Wildlife and Countryside Act 1981 (as amended), excluding species that are only protected in relation to their sale (see reflecting the fact that the proposed development does not include any proposals relating to the sale of species; species included on Schedule 2 of The Conservation (Natural Habitats, andc.) Regulations 1994 (SI 1994 No. 2716); and badgers, which are protected under the Protection of Badgers Act 1992.

Reptiles and Amphibians

6.6.104 The desk study revealed no records of reptile or amphibian species within the search area. Due to the specific protection afforded to these species, further surveys were undertaken to confirm their presence or absence and relative abundance within habitats identified during Phase I surveys that were considered to have potential to support them, including:

- ponds with relatively shallow edges and marginal or emergent vegetation (potentially suitable for great crested newt, *Triturus cristatus*)
- ditches and surrounding damp rough grassland (potentially suitable for grass snake, *Natrix natrix,* and slow worm, *Anguilis fragilis*)
- scrub and dense but short vegetation that is open to the sun (potential habitats for common lizard, *Lacerta viviparous*)

6.6.105 No reptiles or their field signs were recorded during the targeted surveys and it is, therefore, considered that these species are unlikely to be present within the study area.

6.6.106 Three ponds were identified within the study area with potential for great crested newt. One is located on Rose Hall Farm to the southwest of the Walpole substation (TF 496 161); one is a garden pond in Holmleigh House (TF 490 167); the third is at Bank House (TF 491 168) to the east. No newts were recorded following four visits to the Rose Hall Farm pond. Access to the Bank and Holmleigh ponds was denied by the landowners. There is circumstantial evidence to suggest that the pond at Bank House supports fish and wildfowl and has limited aquatic vegetation, which reduces the potential for newts to occur. However, due to the lack of access, the status of those ponds with regard to the presence of newts remains unknown.

6.6.107 A number of hedges were mapped on site, and will be crossed by the cable route. Intact hedges (those that are over 20 m in length) may qualify as 'important hedges' under the Hedgerow Regulations (1997), requiring consent from the local authority for their removal. Species-rich hedges that do not qualify as 'important hedges' could qualify as UK BAP Priority Habitats under 'ancient' or 'species-rich' hedges. Hedges that qualify under the Regulations or UK BAP Priority Habitats are likely to be of conservation importance. Due to their relative scarcity within the survey area, intact hedges are considered to be a feature of *district importance*.

Mammals

Bats

6.6.108 The data search produced several records for pipistrelle bats, *Pipistrellus* sp., within the search area. A grounded female was recorded in 1997 at Gedney Drove End, 1 km from the proposed development area. A roost was recorded within the 500 m buffer around the development corridor at Wingland in 2002. A common pipistrelle, *P. pipistrellus*, was recorded at feeding areas on Chalk Lane, 1 km from the site, in 1999. Another was recorded in 2002, about 150 m from the cable corridor.

6.6.109 A small colony of brown long-eared bats, *Plecotus auritus*, was found in a disused chapel located within 1 km of the survey area in 1990. There were also 22 unidentified bat records ranging from 1990 and 2005 within the data search area.

6.6.110 During the extended Phase I surveys potential locations for bat roosts were identified in buildings, particularly farmhouses, barns and outbuildings. Buildings with features such as hanging tiles, access to roof spaces, lead flashings with gaps, soffit boards with access points and ridge tiles are expected to have the most potential. There are approximately 18 buildings within the survey area that have significant potential to support bats.

6.6.111 Bats will also roost within suitable trees, those with the highest potential include trees with hollows or thick ivy growth. Few mature trees are present within the survey area and none were considered to have high potential for bat roosts. Target Note 3 (Figure 6.11) is an orchard that contained many suitable trees with bat roost potential (in addition to the 51 trees individually noted). The trees located in this area were a mixture of medium and low potential with features such as woodpecker holes, cracked or peeling bark. The area indicated by Target Note 6 (Figure 6.15) is a mature hawthorn hedgerow, which is covered in ivy and may contain trees with the potential to support bat roosts.

6.6.112 Potential foraging habitat occurs throughout the survey area. Rough grassland and scattered scrub, for example, provides potential opportunities for species as noctule and serotine. Common and soprano pipistrelle are likely to forage along hedgerows and other linear features, including vegetated ditches. Intact, well-developed hedgerows are likely to be particularly important, such as those associated with the 'old sea bank' running through the centre of the site.

6.6.113 Targeted bat surveys were undertaken in areas identified as potential foraging and roosting habitat. The surveys identified that the area of the cable route and proposed substation are used by three species of bat for foraging (Daubenton's bat, 45 pipistrelle bat and an unidentified *Myotis* species) and may be used by a fourth species (55 pipistrelle bat). The activity of the Daubenton's bat was centred on a large wet drain (the same drain on two occasions), whereas the pipistrelle activity occurred over terrestrial habitats, with some use also being made of the drains. Pipistrelle activity of each species is centred on areas of shelter, which was provided by woodlands, by various field and roadside boundaries, and around farm and domestic buildings. The single record of the *Myotis* bat was made near a drain.

6.6.114 There was very little or no bat activity in the extreme north of the cable route corridor where the conditions are more exposed and the landscape less mature than inland. There is very little use of the arable land.

6.6.115 Surveys and examination of the potential for bat roosts (including those undertaken by National Grid–see Appendix A2.14 did not identify the presence of any within the study area.

Water Voles

6.6.116 The desk study revealed several water vole, *Arvicola terrestris*, records in the Norfolk area, including within the survey area, adjacent to the A17 and close to Walpole St Peter in the south of the desk study search area. All records provided by the records centre were obtained during the last ten years, mainly from 1997 surveys.

6.6.117 During the extended Phase I survey, several ditches, in addition to the River Nene itself, were identified with potential habitat for water voles. Further detailed inspections of these ditches during May and June 2006 failed, however, to identify signs of water voles (such as faeces, latrines, feeding stations, borrows or footprints). Burrows and feeding signs were seen at the pond at Crown Farm (TF 511 198). This is isolated from the main drainage system, but it may indicate a very small local population.

Otters

6.6.118 While the desk study revealed no records of otter, *Lutra lutra*, within the search area, it is known that otters are present within the Wash SAC (Special Area of Conservation).This species is identified as an interest feature for this site, although this is not a primary reason for selection (www.jncc.gov.uk).

6.6.119 No evidence of otters, such as presence of typical field signs (eg spraints (faeces), footprints, holts or lie-up sites, prey remains) was observed during Phase I surveys or targeted surveys of key ditches undertaken during May and June 2006. These surveys included a 4 m wide ditch at Target Note 7 and a 2 m wide ditch with steep banks at Target Note 8 (Figure 6.15).

6.6.120 The lack of physical evidence of otters within the survey area suggests that this species probably uses ditches, particularly larger ditches, only occasionally to forage and disperse.

Brown Hares

6.6.121 Although the desk study revealed no previous records of brown hare, *Lepus europaeus*, within the search area, three sightings were made during the extended Phase I survey (Target Notes, 9, 10 and 11 -- see Figures 6.15, 6.14 and 6.16 respectively).

6.6.122 Brown hare is a UK BAP priority species and a Lincolnshire BAP species. As the preferred habitat of this species is farmland, the arable fields throughout the proposed cable route corridor provide suitable habitat for this species. The longer grassland around the River Nene would provide sufficient cover for the species to create a form (a depression in the ground where they rest and raise their young).

Badgers

6.6.123 Badgers and their setts are protected under various legislation, drawn together under the Protection of Badgers Act 1992. This makes it a criminal offence to:

- wilfully kill, injure, take, possess, or cruelly ill-treat a badger, or attempt to
- to interfere with a sett by damaging or destroying it
- to obstruct access to, or any entrance of, a badger sett
- to disturb a badger when it is occupying a sett

6.6.124 This legislation effectively prevents development on a site, or within 30 m of a site, occupied by badgers without mitigation being agreed and carried out prior to construction works.

6.6.125 Although the desk study revealed no previous records of badger, *Meles meles*, within the search area, evidence of badger activity was identified during the extended Phase I habitat survey and targeted badger surveys.

6.6.126 Detailed information on the location of badgers is provided in the Confidential Badger Annex.

Invertebrates

6.6.127 Intensively farmed arable land, which comprises the majority of the survey area, has very low potential for invertebrates. The desk study revealed no existing records of invertebrates within the search area.

6.6.128 Nevertheless, the presence of some aquatic habitats (including salt marsh, reedbeds and ponds) provides opportunities for some species, including:

Odonata *(Dragonflies and Damselflies)*

6.6.129 Dragonflies and damselflies are primarily associated with open standing water and permanent water courses, although some species will also use temporary and ephemeral wetlands. The relative scarcity of open (standing) water habitats and the intensive management of many of the drainage ditches present within the survey area suggest, however, that dragonfly and damselfly diversity is likely to be relatively low.

Salt Marsh or Lagoon Species

6.6.130 Salt marsh supports specialist invertebrate species. Due to a nationwide decline in the extent of salt marsh habitat many of these species have also declined in abundance. The following BAP priority species have significant populations on salt marsh: the ground beetles, *Amara strenua* and *Anisodactylus poeciloides*, and the narrow-mouth whorl snail, *Vertigo angustior*. The lagoon sand shrimp, *Gammarus insensibilis*, is a UK BAP species. Within the UK, it is fairly widely distributed in lagoons along the south and east coasts of England, between Dorset and Lincolnshire. It is associated with tidal lagoons and, as such, there are areas within the survey area that could provide suitable habitat for the species. As the proposed route will avoid these habitats, further surveys have not been undertaken.

Identification of Valued Ecological Receptors

Designated Sites

6.6.131 No part of the cable route or areas affected by substation works lies within any existing conservation designation. The landfall for the cable lies immediately adjacent to parts of the Wash designated as Ramsar Site, SAC, SPA, SSSI and NNR. On this basis the inter-tidal and sub-tidal parts of the Wash are of international importance. The potential effects of activities below MHWS on these sites are considered in the Offshore ES. Potential indirect impacts of onshore activities on this designation are considered in this assessment.

Habitats

Arable

6.6.132 The majority of the cable route comprises agricultural land in arable production, which is considered to be of less than parish value and impacts on this habitat are not considered further. Arable fields are, however, used by harrier species, including marsh harrier, for nesting and brown hare (see discussion under species below).

Grassland and Ruderal Habitats

6.6.133 Several grassland and ruderal communities recorded within the survey area are considered to be of very little ecological value due to their limited species diversity, and the predominance of common and widespread plant species, including:

- improved or semi-improved species-poor grassland
- semi-improved species-poor grassland

- amenity grassland
- tall ruderal

6.6.134 These habitats are not considered further in the assessment.

6.6.135 Unimproved and semi-improved neutral grassland was found as strips along the banks of the ditches and field margins. Unimproved grasslands are defined as those that have not been artificially 'improved' by the application of fertiliser. The lack of artificial fertiliser allows a much greater diversity of species, which can support a diverse population of invertebrates, in turn providing food for reptiles, bats and badgers. Cereal field margin is a UK BAP priority habitat. However, the habitats within this survey area are much narrower than the 6–10 m wide strips considered to be of most importance for biodiversity within the BAP action plan. The strips along the cereal field margin within this study area tend to be very small, species-poor strips, being those areas that cannot be cut directly by farm machinery. The narrow character of these strips and their proximity to highly intensive agriculture also suggests that they could be strongly influenced by fertiliser and herbicidal applications.

6.6.136 In addition, a larger area of semi-improved neutral grassland was recorded immediately to the east of the existing substation. While this area appears to be of limited botanical value it does provide foraging opportunities for other species including birds and badger.

6.6.137 Neutral grassland habitats are limited in extent, the majority of these habitats form narrow field margins. To the extent that these habitats provide some opportunity for foraging wildlife, including breeding and wintering bird species, they are considered to be of no more than parish or local importance and are not considered further in this assessment.

Woody Habitats

6.6.138 Dense continuous scrub was recorded in the southern part of the survey area, where it forms a moderately large expanse to the south and west of the existing substation. The only other significant expanse of this habitat is adjacent to Crown Farm in the central part of the survey area to the north of the A17 (Target Note 12, Figure 6.12). These patches are of importance for foraging and, potentially, breeding birds.

6.6.139 Scattered scrub occurs throughout the survey area, principally as lines of shrubs associated with field boundaries. These lines of shrubs are too sparse to be considered hedges and are, consequently, of little ecological importance.

6.6.140 Semi-natural broad-leaved woodland was sparsely recorded within the survey. The largest areas are found south of East Lighthouse adjacent to the River Nene and to the west of the River Nene. As Centrica is not considering cable routes in these locations, there is no likelihood of an impact on these habitats and they are not considered further in this assessment.

6.6.141 Plantation broad-leaved woodland and mixed plantation occur, generally as small game covers and associated with gardens, throughout the survey area. These small features are of no more than parish or local importance. The most significant plantation is an orchard located to the west of East Croft Field (Target Note 3). Due to its maturity this feature is considered to be of district importance. As the proposed cable route avoids this feature it is not considered further in this assessment.

Wetland Habitats

Salt Marsh

6.6.142 Of the habitats types described by the Phase 1 survey of the site, the areas of salt marsh are of the highest conservation importance, they are a UK BAP habitat and a local BAP habitat in the Lincolnshire BAP (Lincolnshire Wildlife Trust 2000). Salt marsh is an important resource for wading birds and wildfowl; it provides high tide refuges for birds feeding on mudflats; breeding sites for waders, gulls and terns; winter food for wild ducks and geese. It is an important habitat for invertebrates and sheltered nursery sites for fish.

6.6.143 The key area of salt marsh is found on the seaward side of the seawall and forms part of the Wash and North Norfolk Coast SAC and is, therefore, a feature of international importance. The plant communities of this habitat also designated as SSSI and NNR in part because of the breeding bird populations they support (details are included in Volume 1, Offshore).

6.6.144 Several other areas of salt marsh, outside the Ramsar, SAC and SSSI areas, have been mapped, particularly along the banks of the River Nene. As Centrica is not currently considering cable routes that would effect these areas, they are not considered further in this assessment.

Swamp

6.6.145 Small areas of swamp were identified in the western part of the survey area. As these will be unaffected by the proposed cable route they are not considered further in this assessment.

Wet and Dry Ditches

6.6.146 Most of the ditches identified within the survey area are filled with water only intermittently. These ditches are intensively managed for drainage purposes and provide limited opportunities for aquatic plant species and invertebrates. Inspections of ditches likely to be affected by cable installation indicate no evidence of aquatic mammals (water voles and otters). These habitats are considered to be of no more than parish or local importance.

Ponds

6.6.147 There are several small ponds scattered through the survey area. These are generally small and isolated and, as such, are considered to be of less than *parish or local importance*.

Built-up Areas

6.6.148 Built habitats, including hard surfaces and the go-kart track, are considered to have no ecological value and are not considered further in this assessment.

Species

Birds

Breeding Birds

6.6.149 The following breeding (and potentially breeding) species are considered to be valued ecological receptors (VERs) because of their rarity, conservation status or abundance within the survey area. Those species identified as being of conservation value but not considered as VERs are excluded because they are present in low densities and consequently of less than district importance.

6.6.150 Marsh harrier is listed on Annex 1 of the EU Birds Directive and Schedule 1 of the Wildlife and Countryside Act. As there are probably less than 200 pairs in Great Britain, it is considered under JNCC criteria (JNCC 1996) to be a rare breeding bird. A breeding population of any size would be of at least national importance. The breeding bird surveys identified one confirmed breeding pair and one potential breeding pair. On the basis of JNCC SPA selection criteria, a breeding population of two pairs within the study area is of European importance.

6.6.151 Tree sparrow is a species that has suffered substantial declines in its population and range over the past 30 years, with numbers in 1999 a mere 5 per cent of those recorded in 1970. Tree sparrow is a UK BAP priority species and is included on the BoCC Red List (Gregory *et al*. 2002). Red list species are those that are globally threatened, whose population or range has declined rapidly in recent years (ie by more than 50 per cent in 25 years), or which have declined historically and not recovered. A total of 86 pairs of tree sparrow were recorded within the study area with the vast majority of territories associated in close proximity to farmyards or similar buildings. Based on the large abundance of breeding pairs and high conservation value the breeding tree sparrow population within the study area is considered to be of *county importance*.

Potential Breeding Species

6.6.152 Hobby (breeding unconfirmed) is listed on Annex 1 of the EU Birds Directive and Schedule 1 of the Wildlife and Countryside Act. The British hobby population is estimated at 2,200 breeding pairs (Clements 2001). The hobby is a moderately uncommon summer visitor to Norfolk and Lincolnshire, and a single territory recorded in the survey area would represent 8.7 per cent of the total number of pairs present in Norfolk as a whole (11.5 pairs: the mean number of pairs in 2000–01) (Norfolk and Norwich Naturalists' Society 2002). A pair would also represent approximately 0.05 per cent of the national breeding population. The population of this species in the survey area is therefore considered to be of county importance.

6.6.153 Barn owl (breeding unconfirmed) is listed on Schedule 1 of the Wildlife and Countryside Act. The British barn owl population is estimated at 4,000 breeding pairs (Toms *et al*. 2001). In East Anglia, notable increases in barn owls have been observed, indicating that there has been a real increase in densities in the region since the mid 1980s. A single territory recorded within the survey area would represent 2.8 per cent of the minimum Norfolk county population (mean minimum number of 35.5 pairs in 2000–01) (Norfolk and Norwich Naturalists' Society 2001). However, it is noted that due to the species' sedentary nature these figures are significant underestimates of the true Norfolk total. A single territory represents 0.025 per cent of the national population estimate. The population of this species within the survey area is therefore considered to be of district importance.

6.6.154 The breeding bird surveys undertaken within farmland areas and salt marsh areas indicate the presence of foraging Montagu's harrier. There is no evidence of breeding within the survey area, but it is likely that this species breeds close by on the Lincolnshire or Norfolk coast. This species will breed within cereal fields, so its potential future presence within the survey area cannot be discounted. This species is listed on Annex 1 of the EU Birds Directive and Schedule 1 of the Wildlife and Countryside Act. As there are probably less than seven pairs in Great Britain, it is considered to be a very rare breeding bird. The presence of a breeding population of any size would be of at least national importance. There are no SPA selection criteria established for this species in Britain.

Non-Breeding (Winter) Farmland Birds

6.6.155 The farmland winter bird assemblage is considered to be of county importance. This conclusion is based on the large diversity of species recorded and the relatively large number of species of conservation interest including tree sparrow and house sparrow (see below). In addition, species such as skylark, twite and snow bunting were also recorded in flocks, and noted to be highly mobile within the survey area using feeding areas before moving to new foraging grounds. These species were observed to associate with set-aside or stewardship fields and salt marsh. The importance of the survey area is likely to differ in any one year depending on the farming practices at that time.

6.6.156 The potential impacts associated with development proposals are related to disturbance during construction, temporary habitat loss during construction and some permanent habitat loss (restricted to Section A).

6.6.157 Of the 11 sections within the ornithological survey area Sections B, C, F, G, H, I, J and K were all noted to support wintering bird populations of some conservation importance. It is considered that the proposed development will have no potential negative effects to Sections B, H, I, J due to their distance from the proposed cable corridor route.

6.6.158 Within the remaining sections, C, F, G and K, the following species of conservation significance occurred regularly.

6.6.159 The tree sparrow is primarily associated with farmyards and hedgerows. This species has undergone rapid decline (>50 per cent) within Britain over past 25 years

(RSPB 2002). Tree Sparrows were recorded in 6 of the 11 survey sections, and were most abundant in Area F where a maximum of 24 individuals were recorded. On this basis the tree sparrow population within the survey area is considered to be of district importance.

6.6.160 The barn owl is recorded in association the networks of linear ditches primarily in Section G. Ditches are particular suitable habitat for barn owls, which are known to use linear water bodies both as hunting grounds and flight corridors. On this basis the barn owl population within the survey area is considered to be of district importance.

6.6.161 The house sparrow is primarily recorded in association with farmyards and private gardens within the survey area. Although numbers of house sparrows in Britain have declined significantly in recent years, this species is still widespread and abundant and the population recorded within the survey area (maximum of 145 individuals in survey Section B) is considered to be of no more than local importance and is not considered further in this assessment.

Onshore inter-tidal birds

6.6.162 The inter-tidal bird species listed in Table 6.17 and identified as regularly occurring on the onshore habitats in close proximity to the seawall are considered to VERs.

Table 6.17 | **Inter-tidal bird species occurring regularly in close proximity to the seawall**

Species	Conservation value	Justification
golden plover	international	SPA/Ramsar citation feature
grey plover	international	SPA/Ramsar citation feature
knot	international	SPA/Ramsar citation feature
dunlin	international	SPA/Ramsar citation feature
curlew	international	SPA/Ramsar citation feature

Amphibians

6.6.163 Great crested newts receive protection under the Habitats Regulations 1994 and the Wildlife and Countryside Act 1981 (as amended). These ensure that individual newts and all their habitats (breeding, refuge and foraging) are protected. Surveys confirmed that great crested newts were absent from those water bodies identified as potential habitats. However, because access was refused the status of great crested newts is unknown in two ponds that are located within 500 m of the development area. Therefore newts could be in the area of the development, which offers suitable foraging and refuge habitats. If a population is present it is considered that it would be of parish or local importance.

Mammals

Bats

6.6.164 The site is unlikely to be of particular importance for bat species due to the relative paucity of bat roosts and limited foraging opportunities. Buildings, particularly older farm buildings and outhouses, and some older trees with hollows, do provide some roosting opportunities. Aside from roosts, the most important habitats for bats will be those associated with foraging. Within the open, intensively farmed landscape present within the survey area, the key habitats are expected to be linear features such as intact hedges and the more substantial ditches, particularly wet ditches.

6.6.165 Surveys determined that activity within the site is not high and that the survey area is not considered to be of particular importance as foraging habitat. Nevertheless, all bat species are listed on Annex IV of the EU Habitats Directive and are, therefore, protected in England and Wales by the Conservation (Natural Habitats etc.) Regulations 1994. In addition, bats are also protected under Section 9 of the Wildlife and Countryside Act 1981, as updated by the Countryside and Rights of Way (CRoW) Act 2000.

6.6.166 The bat population of the survey area is, therefore, considered to be of no more than parish importance, but impacts are considered further in light of their status as European protected species.

Water Voles

6.6.167 The surveys determined that the watercourses of the study area are devoid of water voles. Burrows and feeding signs were seen at the pond at Crown Farm (TF 511 198). This is isolated from the main drainage system but it may indicate a very small local population. This population of water voles is considered as being of no more than *district importance*. In addition, the habitats of the water vole are protected by the Wildlife and Countryside Act 1981 as updated by the Countryside and Rights of Way (CRoW) Act 2000.

6.6.168 Wet ditches within the survey area support a small population of water voles considered to be of no more district importance. In addition, the habitats of the water vole are protected by the Wildlife and Countryside Act 1981 as updated by the Countryside and Rights of Way (CRoW) Act 2000. The water vole population of the survey area is, therefore, considered to be of district importance *(*UK protected species*)*.

Brown Hares

6.6.169 Brown hares were observed occasionally during site surveys. This species tends to be found in arable land, which covers the majority of the site. It is expected, therefore, that they will be present throughout the survey area in low numbers.

6.6.170 This species receives little legal protection, but it is listed in the Bern Convention 1979, which prohibits indiscriminate killing of this species, it is also both a UK BAP priority species and a local BAP species for both Norfolk and Lincolnshire. The

breeding season is between February and September, during which time leverets may be vulnerable to disturbance.

6.6.171 The brown hare population is considered to be of district importance.

Otters

6.6.172 Otters are UK BAP priority species and are fully protected under Schedule 5 of the Wildlife and Countryside Act 1981, as updated by the Countryside and Rights of Way Act 2000. This species is a feature of interest (although not a primary reason for selection) of the adjacent Wash and North Norfolk Coast SAC.

6.6.173 While the extended Phase I survey and targeted otter surveys provided no indication of otters, it is considered likely that this species will forage within the River Nene and its tributaries. In this respect, the site is not considered to be of particular importance for this species, although disruption to the network of ditches could potentially inhibit dispersal opportunities.

6.6.174 Otters are, however, European protected species as they are listed on Annex IV of the EU Habitats Directive and, therefore, protected in England and Wales by the Conservation (Natural Habitats etc.) Regulations 1994. In addition, Otters are also protected under Section 9 of the Wildlife and Countryside Act 1981, as updated by the Countryside and Rights of Way (CRoW) Act 2000.

Badgers

6.6.175 Signs of badger were recorded in several locations throughout the survey area during the Phase 1 survey, in patches of rough grassland, scattered and dense scrub, and woodland. As these habitats are considered to have good potential to support badgers, further surveys were undertaken to identify the locations of any setts and favoured foraging areas.

6.6.176 The badger surveys did not identify any additional signs of badger activity or the location of any setts to the east of the River Nene. Badgers receive full protection under the Protection of Badgers Act 1992, on animal welfare grounds rather than nature conservation value, and are common in local, county and national contexts. There is no evidence of badgers using the site other than for light foraging although they are known to be in the wider area. Badger use of the study area is limited and as such considered to be of parish or local importance.

Invertebrates

6.6.177 The survey area provides limited habitat for invertebrates, although the presence of standing (open) water habitats (particularly those that support marginal vegetation such as reeds) and ditches provides opportunities for Odonata (dragonflies and damselflies). In addition, there is a range of invertebrate species specifically associated with salt marsh habitats.

6.6.178 The importance of the site for Odonata is considered limited due to the relative scarcity of standing (open) water habitats and wet ditches. Ponds are infrequent and widely separated within the survey area. Ditches are present throughout, although many appear to be dry and these will provide limited opportunity for foraging and breeding. It is likely that dragonflies and damselflies will disperse via the network of ditches, particularly those that retain water. In this respect the ditch immediately landward of the coastal seawall is expected to be most important for these species. It is concluded that the dragonfly and damselfly communities and populations are unlikely to be of more than parish or local importance and are, therefore, not considered further.

6.6.179 Information about the distributions of invertebrates associated with salt marsh habitats is limited. However, the potential for species such as narrow-mouthed whorl snail and the lagoon sand shrimp (*Gammarus insensibilis*) cannot be discounted. It is expected, however, that these species, if present, will be restricted to the larger expanses of salt marsh seaward of the seawall and, in the case of the lagoon sand shrimp, within the brackish lagoon located to the west of the River Nene. As these habitats will not be affected by the proposed onshore works these species are not considered further in this assessment.

Summary of Valued Ecological Receptors

6.6.180 Table 6.18 summarises the VERs within the zone of influence of the proposed cable route and substation works. Features of less than district importance (except for protected species) are not included.

Table 6.18 | **Potential valued ecological receptors present within the zone of influence of the proposed development**

Feature	Details	Importance
designated sites	the Wash (Ramsar, SPA, SAC, SSSI and NNR)	international
habitats	hedges (intact)	district
	salt marsh (below MHWS)	international
species – birds	winter farmland birds assemblage	county
		national
	breeding marsh harrier and Montagu's harrier (potential only)	at least national
	tree sparrow population	county
	barn owl population	district
	onshore inter-tidal birds (golden plover, grey plover, knot, dunlin, curlew)	international
species – amphibians	great crested newt (unconfirmed)	parish or local (European protected species)

species – mammals	bat populations	parish or local (European protected species)
	water vole population	district (UK protected species)
	brown hare population	district
	otter population	parish or local (European protected species)
	badger population	parish or local (UK protected species)

Predicted Changes in Baseline

6.6.181 Construction works for the onshore components of Lincs are not expected to commence until 2008, with works for Docking Shoal and Race Bank being undertaken in subsequent years. Predicted changes in baseline conditions for VERs, without the implementation of the development proposals, are highlighted below.

Sites

6.6.182 No changes expected.

Habitats

Hedges (Intact)

6.6.183 Since 1945 there has been a drastic loss of hedgerows through removal and neglect throughout the UK, especially in eastern counties of England (www.ukbap.org.uk). Between 1984 and 1990, the net loss of hedgerow length in England was estimated at 21 per cent: a result of outright removal and neglect. More recently, changes in attitudes and policy together with the introduction of grant schemes has slowed decline and in some areas has led to the planting of new hedgerows.

6.6.184 There are relatively few intact hedgerows within the study area. Land within the northern part of the site has been relatively recently reclaimed and may never have possessed an extensive network of hedgerows. Further south, where hedgerows may once have been more abundant, many field boundaries have already been cleared. It is expected that there is little further pressure for hedgerow removal within the study area and for the purposes of this assessment it is assumed that there will be no change in the baseline within the time-frame of the proposed works.

Species

Farmland Birds Assemblage

6.6.185 The success of the farmland breeding bird community in any one year is likely to be largely dependent on the agricultural practices being implemented at the time. In any one year the cropping regimes (eg summer cereal) or implementation of stewardship schemes on a farm may provide highly favourable breeding conditions for birds, while a subsequent year could see a change in agricultural practice (eg winter cereal), which may result in a reduction in breeding success.

6.6.186 An additional consideration in the future baseline predictions for the farmland breeding bird community is the current published trends for birds of conservation importance (Eaton *et al.* 2005). The declines in farmland bird populations are well-documented by conservation organisations such as the RSPB and BTO, and current trends for species such as grey partridge, turtle dove, linnet, bullfinch, yellowhammer and corn bunting all show continuous long-term (1970–2003) and short-term (1994–2004) declines across the UK, although the rate of decline has slowed in recent years. Measures are in place on a national scale to attempt to revert the decline in farmland bird species (Environmental Stewardship Scheme implemented in England in 2005).

6.6.187 Consequently, the overall future predicted baseline for the farmland breeding bird community, while likely to fluctuate and decline in the short term (<10 years) is likely to remain stable in the longer term with potential for increase dependent on stewardship uptake within the local farming community.

Breeding Marsh Harrier and Montagu's Harrier

6.6.188 As indicated above, the future breeding activity for both marsh harrier and Montagu's harrier within the survey areas cannot be discounted, nor can it be predicted. The location and extent of breeding will depend on land-use, particularly cropping regime at the time.

Tree Sparrow Population

6.6.189 Population trends for tree sparrow show a dramatic long-term decline (98 per cent). However, short-term trends show a moderate increase (48 per cent). The overall future predicted baseline for the tree sparrow population is that they are likely to fluctuate and potentially increase further in the short term (<10 years), but remain stable in the longer term with potential for long-term increase dependent on stewardship uptake within the local farming community.

Barn Owl Population

6.6.190 Monitoring of the breeding success of barn owls has shown a downward trend. This follows a long period of increase, presumably as part of the species' recovery from the detrimental effects of organochlorine pesticides in the 1950s and 1960s. The new downward trend is a result of a recent run of poor years (lack of food availability and low fledging success), and might indicate that breeding season food supplies for barn owls are becoming less abundant. The overall future predicted baseline for the barn owl population is that they are likely to fluctuate in the short term dependent on conditions and food availability during the breeding season(<10 years), but remain stable in the longer term with potential for increase dependent on stewardship uptake within the local farming community.

Bat Populations

6.6.191 No changes are anticipated for these species within the survey area for the foreseeable future.

Onshore Inter-tidal Birds

6.6.192 A key consideration in the future baseline predictions for the wintering waterbird assemblage is the current published information on trends for Birds of Conservation Importance (Eaton *et al*. 2006).

6.6.193 Trends suggest that there was a continued increase in wintering waterbirds in the UK from the mid 1970s to the mid to late 1990s, with numbers approximately doubling during this period. This population increase was in part a result of the establishment of a network of protected sites, reductions in hunting pressure and improved feeding opportunities on agricultural land. In the late 1990s a decrease in waterbird abundance occurred, primarily for wildfowl species. More recently this decline appears to have stabilised; however, overall abundance remains below the peak of the mid 1990s. Within the overall pattern of the waterbird indicator, individual species or populations show differing trends.

6.6.194 Of the five birds occurring within the onshore habitats, four show evidence of decline (grey plover –37%, knot –19%, dunlin –9%, curlew –8%) based on the ten-year trend (ten-year trends are the percentage changes between the three-year means for the winters 1991–92, 1992–93 and 1993–94 and the winters 2001–02, 2002–03 and 2003–04). Reasons identified for declines in these species include reductions in reproductive success or survival, climate change, and birds moving away from the UK and thus not actually decreasing in number at a wider population scale. No trend data is available for golden plover.

6.6.195 Climate change and sea level rise have the potential to influence the future of the wintering waterfowl assemblage significantly. The most recent predictions are that relative sea level rise in Eastern England will be between 21 and 76 cm by the 2050s (Hulme *et al*. 1999). The Wash has been identified as one of the most vulnerable areas to the effects of sea level rise, due to its location and topography. However, the study area is currently subject to salt marsh accretion as a result of increased sediment deposition. The potential interactions between sea level rise and salt marsh accretion are unknown at this time; however, it is considered that none of these effects will occur within the proposed time frame of the development construction.

6.6.196 An additional consideration for predicting future baseline populations of waterfowl is the condition of the Wash itself. Based on the SSSI condition assessment undertaken by English Nature (compiled in August 2006), 75 per cent of the Wash is in favourable or recovering condition with the remaining 25 per cent unfavourable and declining.

6.6.197 Based on the trends of the species, condition of the Wash, and predicted changes in climate and sea level, it is considered that within the duration of the development proposals the species may be subject to varying degrees of fluctuation but will continue to feature as an ecological receptor of international importance.

Great Crested Newt Population (Unknown)

6.6.198 No changes are anticipated for this species within the survey area for the foreseeable future.

Water Vole Population

6.6.199 No changes are anticipated for this species within the survey area for the foreseeable future.

Brown Hare Population

6.6.200 No changes are anticipated for this species within the survey area for the foreseeable future.

Otter Population

6.6.201 No changes are anticipated for this species within the survey area for the foreseeable future.

Badger Population

6.6.202 No changes are anticipated for this species within the survey area for the foreseeable future.

Summary of the ecological baseline of the study area

6.6.203 The results of a desk-based study, Phase 1 habitat survey and targeted protected species surveys indicate that the study area comprises a range of habitat types typical of the location and is largely dominated by intensively managed arable farmland. The vast majority of habitat within the study area is considered to be of low conservation value with the exceptions being the small areas of salt marsh (UK BAP habitat) and established hedgerows (due to scarcity within the area).

6.6.204 The study area is considered to be of limited value for non-avian fauna, including bats, water voles, brown hare and badgers.

6.6.205 A range of both breeding and wintering farmland bird species occurs within the study area. Surveys indicate the presence of bird species populations of conservation importance (including tree sparrow and marsh harrier) as well as species assemblages of conservation importance. The near-shore areas of the study area also provide both feeding and roosting habitat for the waterfowl of the Wash SPA/Ramsar.

Summary

6.6.206 The results of a desk-based study, Phase 1 habitat survey and targeted protected species surveys indicate that the study area comprises a range of habitat types typical of the location and is largely dominated by intensively managed arable farmland. The vast majority of habitat within the study area is considered to be of low

conservation value with the exceptions being the small areas of salt marsh (UK BAP habitat) and established hedgerows (due to scarcity within the area).

6.6.207 The study area is considered to be of limited value for non-avian fauna including bats, water voles, brown hare and badgers.

6.6.208 A range of both breeding and wintering farmland bird species occur within the study area. Surveys indicate the presence of bird species populations of conservation importance (including tree sparrow, marsh harrier) as well as species assemblages of conservation importance. The near-shore areas of the study area also provide both feeding and roosting habitat for the waterfowl of the Wash SPA/Ramsar.

6.7 Transport and Traffic

Introduction

6.7.1 This chapter of the Environmental Statement (together with Chapter 7.7) considers the potential effect that the onshore elements of the grid connection for the proposed Lincs, Docking Shoal and Race Bank Offshore Wind Farms may have on transportation. In this chapter the approach to the transport and traffic assessment is outlined and baseline traffic conditions are described.

6.7.2 Chapter 7.7 identifies those aspects of the proposed developments that may introduce additional demands on the transport infrastructure, assesses the significance of potential impacts and identifies appropriate mitigation.

6.7.3 The assessment concentrates on road traffic associated with the construction phase of the substation site and associated works, and the effects on the local access routes as outlined below.

- Route 1 – A47, B198, Lynn Road, School Road, Mill Road, Walpole Bank to Walpole substation
- Route 2 – A17, King John Bank, Gooses Lane/Marsh Road/French's Road and other unclassified roads leading to easement
- Route 3 – A17, Lynn Road, Grange Road/Anchor Road leading to easement
- Route 4 – A17, East Bank, Garners Lane/Hospital Road/Sluice Road leading to easement

Approach to the assessment

Transport Policies

National Planning Policy Guidance

6.7.4 Planning Policy Guidance (PPG) 1 – *General Policy and Principles* (Revised February 1997) provides a commentary on planning policy, which the local planning authority must consider when preparing development plans. The guidance may also be material to decisions in individual planning applications and appeals. Paragraph 1 of the guidance states that a key role of the planning system is to enable the provision of jobs in a way that is consistent with the principles of sustainable development. It should be positive in promoting competitiveness, while protective towards the environment of the community.

6.7.5 National Planning Policy Guidance on transport matters is primarily derived from PPG 13 – *Transport* (Revised March 2001). The main emphasis of the guidance is to establish sustainable transport patterns through the integration of planning and transport. The document states that in support of this objective, local planning authorities should:

- support sustainable transport choices for moving both people and freight
- promote accessibility to jobs and services by public transport, walking and cycling
- reduce the need to travel, especially by car
- have regard to the regional transport strategy (RTS), which forms part of the regional planning guidance (RPG)
- ensure that the strategies set out in development plans and transport plans complement each other
- ensure that development plans and planning applications that result in employment offer a realistic choice of access to public transport, walking and cycling
- protect sites and routes that are important to developing transport infrastructure
- use parking policies alongside any other planning and transport measures to promote sustainable transport choices

6.7.6 Where developments would have significant implications, transport assessments should be prepared to accompany a planning application. For small schemes these should simply outline transport aspects of the development; for lesser schemes they should illustrate accessibility to the site by all modes of transport and give details of any measures that are proposed to improve public transport, walking and cycling facilities and to reduce the reliance on the private car (PPG 13, paragraph 23). Where appropriate, travel plans should be included.

6.7.7 As the transport effects of the scheme are expected to be restricted to the construction phase, an assessment of the impacts arising from construction traffic is presented in Section 7.7. The project will not result in the creation of any significant new permanent transport effects at the substation site and so a separate transport assessment for the ongoing operation of the site is not required. The implementation of a travel plan and assessment of transport modes and patterns are also considered inappropriate.

6.7.8 The continuing importance of transport in meeting the Government's objective for sustainable development is reiterated in Planning Policy Statement (PPS) 1 – *Developing Sustainable Communities, 2005* and the importance of public transport in ru-

ral areas is emphasised in PPS 7 – *Sustainable Development in Rural Areas* (August 2004).

Local and regional planning policies

6.7.9 Objectives of regional planning policies relating to transportation are detailed in Chapter 2. Key policies include Policy T1 of the Norfolk Structure Plan, which seeks to restrict access to the road hierarchy outside development boundaries, and Policy M1 of the Lincolnshire Structure Plan.

6.7.10 The development guide further states 'The slowing, waiting, and turning and manoeuvring of vehicles at new junctions and accesses onto these higher category roads would be likely to affect the safety and freedom of flow of other traffic using such roads…'. The existing junctions along the A17 and B198 are all in the form of ghost island junctions (T-junctions with right-turning lanes along major roads) (see Appendix A2.10) that would have been designed with the standards outlined in TD42/95.

Circular 4/2001: Control of Development Affecting Trunk Roads and Agreements with Developers under Section 278 of the Highways Act 1980

6.7.11 Research shows that the formation of new access to trunk roads is liable to lead to a greater risk of accidents. Circular 4/2001 actively discourages the formation of new access onto trunk roads. Due to the location of the site, new junctions will not be required along the A47.

6.7.12 The onshore works will not generate significant traffic or heavy vehicles beyond the construction period. They will not have a significant permanent impact on the operation of the road network and no additional transport infrastructure is required for the scheme. Access improvements are provided by virtue of the improved site access at the substation. Although minor roads and heavy vehicles will be used during the construction phase, these effects are temporary and the development will not have a significant long-term or residual effect. The primary network can be accessed within 4 km from the substation and cable route, and the use of agreed haulage routes along the most direct and suitable approach via Walton and Sutton Bridge will discourage unnecessary use of other minor roads.

Highway Capacity, Conditions and Safety

6.7.13 Information on previous recorded personal injury accidents (PIA) along the adjoining road network has been obtained from the Lincolnshire Road Safety Partnership and Norfolk County Council, Safety and Traffic Management.

6.7.14 A visual inspection of the adjoining road network has been undertaken in order to identify further potential constraints in terms of highway and pedestrian safety. Observations were also made in relation to user delay and the physical condition of the road.

Highway Characteristics for Heavy Vehicles and Abnormal Loads

6.7.15 Further consideration was given to the abnormal and indivisible loads required to deliver 132/400 kV transformers to the site via the Class III roads, at a gross transport weight of approximately 150 tonnes for Lincs and up to 275 tonnes for Docking Shoal and Race Bank. An initial study reviewed all the potential routes to the site and the condition and alignment of constraints along the routes, such as bridges and other structural crossings (Appendix A2.10). A subsequent study looked at the swept path of delivery vehicles at specific locations along the route through Walton (Appendix A2.11).

6.7.16 Surveys considered both horizontal and vertical geometry, and were used to develop swept path analysis of the surveyed locations to confirm feasibility.

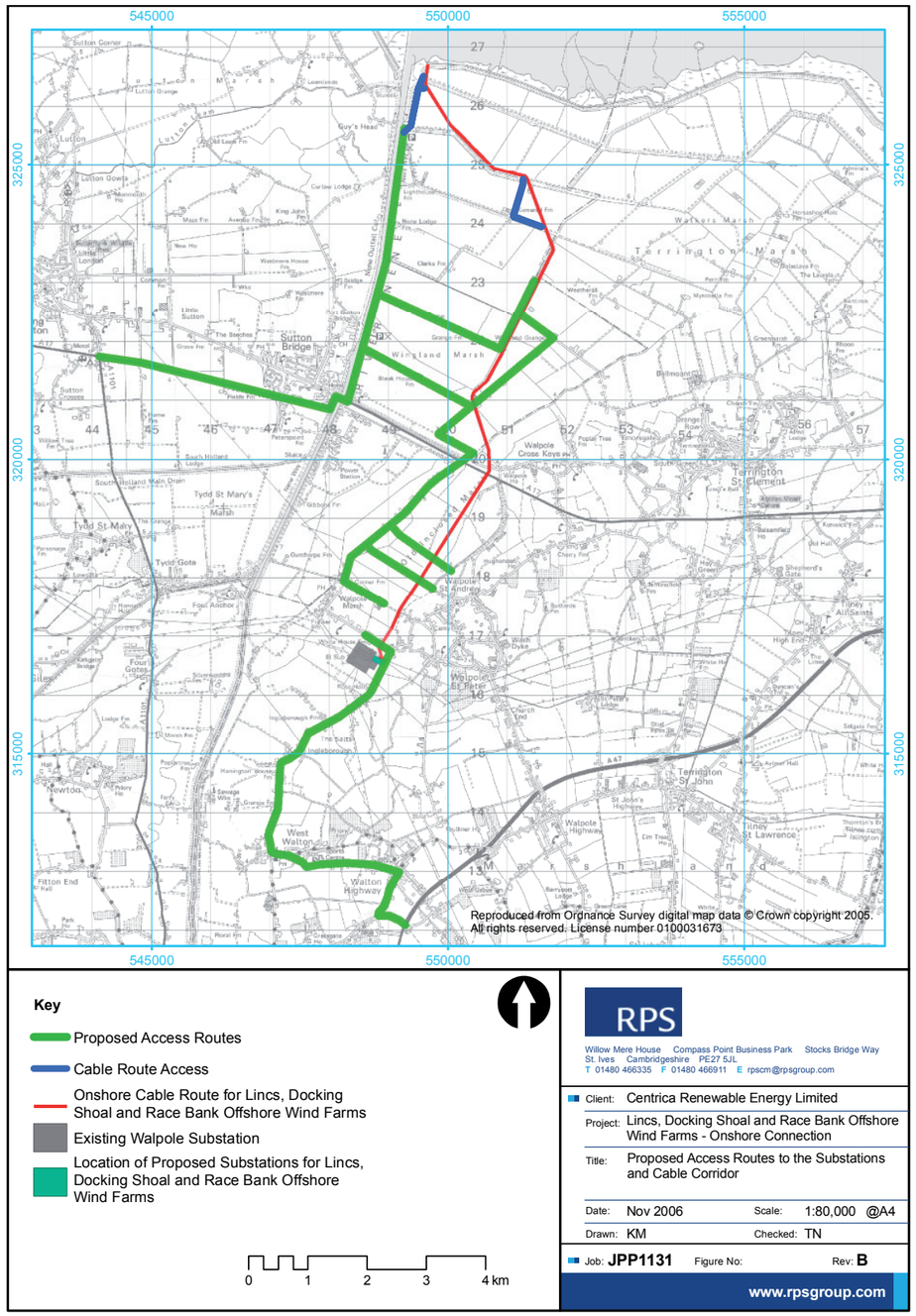

Figure 6.18 | Proposed access to the substation

The Existing Situation

The Primary Road Network

6.7.17 The A17 is a high standard de-trunked road forming part of the county's primary route network of inter-urban roads and serves north Norfolk and Lincolnshire, including the towns of King's Lynn, Sutton Bridge and Holbeach.

6.7.18 The A17 comprises a two-lane (one lane in either direction) carriageway from its junction with the A1101 and within the vicinity of the cable route, and a two-lane dual carriageway (two lanes in either direction) towards the eastern end, nearing King's Lynn. The A17 Crosskeys Bridge area experiences some existing traffic congestion as identified by Lincolnshire County Council (LCC).

6.7.19 The A47 is a trunk road linking the major urban conurbations of Leicester, Peterborough and King's Lynn. Within the vicinity of the B198, the A47 is wide single two-lane carriageway.

Local Road Network

6.7.20 It is proposed that access to the substation and easement will be taken via the B198, King John Bank, Grange Road and Eastbank. The proposed access routes are shown on Figure 6.18.

6.7.21 The routes will subsequently be accessed from the primary route network, as listed below, and are described in more detail in the *RPS Transport Report*, Appendix A2.10:

- Route 1 – A47, B198, Lynn Road, School Road, Mill Road, Walpole Bank to Walpole substation
- Route 2 – A17, King John Bank, Gooses Lane/Marsh Road/French's Road and other unclassified roads leading to easement
- Route 3 – A17, Lynn Road, Grange Road/Anchor Road leading to easement
- Route 4 – A17, East Bank, Garners Lane/Hospital Road/Sluice Road leading to easement

Traffic Flows

6.7.22 Manual classified count (MCC) and automatic traffic count (ATC) data were obtained from LCC for the following locations and dates.

- A1101 Wisbech Road, south of roundabout with the A17, MCC, April 2001
- A17 Sutton Bridge, MCC, April 2005
- A47 St Johns Highway, ATC, February 2006

6.7.23 The survey locations are shown on Figure 6.19 with a summary of the traffic data, including peak hour and heavy vehicle movements. Extracts from the data contained in the above sources are also given in Appendix A2.10 . A summary of the data relevant to this assessment is provided in Table 6.19.

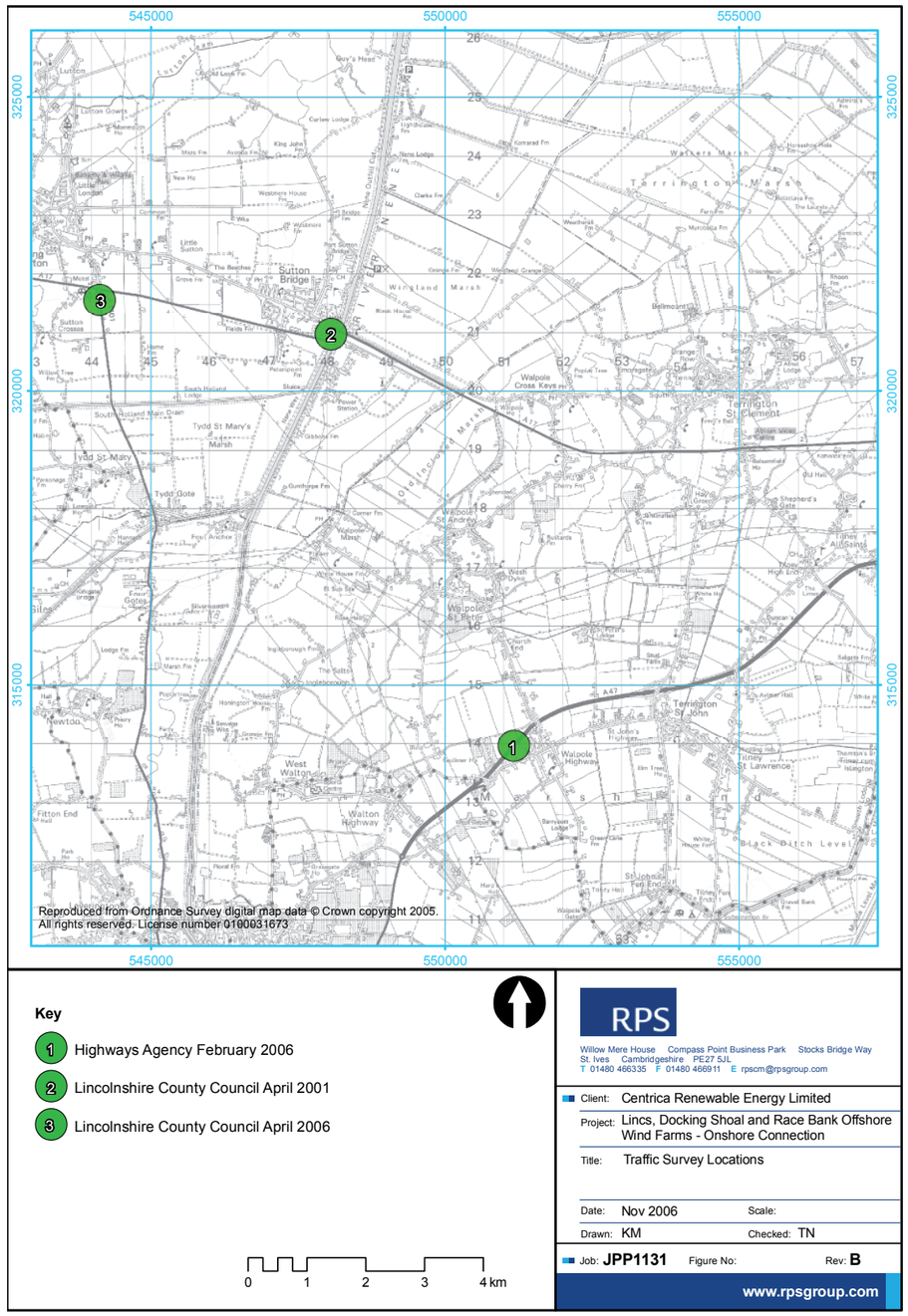

Figure 6.19 | Traffic flow survey locations

Table 6.19 | **Existing two-way traffic flows, local highway network**

	Weekday					
	am, peak hour (8–9am)		pm, peak hour, pm (5–6pm)		12 hour (7am–7pm)	
	total	HGV	total	HGV	total	HGV
A47 St Johns Highway [1]	1705	274	1523	149	13750	2909
A1101 Wisbech Road [2]	506	102	367	49	5483	1051
A17 Sutton Bridge [3]	1252	258	1394	159	13592	2688

(1) Automatic traffic count – Highways Agency, February 2006
2) Manual classified count – Lincolnshire County Council, 26 April 2001
(3) Manual classified count – Lincolnshire County Council, 28 April 2005

Accidents

6.7.24 A total of 18 personal injury accidents have been reported by Norfolk County Council in the preceding three-year period to 1 March 2006 on the identified construction Access Route 1 between the A47 and the B198, including the A47 roundabout. These are summarised as follows.

- Four accidents (all slight) on the A47 within 50 m of the B198 roundabout; turning movements at the junction were not recorded as contributory factors in any of these accidents, which involved rear-end collisions and loss of vehicle control
- Ten accidents (two serious, eight slight) involving turning movements at the Lynn Road/B198 junction
- One accident (slight) at the junction of Lynn Road and School Road
- One accident (slight) along School Road

6.7.25 Of the accidents that occurred at the junction of the B198 and Lynn Road, seven involved vehicles turning right onto Lynn Road from the B198. Onsite observations note that forward visibility is not restricted at this junction. The other accidents along the route involved loss of control, turning right onto the B198 and tail-end collisions.

6.7.26 Lincolnshire County Council reported that 32 accidents occurred along the A17 between the roundabout of the A17/A1101 Wisbech Road and the junction of the A17/Grange Road/King John Bank, ie Routes 2–4. Of these accidents, only two accidents were recorded at the Grange Road/King John Bank junction; one which involved a vehicle exiting King John Bank. No accidents were reported at the A17/Eastbank junction.

6.7.27 The majority of accidents that occurred along the A17 were attributed to driver misjudgement, speed and loss of control.

6.7.28 The accidents described above, identify that there is an accident problem at the junction of the B198 and Lynn Road, and that suitable traffic management measures, such as the erection of advanced warning signs, should be considered. Road signs conforming to the *Traffic Signs Regulations and General Directions 2004*, diagrams 506 and 511, are generally accepted as sufficient driver warning for HGV movements.

6.7.29 The records confirm that there are no existing accident or road safety issues along the proposed construction Access Routes 2–4.

6.7.30 The above analysis demonstrates that the current road network accommodates existing vehicle movements in a safe manner with vehicle speeds consistent with the geometric layout of the road network. There is only one location, the junction of the B198 and Lynn Road, where additional measures will be required with the agreement of Norfolk County Council.

Summary

6.7.31 This section has described the existing situation with respect to traffic and transport.

6.7.32 The primary road network of the area comprises the A17, a high standard, de-trunked two-lane road serving North Norfolk and Lincolnshire, including the key regional centres of King's Lynn, Sutton Bridge and Holbeach, and the A47, a trunk road linking the major conurbations of Leicester, Peterborough and King's Lynn.

6.7.33 The site of the substation and cable route can be accessed via these major roads and by the local road network including the B198 Lynn Road, King John Bank, Grange Road and Eastbank.

6.7.34 Information on traffic flows on key roads has been obtained and these indicate peak daily (12 hour) two-way movements of 13,592 vehicles on the A17, 13,750 on the A47 and 5,483 on the A1101. About 20 per cent of these movements are due to HGVs. Information on traffic accidents indicates that the current road network safely accommodates these vehicle movements, although there is one location where additional measures may be required to minimise accident risks.

6.8 Flood Risk and Coastal Defences

Introduction

6.8.1 The area of interest is located around Sutton Bridge in East Lincolnshire, and includes land up to 4 km to the east of the River Nene as it drains north from Wisbech (Foul Anchor) to the coast. Land west of the River Nene (Guy's Head) to the coast was initially also included, although now no longer part of the evaluated route. Coastal areas of land, especially Breast Sand to the east of the mouth of the River Nene, are also included.

6.8.2 This chapter outlines the findings from the site walkover that was completed in November 2005 by RPS. The walkover has informed a baseline study from which impacts in areas adjacent to or traversed by the proposed cable route have been considered. This chapter will also consider the land area that is required for the proposed extension of Walpole electrical substation. Potential impacts arising from the construction, operation and decommissioning of the proposed developments, and identification of appropriate mitigation, are addressed in Chapter 7.8.

Description of the Proposed Route

6.8.3 A number of routes for the cable were initially proposed, and the site walkover that was made reflected these. The walkover included 94 observation locations within the inland and coastline area, with water quality sampling completed at 18 of these.

6.8.4 The route that has been adopted for this Environmental Statement (ES) is shown in Figure 6.20. The cable route has a landfall at Breast Sand to the east of the River Nene at NGR 5496 3267, and continues in a roughly southwesterly and southerly direction for approximately 11 km towards the Walpole substation that is situated to the west of Walpole St Peter at NGR 5488 3168.

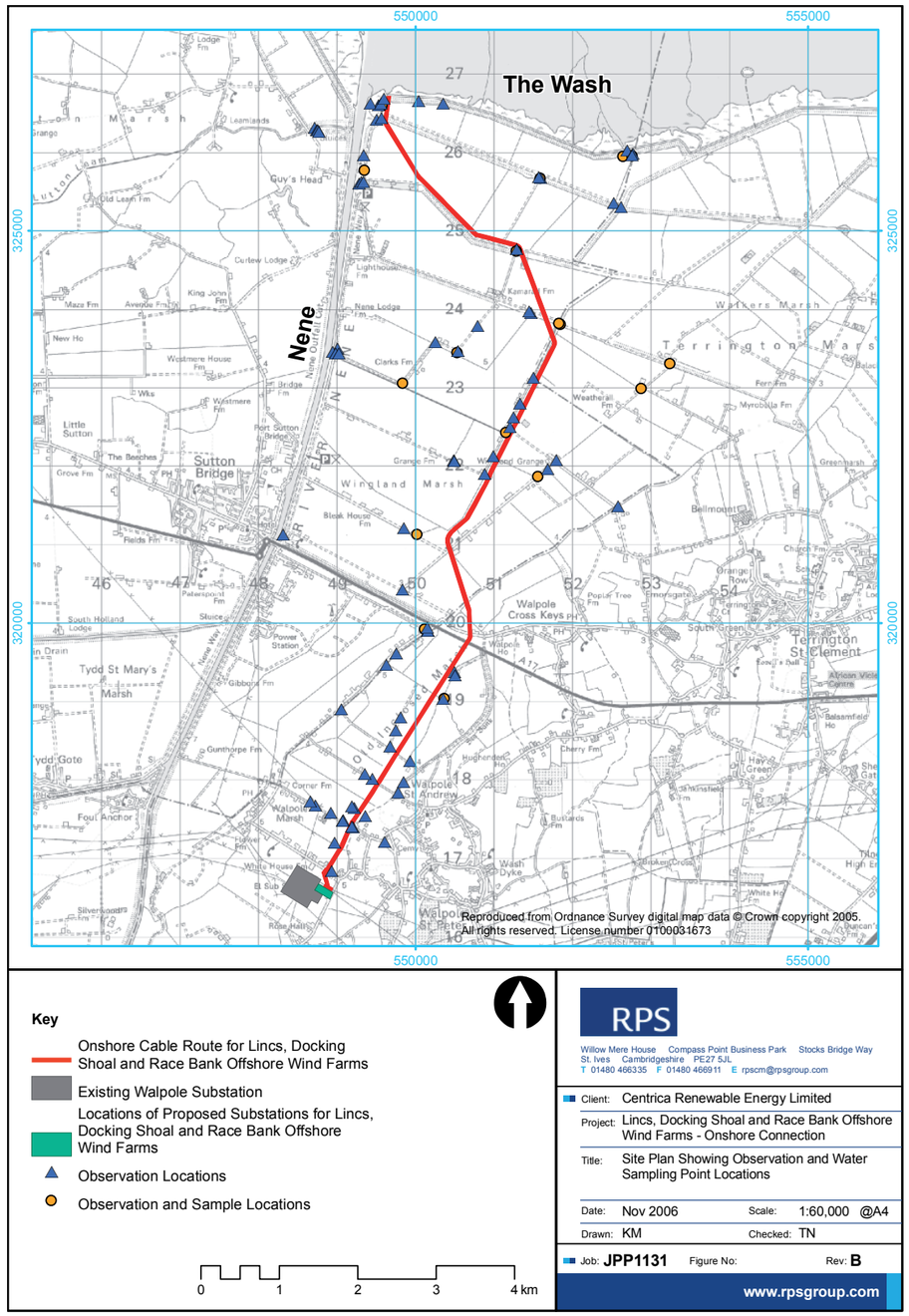

Figure 6.20 | Onshore cable route

Approach to the assessment

Guidance and Consultation

6.8.5 Guidance from the Environment Agency and from the King's Lynn Consortium of Internal Drainage Boards has been sought in the completion of this ES. Additional guidance from relevant maps and reports in the area has also been used to develop the baseline. Direct consultation with drainage engineers from the Inland Drainage Board and from relevant departments of the Environment Agency was sought to complete aspects of the ES, and this correspondence is included in Appendix A2.12.

6.8.6 Planning Policy and Guidance Note 25 on Development and Flood Risk (PPG 25) requires an FRA (Flood Risk Assessment) to ascertain whether the proposed development will be at risk of flooding, or will have an adverse impact on flood risk in the immediate surrounds or elsewhere in the catchment. This assessment also includes a review of any potential adverse effects on the existing surface-water drainage system, and therefore on the surface-water runoff regime in the area.

Local and regional policies

6.8.7 Local and regional policies relevant to flood risk are identified in Table 2.4 in Chapter 2. Key policies include:

- RSS8 East Midlands:
  - Policy 36
- RPG6 East Anglia:
  - Policy 44
- Norfolk Structure Plan:
  - Policy RC3
- Lincolnshire Structure Plan:
  - Policy NE13
- King's Lynn and West Norfolk Local Plan:
  - Policy 9/21
- South Holland Local Plan:
  - SG9

Evaluating the importance of features

6.8.8 The value, importance and sensitivity of features potentially affected by the proposed developments is evaluated as indicated in Table 6.20.

Table 6.20 | **Examples of important and sensitive features**

Importance of attribute	Definition
very high	feature or attribute with very high quality and rarity, and important at a regional or national scale (examples include: EC designated Salmonid fishery; an area where there is high potential for flooding of a large number of residential properties and infrastructure; or a potable water supply to a large population)
high	feature or attribute with high quality and rarity, important at a local scale, or feature or attribute of medium quality and rarity, important at a regional or national scale (examples include: EC Designated Cyprinid fishery; a watercourse achieving GQA class A or B; or a water feature that supports a potable water supply to a small population)
medium	feature or attribute with medium quality and rarity, important at a local scale, or a feature of low quality and rarity, important at a regional or national scale (examples include: a watercourse achieving GQA class C or D; a water feature that supports an abstraction for agricultural or industrial use; or an area where there is existing flood risk for a small number of properties or gardens)
lower	feature or attribute with low quality and rarity, important at a local scale (examples are a watercourse achieving GQA Class E or unclassified, or a floodplain with limited existing development)
negligible	feature or attribute that is insignificant at the local scale

Baseline Description

Description of Flood Risk

6.8.9 The Environment Agency requested that a flood risk assessment (FRA) be completed in their response to the scoping opinion (see Appendix A2.12). The FRA has been completed in accordance with PPG25 (Development and Flood Risk) and with reference to Environment Agency Guidance Note 4 (Environment Agency 2002), which provides the minimum requirements for developments within Zone 3 – high risk. A description of flood risk for this development is summarised below.

6.8.10 The Environment Agency use flood maps to provide a first indication of the flood risk to a particular area (Figure 6.21). These show areas that are affected by the 1-in-100 year and 1-in-1,000 year return period fluvial events and by the 1-in-200 year and 1-in-1,000 year return period tidal events. The proposed cable route and substation extension are all within Flood Zone 3 (high risk), with this relating to the 1-in-100 year fluvial and 1-in-200 year tidal floodplain for the River Nene and the Wash. The flood maps also show the development area to be protected by flood defences.

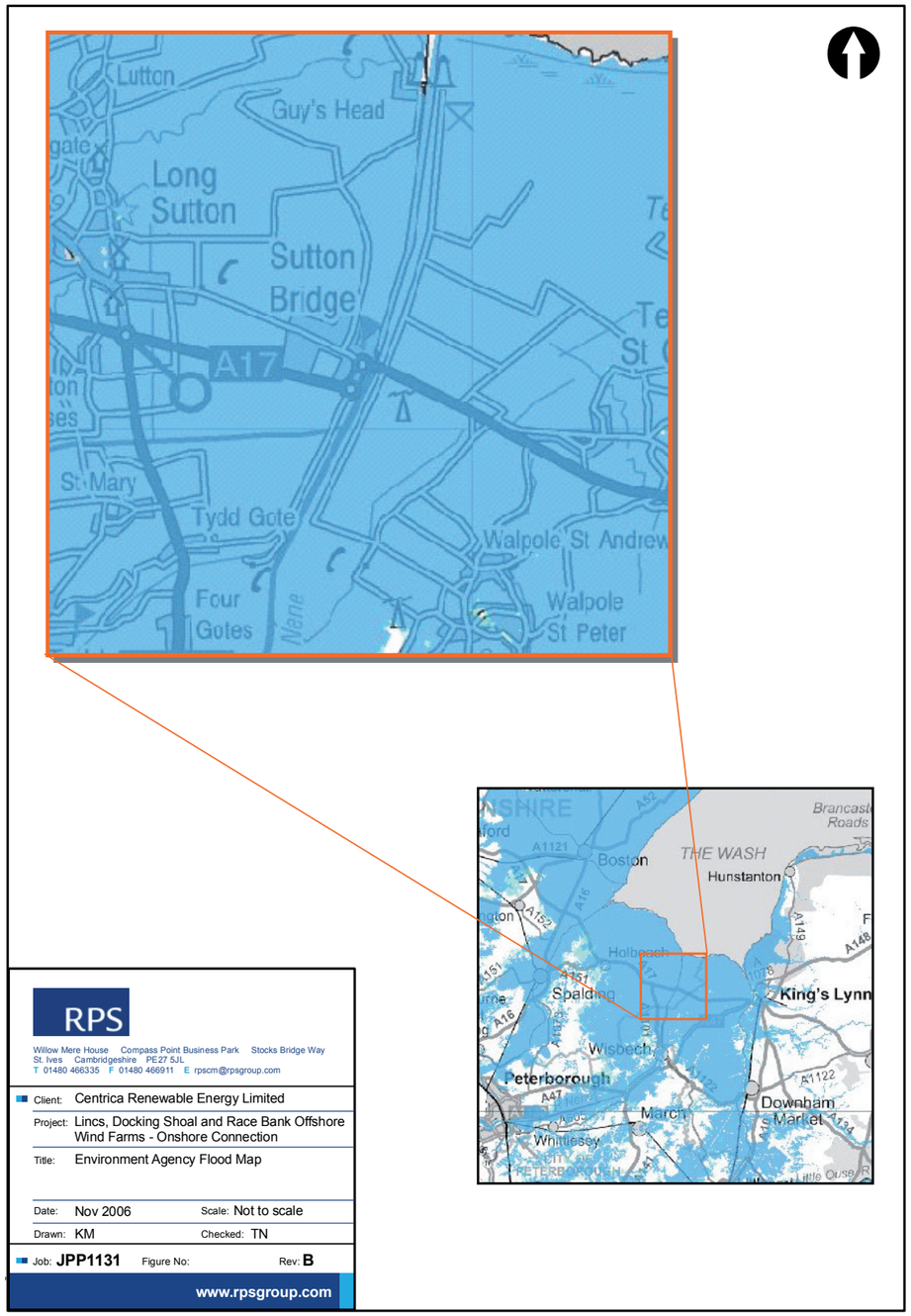

Figure 6.21 | Environment Agency Flood Map

6.8.11 The Environment Agency has provided comment on flood risk management in this area, together with information from the *River Nene Strategic Model* (January 2006). This showed fluvial flood levels (including climate change) at a number of points along the watercourse for different return periods (Table 6.21), as outlined in the FRA (see Appendix A2.12). Modelled fluvial flood levels ranged from 5.99 m (1-in-100) and 6.13 m (1-in-200) at s0-0 (beside the coastline) to 5.93 m (1-in-100) and 6.06 m (1-in-200) at s9-4 (approximately 12 km inland). The more extreme flood levels of the 1-in-1,000 year fluvial event are 6.38 m at s0-0 ranging to 6.31 m at s9-4.

6.8.12 The Environment Agency has advised that climate change is applied to the 1-in-100-year flood level through a 20 per cent increase in river flow within the catchment. This is in line with current estimates of climate change over approximately the next 50 years.

Table 6.21 | **Fluvial flood levels (excluding and including climate change) along the River Nene, as based upon the River Nene Strategic Model (January 2006)**

Label	Easting	Northing	Excluding climate change			Including climate change		
			100 yr	200 yr	1,000 yr	100 yr	200 yr	1,000 yr
s0-0	549202	325736	5.53 m	5.69 m	6.08 m	5.99 m	6.13 m	6.38 m
s5-6	547919	320421	5.50 m	5.65 m	6.03 m	5.94 m	6.08 m	6.32 m
s9-4	546541	316746	5.49 m	5.64 m	6.02 m	5.93 m	6.06 m	6.31 m

6.8.13 The 1-in-200 year tidal flood levels at West Lighthouse, towards the mouth of the River Nene, have been modelled at 6.19 m.

Description of Coastal Defences

6.8.14 The adopted route has a landfall at Breast Sand to the east of the River Nene. As such, there will be a need to cross the coastal flood defences here, along with other inland flood defences and internal drains in the corridor towards the substation.

6.8.15 There are flood defences that protect the area, with these situated beside the River Nene, along the coastline, and at other inland locations (with most remnant from previous land reclamations). Coastal flood defences have been designed to a 200-year standard, with crest heights between 7.5 m and 7.6 m (ordnance datum, Newlyn). The defences are about 1.50 m greater than the 1-in-100 year and 1.10 m greater than the 1-in-1,000 year fluvial flood levels, and are 1.30 m greater than the 1-in-200 year tidal flood level.

6.8.16 All Environment Agency flood assets are reported to be in good condition and are inspected regularly. There are no future improvements to these flood defences planned, although there is an ongoing tidal Nene stoning strategy in place to help prevent erosion of the bank toe. The Environment Agency has advised that this stoning strategy is used to enforce the banks, with stones put on the bed beside the bank where the berm is lower than a certain point. The coastal and inland flood defences are predominantly linear earth embankments, with some sections of floodwall.

Summary

6.8.17 The proposed cable route and substations are all located within Flood Zone 3 (High Risk), according to the 1-in-100-year fluvial and 1-in-200-year tidal floodplain for the River Nene and the Wash. Because of this a flood risk assessment has been completed for the development in accordance with relevant Environment Agency guidance. Modelled flood levels (including the effects of climate change) range from 5.99 m (1-in-100-year) and 6.13 m (1-in-200-year) at the coast to 5.93 m (1-in-100-year) and 6.06 m (1-in-200-year) at approximately 12 km inland.

6.8.18 The installation of cables will require the crossing of coastal and inland flood defences, which comprise earth embankments with some section of floodwall. These defences are currently reported to provide adequate protection from flooding and to be in a good condition, as determined from regular inspections. The flood risk assessment assumes that horizontal directional drilling will be used for the installation of cables, with this activity completed according to an agreed construction methodology for the crossing of these flood defences.

6.9 Hydrology, Hydrogeology, Geology and Soils

Introduction

6.9.1 The area of interest is around Sutton Bridge in East Lincolnshire, and includes land up to 4 km to the east from the River Nene as it drains north from Wisbech (Foul Anchor) to the coast. Land west of the River Nene (Guy's Head) to the coast was initially also included, but is no longer part of the evaluated route. Coastal areas of land that are to the east of the mouth of the River Nene, especially Breast Sand, are also included.

6.9.2 This chapter outlines the findings from the site walkover that was completed in November 2005 by RPS (Planning, Transport and Environment). The walkover has informed a baseline study from which impacts in areas adjacent to or traversed by the proposed cable route can then be considered. This chapter will also consider the land area that is required for the proposed extension of the Walpole electrical substation.

6.9.3 Potential impacts arising from the construction, operation and decommissioning of the proposed developments, and identification of appropriate mitigation, are addressed in Chapter 7.9.

Description of Proposed Route

6.9.4 A number of routes for the cable were initially proposed, and the site walkover reflected these. The walkover included 94 observational locations within the inland and coastline area, with water quality sampling completed at 18 of these.

6.9.5 The route that has been adopted for these proposals is shown in Figure 6.22. The cable route has a landfall at Breast Sand to the east of the River Nene at NGR 5496 3267, and continues in a roughly southwesterly and southerly direction for approximately 11 km towards the Walpole substation, which is situated to the west of Walpole St Peter at NGR 5488 3168.

Approach to the assessment

Guidance and Consultation

6.9.6 Guidance from the Environment Agency and from the King's Lynn Consortium of Internal Drainage Boards was sought. Additional guidance from relevant maps and reports of the area has also been used to develop the baseline. Direct consultation with drainage engineers from the Inland Drainage Board and from relevant departments of the Environment Agency was sought to complete aspects of the Environmental Statement; this correspondence is included in Appendix A2.12.

Relevant legislation

6.9.7 The assessment is conducted with reference to legislation relevant to specific surface water quality and drainage, hydrogeology, geology and soils, and has also considered a number of policy and guideline documents. These include:

- Land Drainage Act 1991
- Water Resources Act 1991
- The Water Act 2003
- Environment Act 1995
- Water Environment (Water Framework Directive) (England and Wales) Regulations (2003)

6.9.8 Several standards and guidelines which provide details of assessment methodologies and mitigation techniques are referred to. These include:

- Environment Agency Pollution Prevention Guidelines
- CIRIA C502 – Environmental Good Practice on Site, 1999
- CIRIA – Control of Water Pollution for Construction Sites, 2000

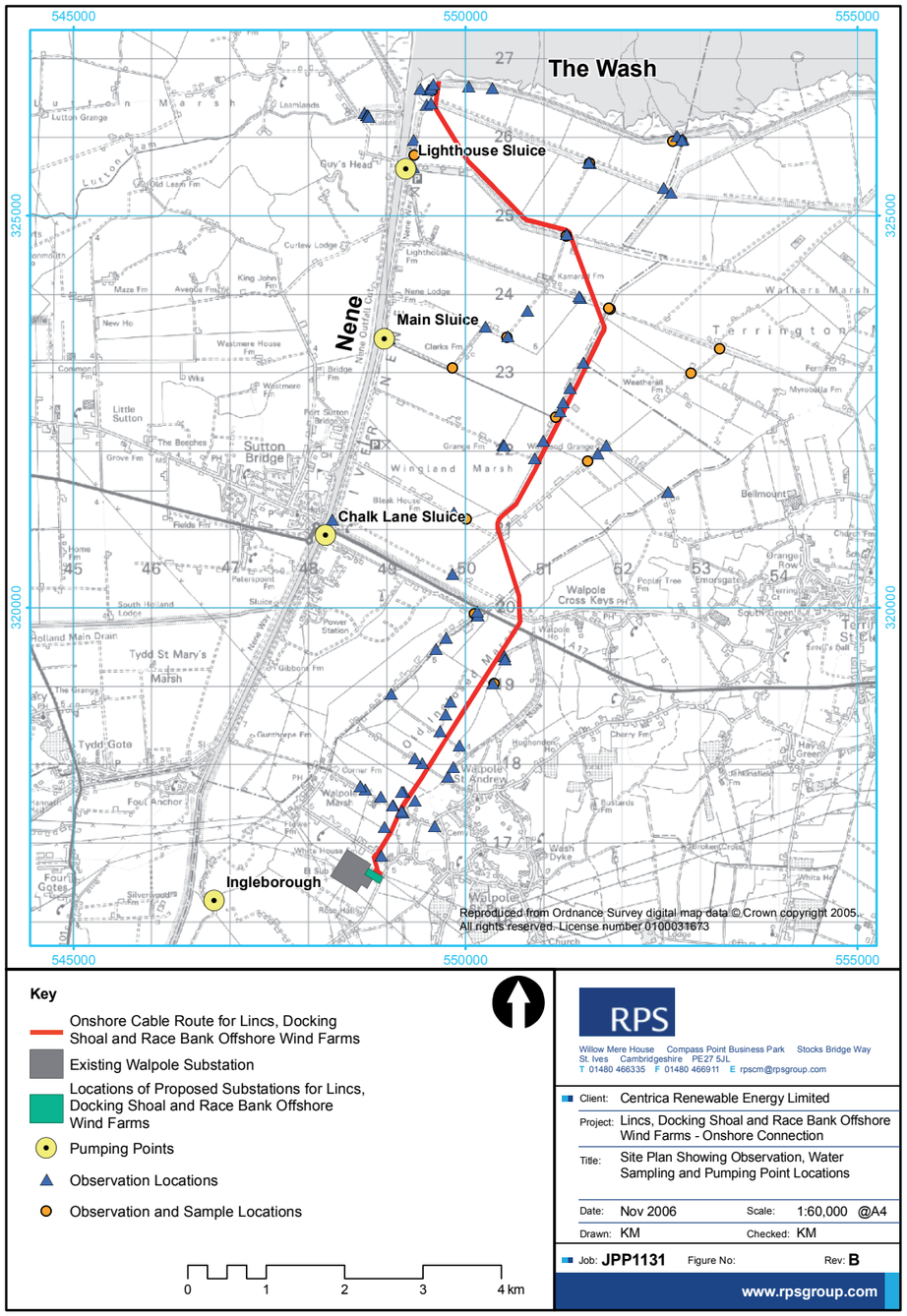

Figure 6.22 | Locations of observation, water sampling and pumping points

Local and regional policies

6.9.9 Local and regional policies relevant to flood risk are identified in Table 2.4 in Chapter 2. Key policies include Policy 33 of RSS8 East Midlands, Policy 4/24 of the King's Lynn and West Norfolk Local Plan, and Policy SG10 of the South Holland Local Plan.

Evaluating the importance of features

6.9.10 The value, importance and sensitivity of features potentially affected by the proposed developments is evaluated as indicated in Table 6.22.

Table 6.22 | **Examples of important and sensitive features**

Importance of attribute	Definition
very high	feature or attribute with very high quality and rarity, and important at a regional or national scale (examples include: EC designated Salmonid fishery; an area where there is high potential for flooding of a large number of residential properties and infrastructure; or a potable water supply to a large population)
high	feature or attribute with high quality and rarity, important at a local scale, or feature or attribute of medium quality and rarity, important at a regional or national scale (examples include: EC Designated Cyprinid fishery; a watercourse achieving GQA class A or B; or a water feature that supports a potable water supply to a small population)
medium	feature or attribute with medium quality and rarity, important at a local scale, or a feature of low quality and rarity, important at a regional or national scale (examples include: a watercourse achieving GQA class C or D; a water feature that supports an abstraction for agricultural or industrial use; or an area where there is existing flood risk for a small number of properties or gardens)
lower	feature or attribute with low quality and rarity, important at a local scale (examples are a watercourse achieving GQA Class E or unclassified, or a floodplain with limited existing development)
negligible	feature or attribute that is insignificant at the local scale
less than local	areas of heavily modified or managed vegetation of low species diversity or low value as habitat to species of nature conservation interest; common and widespread species

Baseline Description

6.9.11 The Environment Agency classifies waters in a river basin into five categories: rivers, lakes, transitional waters (estuaries and lagoons), coastal waters, and groundwater. Identification of these waters is based upon physical and chemical characteristics. The waters in the area are outlined below, along with some additional hydrological aspects.

6.9.12 The geology and hydrogeology along the proposed cable route and in the vicinity of the substation extension is also described, along with the soils in the wider area.

Rivers

6.9.13 There are four main rivers in the wider area: the River Nene, Lutton Leam, South Holland Main Drain, and North Level Main Drain. These were all considered in the early stages of the project before the finalisation of the cable route.

6.9.14 The River Nene is the main conduit for waters in the area, and has a large catchment area (2,267 km^2), flowing north and discharging to the Wash (549400E, 326800N). The Lutton Leam drains a small catchment (36 km^2) west of the Nene, joining the lower reaches of the Nene via a sluice close to Guy's Head (549200E, 326300N). The South Holland Main Drain has a medium-sized catchment (193 km^2) draining westward to join the Nene (547600E, 320100N) south of Sutton Bridge. The North Level Main Drain also has a medium-sized catchment (210 km^2) draining northeastward towards the Nene (546900E, 318300M) at Tydd Gote.

6.9.15 No river quality objectives or target River Ecosystem Classes have been established for the main rivers within the study area. None of the rivers is classified under the EC Freshwater Fish Directive as Salmonid or Cyprimid fisheries.

6.9.16 Although the proposed cable route is close to the River Nene, there is no requirement to cross this watercourse, and there should be no direct impact on it. The three other watercourses are distant from the proposed works, and there should be no impact on them. A number of internal drains are likely to be affected, as discussed below.

Lakes

6.9.17 There are no recognised lakes in the wider area.

Transitional Waters

6.9.18 Two transitional waters are recognised in the area: the River Nene and the Wash. The Wash is a polyhaline and macrotidal water body with a surface area of 13,360 ha. The lower reaches and mouth of the River Nene as it discharges to the Wash are also a polyhaline and macrotidal water body, with a surface area of 147 ha. (A polyhaline water body is one with a high salinity of about 30 to 335 parts per thousand (ppt); a macrotidal system is one that has a large difference between mean high and mean low spring tides: between 4 m and 6 m.)

Coastal Waters

6.9.19 There is one recognised area of coastal waters in this area: the Outer Wash. This is a euhaline and macrotidal water body that is shallow.

Land Drains

6.9.20 The eastern part of the River Nene catchment and the adjoining tributaries are typical of the Fens, with low-lying and open terrain that is generally less than 10 m

above sea level. The land has historically supported a rich agricultural base, and is heavily managed.

6.9.21 An extensive network of drains controls water levels in the area. These drains are maintained by private landowners and the King's Lynn Consortium of Internal Drainage Boards. During an assessment of the area in November 2005, the cable route was found to cross 27 drains that were dry at that time and another 10 drains with standing water. There are additional drains around the perimeter and leading from the existing substation. These waters are discharged to surrounding watercourses, in this case the River Nene. Waters are released by structures from the drainage network during a low tide, and are held back during a high tide to prevent the ingress of tidal waters.

6.9.22 There are three sluice gates along the lower reaches of the River Nene (see Figure 6.22): Lighthouse Sluice close to the mouth (549240E, 325600N), Main Sluice (548965E, 323435N) and Chalk Lane Sluice (548215E, 320930N). The proposed cable route crosses over or approaches close to a number of drains that discharge to these sluice gates. A pumping station at Ingleborough (546790E, 316261N) controls the release of waters at the southern end of the route, including the Walpole substation.

Surface Water Quality

6.9.23 A total of 94 observational locations were visited over the general area during the site walkover, with waters sampled at 18 locations (sampling sites A to R, Figure 6.22, all of which are on drains). At the time of the walkover, several of the drains were dry, particularly those around the Walpole electrical substation and in areas more distant from the coastline and the River Nene. The sample of watercourses was intended to represent the proposed cable route, with the measurements generally applicable to the length of the drain.

6.9.24 Observations were made of the character of the water and watercourse, with a number of key water parameters analysed on site. This provided data on temperature, acidity, specific conductivity, dissolved oxygen, percentage dissolved oxygen (DO) and oxidation-reduction potential for each sample (Appendix A2.13). The concentrations of certain trace metals, nutrients, biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids, and extractable petroleum hydrocarbons were analysed from samples sent to an accredited (ISO 17025 / MCERTS) laboratory.

6.9.25 The maximum and minimum values for these are shown in Table 6.23, together with the sampling locations (sampling locations are indicated in Figure 6.22). Although the sampling locations are all on drains, Environment Agency Environmental Quality Standards (EQS) for rivers and marine environments are shown for reference. The data indicate that sampling location B has the poorest water quality due to relatively high values for most indicators. Sampling location O, however, has lower values indicating a higher standard of water quality.

Table 6.23 | **Maximum and minimum values for water quality indicators from water samples along cable route**

Parameter	Maximum	Location of maximum	Minimum	Location of minimum	River standard	Marine standard
arsenic	*474 µg/l	G	1 µg/l	N	50 µg/l	25 µg/l
boron	*5,425 µg/l	E	*900 µg/l	R	2000 µg/l	7,000 µg/l
cadmium	2.9 µg/l	B	≤ 0.4 µg/l	All other locations	5 µg/l	2.5 µg/l
chromium	224 µg/l	B	14 µg/l	A, O	5 µg/l to 250 µg/l	15 µg/l
copper	*268 µg/l	B	20 µg/l	D	1 µg/l to 28 µg/l	5 µg/l
lead	*226 µg/l	B	5 µg/l	O	4 µg/l to 250 µg/l	25 µg/l
nickel	103 µg/l	B	4 µg/l	K, O	50 µg/l to 200 µg/l	30 µg/l
selenium	120 µg/l	B	2 µg/l	Q		
zinc	*859 µg/l	B	37 µg/l	D	8 µg/l to 500 µg/l	
mercury		All sites	< 0.05 µg/l		1 µg/l	0.3 µg/l
BOD	217	B	2			
COD	726	B	23	O		
nitrates	2.1 mg/l	O	≤ 0.3 mg/l	All sites except L, O, Q	25 mg/l	
nitrites	1.19 mg/l	C	< 0.05 mg/	B, F, Q		
ammoniac nitrogen	20.5 mg/l	B	0.2 mg/l	F, Q		
total suspended solids	9,880 mg/l	B	12 mg/l	O		

An asterisk (*) indicates a value above the river standard.

6.9.26 Analysis of water quality samples revealed relatively high concentrations of arsenic at several locations, particularly B and G (where concentrations in the range 174 mg/l to 474 mg/l were recorded). About 30 per cent of the samples show relatively high concentrations of boron (1,916 mg/l to 5,425 mg/l), particularly at sampling sites B, C, E, M and O. These higher values are attributed to tidal inflows at these sampling locations.

6.9.27 About 30 per cent of the samples show a relatively high concentration of chromium (154 µg/l to 224 µg/l), particularly at sampling sites B and I. About 20 per cent of the sampling sites show a relatively high concentration of copper (268 µg/l) and nickel (103 µg/l), particularly at sampling site B. About 20 per cent of samples show a relatively high concentration of lead (63 µg/l to 226 µg/l) and zinc (189 µg/l to 859 µg/l), particularly at sampling sites B, G and Q. About 20 per cent of samples show a relatively high concentration of nitrite (0.31 mg/l to 1.19 mg/l), particularly at sampling sites C, L and N. These higher values are associated with inflows of surface waters or storm-water runoff.

6.9.28 About 10 per cent of samples show a relatively high biological oxygen demand (11 mg/l to 217 mg/l) and 30 per cent a relatively high chemical oxygen demand (209 mg/l to 726 mg/l), with values particularly high at sampling sites B, G, M and N. About 20 per cent of samples show a relatively high volume of total suspended solids (686 mg/l to 9880 mg/l), particularly at sampling sites A, B and G. These heightened values are associated with additional industrial or domestic inflows of water.

6.9.29 At all of the sampling sites there were found to be normal concentrations of cadmium, mercury, nitrate and ammoniacal nitrogen, as indicated by the EQS.

6.9.30 In summary, the water quality assessment shows that sampling sites B and G have relatively high concentrations of metal ions, when compared to river or marsh EQS. This is thought to reflect agricultural storm-water runoff, and possibly also domestic flows into the drains and residual effects of previous marine incursions.

Geology

6.9.31 The solid geology in the area is located at depths of greater than 30 m. It consists of Jurassic clay and limestone that outcrop to the west of the site. Above the solid geology is a deep sequence of alluvial and glacial deposits. These deposits can be divided into two groups: those deposited during the glacial and interglacial episodes of the Pleistocene some 150,000 to 15,000 years ago, and those that accumulated in post-glacial times.

6.9.32 A complex sequence of post-glacial deposits that are up to 25 m thick, and made up of marine and freshwater clays, sands and peats, underlies the marshland and fenland in the area. Other Recent deposits fringe the coastal area of the Wash. The marshland area has been reclaimed from salt marsh within historic times, with the earliest reclamations probably dating from the Saxon period. These reclaimed salt marsh deposits are soft reddish-brown clays with silt laminae, generally 1 m to 2 m thick, deposited in the last 2,000 years (Terrington Beds). Within this clay bed there is a complex network of silt-filled channels, the remains of a former pattern of tidal creeks.

6.9.33 The recent sediments of the offshore area have been classified on the basis of lithology. Clean sand occurs in the three main areas: the beaches on the north Norfolk coast; the outer margins of sand banks; and (as bars) in the tidal river channels. Sand with mud laminae occurs on the inshore side of larger sand banks and below low water mark at depths greater than about 6 m below ordnance datum. Mud with sand laminae occurs on the tidal flat. The offshore area about Breast Sand is mud with sand laminae, then with saltings about the transitional area between the land and sea.

6.9.34 The cable route crosses the mud with sand laminae of Breast Sand, and lands on the saltings beside the mouth of the River Nene. The route continues inland, and is underlain throughout by the reclaimed salt marsh deposits of the Terrington Beds. This same soft clay with silt laminae deposit also underlies the substation extension.

6.9.35 A more detailed understanding of the geology and hydrogeology about the proposed substation extension is provided by site investigation reports completed with previous redevelopment works. Soft, firm and stiff, generally sandy clay from ground level to depths of about 0.3 m are found, with a second layer at 2.6 m. This overlies silty sand (ranging from very loose to dense) with occasionally bands or lenses of sandy clay at varying depth. These previous investigations indicated that groundwater levels were approximately between 1.7 m and 2.10 m below ground.

Hydrogeology

6.9.36 The area has been mapped as a single groundwater unit. The groundwater has not been assessed by the Environment Agency for risk. However, the aquifer is considered to be an unproductive unit owing to the variable lithology of these alluvial deposits, and with potentially poor water quality as a result of saline intrusion from coastal areas.

6.9.37 The groundwater vulnerability map (Figure 6.23) shows the area to the east and west of the River Nene to be a non-aquifer and negligibly permeable. Areas to the east, by approximately 15 km and beyond the river Great Ouse and King's Lynn, contain a minor aquifer (variably permeable) and a major aquifer (highly permeable). These areas are considered to be sufficiently distant that any impact upon the hydrogeology would be negligible.

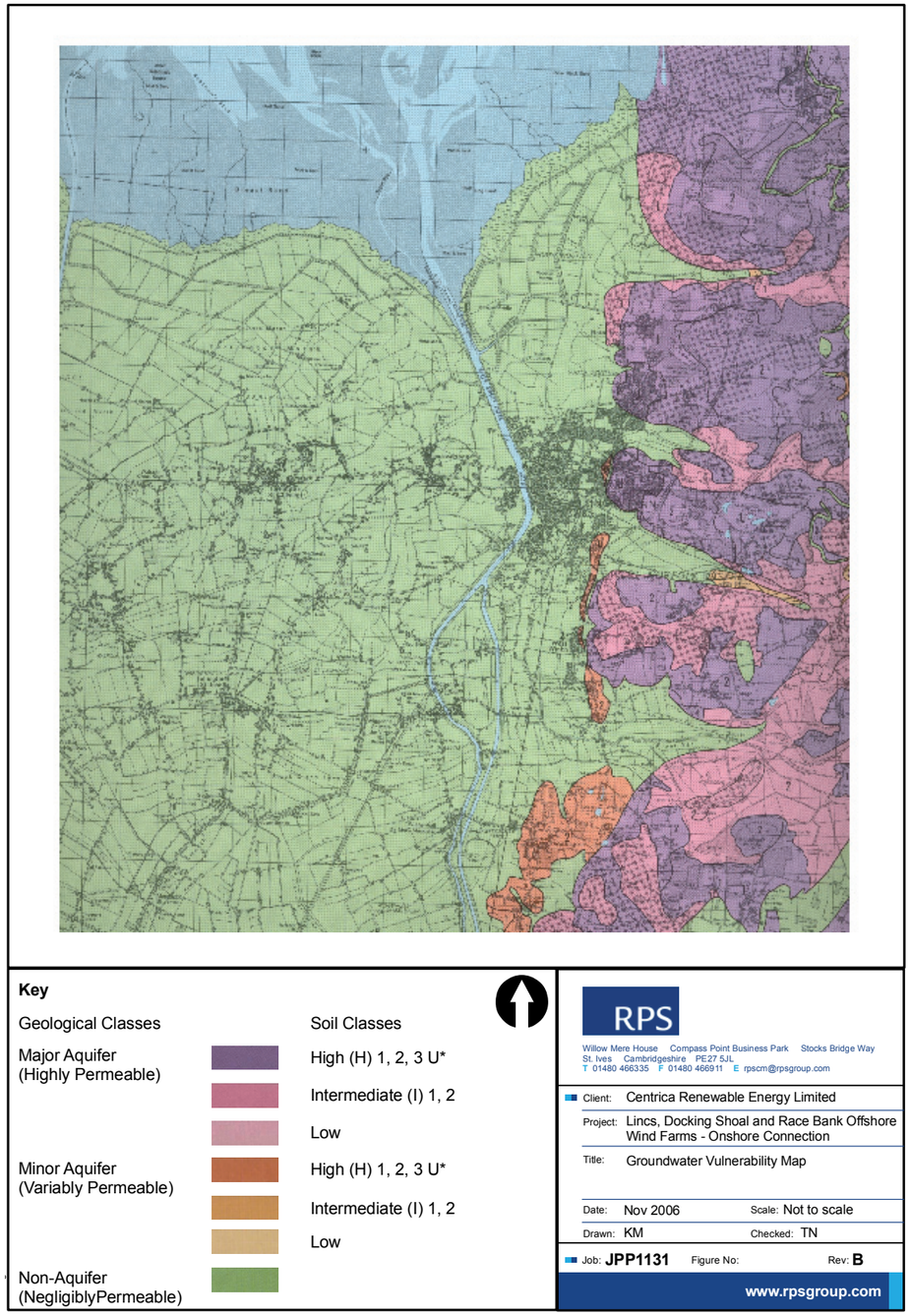

Figure 6.23 | Groundwater vulnerability map

6.9.38 There are three licensed abstractions of water in the general area of the proposed cable route. All three licences are held by E. W. Bell and Co, and involve the abstraction of groundwater for general agriculture and spray irrigation purposes. The total annual licensed quantity is 41,900 m^3 (20,000 m^3, 18,200 m^3 and 13,700 m^3). These presumably abstract water from local sand lenses in the alluvium.

Soils

6.9.39 There are three principal soil types along the proposed cable route (SSEW 1:250,000 map: *Soils of Eastern England*). All are developed from alluvial silt, and differences between them are small.

6.9.40 At the landing point and eastbound, the soils are of the Agney association, with these being fine to coarse calcareous alluvial gleyic soils. Soils of the Wisbech association are encountered as the route heads southwards; these are similar to, but generally coarser than, those of the Agney association. To the east and around the Walpole substation are soils of the Blacktoft association. These are gleyic brown calcareous alluvial soils which are similar to, but slightly better drained than, the other soil associations.

6.9.41 For all three soils, the land is flat, and ditches and pumps control the groundwater. These soils are highly productive and are typically used for the growth of cereals, sugar beet, potatoes and field vegetables.

6.9.42 Tenant farmer John Proctor has details of previous soil reports undertaken on the reclaimed land adjacent to the coast. It is understood that the soil in these reclaimed areas overlies sand to a depth of between 1 m and 15 m. The clay fraction of the upper layer is between about 25 and 30 per cent. The underlying sand is unstable. The farmland here is between about 3 m and 4 m above sea level, with the tidal sluices entering the Nene at about 1 m below sea level.

6.9.43 A more detailed understanding of the soils about the proposed substation extension is provided by site investigation reports completed with previous redevelopment works by the Eastern Electricity Board (Report Reference: CM/MTS/SM741 and SM743) in 1989. These investigations revealed the presence of very loose fine sand to around 4 m depth. As a result, it was recommended that all foundations be supported on piles.

Summary

6.9.44 There are four main rivers in the wider area considered in this assessment. The most important of these is the Nene, which is the main conduit for water in the area. An extensive network of drains controls water levels in the area; all of those likely to be affected by these proposed developments feed to the Nene. Surveys of water quality indicate elevated levels of metal ions at some locations, thought to be due to agricultural storm-water runoff, domestic flows and possibly the residual effects of previous marine incursions.

6.9.45 The cable route crosses reclaimed land comprising soft clay with silt laminae deposits. This same substrate underlies the proposed substation areas. Soils are developed from alluvial silt, are highly productive and consequently support intensive agricultural use.

6.9.46 The area is mapped as a single groundwater unit and previous investigations have indicated that groundwater levels are approximately 1.7–2.1 m below ground. The area is considered a non-aquifer and negligibly permeable, although there are local abstraction licences, presumably for abstraction of water from local sand lenses.

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Onshore

Chapter 7 | Evaluation of Environmental Effects, Mitigation Measures and Monitoring

7 Evaluation of Environmental Effects, Mitigation Measures and Monitoring

7.1 Introduction

7.1.1 This chapter of the Environmental Statement presents an assessment of predicted impacts on the physical, biological and human environment arising from the proposed development. The sections within it deal with the following aspects in turn:

- cultural heritage
- landscape and visual assessment
- socioeconomics and tourism
- noise
- ecology and nature conservation
- transport and traffic
- flood risk and coastal defences
- hydrology, hydrogeology, geology and soils

7.1.2 Each section considers the important aspects of the proposal requiring assessment, and any potential impacts, proposed mitigation, predicted residual effects, and cumulative impacts.

7.2 Cultural Heritage

Assessment of Potential Effects

Introduction

7.2.1 The assessment of potential effects considers both direct (physical) and indirect (principally visual) effects on the historic environment within the study area arising from the onshore components of Lincs, Docking Shoal and Race Bank Offshore Wind Farms. Direct effects on archaeological remains usually constitute the disturbance or removal of such remains and are therefore considered as adverse. Indirect effects on built heritage features and the general historic environment are usually visual effects on setting, and in the case of the cable route will be temporary impacts during construction. The degree of impact is determined by assessing the importance of the receptor and the magnitude of the likely impact.

7.2.2 The baseline cultural heritage environment is described in Section 6.2. The detailed proposals of the scheme are described in Chapter 5. The works would involve the excavation of trenches within a common corridor, up to 1,250 mm deep on average, through reclaimed land within the former Wash estuary, and the construction of a substation for each of the proposed wind farms.

Assessment of Impacts

7.2.3 Impacts upon the historic environment base are often permanent adverse impacts resulting from the loss of elements of the resource base as a result of construction activities. There may be temporary adverse impacts upon the settings of sites during construction, or permanent adverse impacts when such settings are affected by the development itself. In particular, with regard to the historic built environment, well-designed development can result in beneficial impacts.

7.2.4 Impacts upon historic environment resources may therefore be short-term or long-term, and can include:

- *Direct impacts*: Tangible physical impacts, such as demolition of a building or removal of archaeological remains through groundworks. In terms of the historic environment, direct impacts are almost always permanent.

- *Indirect impacts*: These do not usually physically affect the resource, but may alter its setting or utility. Examples of indirect impacts include visually intrusive structures or the restoration of views. The effects of acoustic and light pollution are also indirect impacts. In some cases indirect impacts may physically affect the resource: for example, contamination of buried remains as a result of accidental spillages of pollutants, alterations to hydrological regimes, or alterations required to historic buildings (eg double glazing to mitigate a rise in noise levels).
- *Cumulative impacts*: The cumulative effect of multiple impacts may produce a greater collective effect, for example on the 'group value' of individual resources or on the character of a wider historic landscape, or the degradation of a single resource as a result of multiple impacts.
- *Positive impacts*: For example, increased knowledge resulting from the recording and analysis of archaeological sites and historic buildings, or the potential to improve the setting and amenity of the historic environment, and the opportunity to involve and inform local business and residential communities about their historic environment.

Assessment of Impact Significance

7.2.5 The significance of impacts reflects both the importance of the historic environment resource and the degree to which the resource would be affected. (Refer to paragraph 6.2.24 for a description of the criteria for evaluating the importance of resources.) Significance is determined as presented in Table 7.1.

Table 7.1 | **Significance of potential impacts on the historic environment**

Impact significance	Criteria
major beneficial	the proposals would: • provide potential, through removal of damaging or discordant existing impacts (direct or indirect) on internationally, nationally or regionally significant historic environment resources, for significant or extensive restoration or enhancement of characteristic features or their setting • remove existing visual intrusion, so that the integrity, understanding and sense of place of a highly valued area, or a group of sites or features of international, national or regional importance, is re-established
moderate beneficial	the proposals would: • enhance existing historic landscape or townscape character through beneficial landscaping or good design • restore or enhance the form, scale, pattern or sense of place of the historic environment resource through good design • remove or reduce existing impacts affecting internationally or nationally important historic environment resources or their setting or context
minor beneficial	the proposals would remove or reduce existing impacts (direct and indirect) affecting locally or regionally important historic environment resources or their setting or context
neutral	the proposals would have no appreciable impacts, either positive or negative, on any known or potential historic environment resources
minor adverse	the proposals would: • result in damage to, or loss of, locally important historic environment resources • result in minor damage to regionally important historic environment resources • compromise or degrade the setting or context of locally or regionally important historic environment resources • temporarily compromise or degrade the setting or context of nationally significant historic environment resources
moderate adverse	the proposals would: • result in severe damage to, or loss of, regionally important historic environment resources • result in damage to internationally or nationally important historic environment resources • severely compromise or degrade the setting or context of regionally important historic environment resources • compromise or degrade the setting or context of internationally or nationally significant historic environment resources
major adverse	the proposals would: • result in severe damage to, or loss of, internationally or nationally important historic environment resources • severely compromise or degrade the setting or context of internationally or nationally significant historic environment resources

7.2.6 In addition, the term *negligible* may be used where the significance of an impact is measurable but less than *minor* (eg a slight impact to the setting of a locally significant historic environment resource).

Potential Construction Effects

7.2.7 An assessment of the potential impacts of the Onshore Works associated with Lincs, Docking Shoal and Race Bank has been undertaken, the results of which are indicated below.

Lincs

Direct Effects

7.2.8 Construction of the development would not affect any known archaeological sites. There are no recorded archaeological sites, features or finds within the onshore cable corridor and construction compounds as proposed, nor within the substation compound.

7.2.9 Any direct impact on the remains of the Second World War Hawker Hurricane would be an impact of *moderate adverse* effect. This site is not designated, but is protected under the Protection of Military Remains Act 1986. However, as the route has been designed to avoid this site the potential impact is assessed as *neutral*. Nevertheless to prevent accidental damage it is appropriate to exercise caution during works taking place within 150 m of the presumed crash site.

7.2.10 The Second World War pillbox at the junction of Hospital Road and Cocklehole Road is seen as regionally significant. Any direct impact on this structure would result in a *moderate adverse* effect.

7.2.11 The probable salterns located close to the substation are seen as locally significant. Any direct impact on these features would result in a *minor adverse* effect.

7.2.12 The 'Roman' seawall is seen as regionally significant and any direct impact on this feature would result in a *minor adverse* effect. The nineteenth- and twentieth-century seawalls are seen as locally significant. Any direct impact on these features would be a *minor adverse* effect.

7.2.13 The potential for the presence of previously unidentified archaeological remains within the cable route (and associated construction compounds) is considered to be very low, due to the relatively recent date of reclamation of this land. The likely impact of the scheme on potential buried archaeological deposits is considered to be a *minor adverse* effect.

7.2.14 The potential for the presence of significant palaeoenvironmental deposits within 1.5 m of the current surface is also considered to be very low. If such deposits are present, then they are likely to extend well beyond the cable trench and therefore the impact of the scheme on the deposits is considered to be a *minor adverse* effect.

Indirect Effects

7.2.15 The proposed development would not create significant changes to the settings of historic environment features as a result of visual effects in the wider landscape.

7.2.16 The scheme is situated within an area characterised as 'recent enclosure': this implies a landscape that has derived its character from land reclamation and improvement since 1796. This landscape consists of large, rectilinear fields divided by drainage ditches and embanked rivers, and as such contains no historic hedgerows or other such elements. Industrial development, such as that associated with the Port Sutton Bridge and Sutton Bridge Power Station, already forms a significant visual element within the landscape.

7.2.17 There will be potential indirect effects during construction on the settings of two Grade I Listed Buildings (St Andrew's church and St Peter's church), five Grade II* Listed Buildings , and on thirteen Grade II Listed Buildings. The effects would result from the visible presence of the fenced-off cable route and construction compounds, the substation extension, and the associated construction traffic. The impact of the scheme proposals on the settings of these Listed Buildings is considered to result in a *minor adverse* effect.

7.2.18 There will be some impacts on the settings of the probable salterns close to the substation. These impacts are considered to result in *negligible* effects.

7.2.19 There will also be some impacts on the settings of non-listed historical structures, principally a small number of pillboxes of Second World War date. These impacts are considered to result in *minor adverse* effects.

Docking Shoal

7.2.20 The potential effects resulting from the proposals associated with Docking Shoal will be the same as for Lincs with regard to the cable route, and no additional mitigation measures are required.

7.2.21 The ground works associated with the construction of the substation will be undertaken at the same time as the construction of the Lincs substation. The potential impacts on salterns have been identified in the assessment for Lincs (above) and considered to be of minor significance. To facilitate installation of electrical equipment a working compound will be established as indicated in Figure 5.18. The establishment of this compound also has the potential to affect salterns; however, this impact is considered to be of minor significance.

Race Bank

7.2.22 The potential effects resulting from the proposals associated with Race Bank will be the same as for Docking Shoal with regard to the cable route and substation, and additional mitigation measures are required.

Potential Operational Effects

7.2.23 There would be no direct effects on any historic environment feature during the operation of the scheme. The effects of site operation on the settings of Listed Buildings are considered to be neutral.

7.2.24 There would be some impacts on the settings of the probable salterns close to the substation as a result of the extension to this structure. These impacts are considered to be *negligible* effects.

Potential Decommissioning Effects

7.2.25 It is predicted that the effects of decommissioning, if this occurs, will be the same as those predicted for construction.

Mitigation

Construction Effects

7.2.26 Following the guidance issued in PPG16 and the policies established in the relevant structure and local plans, the approach to mitigation is based on avoidance, enabling preservation *in situ*. The baseline assessment has established that there is a low potential for archaeological remains to be encountered.

7.2.27 No direct impacts are expected with regard to the Hurricane crash site. In order to ensure the site is protected in accordance with the Protection of Military Remains Act, a 150 m exclusion zone from the recorded impact site will be implemented. An archaeological watching brief will be maintained during topsoil stripping of the construction easement in this area, and during excavation of the cable trench.

7.2.28 The Second World War pillbox at the junction of Hospital Road and Cocklehole Road should be excluded from the construction easement and should be fenced off during construction. Care should be taken to ensure that this structure remains undamaged.

7.2.29 Where the cable route runs adjacent to the medieval ('Roman') sea bank, the bank itself should be excluded from the fenced construction easement. Where sea banks are disturbed during the installation of cables they will be re-instated on completion of works.

7.2.30 It is considered unlikely that there will be any effects on previously unidentified buried archaeological remains within the cable construction easement, as it lies within an area of recently reclaimed land.

7.2.31 It is also considered unlikely that former ground surfaces are present in the upper 1.5 m of ground within the proposed cable corridor and substation. However there is still a limited potential for palaeoenvironmental remains to be present, particularly within any areas where deeper excavation may be required, such as any pits required for directional drilling. It is therefore proposed that a programme of geoarchaeological investigation be undertaken in conjunction with any advance geotechnical survey. This would enable the characterisation of the underlying deposit sequence and would allow for a suitable strategy of further mitigation (ie recording and analysis) to be drawn up and agreed in advance of construction.

7.2.32 A geophysical survey of the probable salterns in the vicinity of the proposed substation has already been undertaken (Appendix A2.20). This will be followed by further evaluation as appropriate. If the proposed works are likely to have a direct impact on any saltern, a programme of further appropriate mitigation will be drawn up and agreed with Norfolk Landscape Archeology in advance of construction.

Residual Effects

7.2.33 Following implementation of the mitigation measures proposed above, the residual effects during construction are assessed as minor adverse or negligible.

7.2.34 The residual effects during operation are assessed as negligible or neutral.

Summary of Effects

Lincs

7.2.35 The proposed scheme will not cause any *major adverse* or *moderate adverse* effects upon known or potential historic environment features within the connection corridor or substation compound as presented.

Table 7.2 | **Summary of direct effects – Lincs**

Potential effect	Mitigation	Residual effect
Construction		
Direct impacts on Second World War Hurricane crash site. Neutral.	Use of a 150 m buffer zone. Archaeological watching brief of a 100 m section of cable trench during construction.	*Neutral*
Direct impacts on Second World War pillbox. Moderate adverse.	Exclude structure from construction easement. Fence off if necessary.	*Neutral*
Direct impacts on early medieval sea bank. Minor adverse.	Avoid any damage to this sea bank where cable route is directly adjacent. Reinstatement of bank to existing profile on completion of cable installation. If there is any excavation of sea walls during cable installation, an archeologist will be present to record any features revealed.	*Minor adverse*
Direct impacts on eighteenth- to twentieth-century sea banks. Minor adverse.	Reinstatement of banks to existing profile on completion of cable installation. If there is any excavation of sea walls during cable installation, an archeologist will be present to record any features revealed.	*Minor adverse*
Direct impacts on probable salterns. Minor adverse.	Further mitigation as appropriate following further evaluation.	*Negligible*
Impacts to possible palaeoenvironmental remains. Minor adverse.	Geoarchaeological investigation during advance geotechnical survey. Further work as appropriate.	*Minor adverse*
Previously unidentified archaeological remains. Minor adverse.	Targeted watching brief.	*Minor adverse*

Potential effect	Mitigation	Residual effect
Operation		
Neutral effects.	None proposed.	*Neutral*

Table 7.3 | **Summary of indirect effects – Lincs**

Potential effect	Mitigation	Residual effect
Construction		
Effects on settings of Listed Buildings. Minor adverse	None proposed	*Minor adverse*
Effects on settings of non-listed historical buildings. Minor adverse.	None proposed	*Minor adverse*
Effects on settings of probable salterns. Negligible	None proposed	*Negligible*
Operation		
Effects on settings of probable salterns. Negligible	None proposed	*Negligible*
Effects on settings of listed buildings. Neutral	None proposed	*Neutral*

7.2.36 Because of the limited potential for archaeological remains to exist within the site, it is anticipated that there will be no significant adverse effects on the historic environment resource as a result of the proposed works. Potential impacts along the cable route can be effectively mitigated through the implementation of a soil core survey carried out by a qualified geoarchaeologist and through the use of a targeted watching brief and an appropriate level of archaeological recording.

Docking Shoal

Table 7.4 | **Summary of direct effects – Docking Shoal**

Potential effect	Mitigation	Residual effect
Construction		
Direct impacts on Second World War Hurricane crash site. Neutral.	Use of a 150 m buffer zone. Archaeological watching brief of a 100 m section of cable trench during construction.	*Neutral*
Direct impacts on Second World War pillbox. Moderate adverse.	Exclude structure from construction easement. Fence off if necessary.	*Neutral*
Direct impacts on early medieval sea bank. Minor adverse.	Avoid any damage to this sea bank where cable route is directly adjacent. Reinstatement of bank to existing profile on completion of cable installation.	*Minor adverse*
Direct impacts on eighteenth- to twentieth-century sea banks. Minor adverse.	Reinstatement of banks to existing profile on completion of cable installation.	*Minor adverse*
Direct impacts on probable salterns. Minor adverse.	Further mitigation as appropriate following further evaluation.	*Negligible*
Impacts to possible palaeoenvironmental remains. Minor adverse.	Geoligical investigation during advance geotechnical survey. Further work as appropriate.	*Minor adverse*
Previously unidentified archaeological remains. Minor adverse.	Targeted watching brief.	*Minor adverse*
Operation		
Neutral effects.	None proposed.	Neutral

Table 7.5 | **Summary of indirect effects – Docking Shoal**

Potential effect	Mitigation	Residual effect
Construction		
Effects on settings of Listed Buildings. Minor adverse.	None proposed	*Minor adverse*
Effects on settings of non-listed historical buildings. Minor adverse.	None proposed	*Minor adverse*
Effects on settings of probable salterns. Negligible.	None proposed	*Negligible*
Effects on wider historic environment. Negligible.	None proposed	*Negligible*
Operation		
Effects on settings of probable salterns. Negligible.	None proposed	*Negligible*
Effects on settings of listed buildings. Neutral.	None proposed	*Neutral*

Race Bank

Table 7.6 | **Summary of direct effects – Race Bank**

Potential effect	Mitigation	Residual effect
Construction		
Direct impacts on Second World War Hurricane crash site. Neutral.	Use of a 150 m buffer zone. Archaeological watching brief of a 100 m section of cable trench during construction.	*Neutral*
Direct impacts on Second World War pillbox. Moderate adverse.	Exclude structure from construction easement. Fence off if necessary.	*Neutral*

Potential effect	Mitigation	Residual effect
Direct impacts on early medieval sea bank. Minor adverse.	Avoid any damage to this sea bank where cable route is directly adjacent. Reinstatement of bank to existing profile on completion of cable installation.	*Minor adverse*
Direct impacts on eighteenth- to twentieth-century sea banks. Minor adverse.	Reinstatement of banks to existing profile on completion of cable installation.	*Negligible*
Direct impacts on probable salterns. Minor adverse.	Further mitigation as appropriate following further evaluation.	*Negligible*
Impacts to possible palaeoenvironmental remains. Minor adverse.	Geoligical investigation during advance geotechnical survey. Further work as appropriate.	*Minor adverse*
Previously unidentified archaeological remains. Minor adverse.	Targeted watching brief.	*Minor adverse*
Operation		
Neutral effects.	None proposed.	*Neutral*

Table 7.7 | **Summary of indirect effects – Race Bank**

Potential effect	Mitigation	Residual effect
Construction		
Effects on settings of Listed Buildings. Minor adverse	None proposed	*Minor adverse*
Effects on settings of non-listed historical buildings. Minor adverse.	None proposed	*Minor adverse*
Effects on settings of probable salterns. Negligible	None proposed	*Negligible*
Effects on wider historic environment. Negligible	None proposed	*Negligible*
Operation		
Effects on settings of probable salterns. Negligible	None proposed	*Negligible*
Effects on settings of listed buildings. Neutral	None proposed	*Neutral*

Cumulative effects

7.2.37 The potential impacts of the proposed activities associated with each of the wind farms have been assessed individually and no residual impacts of more than *minor* significance are predicted. There will be no cumulative effects arising from the construction of the substation area as all groundworks will be completed during the first year of construction when the Lincs substation is constructed. Installation of onshore cables for the wind farms will take place sequentially, but along the same route and within a combined corridor of approximately 50 m. This route has been designed to avoid the location of the aircraft site (Hawker Hurricane); in addition, mitigation for all three projects has been identified to protect this site and other features of interest (the Second World War pillbox and the 'Roman' seawall) effectively. Consequently the potential cumulative impacts on these features are also considered to be of *neutral* significance.

7.2.38 Approaches to crossing eighteenth- to twentieth-century sea banks will be the same in each case and potential cumulative impacts are not considered to be any more significant than those arising from each scheme alone; they are, therefore, assessed as being of *minor adverse* significance. The potential for presence of previously unidentified archaeological remains along the cable route is considered to be very low and an impact of no more than *minor adverse* significance is predicted for the installation of all three sets of circuits either alone or together.

7.2.39 Construction works proposed by National Grid (National Grid's 400 kV substation extension to provide wind farm connections – see Appendix A2.14) at the existing Walpole Marsh substation have the potential to cause an impact to two Romano-British or medieval salterns. A programme of archaeological evaluation of the probable salterns in the vicinity of the proposed substation extension has already been drawn up, commencing with a geophysical survey (see Appendix A2.20). This will be followed by further evaluation as appropriate.

7.2.40 No cumulative impacts on cultural heritage are anticipated as a result of the extension of the Sutton Bridge power station.

Conclusions

7.2.41 There is limited potential for archaeological remains within the areas affected by cable installation and substation construction and operation. It is anticipated that there will be *no* significant adverse effects on the historic environment resource as a result of the proposed works, for Lincs, Docking Shoal or Race Bank either alone or together. Potential impacts along the cable route for the onshore works associated with all three wind farms can be effectively mitigated through the implementation of appropriate surveys and through the use of a targeted watching brief and an appropriate level of archaeological recording.

7.2.42 The proposed development would not create significant changes to the settings of historic environment features as a result of visual effects in the wider landscape.

7.2.43 A geophysical survey of the substation area indicates the likely presence of salterns to the east of the existing substation. Further mitigation for these features will be drawn up and agreed with Norfolk Landscape Archaeology in advance of construction.

7.3 Landscape and Visual Assessment

Assessment of Potential Impacts

7.3.1 This chapter of the Environmental Statement considers the nature and extent of the likely landscape and visual effects arising from both the cable corridor and the substation elements. It considers the effects arising from the three separate, but related, offshore wind farms at Lincs, Docking Shoal and Race Bank, as identified in Section 6.3.The purpose of the assessment is to determine the magnitude and consequent significance of any change arising from the proposed developments upon the landscape character, as well as the potential effect upon views, visual amenity and receptor groups within the visual envelope.

7.3.2 This is assessed using the recognised Landscape Institute / Institute of Environmental Management and Assessment (2002) evaluation process. This looks at the physical form and attributes of the landscape as well as how visible the proposals would be from a range of representative viewpoints, visual receptor groups and on general visual amenity within the visual envelope. It also looks at the quality and sensitivity of identified landscape and visual receptors. The magnitude of effect upon the landscape and visual environment then takes into account the scale, extent and duration of the effect. The assessment methodology is detailed in full in Appendix A2.15.

7.3.3 Appropriate landscape mitigation measures for the substations and the cable corridor have also been considered, described and any subsequent residual effects have been assessed.

The Onshore Proposals

7.3.4 The onshore elements will connect the infrastructure of the offshore wind farm developments at Lincs, Docking Shoal and Race Bank with the existing National Grid infrastructure at the Walpole electricity substation, which is located between Walpole St Peter and Walpole Marsh. The onshore proposals, for each development, will encompass two interconnected elements which are located within the overall study area for the proposed works (illustrated on Figure 6.2).

7.3.5 The proposed onshore works for the substations are described in detail in Chapter 5, but broadly include two elements that are relevant to the assessment of potential landscape and visual effects:

- the construction of an underground cable trench which will run from the landfall at the Mean High Water Spring (MHWS) mark, approximately 250 m to the east of the mouth of the River Nene and approximately 6 kilometres NNE of Sutton Bridge over a distance of 11 km to the existing Walpole Marsh substation (the installation of cables within the corridor will also be phased as three related but separate installation operations for Lincs, Docking Shoal and Race Bank; they will, however, be placed within the same corridor with a total maximum width of 50 m)
- the construction of substations adjacent to the existing Walpole Marsh substation to accommodate the connection of Lincs, Docking Shoal and Race Bank offshore wind farms (three related but separate substations); these works also include an extension to the existing 400 kV substation, to be undertaken by National Grid

7.3.6 Reference should be made to Figure 6.2 for details of the site location. For details of the offshore connection route elements, including the effects of the cable route activities through the inter-tidal and sub-tidal zones of the Wash, refer to Volume 1 of this Environmental Statement.

7.3.7 The assessment will therefore describe the effects that arise from works that are common to the three projects where they affect identified landscape and visual receptors. The assessment will also describe the effects that are, in turn, unique and common to any individual project. With this in mind the assessment will consider (for the identified landscape and visual receptors indicated in Section 6.3) the construction and operation effects of:

- Lincs alone
- Docking Shoal in combination with Lincs
- Race Bank in combination with Lincs and Docking Shoal

7.3.8 The assessment for each development will therefore assume that the previous development phase is operational. The effects of each of the separate, but related, developments are then summarised in the effects tables.

7.3.9 Reference should be made to Section 6.3 for the description of those elements that are relevant to the landscape and visual assessment.

Landscape Effects

Effects on Designated Landscapes

7.3.10 The entire coastline of the Wash is recognised, both nationally and internationally, for its nature conservation and scientific value. The anticipated ecological effects on the Wash are discussed in Volume 1 of this ES. Inland the District of South Holland contains only a sparse coverage of landscape designations of local or national significance. Within the study area there is only an isolated local designation at the peripheries of the northern section of the cable route corridor, extending across the coastal landscape margins.

Construction and Operation of Lincs Onshore Connection – Cable Corridor

7.3.11 During the installation of the Lincs onshore circuits, there will be short-term landscape effects upon the western margins of the Area of Important Landscape Quality. This is due to the activities connected with the landfall construction arrangements and trenching work for the cable corridor. An increase in vehicles will also result in a minor temporary change to the remote character of the area. The extent

of effects will, however, be dependent on working methods, relating to the number and type of vehicles and the storage of excavated material.

7.3.12 The open and exposed nature of the landscape will, however, reduce the magnitude of the effect of cable installation on this area to low as it will generally be perceived within the wider landscape with a mixture of built and natural elements present. The significance of effect, combined with a generally medium sensitivity to the type of change in the short term, is therefore considered to be *minor*. In the longer term, after completion of the development, there will be *no* significant effect on the open character of this Area of Important Landscape Quality. Occasional effects relating to the maintenance of the cable route will only be of *minor* to *negligible* significance.

7.3.13 The landscape to the east includes the Norfolk Coast Area of Outstanding Natural Beauty (AONB) (located approximately 8 km east of the proposed boundary of works), and a further Area of Important Landscape Quality (located approximately 6.5 km southeast of the existing substation). As both of these areas lie beyond the anticipated visual envelope of the development there will be *no* significant effects upon either of these designated landscapes, during or after construction.

Construction and Operation of Lincs Onshore Connection – Substation Construction

7.3.14 Although the Lincs substation will provide a notable addition to the existing substation site, it is not anticipated that there will be any significant effect on any of the identified designated landscapes above. This is due to a combination of distance from the development, the effects of the intervening screening features including existing vegetation that surrounds and contains the substation site, and the fact that the development only constitutes an extension to an existing similar feature.

Construction and Operation of Docking Shoal and Race Bank

7.3.15 The subsequent onshore connection and cable-laying works for the Docking Shoal and Race Bank Offshore Wind Farm developments will each give a similar magnitude of effect to that identified for the Lincs cable corridor, for both the construction and the operation of the cable corridor. Both developments will therefore result in a low magnitude of effect. When this is combined with a generally medium sensitivity to the type of change proposed, the resultant significance of effect is assessed to be *minor*.

7.3.16 The subsequent construction of substations will also provide, for each development, notable additions to the existing substation. However, in common with those for the Lincs Offshore Wind Farm, it is not anticipated that these will cause any significant effect on any of the designated landscapes identified above.

Effects on Landscape Character

Construction and Operation of Lincs – North of the A17

7.3.17 To the north of the A17, the landscape has a distinctive and remote character comprising open, flat, low-lying agricultural land with extensive vistas to level horizons. In this open landscape, sea defence embankments and isolated blocks of vegetation gain significance and prominence. Although the construction activity and excavation works associated with the Lincs onshore connection development within the cable corridor will result in temporary isolated effects on the remote character of this area, the long-distance views across this expansive landscape and the nature of the work will, nevertheless, assist with containing the magnitude of effect to low. When this is combined with a low to medium sensitivity to the proposed change, the significance of effect during construction is considered to be *minor*. After construction and during operation, the effects of the cable corridor will be *negligible*. Although there will be intermittent maintenance work it will be of a temporary nature and will not cause a lasting effect on the landscape characteristics of the area. Refer to Table 7.8 for details.

7.3.18 As the Walpole substation lies approximately 3 km to the south of this area, the construction activity and operational elements associated with the Lincs onshore substation and connection will not have any effect on the landscape characteristics to the north of the A17. Furthermore, the screening effects of intervening vegetation and existing industrial features to the south of the A17 will reduce the magnitude and significance of effect to *negligible* from this area.

Construction and Operation of Lincs – South of the A17

7.3.19 The more enclosed and diverse landscape character of the area to the south of the A17 surrounding the substation, with its characteristic strong built influence, generally provides a more intricate scale and character which will be affected by the excavation of the cable route corridor and the substation for the Lincs development. As a result the magnitude of effect during construction is considered to be low to medium. When this is combined with the low to medium sensitivity of the landscape character to the type of change proposed, and bearing in mind the high number of prominent built features, the significance of effect is considered to be *minor* to *moderate*. In the longer term there will be a *negligible* effect arising from the cable connection works and only a *minor* effect upon the local area of the substation with a slight increase in the existing concentration of industrial elements.

Construction and Operation of Docking Shoal and Race Bank – North of the A17

7.3.20 The construction activity and excavation works associated with both the Docking Shoal and the Race Bank onshore connection developments of the cable corridor will result in temporary direct effects on the remote character of this area. The long-distance views across this expansive landscape and the nature of the work will, however, assist with reducing the magnitude of effect to low for each development. When this is combined with the low to medium sensitivity to change for this area to the cable route construction, the significance of effect during construction is considered to be *minor* for both developments. The post-construction and operational effects of the cable-laying works from both developments will be *negligible*.

7.3.21 The construction activity and operational elements associated with the construction of two further substations adjacent to the existing Walpole substation will not have any effect on the landscape characteristics to the north of the A17.

Construction and Operation of Docking Shoal and Race Bank – South of the A17

7.3.22 To the south of the A17 the enclosed and diverse landscape character will generally provide more containment from both the excavation works undertaken within the cable route corridor and the substations, for both the Docking Shoal and Race Bank developments. As a result the magnitude of impact during construction for each is considered to be low to medium. When this is combined with a low to medium sensitivity to the type of change proposed, and bearing in mind the high number of prominent built features, the significance of effect is considered to be *minor* to *moderate*. In the longer term there will be a *negligible* effect arising from the cable connection works and only a *minor* effect on the local area of the substation with a slight increase in the existing concentration of industrial elements.

Effects on Landscape Features

Construction and Operation of Lincs – the Wider Landscape

7.3.23 During the installation of the Lincs circuits, there will be some associated *minor* isolated effects on the sea defence embankments, ditches, isolated hedgerows and individual mature trees in the wider landscape. Where effects do occur, appropriate working methods will be implemented to limit the effect on existing features. Where this cannot be achieved, existing landscape features will be reinstated, where appropriate, to avoid a permanent change to the landscape feature. Where vegetation is unavoidably lost, it will be replaced with species of a similar type and habit to those lost. The magnitude of effect upon the wider landscape is considered to be low to negligible. When this is combined with a low sensitivity to change, the significance of effect upon the wider landscape features is considered to be *minor* to *negligible*.

Construction and Operation of Lincs – the Substation Site

7.3.24 The proposed substation construction works for the Lincs development includes the substation site preparation, access road, security fencing and landscape mitigation proposals (elements that will also form part of the subsequent Docking Shoal and Race Bank substations) as well as the installation of electrical plant for the Lincs development. These works will result in the loss of some mature individual tree specimens and the hedgerow vegetation along the existing entrance road and from the northern access point to the development from Walpole Bank. The associated work connected with the National Grid extension works will also involve the loss of the mature scrub vegetation along the majority of the southern boundary of the site. The magnitude of effect arising from the Lincs substation works is, therefore, considered to be medium to high in the short term. When this is combined with a low to medium sensitivity to change, given the extent and varied structure of vegetation surrounding the site, this will create a *moderate* effect on the site vegetation. With the addition of the landscape mitigation proposals (which will be implemented as part of the site preparation works during the Lincs development), and landscape management and enhancement of existing boundary vegetation, particularly along Walpole Bank, the magnitude will be reduced to low to negligible and the significance will be *minor* to *negligible* as a result.

Construction and Operation of Docking Shoal and Race Bank – the Wider Landscape

7.3.25 During the installation of circuits for Docking Shoal and Race Bank, there will be further *minor* and isolated effects on the landscape features of the wider landscape. These will be similar in type and duration to the Lincs development effects. Where effects do occur from each development, the detailed proposals will consider appropriate working methods to limit the effects and avoid loss of existing features. Where this cannot be achieved the proposals will include the restoration and reinstatement of these features, within the wider landscape, with species of a similar type and habit to those lost. The magnitude of effect is considered to be low to negligible. When this is combined with a low sensitivity to change, the significance of effects on the wider landscape features is considered to be *minor* to *negligible*.

Construction and Operation of Docking Shoal – the Substation Site

7.3.26 The proposed substation development work for the onshore connection of the Docking Shoal Offshore Wind Farm will include an additional transformer, SVCs and bus-bars for the development. These elements will, however, be located on an open, prepared parcel of land, located between the existing substation plant, the new plant for the Lincs development and the retained access road. They will thus be an infill development rather than an extension to the existing substation and will not include the loss of any significant landscape features. The magnitude and significance of effect on the landscape features of the site, during both the construction and the operation of the infill development for Docking Shoal, is therefore assessed to be *negligible*.

Construction and Operation of Race Bank – the Substation Site

7.3.27 The proposed substation development work for the onshore connection of the Race Bank Offshore Wind Farm will also include an additional transformer, SVCs and bus-bars for the development. These elements will also be located on an open, prepared parcel of land, located between the new plant for the Lincs development, the retained access road and Walpole Bank. The Race Bank substation works will thus form a further extension to the existing substation but will not necessitate the loss of any significant landscape features. The magnitude and significance of effect on the landscape features of the site, during both the construction and the operation of the infill development for Race Bank, is therefore assessed to be *negligible*.

Duration of Landscape Effects

Lincs Onshore Connection

7.3.28 Both the extent and the duration of the proposed onshore developments for the Lincs Offshore Wind Farm are limited, as the results will either lie underground or provide an addition to the existing composition of built elements in an already industrialised landscape. The effects upon the landscape and its characteristic features will therefore be restricted mainly to the construction phase with a number of generally minor temporary changes to the local character along the cable corridor route, after which there will only be isolated intermittent effects resulting from the maintenance of the cable route. There will, however, also be more moderate effects on the loss of landscape features within the substation site, which will continue in

the short term during operation. Following the successful establishment of appropriate mitigation planting to accommodate any unavoidable loss of vegetation, the resultant effect would, however, generally be *minor* to *negligible*. Table 7.8 provides a summary of the landscape effects for the Lincs development.

Table 7.8 | **Landscape effects on identified receptors – Lincs**

Receptor	Sensitivity to proposed change	Magnitude of effect	Significance of effect
designated landscapes	*medium*	low	minor
local landscape character (north of A17)	*low* to *medium*	low	minor
local landscape character (south of A17)	low to medium	low to medium	*minor* to *moderate*
landscape features (wider landscape)	low	low to negligible	*minor* to *negligible*
landscape features (substation site construction)	low to medium	medium to high	*moderate*

Note: this table indicates the significance of effects prior to reinstatement and establishment of landscape mitigation

Docking Shoal Onshore Connection

7.3.29 Both the extent and the duration of the proposed onshore developments for the Docking Shoal Offshore Wind Farm are limited, as the results will (as for Lincs) lie either underground or provide an addition to the existing composition of built elements set within an already industrialised landscape. As installation works will take place in the same corridor as those for the Lincs development, the extent of the effects arising from this element of the development will be alike, with generally *minor* temporary changes to the local landscape character along the cable corridor, and only isolated intermittent effects resulting from the maintenance of the cable route thereafter. There will, however, be no significant effects resulting from the addition to the substation as there will be no further loss of landscape features, and the Docking Shoal electrical plant will provide some connection between the existing substation features and the Lincs extension works. As a result, the significance of effect will generally be *negligible*. Table 7.9 provides a summary of the landscape effects for the Docking Shoal development.

Table 7.9 | **Landscape effects on identified receptors – Docking Shoal**

Receptor	Sensitivity to proposed change	Magnitude of effect	Significance of effect
designated landscapes	medium	low	*minor*
landscape character (north of A17)	low to medium	low	*minor*
landscape character (south of A17)	low to medium	low to medium	*minor* to *moderate*
landscape features (wider landscape)	low	low to negligible	*minor* to *negligible*
landscape features (substation site construction)	low to medium	negligible	*negligible*

Note: this table indicates the significance of effects prior to reinstatement and establishment of landscape mitigation

Race Bank Onshore Connection

7.3.30 The effects of the onshore proposals for the Race Bank development will be similar both in extent and duration to those arising from Docking Shoal, as the construction work will repeat the same laying operations along the same cable route. The magnitude of landscape effects will therefore be *minor* during construction and only of isolated *minor* significance thereafter. Furthermore, there will be no significant effects resulting from the extension to the substation, as the Race Bank development will not result in any further loss of landscape features. As a result, the significance of effect will generally be *negligible*. Table 7.10 provides a summary of the landscape effects for the Race Bank development.

Table 7.10 | **Landscape effects on identified receptors – Race Bank**

Receptor	Sensitivity to proposed change	Magnitude of effect	Significance of effect
designated landscapes	medium	low	*minor*
landscape character (north of A17)	low to medium	low	*minor*
landscape character (south of A17)	low to medium	low to medium	*minor* to *moderate*
landscape features (wider landscape)	low	low to negligible	*minor* to *negligible*
landscape features (substation site construction)	low to medium	negligible	*negligible*

Note: this table indicates the significance of effects prior to reinstatement and establishment of landscape mitigation

Visual Effects

Introduction

7.3.31 The approach to undertaking the visual assessment is first to determine the visual envelope of the proposed development and then to determine how visible the development would be from a number of agreed representative viewpoints, its effect on visual receptor groups, and the extent and significance of effects on general visual amenity within the visual envelope. The full methodology for this is detailed in Appendix A2.15. The visual envelope for the three separate, but related, developments for Lincs, Docking Shoal and Race Bank is illustrated in Figure 6.3.

Effects on General Visual Amenity

7.3.32 The general visual amenity effect of all three separate but related developments, for Lincs, Docking Shoal and Race Bank, is limited in extent as the work is restricted to underground cabling works and construction of new substations adjacent to the existing Walpole substation. The extent of significant visual exposure during the excavation and construction of the cabling work will be largely confined to the immediate area comprising local roads and neighbouring roadside properties, which are generally within 500 m of the cabling trench. This is illustrated on Figure 6.3. The visual effects associated with construction are likely to concern the activities of construction machinery and the construction of temporary tracks to enable access for the construction machinery. Visual effects arising from construction of the cabling trench would largely be temporary and limited to the construction period, with the exception of the unavoidable loss of isolated existing vegetation. After construction, it is judged that there would be *no* significant permanent visual effects.

7.3.33 The potential visibility of the new substations in the immediate vicinity of the site following construction is shown on Figure 6.3. Visibility of the substations within the identified visual envelope will vary according to the presence of localised blocks of screening vegetation as described in Chapter 6.3.

7.3.34 The following analysis refers to the general effects from each of the three separate but related cable installation and substation developments for Lincs, Docking Shoal and Race Bank, on the identified receptor groups within the visual envelope of the proposed onshore development.

Visual Effects upon Visual Receptor Groups

Residents

7.3.35 Local residents are judged to generally have a higher level of sensitivity to change in their landscape and seascape and visual environment, and views from their own homes are judged to be the most sensitive as these views are consistently available. For details refer to Appendix A2.15.

Cable Route

7.3.36 Areas of settlement most likely to receive significant visual exposure, and thus effects, from the cable installation for Lincs, Docking Shoal and Race Bank are primarily located in the Wingland Marsh area directly north of the A17 and the Old Enclosed Marsh area directly south of the A17. Within these areas there are a few roadside properties along Anchor Road, Cocklehole Road, Grange Road, Hospital Road and Garners Road. These roads generally comprise straight, quiet country lanes and are intermittently lined by short clipped hedgerows. Views are available from the roads across large-scale arable fields where there are breaks in the hedgerows. Although the magnitude of visual effect upon these residents during cable installation works (which include minor improvements to the local highway to assist with site access during installation) is anticipated to vary between medium and high, depending on the distance from the cable route, the effect will be temporary and confined to a short construction period. Given the medium to high sensitivity of local residents in these areas, the overall significance of effect during construction upon this visual receptor group will vary between *moderate* and *major*. Beyond these immediate receptors the significance of visual effects upon residents will be more *moderate* to *minor*. Following construction, however, there will be no anticipated permanent visual effects and the significance of visual effects upon residents to the north of the A17 after construction is judged to be *negligible*. Refer to the Summary Table 7.11.

Substation

7.3.37 The residents most likely to experience the greatest visual exposure during the construction and operation of the substation developments for Lincs, Docking Shoal and Race Bank are those living in properties on French's Road and Walpole Bank. Residents from isolated properties on the outskirts of Walpole St Andrew, Walpole St Peter and Walpole Marsh will also potentially have some visual exposure. However, most views towards the new substations will be screened, in part, by mature boundary vegetation on the outskirts of these settlements. Also, the nearest isolated dwellings to the substation commonly have strong evergreen shelter belts which limit the views from these properties over the wider landscape. The magnitude of visual effect on these residents during construction and the short-term operation of the substation is, therefore, generally judged to be low to negligible with the exception of those at the nearest properties along French's Road and Walpole Bank, where a medium magnitude of effect is generally experienced.

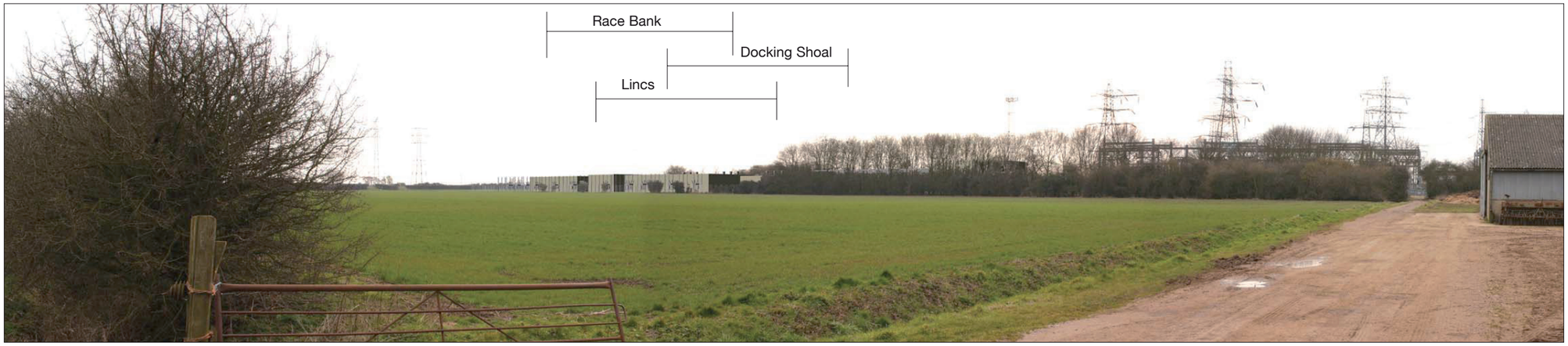
7.3.38 Given the medium to high sensitivity of local residents to change, the overall significance will generally be *minor* with isolated *moderate* to *major* significance of effect in the short term, prior to the implementation and establishment of mitigation proposals, upon residents at the nearest properties. Refer to the Summary Table 7.11. below and to the residual effects assessment for further details.

Travelling Public

Cable Route

7.3.39 Travellers using local roads north of the A17 will have views of the construction activities associated with cable laying. However, in each case these views will be transitory and intermittent in nature. As such, the magnitude of effect on the travelling public during the construction phase for each of the wind farms is assessed as low. When this is combined with a generally low to medium sensitivity to change for this receptor group, the overall significance of effect is judged as *minor*.

Viewpoint 1: Existing View



Viewpoint 1: Photomontage

Grid reference:	548733E, 316948N	Each A3 photomontage sheet has an angle of view of 90º. This is approximately the same as 2.5 prints from a 35mm film with a 50mm lens. The vertical and horizontal scales do not change across their width. For correct monocular perspective the wireframes should be viewed from a distance of 250 mm, curved through 90º.
Elevation AOD:	3.00m	
Height of camera above ground:	c. 1.6 m	
Lens focal length (35mm format):	50 mm	
Date:	13/03/06	The parameter markers within the photomontage view, indicate the approximate extent of the proposals connected with the three separate wind farm developments at Lincs, Docking Shoal and Race Bank, as part of the Centrica works to the substation. The proposals also indicate the anticipated size, scale and distribution of significant features for each of the three developments. The ultimate extent and detailed design of the proposals will, however, need to be subject to final agreement.
Time:	12.15	
Weather:	Overcast	

DATE	**December 2006**	DRAWN	**RC**
SCALE	**NTS**	CHECKED	**SD**
STATUS	**Final**	APPROVED	**WW**

LINCS, DOCKING SHOAL AND RACE BANK OFFSHORE WIND FARMS
ONSHORE CONNECTION

VIEWPOINT 1: VEHICULAR ENTRANCE TO FARM YARD OFF FRENCH'S ROAD

Oxford
T 01865 887050

LDADESIGN

DRAWING NO. **2115.1LO/PM001**

Figure 7.1 | Viewpoint 1: existing view and photomontage showing extents of substation ground works for each wind farm

Viewpoint 2: Existing View

Viewpoint 2: Photomontage

Grid reference:	548775E, 316209N	Each A3 photomontage sheet has an angle of view of 90º. This is approximately the same as 2.5 prints from a 35mm film with a 50mm lens. The vertical and horizontal scales do not change across their width. For correct monocular perspective the wireframes should be viewed from a distance of 250 mm, curved through 90º.
Elevation AOD:	3.00m	
Height of camera above ground:	c. 1.6 m	
Lens focal length (35mm format):	50 mm	
Date:	13/03/06	The parameter markers within the photomontage view, indicate the approximate extent of the proposals connected with the three separate wind farm developments at Lincs, Docking Shoal and Race Bank, as part of the Centrica works to the substation. The proposals also indicate the anticipated size, scale and distribution of significant features for each of the three developments. The ultimate extent and detailed design of the proposals will, however, need to be subject to final agreement.
Time:	12.45	
Weather:	Overcast	

DATE	**December 2006**	DRAWN	**RC**
SCALE	**NTS**	CHECKED	**SD**
STATUS	**Final**	APPROVED	**WW**

LINCS, DOCKING SHOAL AND RACE BANK OFFSHORE WIND FARMS
ONSHORE CONNECTION

VIEWPOINT 2: WALPOLE BANK, ADJACENT TO ROSE HALL FARM

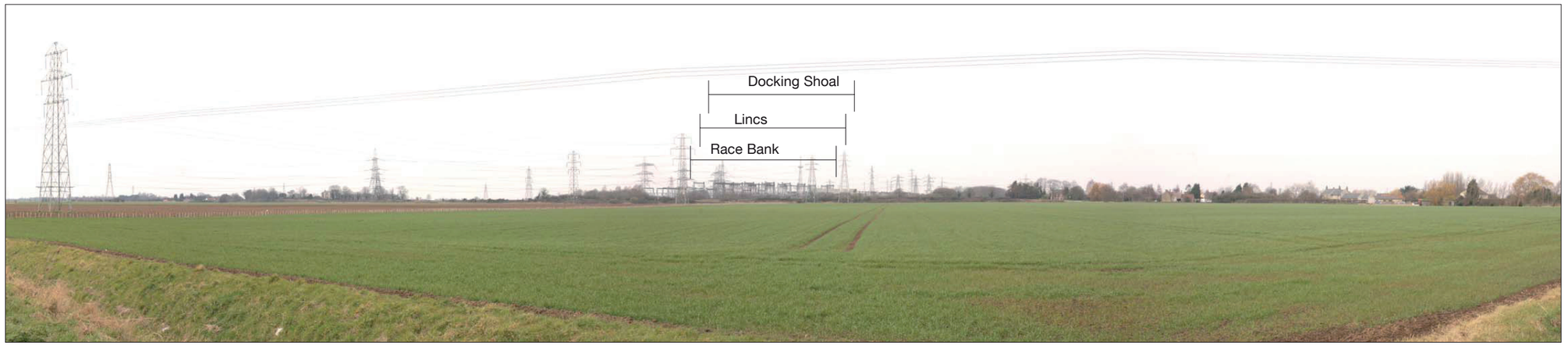
Oxford
T 01865 887050

LDADESIGN

DRAWING NO. **2115.1LO/PM001**

Figure 7.2 | Viewpoint 2: existing view and photomontage showing extents of substation ground works for each wind farm

Viewpoint 3: Existing View



Viewpoint 3: Photomontage

Grid reference:	549619E, 316480N	Each A3 photomontage sheet has an angle of view of 90º. This is approximately the same as 2.5 prints from a 35mm film with a 50mm lens. The vertical and horizontal scales do not change across their width. For correct monocular perspective the wireframes should be viewed from a distance of 250 mm, curved through 90º.
Elevation AOD:	3.00m	
Height of camera above ground:	c. 1.6 m	
Lens focal length (35mm format):	50 mm	
Date:	13/03/06	The parameter markers within the photomontage view, indicate the approximate extent of the proposals connected with the three separate wind farm developments at Lincs, Docking Shoal and Race Bank, as part of the Centrica works to the substation. The proposals also indicate the anticipated size, scale and distribution of significant features for each of the three developments. The ultimate extent and detailed design of the proposals will, however, need to be subject to final agreement.
Time:	11.45	
Weather:	Overcast	

DATE	**December 2006**	DRAWN	**RC**
SCALE	**NTS**	CHECKED	**SD**
STATUS	**Final**	APPROVED	**WW**

LINCS, DOCKING SHOAL AND RACE BANK OFFSHORE WIND FARMS
ONSHORE CONNECTION

VIEWPOINT 3: POLICE ROAD, EASTERN EDGE OF WALPOLE ST PETER

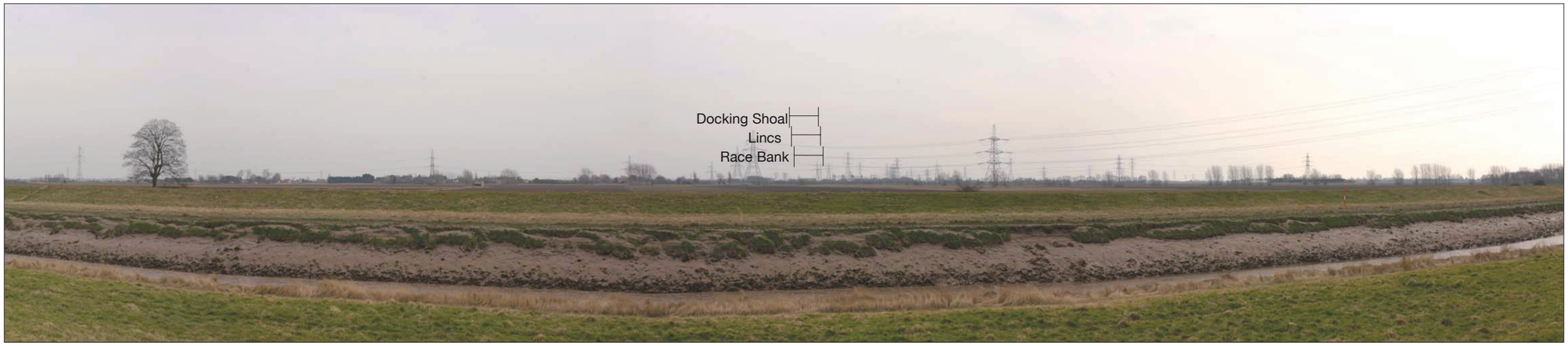
Oxford
T 01865 887050

LDADESIGN

DRAWING NO. **2115.1LO/PM001**

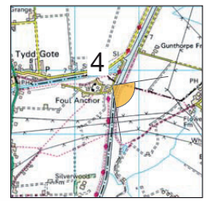
Figure 7.3 | Viewpoint 3: existing view and photomontage showing extents of substation ground works for each wind farm

Viewpoint 4: Existing View



Viewpoint 4: Photomontage

Grid reference:	546602E, 317745N	Each A3 photomontage sheet has an angle of view of 90º. This is approximately the same as 2.5 prints from a 35mm film with a 50mm lens. The vertical and horizontal scales do not change across their width. For correct monocular perspective the wireframes should be viewed from a distance of 250 mm, curved through 90º.
Elevation AOD:	0.96m	
Height of camera above ground:	c. 1.5 m	
Lens focal length (35mm format):	50 mm	
Date:	13/03/06	The parameter markers within the photomontage view, indicate the approximate extent of the proposals connected with the three separate wind farm developments at Lincs, Docking Shoal and Race Bank, as part of the Centrica works to the substation. The proposals also indicate the anticipated size, scale and distribution of significant features for each of the three developments. The ultimate extent and detailed design of the proposals will, however, need to be subject to final agreement.
Time:	13.45	
Weather:	Overcast	



DATE	December 2006	DRAWN	RC
SCALE	NTS	CHECKED	SD
STATUS	Final	APPROVED	WW

LINCS, DOCKING SHOAL AND RACE BANK OFFSHORE WIND FARMS
ONSHORE CONNECTION

VIEWPOINT 4: NENE WAY, SOUTHEAST EDGE OF FOUL ANCHOR

Oxford
T 01865 887050

LDADESIGN

DRAWING NO. **2115.1LO/PM001**

Figure 7.4 | Viewpoint 4: existing view and photomontage showing extents of substation ground works for each wind farm

Substation

7.3.40 Although mature vegetation and low-clipped hedgerows commonly line local roads and restrict views towards the substation, during the construction and operation of each of the substation developments views will be available towards both the construction activity and the substation structures from Walpole Bank and through isolated gaps along French's Road. The view will however, be generally restricted further by the existing mature vegetation around the substation compound.The magnitude of effect on the travelling public south of the A17, both during and after construction of the substations, is therefore judged to be low to negligible. When this is combined with a low to medium sensitivity to change, the overall significance of effect is judged as *minor* to *negligible*. Refer to the Summary Table 7.11 below for further details.

Visitors and the Tourism or Amenity Resource

Cable Route

7.3.41 This group embraces a wide variety of individual visual receptor groups and includes those who enjoy views across the coastal habitats of the Wash and the estuarine landscape of the River Nene. During cable installation works for each of the wind farms there will be a degree of temporary visual effect upon birdwatchers and walkers in the area east of the mouth of the River Nene. The magnitude of effect is assessed as generally low to medium during the construction phase and negligible after construction. When this is combined with a generally medium to high sensitivity to the change, the significance of effect will be *moderate* during construction. This will, however, be reduced to *negligible* following completion of cable installation. Cable installation activities will not be visible from the picnic area adjacent to the west bank lighthouse as this area is shrouded by mature trees and hedgerow vegetation.

Substation

7.3.42 As the substation is well contained within the local industrialised landscape there will be a limited effect upon the general visual amenity of the tourist and visitor receptor group. Views will, however, be seen from some small sections of the Nene Way National Trail. The effects on these views have been assessed below, as part of the visual assessment from Representative Viewpoint 4. In general terms, during construction and operation there will be a *negligible* to *minor* effect on this visual receptor group as the substations will not generally be visible to receptors in the wider landscape, as it generally lies behind the existing substation. For details of each receptor group, refer to the Summary Table 7.11.

Table 7.11 | **Summary of visual effects on identified receptors arising from Lincs, Docking Shoal and Race Bank**

Receptor	Sensitivity to proposed change	Magnitude of effect	Significance of effect
residents north of A17 (Wingland Marsh and Old Enclosed Marsh)	medium to high	medium to high (during construction); negligible (post construction)	*moderate* to *major* (during construction); *negligible* (post construction)
residents of Walpole Marsh, Walpole St Andrew and Walpole St Peter	medium to high	low to negligible (locally medium)	*minor* (locally *moderate* to *major*)
travellers north of A17	low to medium	low (during construction); negligible (post construction)	*minor* (during construction); *negligible* (post construction)
travellers south of A17	low to medium	low to negligible (post construction)	*minor* to *negligible* (post construction)
the Wash – birdwatchers	high	low to medium (during construction); negligible (post construction)	*moderate* (during construction); *negligible* (post construction)
picnic area users	medium high	negligible (during and post construction)	*negligible* (during and post construction)
Nene Way National Trail users	medium to high	low to negligible (during and post construction)	*minor* (during construction); *negligible* post construction

Viewpoint Assessment

7.3.43 The following analysis refers to the four agreed representative viewpoints referred to in the baseline conditions. Reference should be made to the existing panoramas (Figures 6.5-6.6) and photomontages (Figures 7.1-7.4) which illustrate the existing and proposed view for each viewpoint. A summary of the effects, for each of the three separate but related substation developments for Lincs, Docking Shoal and Race Bank, is then provided in Tables 7.12—7.14.

Viewpoint 1

7.3.44 Viewpoint 1 is the entrance to a farm off French's Road, between Walpole St Peter and Walpole Marsh, at grid reference 48133 16948. It is approximately 130 m north of the substation.

Visual Effects of Lincs Onshore Works

7.3.45 From this viewpoint, which illustrates the view available to travellers along French's Road, the proposed development for the Lincs cable corridor and substation con-

nection (as indicated in Figure 7.1) will be seen to overlap with the edge of the existing substation and will extend the overall horizontal spread of the substation by approximately 30 per cent. The elements of the substation for the Lincs development will, however, be slightly smaller in scale than the visible structures of the existing substation. The new substation will also sit partially behind the existing foreground tree belt for approximately 50 per cent of its horizontal spread. The remainder of the substation elements for the Lincs scheme will interrupt the existing distant view to the southeast and will visually connect existing, visually separate pylons in the view, as seen from this viewpoint.

7.3.46 During the installation of cables and construction of the substation for Lincs, the anticipated magnitude of effect from this viewpoint will be high to medium depending on the sequencing of the works, and the associated effect of the trenching across the open field in the southeast sector of the view, in combination with the construction of the substation. On completion of the trenching and during construction and operation of the substation the magnitude of effect will be reduced slightly to medium.

7.3.47 As the visual sensitivity of the primary receptor group of travellers on French's Road to the proposed change is considered to be low due to the number of existing built elements and containment within the view, the anticipated significance level of effect during the construction phase is judged to be *moderate* to *minor* during construction. Following construction of the cable corridor, and during the construction and operation of the substation before the establishment of the proposed mitigation, the significance of effect is assessed to be *minor*.

Visual Effects of Docking Shoal Onshore Works

7.3.48 During the laying of the Docking Shoal cable route and the construction of the substation connection the anticipated magnitude of effect from this viewpoint will be medium, given the existing nature and industrial context of the view. This will, however, partially depend on the sequencing of the works. On completion of the trenching and during construction and operation of the substation the magnitude of effect will then be reduced to low as the Docking Shoal works will only add a degree of density to the existing composition of industrial features and will not extend the overall spread within the view. When this is combined with a low visual sensitivity of the primary receptor group of travellers on French's Road to the proposed change, the anticipated significance level of effect during construction is judged to be *minor* to *moderate*, and will then be reduced to *minor* during operation.

Visual Effects of Race Bank Onshore Works

7.3.49 During the laying of the Race Bank cable route and construction of the substation connection the anticipated magnitude of effect from this viewpoint will again be medium, depending on the sequencing of the works. Upon completion of the trenching and during construction and operation of the substation the magnitude of effect will then be reduced to low as the Race Bank works will only add a small extension to the existing composition and an intensification of the existing industrial features within a small section of the view. When this is combined with a low visual sensitivity of the primary receptor group of travellers on French's Road to the proposed change, the anticipated significance level of effect during construction is judged to be *minor* to *moderate*, and will then be reduced to *minor* during operation.

Viewpoint 2

7.3.50 Viewpoint 2 is on Walpole Bank, adjacent to Rose Hall Farm, at grid reference 48115 16209. It is approximately 400 m south of the substation.

Visual Effects of Lincs Onshore Works

7.3.51 From this viewpoint, which illustrates the view available primarily to travellers along Walpole Bank, the Lincs substation (as indicated in Figure 7.2) will be seen to extend the existing spread of industrial substation features within the view by approximately 30 per cent to the northeast. However, the cable-laying works to the north will not generally be visible from this location. The proposed elements that form part of the Lincs substation in the view will be visually similar to the existing industrial features, but they will be visually less prominent when viewed alongside the existing structures. The construction and operation of these elements will thus result in a medium magnitude of visual effect as they will form a small addition to the existing industrial composition within the view. As the visual sensitivity of the primary receptor group of travellers on Walpole Bank road to the proposed change is judged to be low to medium, the overall significance level of anticipated effect of the Lincs development is assessed to be *minor* to *moderate* in the short term before establishment of the proposed mitigation for the substation.

7.3.52 The construction of the substation will, when viewed from this viewpoint, also include the National Grid extension work to the south of the access road. This will include, as part of the site preparation, the removal of the existing scrub vegetation from a section of the southern boundary. It will also include, as part of the Centrica works, the removal of a number of semi-mature trees to the northern side of the existing access track to the substation. The magnitude of effect is, therefore, judged to be medium to high in the short term following construction of the development. When this is combined with the low to medium visual sensitivity of the primary receptor group of travellers on Walpole Bank road to the proposed change, the overall significance level of anticipated effect of the Lincs development is assessed to be *moderate* in the short term before establishment of proposed mitigation for the substation.

Visual Effects of Docking Shoal Onshore Works

7.3.53 During the construction and operation of the Docking Shoal cable corridor and substation connection works, the anticipated magnitude of effect from this viewpoint will be low as the electrical plant for this development along with the associated cable corridor works will be located almost entirely behind the Lincs substation and, depending upon the sequencing of the works, also the National Grid extension work. As the visual sensitivity to the proposed change of the primary receptor group of travellers on Walpole Bank road is judged to be low to medium the overall significance level of anticipated effect of the Docking Shoal development, during

construction and operation, is assessed to be *minor* in the short term before establishment of proposed mitigation for the substation.

Visual Effects of Race Bank Onshore Works

7.3.54 During the construction and operation of the Race Bank cable corridor and substation connection works, the anticipated magnitude of effect from this viewpoint will be low as the electrical plant for this development will provide a slight extension to the composition of similar industrial features within the view. The associated cable corridor works will also be located almost entirely behind the existing substation developments. As the visual sensitivity of the primary receptor group of travellers on Walpole Bank road to the proposed change is judged to be *low* to medium, the overall significance level of anticipated effect of the Race Bank development is assessed to be *minor* in the short term before establishment of proposed mitigation for the substation.

Viewpoint 3

7.3.55 Viewpoint 3 is on Police Road, on the eastern edge of Walpole St Peter, at grid reference 49619 16480. It is approximately 610 m east of the substation.

Visual Effects of Lincs Onshore Works

7.3.56 As indicated in Figure 7.3 the new substation will be visible in views directly to the west as seen from this viewpoint, which is illustrative of the view primarily seen by the residential receptor group. Within the view, the Lincs substation will be located immediately and almost entirely in front of the existing substation. It will also be interspersed among the existing concentration of pylons, and therefore the new substation will intensify the existing composition of industrial structures. The Lincs substation will, however, be slightly smaller in scale than the existing substation structure and will also be of a similar type to the existing industrial elements visible in the view. It will therefore not add any new significantly distinct features to the view.

7.3.57 Given the comparable character to the existing development, and the location within a concentrated section of a wider view across an industrial landscape, the Lincs development will, during both construction and operation, only provide a low magnitude of effect. It is also anticipated that the existing industrial features and vegetation cover will limit the extent of visibility of cable installation to low to negligible. When combined with the medium to high visual sensitivity of the primary receptor group of residents at this viewpoint to the proposed change, the overall significance level of anticipated visual effect arising from the Lincs development is assessed to be *minor* to *moderate* during construction and before establishment of proposed mitigation for the substation. Thereafter it will be reduced to *minor*. It is also noted, however, that the majority of properties on the eastern edge of Walpole St Peter with potential views towards the substation are single storey dwellings, commonly with evergreen vegetation along property boundaries. Views to the substation from these properties are, therefore, likely to be restricted.

Visual Effects of Docking Shoal Onshore Works

7.3.58 During the construction and operation of the Docking Shoal circuits and substation connection works the anticipated magnitude of effect from this viewpoint will be low to negligible as the electrical plant for this development, along with the associated cable laying works, will be located almost entirely behind the Lincs substation. As the visual sensitivity of the primary receptor group of residents to the proposed change is judged to be medium to high at this isolated location, the overall significance level of anticipated effect of the Docking Shoal development is assessed to be *minor* in the short term before establishment of proposed mitigation.

Visual Effects of Race Bank Onshore Works

7.3.59 During the construction and operation of the Race Bank circuits and substation connection works the anticipated magnitude of effect from this viewpoint will be low as the electrical plant for this development will be located immediately and almost entirely in front of the existing substations works and will therefore form a minor intensification of elements within a concentrated section of the view. As the visual sensitivity to the proposed change, of the primary receptor group of residents at this isolated location, is judged to be medium to high, the overall significance level of anticipated effect of the Race Bank development is assessed to be *minor* to *moderate* in the short term during construction and before establishment of proposed mitigation.

Viewpoint 4

7.3.60 Viewpoint 4 is on the Nene Way, at the southeast edge of Foul Anchor, at grid reference 46602 11145. It is approximately 2.3 km from the substation.

Visual Effects of Lincs Onshore Works

7.3.61 From this viewpoint, which principally illustrates the view available from the Nene Way National Trail, the Lincs substation will be situated in a small section of the view and almost entirely behind the existing substation (as indicated in Figure 7.4). The Lincs substation will then be framed further to either side by the existing nsetwork of pylons, overhead wires and other industrial features. In addition, the large-scale, expansive nature of this view and the existing diversity and density of constructed elements will reduce the visibility of cable installation, which will only be apparent in minor isolated sections of the view to the north and will generally be absorbed by the level of existing activity and character of the view. As the substation for Lincs will not have any distinct visual significance within the view from this viewpoint, the magnitude of effect is judged to be negligible, both in the short and the long term. When combined with the low visual sensitivity of the primary receptor group of footpath users on the Nene Way at this viewpoint to the proposed change, the overall significance level of anticipated effect of the Lincs development is assessed to be *negligible*.

Visual Effects of Docking Shoal Onshore Works

7.3.62 During the construction and operation of the Docking Shoal circuits and substation connection works, the anticipated magnitude of effect from this viewpoint will be negligible as the electrical plant for this development along with the associated cable installation works will be behind the existing substation. As the visual sensitivity

of the primary receptor group of footpath users on the Nene Way at this viewpoint to the proposed change is low, the overall significance level of anticipated effect of the Docking Shoal development is assessed to be *negligible*.

Visual Effects of Race Bank Onshore Works

7.3.63 During the construction and operation of the Race Bank circuits and substation connection works, the anticipated magnitude of effect from this viewpoint will be negligible as the development, along with the associated cable installation works, will be behind the existing substation and several other existing natural and constructed elements. As the visual sensitivity of the primary receptor group of footpath users on the Nene Way at this viewpoint to the proposed change is low, the overall significance level of anticipated effect of the Race Bank development is assessed to be *negligible*.

Table 7.12 | **Summary of visual effects on representative viewpoints – Lincs**

Viewpoint	Sensitivity to proposed change	Magnitude of effect (excluding mitigation benefits)	Significance of effect
viewpoint 1 – farm entrance, French's Road	low	high to medium (during construction); medium (post construction)	*moderate* to *minor* (during construction); *minor* to *moderate* (post construction)
viewpoint 2 – Walpole Bank, Rose Hall Farm	low to medium	medium (during and post construction); medium to high (including effect of National Grid work)	*minor* to *moderate; moderate* (including effect of National Grid work)
viewpoint 3 – Folgate Road	medium to high	low (during and post construction)	*minor* to *moderate*
viewpoint 4 – Foul Anchor	low	negligible (during and post construction)	*negligible*

Table 7.13 | **Summary of visual effects on representative viewpoints – Docking Shoal**

Viewpoint	Sensitivity to proposed change	Magnitude of effect (excluding mitigation benefits)	Significance of effect
viewpoint 1 – farm entrance, French's Road	low	medium (during construction); low (post construction)	*minor* to *moderate* (during construction); *minor* (post construction)
viewpoint 2 – Walpole Bank, Rose Hall Farm	low to medium	low (during and post construction)	*minor*
viewpoint 3 – Folgate Road	medium to high	low to negligible (during and post construction)	*minor*
viewpoint 4 – Foul Anchor	low	negligible (during and post construction)	*negligible*

Table 7.14 | **Summary of visual effects on representative viewpoints – Race Bank**

Viewpoint	Sensitivity to proposed change	Magnitude of effect (excluding mitigation benefits)	Significance of effect
viewpoint 1 – farm entrance, French's Road	low	medium (during construction); low (post construction)	*minor* to *moderate* (during construction); *minor* (post construction)
viewpoint 2 – Walpole Bank, Rose Hall Farm	low to medium	low (during and post construction)	*minor*
viewpoint 3 – Folgate Road	medium to high	low (during and post construction)	*minor* to *moderate*
viewpoint 4 – Foul Anchor	low	negligible (during and post construction)	*negligible*

Cumulative Effects

Introduction

7.3.64 The purpose of the cumulative impact assessment is to consider the potential effects upon the landscape and visual environments in relation to the existing development and other known consented or proposed development in the area. The *Guidelines for Landscape and Visual Impact Assessment* (Landscape Institute of Environmental Management and Assessment 2002) advises that 'cumulative landscape and visual effects [impacts] result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future'.

7.3.65 The likely cumulative effects have been considered in relation to a number of potential future developments, including the in-combination effects of the individual Centrica works for the separate but related developments for Lincs, Docking Shoal and Race Bank. The assessment considers the following developments:

- Docking Shoal in combination with Lincs
- Race Bank in combination with Lincs and Docking Shoal
- National Grid modifications to the existing substation
- extension to Sutton B power station

Docking Shoal in Combination with Lincs

7.3.66 As identified in the assessment, the cable installation for the Docking Shoal onshore connection will generally have a similar significance of effect on the identified landscape and visual receptors to that arising from Lincs. However, it is not anticipated that this will provide any cumulative effect as the work is largely underground and in sequence, and the effects are largely temporary. On completion of each phase of

installation and where any reinstatement and mitigation of landscape features has been completed, there will be *no* significant cumulative effect on the landscape and visual amenity in the wider landscape. This will, however, be dependent on the timing and duration of the works.

7.3.67 The proposed substation development work for the Docking Shoal onshore connection will be located on an open, prepared parcel of land between the existing substation plant, the substation plant for the Lincs development and the retained access road. It will thus constitute an infill development as opposed to an extension of the existing substation and will not involve the loss of any further landscape features. It will also be located almost entirely behind the Lincs substation when seen from the majority of the surrounding area and by the identified visual receptors. The cumulative magnitude of effect upon the landscape and visual environments is therefore low and the general significance is therefore assessed to be *minor*.

Race Bank in Combination with Lincs and Docking Shoal

7.3.68 The subsequent construction works associated with the cable laying for the Race Bank onshore connection (as identified above) will also have a similar significance of effect on the identified landscape and visual receptors to that arising from Docking Shoal. Again, it is not anticipated that this will have any cumulative effect as the work is largely underground and the construction effect is largely temporary. On completion of each phase, therefore, there will be *no* significant effect on the landscape and visual amenity within the wider landscape. This will, however, again be dependent on the timing and duration of the works.

7.3.69 The proposed substation development work for the Race Bank onshore connection will similarly be located within an open, prepared parcel of land located between the Lincs substation, the retained access road and Walpole Bank. It will thus form a minor extension to the existing substation and will not involve the loss of any further landscape features. It will also be located immediately and almost entirely alongside the Lincs substation from the majority of the surrounding area and to the identified visual receptors. The cumulative magnitude of effect on the landscape and visual environment is therefore low and the general significance is therefore assessed to be *minor*.

National Grid Modifications to the Existing Substation

7.3.70 The combined visual exposure of the Centrica works (for Lincs, Docking Shoal and Race Bank) at the existing Walpole substation, and that of the proposed National Grid modifications and extensions to the existing substation (refer to Appendix A2.14 for details of the National Grid Extension Environmental Report) will broadly extend over a similar area around the existing substation. This is a reflection of the close proximity and integral character of the separate but related substation developments and the enclosed character of the local landscape. As the Centrica and the National Grid developments sit alongside each other the effect will be a high degree of visual relationship between these two developments in views along French's Road and Walpole Bank. As a result the significance of cumulative visual effect is considered to be low within the immediate environment. Elsewhere and including the cable corridor, the combined visual exposure will be reduced to negligible.

7.3.71 The associated work connected with the National Grid extension works will also involve the loss of the significant mature scrub vegetation along the majority of the southern boundary of the site. The cumulative magnitude of effect on the landscape features of the site and the local landscape character is therefore considered to be medium to high in the short term, principally as a direct result of the National Grid work rather than the Centrica works. When combined with a low to medium sensitivity to change given the extent of existing vegetation around the site, this will create a moderate cumulative effect on the site vegetation and immediate landscape setting of the development. With the addition of the landscape mitigation proposals, sensitive landscape management, and enhancement of the existing boundary vegetation this magnitude will, over time, be reduced to low to negligible and the significance will be reduced to *minor* to *negligible* as a result.

Extension to Sutton Bridge Power Station

7.3.72 The potential extension to the Sutton Bridge Power station will not cause any significant landscape or visual cumulative effects as the extension work has a strong relationship to the existing power station, which is already viewed as an individual dominant landmark building within the landscape and visual environment. It is also located approximately 3 kilometres to the north of the Walpole substation and therefore has limited visual relationship with the proposed Centrica and National Grid works, with the intervening vegetation and settlement restricting views.

Mitigation

Mitigation of Onshore Elements

7.3.73 Careful consideration has been given to the route selection of the cable corridor from its landfall to the east of the mouth of the River Nene and across low-lying arable farmland so as to minimise the effects on the landscape resource and the existing visual environment. Further, more detailed consideration will be given to the cable landfall arrangements to ensure that there is only a minimal lasting visible effect upon the landscape resource, its character and constituent features. The detailed proposals will incorporate several mitigation measures in order to reduce or remove the potential effects arising from the cable corridor development. These include the following:

- The selected cable route has taken account of areas of valued and high quality landscape, seeking to avoid these wherever possible. Examples are the Terrington Marsh and Walkers Marsh to the west of the river Great Ouse, both of which lie within the locally designated Area of Important Landscape Quality.
- Where cable routing unavoidably disturbs areas of existing vegetation, these will be replaced with appropriate new planting with species of similar habit, type and character. Details of these will be agreed with the local authorities.

7.3.74 Consideration has also been given to integral landscape mitigation proposals to assist with the screening and visual integration of the new substations. These are illustrated in Figure 7.5 (and the accompanying text) and include:

- proposed environmental bund aligned with field boundaries to approximately 1.6 m in height (to allow for clearance above the cable-laying trench, and mitigation planting proposals)
- proposed linear native woodland mix planting (minimum width 8.5 m)
- proposed infill, reinstatement and reinforcement hedge and boundary planting to provide a more robust screen along Walpole Bank
- proposed screen planting to the southern boundary (as part of the National Grid extension work)

7.3.75 These proposals will provide mitigation for the partial loss of onsite vegetation along the access road and along the southern boundary and will seek to integrate the proposed substation works into the local environment. They will include an indigenous woodland mix to enhance biodiversity and integrate the site into the local landscape and will eventually assist with replicating local views. The proposals have been developed in consultation with the local planning authority.

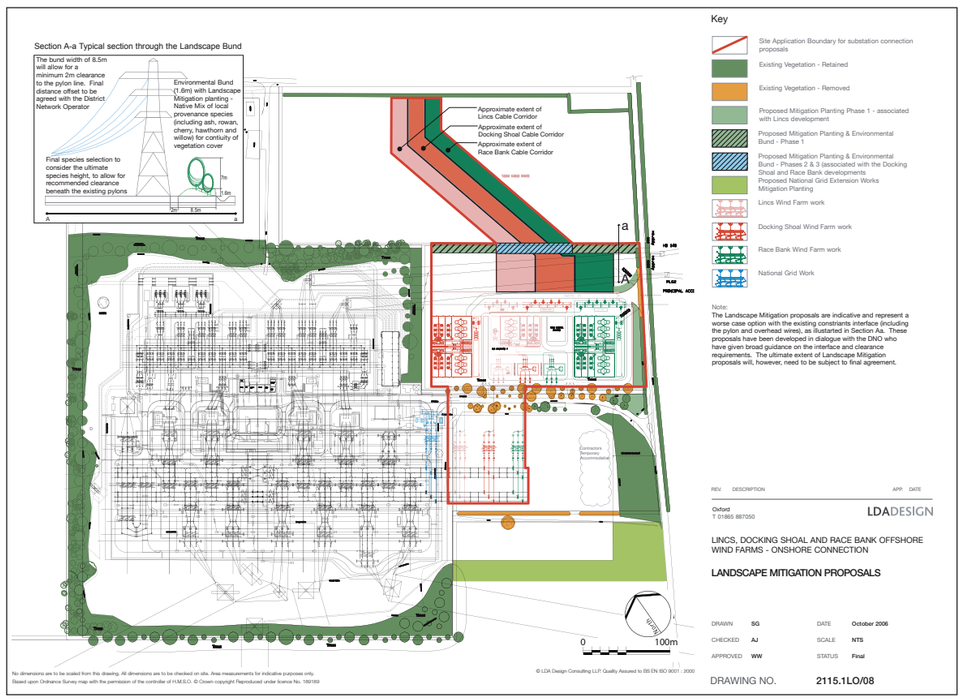


Figure 7.5 | Landscape mitigation proposal

Residual Effects

Landscape Effects

7.3.76 The majority of the study area to the north through which the cable corridor runs lies within a low-lying, relatively undeveloped, open and simple coastal landscape, the character of which is exposed and remote. To the south of the major A17 road corridor the landscape is more varied and better enclosed. It has a number of contrasting built and natural elements present that create a discordant landscape, with a dominant built influence within an open landscape that includes a strong sense of enclosure and localised screening of settlements. Although there will be temporary, short-term, localised effects on the general landscape character, and isolated effects on landscape features, these will generally only be of *minor* significance and limited to the construction activity of each of the three separate but related onshore connection developments for Lincs, Docking Shoal and Race Bank. Depending on the timing and duration of the construction period for each cable corridor development, the anticipated significance of effect will be reduced, generally to an overall *negligible* effect with *minor* isolated effects on landscape features, mainly to the south of the A17.

7.3.77 In addition, there will also be an isolated *moderate* effect, in the short term, on the landscape features of the substation site. However, during the construction of the Lincs substation, the first of the three separate but related developments, landscape mitigation proposals will be implemented as apart of the site preparation works for the three developments. It is then anticipated that there will be no further effects on the local landscape features during the separate but related developments for the Docking Shoal and Race Bank substations. Upon completion of the construction works for the additional two developments, and as the landscape mitigation planting starts to mature, the significance of effect on the landscape and its characteristic features will be reduced to *negligible*.

Table 7.15 | **Residual landscape effects**

Receptor	Sensitivity to proposed change	Magnitude of effect	Significance of effect
designated landscapes	medium	negligible	*negligible*
landscape character (north of A17)	low to medium	negligible	*negligible*
landscape character (south of A17)	low to medium	negligible to low	*negligible* to *minor*
landscape features (substation site)	low to medium	low to negligible	*minor* to *negligible*
landscape features (wider landscape)	low	negligible	*negligible*

Visual Effects

7.3.78 The extent of visual effects of the onshore connection proposals, for each of the three separate but related developments at Lincs, Docking Shoal and Race Bank, is fairly limited in scale and duration. This is largely due to the fact that the proposed developments are either located underground or are part of an addition to an existing composition of industrial elements. The effect of the cable corridor, for each development, on visual receptors and general visual amenity across the majority of the study area would largely be restricted to the construction phase of each development. Following construction, the resultant effect would generally be *negligible* with only isolated *minor* effects where localised vegetation has unavoidably been lost.

7.3.79 It is anticipated that more prolonged effects will arise during the construction and operation of the separate but related substations. However, these effects will also be temporary and on completion of the construction works for the additional two developments the visual effects will generally be reduced to *negligible* with a re-established landscape framework largely replicating the existing landscape character and views. The effects of the proposed development with the landscape mitigation in place have been assessed to derive the residual effects upon the representative viewpoints shown in Table 7.16.

Table 7.16 | **Summary of residual visual effects on representative viewpoints**

Viewpoint	Sensitivity to proposed change	Magnitude of effect	Significance of effect
viewpoint 1 – farm entrance, French's Road.	low	low	*minor*
viewpoint 2 – Rose Hall Farm	low-medium	low	*minor*
viewpoint 3 – Folgate Road	medium	low	*negligible*
viewpoint 4 – Foul Anchor	low	negligible	*negligible*

Conclusions

7.3.80 The assessment process has sought to define the full extent of the likely landscape and visual effects arising from the three separate but related onshore connection developments for Lincs, Docking Shoal and Race Bank at all stages of the project. It is acknowledged that the proposed developments would have effects upon the landscape resource and visual environment within the study area. However, these would generally be restricted to the construction phases of the three developments. In the short term, following the construction phase, both landscape and visual effects would be generally no more than *minor* to *moderate* across the majority of the study area. There would, however, be more significant isolated *major* to *moderate* effects to the roadside properties along Grange Road and Anchor Road to the north of the A17 during construction. *Moderate* effects on boundary vegetation to the substation site and locally isolated views of the substation from Rose Hall Farm would occur in the short term, but would ease as the mitigation planting matured.

7.3.81 The nature of the onshore development, however, being fairly isolated and largely underground, means that the landscape and visual effects arising from the proposed works, with the exception of those arising from the construction of new substations at Walpole, would be largely temporary in nature. The separate but related substations would not, however, create any significant effect on the existing industrial built characteristics of the power station site and both landscape and visual effects would generally be *negligible* in the long term after construction. All vegetated or open areas that would be disturbed would be reinstated to ensure no net residual effect upon either the landscape resource or the visual environment. Furthermore, the work connected with the underground cable route would be substantially reversible after construction and there would be *no* significant residual effect.

7.3.82 The nature, scale and duration of the three separate, but related, developments, however, all combine to make the proposals more acceptable in both visual and landscape terms. It is therefore considered that the overall nature of the effect would be generally neutral from the majority of landscape areas and viewpoints, given that the development is either underground or an addition to an existing industrial feature. The nature of the effect would however be slightly adverse from the closest receptors to the cable corridor and substation. From these areas the effects would remain until after the successful establishment of landscape mitigation proposals, when the effect is generally anticipated to be neutral.

7.3.83 The inevitable effects arising from the proposed developments will also be substantially reversible and, in the medium to longer term, they are anticipated to leave *no* net residual effect upon either the landscape resource or the visual environment.

7.4 Socioeconomics and Tourism

Introduction

7.4.1 This chapter assesses the potential direct and indirect impacts on socioeconomic factors of the proposed onshore works for the Lincs, Docking Shoal and Race Bank offshore wind farms.

7.4.2 Potential impacts arising from the proposed developments are identified and assessed according to the methods identified below, which take account of both the sensitivity of economic, recreational and tourism features of the area and the likely magnitude of effects. Potential impacts arising from the construction, operation and decommissioning of the onshore cables and substations for each of the wind farms are considered. Cumulative effects arising from the construction of all three wind farms and other relevant projects are also considered.

7.4.3 Where potentially significant effects are predicted appropriate mitigation is proposed.

Assessment Of Potential Impacts

7.4.4 When making an assessment of significance the magnitude of change and the importance or sensitivity of the receptor has been taken into account as indicated in Table 7.17.

Table 7.17 | **Examples of the sensitivity of receptors**

Receptor sensitivity	Description
high	assisted areas tourist attractions of regional or natural importance national trails or footpaths
medium	surrounding settlement regional footpaths and recreational routes commercial or other businesses, including shops and services local tourist attractions areas of particular value for rural amenity
low	local footpaths rural agricultural areas

7.4.5 The magnitude of potential changes arising from the proposed developments is evaluated as indicated in Table 7.18. Changes can be either adverse or beneficial.

Table 7.18 | **Magnitude of changes**

Magnitude	Description
major	substantial changes to economic, recreational or tourism opportunities; substantial permanent social or cultural impacts changes well outside the range of natural variation, from which unassisted recovery could be protracted
moderate	moderate changes to economic, recreational or tourism opportunities; medium-term social or cultural impacts potential for recovery within several years without intervention
minor	minor changes to the economy; moderate social or cultural impacts changes that might be noticeable but only temporarily
negligible	changes unlikely to be noticeable

7.4.6 The significance of impacts is assessed in accordance with Table 7.19. Impacts of major and moderate significance would be those that result in substantial changes in the national or regional economy, recreational or tourism opportunities, and are therefore considered to be significant in EIA terms. Impact can be adverse or beneficial depending on the direction of change.

Table 7.19 | **Significance of potential impacts**

Sensitivity	Magnitude			
	major	moderate	minor	negligible
high	*major*	*major*	*moderate*	*low*
medium	*major*	*moderate*	*low*	*low*
low	*low*	*low*	*negligible*	*negligible*

Potential Construction Effects

Economic Activity

7.4.7 The installation of cables and the construction of the substations are not considered likely to have an adverse effect on the local economy. Construction activities would be temporary, with the majority of foundation works completed on the substation in the first year, and cable installation and connection completed over subsequent years (duration would be approximately one year per wind farm).

7.4.8 Construction activities would be localised and would be unlikely to impact any existing businesses adversely. There is the potential for minor disruption to agricultural activities while cable trenches are excavated and onshore circuits are installed. These effects would, however, be localised (restricted to the cable route) and temporary (affecting the same section of route over three consecutive years). As agricultural land is considered to be a receptor of low sensitivity and steps would be taken to ensure that necessary access to agricultural land is maintained throughout the construction period, it is considered that the impacts of construction would be of negligible magnitude and, therefore, of *negligible* significance for the Lincs, Docking Shoal and Race Bank developments.

7.4.9 During the construction phase specialist contractors would be employed. The equipment installed would be of a similar type to the existing equipment, and chosen with a view to minimising the environmental impact of the development. Periodic checking and maintenance of the substation and cables would be undertaken during the lifetime of the scheme by specialist staff, who would not necessarily be locally based. This is expected to be a benefit of negligible magnitude on a feature of medium sensitivity, which implies a beneficial impact of *negligible* significance for the Lincs, Docking Shoal and Race Bank proposals.

Tourism and Recreation

7.4.10 Construction activity would affect one stretch of public footpath (to the east of Wingland Grange), probably requiring temporary closure for a period of several weeks during each of the three years of cable installation. Other major public rights of way, including the Nene Way and the two cycle routes in the region, would not be directly affected by construction activities (Figure 6.7).

7.4.11 The decision to cross the seawall using a horizontal directional drilling (HDD) technique (see Chapter 5) also ensures that neither the Peter Scott Walk nor the salt

marsh habitats (see Section 7.6) within the Wash National Nature Reserve (NNR), which form the key coastal tourism destinations in this area, would be directly affected by construction activities.

7.4.12 The HDD rig used to drill beneath the seawall would be established immediately inshore of the landing point. Ducts for Lincs, Docking Shoal and Race Bank would be installed in a single operation. It is expected that the use of this equipment would cause temporary noise disturbance to users of the Peter Scott Walk. Noise generated by the drilling equipment is anticipated to be no greater than 75 dB at 20 m and temporary; all drilling activities would be completed in a period of 60–74 days during the first year of construction when the Lincs cables would also be installed. Cable laying activities would also generate noise as identified in Section 7.5. Exposure at any one location to noise effects would be temporary (a matter of days for each circuit) due to the rapidity of the installation process. The potential impact during the first year is, therefore, considered to be of minor magnitude. An impact of minor magnitude on the Peter Scott Walk, a feature of medium sensitivity, implies an adverse impact of *low* significance for the Lincs proposal.

7.4.13 During subsequent years when the onshore cables for Docking Shoal and Race Bank would be installed there would be no further drilling at the seawall, and disturbance impacts on the Peter Scott Walk would be restricted to temporary works associated with cable laying. Due to the very short duration of these activities at this location, the magnitude of the potential impact is considered to be negligible. An impact of negligible magnitude on the Peter Scott Walk, a feature of *medium* sensitivity, implies an adverse impact of low significance for the Docking Shoal and Race Bank proposals.

Potential Operational Effects

7.4.14 The substations are located within a predominantly rural location with no identified features of economic, tourism or recreational importance nearby. As a consequence any adverse impacts arising from the operation of the substations for Lincs, Docking Shoal and Race Bank are expected to be *negligible* significance.

7.4.15 The substations would not require additional continuous maintenance and, therefore, there are limited local employment opportunities. Periodic maintenance would be undertaken by specialist contractors who might not be based in the local area or region. This is expected to be a beneficial impact of *negligible* significance for the Lincs, Docking Shoal and Race Bank proposals.

Potential Decommissioning Effects

7.4.16 The potential effects of decommissioning are considered to be the same as those identified for construction.

Mitigation

7.4.17 None is required.

Summary Of Residual Effects

7.4.18 Table 7.20 summarises the predicted impacts of the Lincs proposal, Table 7.21 summarises the predicted impacts of the Docking Shoal proposal, and Table 7.22 summarises the predicted impacts of the Race Bank proposal. It can be seen from these tables that all potential effects are considered to be of *low* or *negligible* significance.

Table 7.20 | **Summary of effects – Lincs**

Phase	Potential impact	Mitigation	Residual impact
construction	Negligible magnitude impact on the local economy and local businesses. Minor disruptions to agricultural activities are considered negligible, because the construction activities would be local and temporary, and because of the low sensitivity of agricultural land. Adverse impact: *negligible* significance. Negligible benefit with respect to local employment opportunities, as construction works would largely be undertaken by specialist contractors who might not be based within the local area or region. Beneficial impact: *negligible* significance. Negligible magnitude impact on tourism and recreational activities related to either the Peter Scott Walk or the salt marsh habitats within the Wash NNR, due to the method (Horizontal Directional Drilling) chosen for crossing the seawall. Although the Peter Scott Walk is considered to be of medium sensitivity, the short duration of works implies a negligible impact. Adverse impact: *low* significance.	none required	*low*
operation	Negligible impact on the local economy and local businesses, including agriculture. Adverse impact: *negligible* significance. No impact on tourism and recreational activities related to either the Peter Scott Walk or the salt marsh habitats within the Wash NNR. *No impact*. Negligible benefit with respect to local employment opportunities, as maintenance works would largely be undertaken by specialist contractors who might not be based within the local area or region. Beneficial impact: *negligible* significance.	none required	*negligible*
decommissioning	Negligible magnitude impact on the local economy and local businesses. Minor disruptions to agricultural activities are considered negligible, because the construction activities would be local and temporary, and because of the *low* sensitivity of agricultural land. Adverse impact: *negligible* significance. Negligible benefit with respect to local employment opportunities, as construction works would largely be undertaken by specialist contractors who might not be based within the local area or region. Beneficial impact: *negligible* significance.	none required	*negligible*

Table 7.21 | **Summary of effects – Docking Shoal**

Phase	Potential impact	Mitigation	Residual impact
construction	Negligible magnitude impact on the local economy and local businesses. Minor disruptions to agricultural activities are considered negligible, because the construction activities would be local and temporary, and because of the low sensitivity of agricultural land. Adverse impact: *negligible* significance. Negligible benefit with respect to local employment opportunities, as construction works would largely be undertaken by specialist contractors who might not be based within the local area or region. Beneficial impact: *negligible* significance. Negligible magnitude impact on tourism and recreational activities related to either the Peter Scott Walk or the salt marsh habitats within the Wash NNR, due to the method (Horizontal Directional Drilling) chosen for crossing the seawall. Although the Peter Scott Walk is considered to be of medium sensitivity, the short duration of works implies a negligible impact. Adverse impact: *low* significance.	none required	*low*
operation	Negligible impact on the local economy and local businesses, including agriculture. Adverse impact: *negligible* significance. No impact on tourism and recreational activities related to either the Peter Scott Walk or the salt marsh habitats within the Wash NNR. *No impact*. Negligible benefit with respect to local employment opportunities, as maintenance works would largely be undertaken by specialist contractors who might not be based within the local area or region. Beneficial impact: *negligible* significance.	none required	*negligible*
decommissioning	Negligible magnitude impact on the local economy and local businesses. Minor disruptions to agricultural activities are considered negligible, because the construction activities would be local and temporary, and because of the low sensitivity of agricultural land. Adverse impact: *negligible* significance. Negligible benefit with respect to local employment opportunities, as construction works would largely be undertaken by specialist contractors who might not be based within the local area or region. Beneficial impact: *negligible* significance.	none required	*negligible*

Table7.22 | **Summary of effects – Race Bank**

Phase	Potential impact	Mitigation	Residual impact
construction	Negligible magnitude impact on the local economy and local businesses. Minor disruptions to agricultural activities are considered negligible, because the construction activities would be local and temporary, and because of the low sensitivity of agricultural land. Adverse impact: *negligible* significance. Negligible benefit with respect to local employment opportunities, as construction works would largely be undertaken by specialist contractors who might not be based within the local area or region. Beneficial impact: *negligible* significance. Negligible magnitude impact on tourism and recreational activities related to either the Peter Scott Walk or the salt marsh habitats within the Wash NNR, due to the method (Horizontal Directional Drilling) chosen for crossing the seawall. Although the Peter Scott Walk is considered to be of *medium* sensitivity, the short duration of works implies a negligible impact. Adverse impact: *low* significance.	none required	*low*
operation	Negligible impact on the local economy and local businesses, including agriculture. Adverse impact: *negligible* significance. No impact on tourism and recreational activities related to either the Peter Scott Walk or the salt marsh habitats within the Wash NNR. *No impact*. Negligible benefit with respect to local employment opportunities, as maintenance works would largely be undertaken by specialist contractors who might not be based within the local area or region. Beneficial impact: *negligible* significance.	none required	*negligible*
decommissioning	Negligible magnitude impact on the local economy and local businesses. Minor disruptions to agricultural activities are considered negligible, because the construction activities would be local and temporary, and because of the low sensitivity of agricultural land. Adverse impact: *negligible* significance. Negligible benefit with respect to local employment opportunities, as construction works would largely be undertaken by specialist contractors who might not be based within the local area or region. Beneficial impact: *negligible* significance.	none required	*negligible*

Cumulative Effects

7.4.19 The decision to cross the seawall using the HDD technique as a single operation for all three wind farms ensures that disturbance to the Peter Scott Walk arising from this activity would be restricted to a a period of approximately six months. This potential impact is already assessed as being of low significance. No additional cumulative impacts are expected to arise with respect to other construction activities which would take place sequentially over three consecutive years.

7.4.20 No additional cumulative impacts are expected to arise with respect to the operation of the three substations.

7.4.21 No additional cumulative impacts are expected to arise with respect to the construction and operation of National Grid's works at Walpole Marsh substation or the extension of Sutton Bridge Power Station.

Conclusion

7.4.22 The potential effects on local businesses, tourism, and recreational activities during the construction, operation and decommissioning of onshore circuits and substations are considered to be of either *low* or *negligible* significance.

7.5 Noise

Introduction

7.5.1 This chapter assesses the potential direct and indirect impacts of the proposed onshore works for the Lincs, Docking Shoal and Race Bank offshore wind farms on the noise environment.

7.5.2 Potential impacts arising from the proposed developments are identified and assessed according to the methods identified below. Potential impacts arising from the construction, operation and decommissioning of the onshore cables and substations for each of the wind farms are considered. Cumulative effects arising from the construction of all three wind farms and other relevant projects are also considered.

7.5.3 Where potentially significant effects are predicted appropriate mitigation is proposed.

7.5.4 For explanation of the technical terms used in the following assessment, see the guidance given under the introduction to Section 6.5, paragraph 6.5.1.

Assessment of Potential Impacts

Significance Criteria – Construction Phase

7.5.5 In order to assess the significance of any short-term noise impact from the construction phase of the proposed developments the expected noise levels at each of the receptor locations (see below for selection of sensitive receptors) have been calculated and compared to existing noise levels.

7.5.6 Calculations forming the basis of this assessment have been undertaken in accordance with the requirements and methodology of BS 5228 Part 1 (BSI 1999a).

7.5.7 Since there are no set standards for the definition of the significance of construction noise effects, the assessment of whether changes in noise levels due to construction are significant will be dependent on the absolute levels of ambient and construction noise, as well as the magnitude, duration and time of occurrence. It is considered that a combination of absolute noise levels and noise levels relative to the existing ambient level can be used to determine the degree of the construction noise impact. Predicted construction noise levels are, therefore, compared to the values in Table 7.23 to determine the significance of potential noise effects.

Table 7.23 | **Criteria for assessing the significance of construction noise effects (all values dB L_{Aeq})**

Assessment period	Significance of impact			
	major	*moderate*	*minor*	*negligible*
night	>50	45–50	40–45	<40
evening	>62	57–62	<57	ambient noise level +3 dB
weekdays	>72	67–72	<67	

Significance Criteria – Operational Phase

7.5.8 There will be *no* impacts arising from the operation of the onshore cables. Operation of the substations for the wind farms has the potential to increase existing background noise levels (L_{A90}) during the day and at night (as they will operate continuously). In addition, operation may affect ambient noise levels (L_{Aeq}).

7.5.9 Potential impacts arising from these changes are assessed according to the semantic scale in Table 7.24.

7.5.10 This scale is frequently implemented by the use of semantic descriptors associated with noise change bands and has a basis in accepted approaches to the assessment of noise impacts, including, for example, the Department of Transport document *Design Manual for Roads and Bridges* (DMRB) (DfT 2004) and its precursor the *Manual of Environmental Appraisal for Trunk Road Assessments* (MEA) (DfT 1983).

This approach has been used in the UK over the last 10 years in the assessment of road traffic schemes and is based on the premise that subjective response to noise from a new source is proportional to the change in overall noise level.

7.5.11 According to this scheme an increase of 3 dB, occurring when acoustic energy due to the proposed development is equal to the baseline ambient noise level, would result in an impact magnitude described as 'slight'. It is often considered useful to categorise the degree of impact according to the extent of the predicted noise change. Impacts of moderate or major significance are considered to be significant in EIA terms

Table 7.24 | **Semantic scale for describing noise change arising from substation operation**

Predicted noise change	Magnitude of change	Significance
decrease of more than 3 dB	significant decrease	*negligible*
decrease or increase of less than 3 dB	no significant change	*negligible*
increase of 3–5 dB	minor increase	*minor*
increase of 6–10 dB	moderate increase	*moderate*
increase of more than 10 dB	substantial increase	*major*

Sensitive Receptors and Assumptions

Selection of Sensitive Receptors

7.5.12 Following collection of the baseline data, four receptors were selected for detailed construction and operational noise impact assessment (the locations of these are shown in Figure 6.8):

- the receptors closest to the proposed substation (Holmleigh House and White House Farm)
- the receptor with the lowest existing background level (5 Kamarad Cottages)
- the receptor closest to the line of construction (Nursery Farm, Marsh Road)

7.5.13 Holmleigh House and White House Farm are potentially affected by noise generated during cable-laying activities and the construction and operation of the substation.

7.5.14 5 Kamarad Cottages and Nursery Farm are only potentially affected by cable-laying activities.

7.5.15 As these are the properties closest to the noise sources an assessment of the effects on them is considered to represent an appropriate worst-case scenario. Any mitigation implemented to reduce noise effects at these properties will be more than sufficient to offset potential effects at more distant receptors.

Assumptions for the Construction Programme

7.5.16 It is envisaged that the onshore works will be undertaken over a three-year period (as described in Chapter 5). The key elements of the construction programme relevant to this assessment are:

- year 1 – Lincs
  - construction of up to ten ducts through the seawall (two for the Lincs project; four for Docking Shoal and Race Bank)
  - laying of two cable circuits between the seawall and the Lincs substation
  - all groundworks associated with the Lincs substation, Docking Shoal substation and Race Bank substation
  - installation of the Lincs substation electrical plant
- year 2 – Docking Shoal
  - installation of four cable circuits between the seawall and the Docking Shoal substation
  - installation of the Docking Shoal electrical plant
- year 3 – Race Bank
  - installation of four cable circuits between the seawall and the Race Bank substation
  - installation of the Race Bank electrical plant

7.5.17 Assumptions about the noise levels of the equipment used in this assessment are detailed in Part 5. These values are derived from the database within BS 5228: Part 1: 1999 (BSI 1999a).

7.5.18 For the purposes of this assessment the indicative construction programme indicated in figures 5.20 and 5.21 (Chapter 5) has been assumed.

7.5.19 The construction operations are proposed to be undertaken within daytime hours only, which is assumed to be between 07.00 and 19.00 hours, Monday–Saturday.

7.5.20 Onshore cables will be laid from the landfall points to their connection points at Walpole Marsh substation. Along this route there are several minor roads and one main road (the A17) as well as ditches and sea defence walls which will need to be crossed. The depth of burial beneath these features varies as summarised in Table 7.25.

Table 7.25 | **Burial of cable and special considerations**

Location	Depth of buried cable	Special consideration
direct buried in farmland	1,250 mm	cable needs to be buried deep enough to prevent damage during field ploughing
direct buried in public roads	1,100 mm	in accordance with UK standards
under seawalls and ditches	1,500–5,000 mm	cables would be pulled into pre-installed ducts using directional drilling
under major roads, ie A17	2,000 mm	cables could be installed into ducts; this could be done using hand excavation in the vicinity of drainage pipes

7.5.21 It is assumed, in the calculations of the noise levels arising from the installation of onshore cables, that the following machinery is used: compacter rammer, wheeled excavator or loader, chip spreader, low loader, tracked crane (moving), trenching machine, tracked excavator, water pump, tipper lorry, tracked pneumatic directional rock drill, lorry, 5 kV generator, dumper, compressor, truck mixer, lorry-mounted concrete pump and tracked loader. Typical plant required for the construction of the substation would include: 360° excavators, articulated dumper trucks, crawler dozers, compaction plant, tracked excavators and cranes.

7.5.22 Sound pressure level information for all of the above plant has been derived from BS 5228: Part 1 (BSI 1999a).

7.5.23 For the purpose of this assessment, all the equipment is assumed to be working 100 per cent of the time for the duration of the assessment period. Calculations have been undertaken with all works at their closest approach to each of the receptors for the entire duration of the assessment period, thus giving an absolute worst-case scenario.

Groundborne Vibration

7.5.24 Within the scope of the substation construction works it may be necessary, in some locations, to undertake a form of piling to consolidate the ground and aid founding onto a competent horizon.

7.5.25 Should this be a requirement the continuous flight auger (CFA) piling technique would be employed. In this approach an auger is used to drill a bore of the required diameter. As the auger is removed cement or lime would be injected into the base of the auger creating a supporting column.

7.5.26 The process creates no significant vibration (unlike, for example, an impact hammer) and no groundborne vibration impacts are, therefore, predicted.

Assumptions for the Operational Phase of the Development

7.5.27 The substations will house three main noise sources: transformers, coolers and static var compensators (SVCs).

7.5.28 The noise associated with the SVCs (inclusive of the coolers) will not exceed that allowed within the National Grid document *NGTS 2.18* (National Grid 2003), of 84.5 dB(A) (56.5 dB(A) at 10 m) and these values have, therefore, been used as a worst case.

7.5.29 With regard to the transformers, sound power level is expected to be no greater than 91 dB(A) (63 dB(A) at 10 m).

7.5.30 It is assumed that SVC compounds and transformers (and coolers) will be enclosed within concrete blast walls of 7 m and 5–7 m respectively. The acoustic performance of this blast wall has been calculated to be approximately 18.5 dB(A) when calculated using the methodology of BS 5228 through each of the frequency bands 125 Hz to 4 KHz.

7.5.31 Furthermore, within the scope of the assessment undertaken, the BS 4142 (1997a) +5 dB(A) character correction has been included within the calculations to take account of any tonal qualities associated with the noise from the operational plant within the substation.

7.5.32 Details of the noise levels and type of equipment used are summarised in Appendix A2.6.

Cumulative Effects

7.5.33 The impact of construction-generated noise associated with the proposed onshore works for each of the three wind farms is assessed individually and cumulatively.

7.5.34 In addition, information has been obtained on the likely noise impacts arising from National Grid's proposed works at Walpole Marsh substation (see Appendix A2.14) and considered in this assessment where appropriate.

Assessment of Potential Effects

Potential Construction Effects

Potential Construction Effects: Holmleigh House

7.5.35 Holmleigh House is potentially affected by noise generated during cable laying and substation construction works; hence both have been assessed.

7.5.36 The potential impact on Holmleigh House of noise arising from works proposed at Walpole Marsh substation by National Grid has been assessed (see Appendix A2.14). A maximum noise level of 60.8 dB(A) is predicted, associated with the activity 'site preparation for contractor accommodation'.

7.5.37 As National Grid's works are likely to take place in the same year as cable installation and substation construction works for Lincs, the potential cumulative impact has been considered in Table 7.26. No cumulative effects arising from National Grid's proposed works are predicted for works undertaken in subsequent years for Docking Shoal and Race Bank. In Table 7.26, therefore, the noise impacts are presented for these alone. These noise levels are based upon noise source data contained in BS 5228 and are considered to be the absolute worst case.

Table 7.26 | **Summary of indicative construction noise levels (all $L_{Aeq\ 12h}$(dB)) at Holmleigh House**

Stage	Works	Lincs alone	Lincs combined with National Grid works	Docking Shoal	Race Bank
Construction activities associated with cable installation					
1	construction or removal of haul road	58	62.6	58	58
2	transportation of cables	57	62.3	57	57
3	trench building – including under roads	60	63.4	60	60
4	cable joining	48	61.0	48	48
5	backfilling trenches	56	62.0	56	56
Activities associated with substation construction					
1	establish site and access (including contractors' compound)	59	63.0	59	59
2	ground improvement	60	63.4	–	–
3	site levelling	56	62.0	–	–
4	installation of Lincs electrical plant	52	61.3	–	–
5	installation of Docking Shoal electrical plant	–	–	52	–
6	installation of Race Bank electrical plant	–	–	–	52

7.5.38 The highest noise level, 60 dB $L_{Aeq,12\ h}$, is predicted for 'ground improvement works'. This level is in the order of 5 dB above the existing measured daytime L_{Aeq12h} at the location. During the first year of construction this activity could occur at the same time as the 'site preparation for contractor accommodation' activity undertaken by National Grid. A worst-case assessment of these cumulative effects predicts a noise level increase of approximately 63 dB(A).

7.5.39 During years 2 and 3 when onshore components of the Docking Shoal and Race Bank wind farms are installed no cumulative construction effects are predicted and the highest noise level is, therefore, 60 dB $L_{Aeq\ 12h}$.

The predicted noise levels at the property from each of the detailed stages of the construction programme have been further compared with the semantic impact significance rating scheme as defined within Table 7.24. The indicative significance ratings for each of the stages of the construction program are as detailed in Table 7.27.

Table 7.27 | **Summary of significance ratings for construction noise for Holmleigh House**

Stage	Works	Lincs alone	Lincs combined with National Grid works	Docking Shoal	Race Bank
Construction activities associated with cable installation					
1	construction or removal of haul road	*negligible*	*minor*	*negligible*	*negligible*
2	transportation of cables	*negligible*	*minor*	*negligible*	*negligible*
3	trench building – including under roads	*minor*	*minor*	*minor*	*minor*
4	cable joining	*negligible*	*minor*	*negligible*	*negligible*
5	backfilling trenches	*negligible*	*minor*	*negligible*	*negligible*
Activities associated with substation construction					
1	establish site and access (including contractors' compound)	*minor*	*minor*	*minor*	*minor*
2	ground improvement	*minor*	*minor*	N/A	N/A
3	site levelling	*negligible*	*minor*	N/A	N/A
4	installation of Lincs electrical plant	*negligible*	*minor*	N/A	N/A
5	installation of Docking Shoal electrical plant	N/A	N/A	*negligible*	N/A
6	installation of Race Bank electrical plant	N/A	N/A	N/A	*negligible*

7.5.40 The majority of the works will be of *negligible* significance with only the trench building, site establishment and ground improvement works being classified as of *minor* significance. These are therefore considered to be acceptable with regard to construction noise impacts when compared with the rating scheme shown in Table 7.24.

7.5.41 During year 1, when construction operations for Lincs are considered together with construction activities being undertaken by National Grid, the significance of these impacts is cumulatively assessed as of *minor* significance. This is considered to be acceptable with regard to construction noise impacts when compared with the rating scheme shown in Table 7.24.

Potential Construction Effects: White House Farm

7.5.42 White House Farm is potentially affected by noise generated during cable-laying and substation construction works; hence both have been assessed.

7.5.43 The potential impact on White House Farm of noise arising from works proposed at Walpole Marsh substation by National Grid has been assessed (see Appendix A2.14). A maximum noise level of 63.2 dB(A) is predicted, associated with the activity 'site preparation for contractor accommodation'.

7.5.44 As National Grid's works are likely to take place in the same year as cable installation and substation construction works for Lincs, the potential cumulative impact has been considered in Table 7.28. No cumulative effects arising from National Grid's proposed works are predicted for works undertaken in subsequent years for Docking Shoal and Race Bank. In Table 7.28, therefore, the noise impacts are presented for these alone. These noise levels are based upon noise source data contained in BS 5228 and are considered to be the absolute worst case.

Table 7.28 | **Summary of indicative construction noise levels (all $L_{Aeq\ 12h}$(dB)) at White House Farm**

Stage	Works	Lincs alone	Lincs combined with National Grid works	Docking Shoal	Race Bank
Construction activities associated with cable installation					
1	construction or removal of haul road	66	67.8	66	66
2	transportation of cables	68	69.2	68	68
3	trench building – including under roads	73	73.4	73	73
4	cable joining	57	64.1	57	57
5	backfilling trenches	64	66.6	64	64
Activities associated with substation construction					
1	establish site and access (including contractors' compound)	55	63.8	55	55
2	ground improvement	56	64.0	–	–
3	site levelling	52	63.5	–	–
4	installation of Lincs electrical plant	49	63.4	–	–
5	installation of Docking Shoal electrical plant	–	–	49	–
6	installation of Race Bank electrical plant	–	–	–	49

7.5.45 The highest noise level during cable laying, 73 dB $L_{Aeq,12\ h}$, is predicted for activities associated with trench building. During the first year of construction this activity could occur at the same time as the 'site preparation for contractor accommodation' activity undertaken by National Grid. A worst-case assessment of these cumulative effects predicts a noise level of approximately 73.4 dB(A).

7.5.46 The highest noise levels during substation construction will be 56.3 dB $L_{Aeq\ 12h}$. This level is some –0.3 dB below the measured $L_{Aeq\ 12h}$of the location. Including noise arising from National Grid's construction activities this value is predicted, as a very worst case, to rise to 64.0 dB(A).

7.5.47 During years 2 and 3 when onshore components of the Docking Shoal and Race Bank wind farms are installed no cumulative construction effects are predicted and the highest noise level is, therefore, 73 dB $L_{Aeq\ 12h}$.

7.5.48 The predicted noise levels at the property from each of the detailed stages of the construction programme have been further compared with the semantic impact significance rating scheme as defined in Table 7.24. The indicative significance ratings for each of the stages of the construction program are as detailed in Table 7.29.

Table 7.29 | **Summary of significance ratings for construction noise for White House Farm**

Stage	Works	Lincs alone	Lincs combined with National Grid works	Docking Shoal	Race Bank
Construction activities associated with cable installation					
1	construction or removal of haul road	*minor*	*moderate*	*minor*	*minor*
2	transportation of cables	*minor*	*moderate*	*minor*	*minor*
3	trench building – including under roads	*major*	*major*	*major*	*major*
4	cable joining	*negligible*	*minor*	*negligible*	*negligible*
5	backfilling trenches	*minor*	*minor*	*minor*	*minor*
Activities associated with substation construction					
1	establish site and access (including contractors' compound)	*negligible*	*minor*	*negligible*	*negligible*
2	ground improvement	*negligible*	*minor*	N/A	N/A
3	site levelling	*negligible*	*minor*	N/A	N/A
4	installation of Lincs electrical plant	*negligible*	*minor*	N/A	N/A
5	installation of Docking Shoal electrical plant	N/A	N/A	*negligible*	N/A
6	installation of Race Bank electrical plant	N/A	N/A	N/A	*negligible*

7.5.49 The majority of the works will be of *negligible* or *minor* significance, but the trench-building operations are assessed as having *major* significance as a result of assumed relatively small separation distances.

7.5.50 The assessment of noise impacts is based on a worst-case scenario that mechanical equipment is operating 100 per cent of the time at the closest approach to the receptor. In practice equipment will be used intermittently and the time for which works will take place adjacent to the property will be very short (a matter of days).

Potential Construction Effects: Nursery Farm

7.5.51 As Nursery Farm is located further than 300 m from the proposed location of the substations it is considered that there will be *no impact* on this sensitive receiver arising from substation construction works for any of the wind farms. Nor will there be cumulative effects arising from construction works proposed to be undertaken by National Grid. In this case, therefore, only potential impacts arising from cable installation have been considered.

7.5.52 Cable-laying activities for the three wind farms will all take place within a corridor of approximately 50 m. It is assumed for the purposes of this assessment that the source of noise for this sensitive receiver will be approximately 30 m from the closest facade of Nursery Farm.

7.5.53 Table 7.30 summarises the impacts of the varying stages of the cable-laying operations at their closest approach to the residential property.

Table 7.30 | **Summary of indicative construction noise levels (all $L_{Aeq\ 12h}$(dB)) at Nursery Farm**

Stage	Works	Lincs	Docking Shoal	Race Bank
Construction activities associated with cable installation				
1	construction or removal of haul road	76	76	76
2	transportation of cables	78	78	78
3	trench building – including under roads	83	83	83
4	cable joining	67	67	67
5	backfilling trenches	75	75	75

7.5.54 Table 7.30 indicates that trench building has the potential to cause the greatest disruption at Nursery Farm, with a predicted noise level of 83 dB $L_{Aeq\ 12h}$. This would exceed the existing daytime measured $L_{Aeq\ 12h}$ by 29 dB.

7.5.55 Although the construction activities are relatively short term, Table 7.31 indicates that these noise levels are assessed as being of *major* significance during each individual stage of the construction operations, based on the scheme presented in Table 7.24. It should be noted, however, that the assessment is based on worst-case assumptions about the operation of machinery. In addition, it should also be noted that the assessment is based on peak predicted noise levels. These conditions will only be experienced for a short period (a matter of days), during which construction activities associated with cable laying occur close to the property.

Table 7.31 | **Summary of significance ratings for construction noise at Nursery Farm**

Stage	Works	Lincs	Docking Shoal	Race Bank
Construction activities associated with cable installation				
1	construction or removal of haul road	*major*	*major*	*major*
2	transportation of cables	*major*	*major*	*major*
3	trench building – including under roads	*major*	*major*	*major*
4	cable joining	*minor*	*minor*	*minor*
5	backfilling trenches	*major*	*major*	*major*

Potential Construction Effects: 5 Kamarad Cottages

7.5.56 As 5 Kamarad Cottages is located approximately 9 km from the proposed location of the substations it is considered that there will be *no impact* on this sensitive receiver arising from substation construction works for any of the wind farms. Nor will there be cumulative effects arising from construction works proposed to be undertaken by National Grid. In this case, therefore, only potential impacts arising from cable installation have been considered.

7.5.57 This property has the lowest ambient noise levels of the sensitive receptors considered and as the route of the cable corridor will pass the property at a distance of approximately 300 m, the potential impacts of cable-laying activities have been assessed on this property.

7.5.58 Table 7.32 indicates the noise levels predicted to affect 5 Kamarad Cottages as a result of the various stages of the cable-laying operations.

Table 7.32 | **Summary of indicative construction noise levels at 5 Kamarad Cottages**

Stage	Works	Lincs	Docking Shoal	Race Bank
Construction activities associated with cable installation				
1	construction or removal of haul road	51	51	51
2	transportation of cables	53	53	53
3	trench building – including under roads	60	60	60
4	cable joining	42	42	42
5	backfilling trenches	50	50	50

7.5.59 As with the other receptors, the stage of works likely to cause the greatest noise impact is the insertion of the cables. At their closest approach the cable laying operations will result in a predicted worst-case noise level of 60.0 dB $L_{Aeq,12\,h}$. This is 8.7 dB above the existing daytime $L_{Aeq\ 12h}$ of the location.

7.5.60 Table 7.33 shows that there will be a *negligible* impact at each stage of the construction operations assessed, with the exception of stage 3 where a *minor* impact is predicted.

Table 7.33 | **Summary of significance ratings for construction noise at 5 Kamarad Cottages**

Stage	Works	Lincs	Docking Shoal	Race Bank
Construction activities associated with cable installation				
1	construction or removal of haul road	*negligible*	*negligible*	*negligible*
2	transportation of cables	*negligible*	*negligible*	*negligible*
3	trench building – including under roads	*minor*	*minor*	*minor*
4	cable joining	*negligible*	*negligible*	*negligible*
5	backfilling trenches	*negligible*	*negligible*	*negligible*

Potential Operational Effects

7.5.61 The new substations are proposed to be in continuous operation at a constant output level; therefore the impact has been assessed for the most sensitive receptors during the quietest parts of both the daytime and night-time periods.

7.5.62 The following operational scenarios have been considered with respect to background noise levels at relevant sensitive receptors:

- year 1 – Lincs 132 kV substation operating
- year 2 – Lincs and Docking Shoal 132 kV substations both operating
- year 3 – Lincs, Docking Shoal and Race Bank 132 kV substations all operating

7.5.63 The receptors used in the assessment of the operational impacts of the substations are Holmleigh House and White House Farm. Both of these properties are within 300 m of the proposed substation extension.

7.5.64 Modification to the existing substation at Walpole Marsh proposed by National Grid will not result in noise increases at either property (see Appendix A2.14) and as a consequence there will be no cumulative impacts with the operation of the three wind farm substations.

Operation Effects: Holmleigh House

External Noise Levels

7.5.65 Table 7.34 indicates the predicted noise levels at Holmleigh House arising from the operation of the wind farm substations.

Table 7.34 | **Summary of predicted operational noise levels at Holmleigh House**

Equipment	Sound pressure level at 10 m	Distance from receptor to piece of equipment	Distance correction (hard ground)	Barrier attenuation 7 m perimeter blast wall	Specific level (hard + barrier)	BS 4142 character correction	Rating level
year 1 – Lincs 132 kV substation							
transformer 1 – 132/400 kV	63.0	274	28.8	–18.5	15.7	5	20.7
SVC 1	56.5	231	27.3	–18.5	10.7	5	15.7
combined operational noise level							21.9
year 2 – Lincs and Docking Shoal 132 kV substations							
transformer 1 – 132/400 kV	63.0	274	28.8	–18.5	15.7	5	20.7
SVC 1	56.5	231	27.3	–18.5	10.7	5	15.7
transformer 2 – 132/400 kV	63.0	266	28.5	–18.5	16.0	5	21.0
SVC 2	56.5	269	28.6	–18.5	9.4	5	14.5
combined operational noise level							24.9
year 3 – Lincs, Docking Shoal and Race Bank 132 kV substations							
transformer 1 – 132/400 kV	63.0	274	28.8	–18.5	15.7	5	20.7
SVC 1	56.5	231	27.3	–18.5	10.7	5	15.7
transformer 2 – 132/400 kV	63.0	266	28.5	–18.5	16.0	5	21.0
SVC 2	56.5	269	28.6	–18.5	9.4	5	14.5
transformer 3 – 132/400 kV	63.0	262	28.4	–18.5	16.1	5	21.1
SVC 3	56.5	277	28.8	–18.5	9.2	5	14.2
combined operational noise level							26.7

7.5.66 These noise levels have been calculated assuming that the SVC compounds for each wind farm will be enclosed by a 7 m concrete blast wall and that transformers (and coolers) will be enclosed by a 5–7 m concrete blast wall.

7.5.67 The significance of potential impacts arising from these predicted noise levels is indicated in Table 7.35.

Table 7.35 | **Impact significance – Holmleigh House**

Period	Operation noise	Background daytime noise (12-hour L_{90})	Difference	Impact significance
Year 1 – Lincs 132 kV substation				
daytime	21.9	40.7	–18.8	*negligible*
night	21.9	34.0	–12.1	*negligible*
Year 2 – Lincs and Docking Shoal 132 kV substations				
daytime	24.9	40.7	–15.8	*negligible*
night	24.9	34.0	–9.1	*negligible*
Year 3 – Lincs, Docking Shoal and Race Bank 132 kV substations				
daytime	26.7	40.7	–14.0	*negligible*
night	26.7	34.0	–7.3	*negligible*

7.5.68 It can be seen that the impact of operational noise levels is negligible for each wind farm either alone or cumulatively, during daytime and night.

Internal Noise Levels

7.5.69 At night it is considered, however, that internal bedroom noise levels would take precedence over external levels, as bedrooms would be the inhabited areas at this time. An assessment of internal noise levels within any room on the facade facing the site has been undertaken assuming the worst case that residents would have windows open for ventilation. Consequently a conservative reduction of –13 dB(A) (PPG 24 Annex 6) due to the facade attenuation has been used in calculations of noise levels.

7.5.70 The calculated internal noise level during each of years 1 to 3 is presented in Table 7.36.

Table 7.36 | **Predicted internal noise levels – Holmleigh House**

Period	Operation noise	Facade corrected level [1]	Reduction due to facade	Resulting predicted internal noise level from the substation
year 1 – Lincs 132 kV substation				
night	21.9	24.9	–13	11.9
year 2 – Lincs and Docking Shoal 132 kV substations				
night	24.9	27.9	–13	14.9
year 3 – Lincs, Docking Shoal and Race Bank 132 kV substations				
night	26.7	29.7	–13	16.7

[1] Facade correction of 3 dB(A) applied as detailed in PPG 24.

7.5.71 The results of the internal noise level predictions from the operation of the substations concludes that in all cases internal noise levels would be wholly within both the 'good' design range of BS 8233 (1999b) and the World Health Organisation overnight internal limit.

7.5.72 It is concluded, therefore, that no additional mitigation measures are required in addition to those already implemented within the design scheme of the substations to protect residential amenity at Holmleigh House.

Operation Effects: White House Farm

7.5.73 Table 7.37 indicates the predicted noise levels at White House Farm arising from the operation of the wind farm substations. These calculations are based on the assumptions outlined at paragraphs 7.5.8 to 7.5.11.

Table 7.37 | **Summary of predicted operational noise levels at White House Farm**

Equipment	Sound pressure level at 10 m	Distance from receptor to piece of equipment	Distance correction (hard ground)	Barrier attenuation 7 m perimeter blast wall	Specific level (hard + barrier)	BS 4142 character correction	Rating level
year 1 – Lincs 132 kV substation							
transformer 1 – 132/400 kV	63.0	341	30.7	–18.5	13.8	5	18.8
SVC 1	56.5	313	29.9	–18.5	8.1	5	13.1
combined operational noise level							19.8
year 2 – Lincs and Docking Shoal 132 kV substations							
transformer 1 – 132/400 kV	63.0	341	30.7	–18.5	13.8	5	18.8
SVC 1	56.5	313	29.9	–18.5	8.1	5	13.1
transformer 2 – 132/400 kV	63.0	353	31.0	–18.5	13.5	5	18.5
SVC 2	56.5	296	29.4	–18.5	8.6	5	13.6
combined operational noise level							22.8
year 3 – Lincs, Docking Shoal and Race Bank 132 kV substations							
transformer 1 – 132/400 kV	63.0	341	30.7	–18.5	13.8	5	18.8
SVC 1	56.5	313	29.9	–18.5	8.1	5	13.1
transformer 2 – 132/400 kV	63.0	353	31.0	–18.5	13.5	5	18.5
SVC 2	56.5	296	29.4	–18.5	8.6	5	13.6
transformer 3 – 132/400 kV	63.0	367	31.3	–18.5	13.2	5	18.2
SVC 3	56.5	364	31.2	–18.5	6.8	5	11.8
combined operational noise level							24.3

7.5.74 These noise levels have been calculated assuming that the SVC compounds for each wind farm will be enclosed by a 7 m concrete blast wall and that transformers (and coolers) will be enclosed by a 5–7 m concrete blast wall.

7.5.75 The significance of potential impacts arising from these predicted noise levels is indicated in Table 7.38.

Table 7.38 | **Impact significance – White House Farm**

Period	Operation noise	Background daytime noise (12-hour L_{90})	Difference	Impact significance
year 1 – Lincs 132 kV substation				
daytime	19.8	42.4	–22.6	negligible
night	19.8	31.2	–11.4	negligible
year 2 – Lincs and Docking Shoal 132 kV substations				
daytime	22.8	42.4	–19.6	negligible
night	22.8	31.2	–8.4	negligible
year 3 – Lincs, Docking Shoal and Race Bank 132 kV substations				
daytime	24.3	42.4	–18.1	negligible
night	24.3	31.2	–6.9	negligible

7.5.76 It can be seen that the impact of operational noise levels is negligible for each wind farm either alone or cumulatively during daytime and at night.

Internal Noise Levels

7.5.77 At night it is considered, however, that internal bedroom noise levels would take precedence over external levels, as bedrooms would be the inhabited areas at this time. An assessment of internal noise levels within any room on the facade facing the site has been undertaken assuming the worst case that residents would have windows open for ventilation. Consequently a conservative reduction of –13 dB(A) (PPG24 Annex 6) due to the facade attenuation has been utilised in calculations of noise levels.

Table 7.39 | **Predicted internal noise levels – White House Farm**

Period	Operation noise	Facade corrected level[1]	Reduction due to facade	Resulting predicted internal noise level from the substation
year 1 – Lincs 132 kV substation				
night	19.8	22.8	–13	9.8
year 2 – Lincs and Docking Shoal 132 kV substations				
night	22.8	25.8	–13	12.8
year 3 – Lincs, Docking Shoal and Race Bank 132 kV substations				
night	24.3	27.3	–13	14.3

[1] Facade correction of 3 dB(A) applied as detailed in PPG 24.

7.5.78 The results of the internal noise level predictions from the operation of the substations concludes that in all cases internal noise levels would be wholly within both the 'good' design range of BS 8233 and the World Health Organisation overnight internal limit.

7.5.79 It is concluded, therefore, that no additional mitigation measures are required in addition to those already implemented within the design scheme of the substations to protect residential amenity at White House Farm.

Mitigation

Construction Effects

7.5.80 Impacts at the specific identified receptors during the construction phase are expected to be of relatively short duration. During the construction period, however, short-term impacts of major significance might be anticipated at certain receptors when operations are at their worst-case closest approach.

7.5.81 In order to minimise impacts, 'best practicable means' will be employed during construction, including, for example:

- careful selection of working methods and programme
- selection of the quietest working equipment available, eg, if appropriate, electric or battery-powered equipment, which is generally quieter than petrol- or diesel-powered
- use of regularly maintained and appropriately silenced equipment
- shutting down of equipment when not in use, ie maintaining a 'no idling' policy
- positioning of equipment behind physical barriers, ie existing features, recently constructed structures, hoarding, etc.
- direction of noise emissions from plant including exhausts or engines away from sensitive locations
- handling all materials in a manner which minimises noise
- switching all audible warning systems to the minimum setting required by the Health and Safety Executive

7.5.82 A key way of reducing short-term construction noise is through the construction of temporary barriers between the noise source and receptor locations. This can be by means of either acoustic fencing or partitioning (density of 10 kgm^{-2} or higher) or temporary storage bunding using surplus material on site.

7.5.83 Care is needed in the design, siting and construction of any barrier if it is to be effective. On level sites, for maximum effectiveness, a barrier should be brought as close as possible to either the noise source or the receiving positions. In addition, there should be no gaps or openings within the barrier and it should be suitably high

and laterally continuous enough to screen the operations completely from view at the receptor location.

7.5.84 Furthermore, the preparation of an environmental management plan for reference throughout the construction phase would assist in identifying potential impacts, and provide specific mitigation measures where considered necessary.

Residual Effects

Construction Noise

7.5.85 BS5228: Pt2: 1997 *Guide to noise and vibration control legislation for construction and demolition including road construction and maintenance* states that with regard to noise control targets for construction works *"All reasonably practicable means should be employed to ensure the protection of local communities"*. The standard then goes on to state that the use of control measures as detailed within this chapter as these control measures. Therefore it is concluded that with the correct implementation and usage of these control measures the impact of the construction phase of the development would be controlled and reduced to within acceptable limits for short term operations.

7.5.86 It is reiterated that within the scope of the construction noise assessment calculations undertaken present an absolute worst case scenario. Within this scenario it is assumed that all plant and equipment would be operational for 100% of the assessment period at full power and at the absolute worst case closest approach separation distance. Therefore the data presented, as required within this type of assessment due to the complexities and variable nature of construction operations, is an instantaneous absolute worst case snapshot of construction noise which would only occur for a very minimal period during the entirety of the construction phase of the development. For the majority of the construction period, when construction plant is being operated at lower utilisation rates and/or at greater separation distances the resulting noise levels at the assessment locations would be reduced from the figures presented within this chapter.

Operational Noise

7.5.87 Prediction of noise levels at the closest residential receptors arising from the normal operation of the substations indicates that noise would be within acceptable levels and that no further mitigation is required.

Cumulative Impacts

7.5.88 This assessment of noise effects has taken into consideration the potential cumulative impacts arising from the construction of the onshore components of the three wind farms together. In addition, noise arising from the construction and operation of National Grid's proposed works at Walpole Marsh substation has been taken into consideration.

7.5.89 No further cumulative impacts are predicted due to the construction and operation of the proposed extension to Sutton Bridge power station.

Conclusions

7.5.90 Potential sources of noise during construction and operation of the onshore components of the proposed wind farm developments, alone and when considered together, have been identified.

7.5.91 The implementation of appropriate mitigation will ensure that temporary noise effects arising from construction activities can be maintained at acceptable levels. The design of the substations ensures that operational noise levels will not significantly increase the noise levels at the nearest residential receptors, and no further mitigation is required to address this issue.

7.5.92 As detailed within paragraphs 7.5.85 and 7.5.86 it is concluded that due to the extremely short term duration over which the worst case predicted noise levels may occur, and with the implementation of the detailed noise control techniques the noise levels from the construction operations associated with the onshore works for the Lincs, Docking Shoal and Race Bank wind farms could be effectively controlled to within acceptable levels.

7.6 Ecology and Nature Conservation

Introduction

7.6.1 This chapter assesses the potential direct and indirect impacts of the proposed onshore works of Lincs, Docking Shoal and Race Bank offshore wind farms on ecology and nature conservation.

7.6.2 Potential impacts arising from the proposed developments are identified and assessed according to the methods identified below, which take account of both the sensitivity of features of importance for nature conservation and the likely magnitude of effects. Potential impacts arising from the construction, operation and decommissioning of the onshore cables and substations for each of the wind farms are considered. Cumulative effects arising from the construction of all three wind farms and other relevant projects are also considered.

7.6.3 Where potentially significant effects are predicted, appropriate mitigation is proposed.

Assessment of Potential Impacts

7.6.4 The assessment method for this ecological assessment is based on guidance issued by the Institute of Ecology and Environmental Management.

7.6.5 The assessment focuses on the valued ecological receptors (VERs) identified in Section 6.6.

7.6.6 The likely effects of the proposed development during construction, operation and decommissioning, and the potential ecological impacts arising from them, are identified and characterised, taking into consideration the following parameters:

- *Positive or negative* – whether the effect will result in net loss or degradation of a VER or whether it will enhance or improve it.
- *Magnitude* – the size or intensity of the effect measured in relevant terms, eg number of individuals lost or gained, area of habitat lost or created, or the degree of change to existing conditions (eg noise or lighting levels).
- *Extent* – the spatial scope of the effect, eg the physical area affected or the geographical pattern of the effect.
- *Duration* – the length of time over which the effect occurs.
- *Reversibility* – the extent to which effects are reversible, either spontaneously or through active mitigation.
- *Timing and frequency* – consideration of the timing of events in relation to ecological change; some effects may be of greater significance if they take place at certain times of year (eg the breeding season). The extent to which an effect is repeated may also be of importance.

Magnitude of Potential Impacts

7.6.7 Ecological receptors are usually sites, habitats, species assemblages or communities, or populations or groups of a species. Effects can be permanent or temporary, direct or indirect, and can be cumulative. These factors are brought together to assess the magnitude of the impact on particular valued ecological receptors and, wherever possible, the magnitude of the impact is quantified. Professional judgement is then used to assign the effects on the receptors to one of four classes of magnitude, defined in Table 7.40.

Table 7.40 | **Definition of magnitude**

Magnitude	Definition
high	a permanent or long-term effect on the extent or size or integrity of a site, habitat, species assemblage or community, population or group. If adverse, this is likely to threaten its sustainability; if beneficial, this is likely to enhance its conservation status
medium	a permanent or long-term effect on the extent or size or integrity of a site, habitat, species assemblage or community, population or group. If adverse, this is unlikely to threaten its sustainability; if beneficial, this is likely to be sustainable but is unlikely to enhance its conservation status.
low	a permanent or long-term reversible effect on a site, habitat, species assemblage or community, population or group whose magnitude is detectable but will not threaten its integrity
negligible	a short-term but reversible effect on the extent or size or integrity of a site, habitat, species assemblage or community, population or group that is within the normal range of annual variation

7.6.8 Potential impacts are characterised initially in the absence of any mitigation, except where this is integral to the design of the development. Any additional mitigation or compensation proposed is identified and its likely effectiveness is assessed.

7.6.9 An indication of the confidence with which predictions of potential impacts are made is given.

Assessment of Impact Significance

7.6.10 The significance and scale of the predicted impacts on VERs arising from the identified effects of the proposed development, including designed-in and additional mitigation measures, are assessed. Significance is assessed as negative, positive or not significant.

Negative Effects

7.6.11 For habitat areas and species, a negative effect is considered to be significant if the favourable conservation status of a VER is compromised by the final design of the development. Conservation status is defined by the Institute of Ecology and Environmental Management (2006) as being:

- *Habitats* – 'conservation status is determined by the sum of the influences acting on the habitat and its typical species that may affect its long-term distribution, structure and functions, as well as the long-term survival of its typical species within a given geographical area'.
- *Species* – 'conservation status is determined by the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within a given geographical area'.

7.6.12 The decision as to whether the favourable conservation status of a VER is likely to be compromised is made using professional judgement based on an analysis of the predicted effects of the development (including consideration of the specific parameters outlined above).

7.6.13 A similar procedure is used for designated sites that are affected by the development, except that the focus is on the effects on the integrity of each site, defined as 'the coherence of ecological structure and function, across a site's whole area, that enable it to sustain the habitat, complex of habitats and/or levels of populations of species for which it was classified'. This assessment is made with reference to the features for which a site has been classified or notified, and involves combining assessments of the effects on the conservation status of each of these features.

7.6.14 For non-statutory sites, such features may not have been formally defined and will need to be agreed with the designating authority (eg local authority or county wildlife trust).

Positive Effects

7.6.15 An effect is considered to be significant if development activities cause:

- a non-valued ecological receptor to become valued;
- restoration of favourable conservation status for a habitat or species population;
- restoration of a site's integrity (where this has been undermined).

7.6.16 The significance of an effect is largely a product of the policy importance or sensitivity of the ecological receptor and the magnitude of the effect on it, moderated by the likelihood of the effect occurring and professional judgement. Table 7.41 illustrates a matrix that can be used for guidance of assessment of significance. Effects are considered to be of major or minor significance, or not significant.

Table 7.41 | **Impact significance**

Magnitude of impact	Value of receptor			
	negligible	low	medium	high
international	ns	*minor*	*major*	*major*
national	ns	*minor*	*major*	*major*
county	ns	ns	*minor*	*major*
local	ns	ns	ns	*minor*
less than local	ns	ns	ns	ns

ns = not significant

Assumptions

7.6.17 Details of the proposal, including installation methods, are provided in Chapter 5. For the purposes of this ecological impact assessment, we make the following assumptions about the construction, operation and decommissioning of the onshore section of the cable route and substation works:

- The assessment of the ecological impacts of the onshore components includes three related, but discrete, offshore wind farm projects: Lincs, Docking Shoal and Race Bank. These projects will share a landfall point, an onshore cable route and the site of a new 132 kV substation adjacent to the existing substation at Walpole Marsh.
- The assessment assumes that all three projects will be constructed and that, in all likelihood, this will take place over three consecutive years in the following order: Lincs, Docking Shoal and Race Bank, installed as separate, but methodologically similar, events. The majority of construction activities for the substation will take place in the first year. Activities in the second and third years will be minor and associated with the physical connection of cables, energisation of transformers, and so on.
- All onshore works will be carried out in accordance with legislative requirements and Environment Agency guidance. Adequate measures will be in place regarding the handling and storage of potentially hazardous substances (including fuels, oil and building materials), responses to spillages and provisions for surface water drainage, including interception of oil and sediment. Terrestrial machinery will be subject to the same level of control.

7.6.18 The assessment therefore considers the impact of:

- Lincs alone
- Docking Shoal in combination with Lincs
- Race Bank in combination with Lincs and Docking Shoal

Summary of Potential Effects

Construction

7.6.19 Construction activities, including cable installation above mean high water spring (MHWS) and substation works, may potentially cause:

- habitat loss
- habitat fragmentation
- disturbance to wildlife
- soil compaction, resulting in changes in flora and fauna
- pollution events

Operation

7.6.20 There are expected to be no operational effects of the buried cables. Operational effects of the substation potentially include:

- disturbance caused by noise of operation
- disturbance caused by site operation and management

7.6.21 The potential impacts of each of these effects is considered on designated sites, habitats and species in turn.

7.6.22 It is assumed that long-term strategies will be in place to reduce the risk of pollution and emissions during the operational lifetime of the substation and cables to acceptable levels. These potential effects are not considered further.

Decommissioning

7.6.23 It is considered unlikely that underground cables would be removed following decommissioning of the wind farms, and there are no plans to do so.

7.6.24 The onshore substation may continue to be used as a substation site after the original offshore wind farm has been decommissioned. It is possible that the substation will be upgraded for use in future offshore renewable developments.

7.6.25 In the event of decommissioning of the offshore works, the effects would be generally similar to those of construction.

Potential Effects of Construction

Designated Sites

7.6.26 No loss of habitat (temporary or otherwise) due to onshore works is anticipated for any designated site.

Habitats

Intact Species-Poor Hedges

7.6.27 The installation of onshore circuits will result in the loss of small sections of three intact species-poor hedge, one to the south of Grange Farm and adjacent to the substation, and two on the northern and southern boundaries of a field immediately south of French's Road.

7.6.28 It is expected that the loss of hedge for Lincs will be no more than the working width required for construction of the trench, haul road and topsoil storage, which is approximately 16 m.

7.6.29 As the hedges affected are isolated and do not form part of a network of hedgerows, no fragmentation is predicted. The effect of Lincs construction works on this habitat is therefore restricted to the direct loss of approximately 50 m of hedge (based on the loss of three sections of hedge of approximately 16 m length). This represents an impact of *negligible* magnitude.

7.6.30 The installation of circuits for Docking Shoal and Race Bank will take place within a combined corridor of approximately 32 m, resulting in a further loss of about 100 m of hedge. Although hedges are likely to recover in time (5–10 years in the absence of reinstatement works), it is unlikely that recovery of this habitat will be fully completed prior to the installation of Docking Shoal (and possibly Race Bank). The combined loss of hedge during the construction of all three projects will increase to approximately 150 m of hedge. This is still considered to be an impact of negligible magnitude, due to the low quality of the hedges affected and the relatively small length affected.

7.6.31 As the hedge affected is isolated and does not form part of a network of hedgerows, no fragmentation is predicted either for Lincs, Docking Shoal and Race Bank alone or together (although see assessment of potential impacts on foraging bats below).

7.6.32 Hedges are of value to other species, including birds and bats, and potential impacts on populations of these species groups arising from temporary hedge loss are considered separately below.

Species Populations

Non-Breeding Farmland Birds

7.6.33 Installation of onshore circuits for Lincs will result in the temporary loss of some habitats likely to be of importance for non-breeding farmland birds – particularly field boundaries, including hedges and grassland. Intact hedges are not extensive within the survey area, and few will be affected by cable-laying activities. Those hedges adjacent to the substation that are likely to be affected by cable laying were found to be of limited importance for non-breeding farmland birds. The hedge to the south of Grange Farm is likely to be of more importance because of its location on the southern boundary of survey sector F (refer to Figure 6.10 for location of survey sectors), an area found to support a relatively large number of birds of importance for conservation. The loss of a small section of this hedge (up to 50 m) will result in a slight reduction of foraging opportunities for non-breeding farmland birds, an impact considered to be of negligible magnitude.

7.6.34 The installation of circuits for Lincs will result in the temporary loss of grassland margins. Although narrow, these habitats are found extensively within the survey area. As this habitat is expected to recover rapidly following completion of construction works, it is considered unlikely that there will be an impact of more than negligible magnitude arising from the temporary loss of relatively small sections of field margin.

7.6.35 The subsequent installation of circuits for Docking Shoal and Race Bank will increase the extent of grassland habitats and hedges that are temporarily lost. Although both habitats will recover after construction of Lincs, it is unlikely that recovery of these habitats will be fully completed prior to the installation of Docking Shoal and possibly Race Bank (particularly hedges that are likely to take 5–10 years to recover in the absence of any reinstatement works). The combined loss of up to 150 m of hedge for up to ten years is considered to be an impact of low magnitude.

7.6.36 Although construction activities will generate some noise, it is not expected that this will cause more than a negligible magnitude disturbance impact to birds, as any effect will be localised and short-lived. No impact of more than negligible is therefore predicted for Lincs, Docking Shoal and Race Bank, either alone or when considered together.

Breeding Marsh Harrier and Montagu's Harrier

7.6.37 The results of breeding bird surveys have identified the presence of at least one pair of breeding marsh harriers within the study area. In addition, there is evidence that Montagu's harrier breeds within adjacent coastal areas outside the survey area.

7.6.38 The potential for impact on both species will be dependent on the location of nests in any year (both species will breed in cereal fields) and the timing of cable-laying activities. If nesting occurs within cereal fields close to the coast, then disturbance is possible. Although it is unlikely that nesting will take place close to the route of the cable (given the extent of cereal fields in this region), the potential for distur-

bance (caused by noise and increased human presence) and abandonment of a nest cannot be discounted.

7.6.39 There is potential for disturbance arising from the installation of onshore circuits for Lincs if birds nest close to the cable route. This would potentially be an impact of medium magnitude. A similar potential also exists for both Docking Shoal and Race Bank if birds also nest close to the cable route during the years that those circuits are installed. The combined installation of circuits over consecutive years could therefore increase the magnitude of this potential impact if birds repeatedly attempted to breed close to the cable route and were repeatedly disturbed over a period of up to three years. The likelihood of this cumulative impact is, however, considered to be very low.

Tree Sparrow

7.6.40 Installation of onshore circuits will result in the temporary loss of some habitats of importance for tree sparrow populations – particularly field boundaries, including hedges and grassland. Intact hedges are not extensive within the survey area and few will be affected by cable-laying activities. Those hedges adjacent to the substation that are likely to be affected by cable laying were found to be of very limited importance for tree sparrows. The hedge to the south of Grange Farm is of greater importance because of its location on the southern boundary of survey sector F, an area found to support a relatively large population of tree sparrows during the winter. The majority of breeding tree sparrows were located in close proximity to farm buildings that will not be subject to habitat loss during the cable installation for any of the three wind farms.

7.6.41 Cable-laying activities will result in the temporary loss of grassland margins. Although narrow, these habitats are found extensively within the survey area. As this habitat will readily recover following completion of construction works, it is considered unlikely that there will be an impact of more than negligible magnitude arising from the temporary loss of relatively small sections of field margin. Hedges will take longer to recover (5–10 years in the absence of reinstatement works), but the relatively small length of hedge affected implies an impact of no more than negligible magnitude.

7.6.42 Although construction activities will generate some noise, it is not expected that this will cause disturbance of more than negligible magnitude to tree sparrow populations, as any effect will be localised and short-lived.

7.6.43 There is potential for temporary habitat loss and disturbance arising from the installation of onshore circuits for Lincs, but due to the small area affected and the temporary nature of the change, this habitat loss is considered to be of negligible magnitude.

7.6.44 The subsequent installation of circuits for Docking Shoal and Race Bank will increase the extent of temporary habitat loss. Although habitats for this species can be reinstated after construction of Lincs, it is unlikely that recovery of these habitats will be fully completed prior to the installation of Docking Shoal (and possibly Race Bank). The areas affected are still, however, relatively small, and their temporary loss is not considered to be an impact of more than negligible magnitude.

7.6.45 Combined installation does not increase the magnitude of potential disturbance impacts, but could result in repeated disturbance over a period of up to three years.

Barn Owl

7.6.46 No potential nesting sites for barn owl will be directly affected by construction works.

7.6.47 Cable laying activities will result in the temporary loss of grassland margins and disruption to some ditches that may support prey for barn owls. These habitats are found extensively within the survey area and the area affected will be relatively small. As these habitats are readily restored following completion of construction works it is considered unlikely that there will be a significant impact arising from the temporary loss of relatively small sections.

7.6.48 There is potential for temporary habitat loss arising from the installation of onshore circuits for Lincs, but due to the small area affected and the temporary nature of the change, this habitat loss is considered to be of negligible magnitude.

7.6.49 The subsequent installation of circuits for Docking Shoal and Race Bank will increase the extent of temporary habitat loss. Although habitats for this species can be reinstated after construction of Lincs, it is unlikely that recovery of these habitats will be fully completed prior to the installation of Docking Shoal (and possibly Race Bank). The areas affected are still, however, relatively small, and their temporary loss is not considered to be an impact of more than negligible magnitude.

Onshore Inter-tidal Birds

7.6.50 The potential impacts to the onshore inter-tidal water assemblage as a result of the onshore cable installation between the months June – September (inclusive) could cause temporary loss of potential roosting habitat on the agricultural fields to the north of the third seawall. The construction activities are likely to cause physical, visual and noise disturbance to any roosting water birds utilising the fields. It is considered that the extent of negative impacts from the terrestrial cable installation will be restricted to farmland habitats only, as the levels of disturbance will be no greater than those occurring in and around the study area on a day-to-day basis.

7.6.51 It is considered that the impacts of the terrestrial cable installation to the onshore water bird assemblage are not significant, because:

- The loss of terrestrial roosting habitat will be temporary and the habitat will be fully restored to its original condition following construction.
- The farmland that the onshore cables will pass through is managed for arable agriculture, and the suitability of the habitat for roosting winter water birds is subject to change in any one year. Accordingly, there are years when the fields

are unsuitable as habitat for roosting water birds, with no apparent negative impact to the water bird assemblage.

- Evidence from the water bird surveys and data review indicates that the fields which the terrestrial cable will pass through appear to be of increasingly lower importance to roosting water birds, potentially as a result of salt marsh accretion, which has resulted in the salt marsh remaining exposed to birds throughout many high tides.
- Any disturbance effects are likely to cause temporary displacement to the water bird assemblage. It is considered that any roosting water birds that are displaced will relocate to similar habitats elsewhere within the nearby area, which are present in abundance.

7.6.52 There is potential for temporary habitat loss arising from the installation of onshore circuits for Lincs but, due to the small area affected and the temporary nature of the change, this habitat loss is considered to be of negligible magnitude.

7.6.53 The subsequent installation of circuits for Docking Shoal and Race Bank will increase the extent of temporary habitat loss. Although habitats for these species can be reinstated after construction of Lincs, it is unlikely that recovery of these habitats will be fully completed prior to the installation of Docking Shoal (and possibly Race Bank). The areas affected are still, however, relatively small, and their temporary loss is not considered to be an impact of more than negligible magnitude.

Amphibians

7.6.54 It is considered that there is little likelihood of an impact on great crested newts. There was no evidence of this species in those water bodies that have been surveyed, and the potential in remaining ponds (for which access was refused) appears to be low, due to a combination of small size and limited extent of suitable habitat features. On this basis, any population that is present is likely to be small. The likelihood that there would be an impact of anything more than negligible magnitude on this population arising from substation construction and the installation of onshore cables (likely to take place approximately 250–300 m from the nearest pond) is also considered to be very low. Nevertheless, to confirm the absence of this species, further surveys will be attempted. If present, appropriate mitigation will be formulated in discussion with Natural England.

Bats

7.6.55 No buildings that may contain bat roosts will be directly affected by construction activities. Mature trees with medium bat roost potential were identified in the area adjacent to the existing substation, but subsequent surveys did not record the presence of any bat roosts in these trees. Potential impacts on these potential roosts will depend on whether individual trees are felled or significantly modified during construction works. Although no bat roosts have been identified during the surveys to date, if any mature trees are identified for removal, then those having roost potential will be re-surveyed before removal and, in the event bats are found, appropriate mitigation will be implemented in consultation with Natural England.

7.6.56 Surveys have indicated that there is low activity by bats within the study area. Where activity was detected, it tended to be associated with field boundaries with relatively intact hedgerows and larger main vegetated ditches. Cable installation for Lincs will result in the loss of field margin features (including some hedges) and disruption to some ditches. The sections affected are expected to be relatively small (approximately 16 m at any field boundary). However, breaks in vegetation of more than 5 m may be sufficient to obstruct foraging flights. The construction works are expected, therefore, to cause some loss and fragmentation of bat foraging habitat. This effect will persist after construction until vegetation has become sufficiently established to sustain foraging activity. In the case of ditches, this is likely to be a relatively short period (one or two seasons). Re-growth of hedges, in the absence of planting, is expected to take longer (5–10 seasons). Due to the low level of bat activity and the small number of hedges affected, this is considered to be an impact of negligible magnitude.

7.6.57 The installation of onshore circuits for Docking Shoal and Race Bank will further increase the width of the construction corridor to a total of approximately 50 m at each boundary feature, and prolong the length of time that connectivity will be broken (particularly in hedges, which take longer to recover than ditches). The area affected is still small and, given the low level of bat foraging activity detected, this is considered to be an impact of negligible magnitude.

Water Vole

7.6.58 Cable laying will require the crossing of approximately 37 ditches, of which ten contained water at the time of survey. Surveys of these ditches did not identify the presence of water voles, and accordingly no impact is predicted.

7.6.59 As signs of water vole have been recorded outside the construction corridor and a population could colonise those ditches with suitable habitat in future, check surveys will be carried out prior to cable installation. In the event that water voles are identified as being present, appropriate mitigation will be determined. Licensing and mitigation via the statutory agencies will be undertaken as necessary.

Otter

7.6.60 No evidence of otter was recorded in the study area. In the event that otters do use the habitats within the study area, the wet ditches are likely to be used primarily for dispersal. The potential effect of the cable installation across the ditches is expected to be habitat fragmentation. This effect is, however, expected to be localised, as ditches will be crossed sequentially as cable laying progresses towards the substation. The effect will also be temporary as smaller ditches will be restored immediately on completion of works. The crossing of larger ditches will involve the installation of a short length of culvert, over which cables will be laid. These culverts will ensure that flows are maintained, and are considered to be sufficiently short that otters will readily pass within them or, more likely, over and around them. No significant long-term disruption to otter movement is predicted.

Brown Hare

7.6.61 Although the cable route will cross habitat suitable for brown hares, it is not expected that there will be significant habitat loss. Rather, brown hares, being a mobile species, would be expected to move away from the source of disturbance, returning once activities have ceased. Young leverets are vulnerable during the first four weeks of their lives as they are left exposed in their form (depression in the grass) and receive little parental care. As the location of forms cannot be predicted it is not known to what extent the proposed works would result in disturbance of leverets.

7.6.62 There is potential for temporary brown hare habitat loss arising from the installation of onshore circuits for Lincs but, due to the small area affected and the temporary nature of the change, this habitat loss is considered to be of negligible magnitude.

7.6.63 The subsequent installation of circuits for Docking Shoal and Race Bank will increase the extent of temporary habitat loss. Although habitats for this species can be reinstated after construction of Lincs, it is unlikely that recovery of these habitats will be fully completed prior to the installation of Docking Shoal (and possibly Race Bank). The areas affected are still, however, relatively small, and their temporary loss is not considered to be an impact of more than negligible magnitude.

Badger

7.6.64 Evidence of badgers (setts, latrines, snuffle holes, etc.) has been detected in the southern part of the survey area.

7.6.65 Inspection of the proposed cable route and the area that will occupied by the substation extension (including temporary working areas) indicates that no part of the cable route or substation works will be located within 30 m of a known badger sett. Although it is likely that badgers may occasionally forage within areas temporarily affected by construction activities (including temporary working areas) associated with the substation extension, there is no evidence that these areas are of particular importance to this species.

Potential Effects of Operation

7.6.66 No effects on any VER due to operation of the cable and substation are predicted. Cables will not require ongoing maintenance, although repairs would be required in the unlikely event that cables are damaged. The effects of repair activities will depend on the location of any damage, but in all cases works are expected to be localised (involving excavation only of the damaged section of cable) and temporary (repairs will typically be completed in a matter of days). Occasional inspection activities of cables and sheath bonding equipment are not predicted to cause disturbance.

7.6.67 Noise levels will be slightly elevated in the immediate surroundings of the substation for the duration of its operation, but it is not expected that this will cause significant disturbance to wildlife. After the implementation of mitigation intended to limit noise disturbance to neighbouring properties, noise levels are unlikely to exceed existing background levels within the vicinity of the substation. These noise levels are not considered to be high enough to cause significant impact on any VER.

7.6.68 Site operation and maintenance activities for Lincs, Docking Shoal and Race Bank are expected to be infrequent and of insufficient magnitude to cause significant disturbance to VERs.

Potential Effects of Decommissioning

7.6.69 It is expected that the impacts of decommissioning would be similar to those identified for construction.

Mitigation

Construction

Boundary Features

7.6.70 Specific mitigation measures will be implemented to reduce impacts on field boundary features that are of importance for foraging bats and birds. To maintain the integrity of hedges and vegetated ditches during construction, temporary screens (incorporating natural materials such as brush) will be erected at night and at other times when works are not taking place. They will be placed so as to maintain the continuity of these linear features and hence their attractiveness to foraging bats.

7.6.71 On completion of works, hedges removed during construction will be reinstated using locally sourced native shrub species. Ditch vegetation will also be reinstated as appropriate.

Marsh Harrier and Montagu's Harrier

7.6.72 To prevent potential impacts on nesting marsh harrier and, potentially, nesting Montagu's harrier, it is proposed that, if cable laying works are scheduled to take place during the breeding season, suitable nesting habitat along the cable route be cleared before the commencement of the breeding season (ie before March). The extent of clearance will be no wider than the proposed working corridor (ie approximately 16 m in any year), as the intention is to prevent only nesting directly within the corridor. This measure will mitigate potential impacts arising from the installation of the circuits for each of the wind farms individually, and any cumulative effects that may arise from their combined installation.

Amphibians

7.6.73 The status of great crested newts within the nearby ponds is unknown. Attempts will be made to obtain access in Spring 2007 in order that surveys can be undertaken. If no great crested newts are found using the ponds, then no mitigation will be required. In the event that great crested newts are found, or if access to the ponds is again denied, newt mitigation measures may be required to be put in place following consultation and a licence application to Natural England. Measures may include newt fencing and watching briefs and toolbox talks for site workers.

Bat Roosts in Trees

7.6.74 Although no bat roosts have been identified during the surveys to date, if any mature trees are identified for removal or significant modification at the detailed design stage, those identified as having medium bat roost potential will be re-surveyed before removal. In the event bats are found, a procedure for bat exclusion from trees with identified roosts will be agreed with Natural England. Alternative roosts will be provided in the form of bat boxes, located within suitable adjacent habitat. Potential impacts to any bat roosts are associated with the Lincs development only.

Brown Hare

7.6.75 It is considered that route clearance proposed for minimising risk to potential breeding harriers will also deter breeding activity of brown hares within and immediately adjacent to the cable route, and hence minimise the risk of disturbance to leverets.

Water Vole

7.6.76 Prior to construction works, surveys of the ditch sections to be affected by cable works will be undertaken to ascertain if water voles have moved into the area.

7.6.77 To ensure that water voles and water vole habitat, if identified, are not directly affected by construction works taking place at the crossing points of ditches, steps will be taken to implement appropriate methods to prevent impacts to water voles and their habitat (such as temporary exclusion methods). If required, a detailed mitigation plan will be developed prior to the commencement of construction, in agreement with Natural England.

Badger

7.6.78 To prevent disturbance to badgers, surveys will be undertaken before construction begins to ensure that no setts have been established within 30 m of working areas. In the event that evidence of badgers is identified, appropriate steps to avoid (if feasible) or close setts (with appropriate mitigation) will be undertaken in consultation with Natural England.

General

7.6.79 It is assumed that long-term strategies will be in place to reduce the risk of pollution and emissions, arising from all construction activities, to acceptable levels.

Operation

7.6.80 No additional mitigation is required during the operational phase.

Decommissioning

7.6.81 Mitigation for the decommissioning phase would be as for the construction phase

Summary of Residual Impacts

Table 7.42 | **Significance of impact to habitats and species for Lincs**

Description of feature	Proposed activity	Unmitigated impact of activity on feature	Impact of activity on integrity or conservation status of feature	Mitigation	Significance of residual impacts
Habitats					
intact hedges	cable installation: construction activities resulting in loss of sections of species-poor hedgerow	adverse impact extent: approx 50 m magnitude: total loss within those sections affected duration: temporary complexity: direct frequency: completed in 1 year reversibility: reversible confidence: certain	the impact will be on isolated hedges, so no fragmentation is predicted; hedges can be replanted following completion of works	affected hedges will be reinstated on completion of works clearance during the bird breeding season will be avoided, to minimise impacts on breeding birds that use this habitat (eg tree sparrow)	*not significant*
Species					
non-breeding farmland birds	cable installation: construction activities resulting in temporary loss of small areas of hedgerow and grassland margins of limited importance for non-breeding farmland birds	adverse impact extent: approx. 50 m of hedge and small areas of grassland magnitude: temporary loss of feeding habitat duration: temporary complexity: direct frequency: completed in 1 year reversibility: reversible confidence: certain	temporary loss of habitat will reduce foraging opportunities, although the magnitude of this effect will be low due to the relatively small extent of the impact; an effect on the integrity of the assemblage is unlikely considering the availability of alternative breeding and foraging opportunities	affected hedges and grassland would be reinstated on completion of works	*not significant*
breeding marsh harrier	cable installation: construction activities resulting in disturbance to nesting birds	adverse impact extent: potential nesting sites within arable fields adjacent to onshore cable route magnitude: potential abandonment of breeding attempt if works conducted during breeding season duration: temporary complexity: direct frequency: completed in 1 year reversibility: irreversible confidence: unlikely	if this species is present, the worst-case scenario would be nest abandonment and failure to breed in that season	as a precaution, cable routes will be cleared before the start of the breeding season to deter breeding activity in areas where disturbance would be likely during construction	*not significant*

Description of feature	Proposed activity	Unmitigated impact of activity on feature	Impact of activity on integrity or conservation status of feature	Mitigation	Significance of residual impacts
breeding Montagu's harrier	cable installation: construction activities resulting in disturbance to nesting birds	no impact predicted at this stage as species has not been confirmed breeding within the survey area; check surveys to be undertaken prior to construction to identify presence	if this species is confirmed to be breeding in the survey area, the worst-case scenario would be nest abandonment and failure to breed in that season	as a precaution, cable routes will be cleared before the start of the breeding season to deter breeding activity in areas where disturbance would be likely during construction	*not significant*
tree sparrow	cable installation: construction activities resulting in temporary loss of habitat for tree sparrow	adverse impact extent: maximum of 16 m of hedge and small areas of grassland magnitude: temporary loss of feeding habitat duration: temporary complexity: direct frequency: completed in 1 year reversibility: reversible confidence: certain	temporary loss of habitat will reduce foraging opportunities, although the magnitude of this effect will be low due to the relatively small extent of the impact; an effect on the integrity of the population is unlikely considering the availability of alternative foraging opportunities	affected hedges and grassland would be reinstated on completion of works	*not significant*
barn owl	cable installation: construction activities resulting in temporary loss of habitat for foraging barn owl	adverse impact extent: small pockets of habitat loss magnitude: small loss of foraging habitat duration: temporary complexity: direct frequency: completed in 1 year reversibility: reversible confidence: likely	temporary loss of habitat will reduce foraging opportunities, although the magnitude of this effect will be low due to the relatively small extent of the impact; an effect on the integrity of the population is unlikely considering the availability of alternative foraging opportunities	affected habitats (hedges and grassland) would be reinstated	*not significant*
inter-tidal onshore birds	cable installation: construction activities will result in some temporary loss of habitat along with potential disturbance from construction activities	adverse impact extent: arable fields along near shore cable route magnitude: temporary habitat loss and disturbance along installation route duration: temporary frequency: completed in 1 year reversibility: reversible confidence: likely	temporary habitat loss and disturbance within the near shore agricultural area is unlikely to adversely affect the integrity of the onshore waterbird assemblage the magnitude of this effect will be low due to the variations in suitability of arable land for birds arising from normal agricultural practices and the extent of alternative habitats within the survey area (salt marsh) and wider area	affected habitats (arable fields) would be reinstated	*not significant*
great crested newt	cable installation: construction activities could result in some loss and fragmentation of terrestrial habitat	no impact predicted at this stage as species has not been confirmed within the survey area; surveys to be undertaken in 2007 to confirm absence of this species from the remaining ponds	if the species is confirmed to be within the survey area, the worst-case scenario would be a small proportion of terrestrial habitat loss	given the poor pond habitat and the distance from the works, any impacts on newts, if present, are likely to be limited; any impacts would be offset by appropriate mitigation	*not significant* based on current information

Description of feature	Proposed activity	Unmitigated impact of activity on feature	Impact of activity on integrity or conservation status of feature	Mitigation	Significance of residual impacts
great crested newt	substation construction: activities will result in some loss and fragmentation of terrestrial habitat	no impact predicted at this stage as species has not been confirmed within the survey area; surveys to be undertaken in 2007 to confirm absence of this species from the remaining ponds	if the species is confirmed to be within the survey area, the worst-case scenario would be a small proportion of terrestrial habitat loss	given the poor pond habitat and the distance from the works, any impacts on newts, if present, are likely to be limited; any impacts would be offset by appropriate mitigation	*not significant* based on current information
bat	cable installation: construction activities will result in some loss and fragmentation of foraging habitat	adverse impact extent: breaches of approximately 16 m at field boundaries along the cable routes magnitude: temporary fragmentation duration: temporary complexity: indirect frequency: completed in 1 year reversibility: reversible confidence: certain	temporary breaches of linear features (including hedges) may result in the fragmentation of foraging flight lines; the magnitude of this impact is low due to the limited use of the area by bats	temporary screens will be placed across breaches to maintain integrity of flight lines affected hedges and grassland would be reinstated on completion of works	*not significant*
bat	substation construction: construction of substation may require felling of trees potentially containing bat roosts	no impact predicted at this stage as species has not been confirmed within the survey area; surveys to be undertaken prior to construction to confirm absence of this species from the potential roost sites	permanent loss of a small number of potential roosts is unlikely to adversely affect the integrity of the bat population of the survey area; in light of the protected status of bats, however, steps must be taken to avoid impacts on active roosts	surveys to identify specific roosts will be undertaken before construction begins a procedure for bat exclusion will be agreed with Natural England; alternative roosts in the form of bat boxes would be erected within suitable adjacent habitat	*not significant*
water vole	cable installation: construction activities could result in the loss of water vole habitats (wet ditches)	no impact predicted at this stage as species has not been identified within the construction area; check surveys to be undertaken prior to construction to confirm absence	drain culverts will be installed in larger ditches given the extent of wet ditch habitats within the survey area (and wider area) the combined loss of these small sections is not considered to be significant; however, construction activities have the potential to directly kill or injure water voles if found to be present	surveys to confirm absence of water voles will be carried out before construction; if water voles are present, steps will be taken to relocate potentially affected animals a detailed mitigation plan will be developed, in agreement with Natural England, prior to commencement of construction activities	*not significant*

Description of feature	Proposed activity	Unmitigated impact of activity on feature	Impact of activity on integrity or conservation status of feature	Mitigation	Significance of residual impacts
otter	cable installation: construction activities could result in breaks in continuity of otter dispersal habitat (wet ditches)	no impact predicted at this stage as species has not been identified within the construction area	cable installation across the ditches could cause habitat fragmentation; this effect will be localised, as ditches will be crossed sequentially; the crossing of larger ditches will involve the installation of a short length of culvert over which cables will be laid	culverts will ensure that flows are maintained, and are considered to be sufficiently short that otters will readily pass within/over/around them	*not significant*
brown hare	cable installation: construction activities may potentially disturb leverets	adverse impact extent: arable fields along cable route magnitude: temporary habitat loss and disturbance along installation route duration: temporary complexity: indirect frequency: completed in 1 year reversibility: reversible confidence: unlikely	construction activities are unlikely to affect adult brown hares as they will avoid areas affected by construction activities; however, leverets are vulnerable to disturbance and construction could result in death or injury if forms are damaged or disturbed	as a precaution, cable routes will be cleared prior to the commencement of the breeding season to deter breeding activity in areas where disturbance would be likely during construction	*not significant*
badger	substation construction: construction of substation extension may result in permanent loss of a small area of potential foraging habitat	no impact predicted at this stage as species has not been confirmed within the substation area; check surveys to be undertaken prior to construction to confirm absence	no evidence of badger activity in the vicinity of the substation recorded; given the extent of alternative habitat available, this is highly unlikely to affect the integrity of the badger population	surveys will be undertaken before construction to confirm the absence of setts in the construction area; if they are present, an appropriate plan will be developed for avoidance or sett closure	*not significant*
badger	substation construction: establishment of working area for substation extension works will result in temporary loss of a small area of potential foraging habitat	no impact predicted at this stage as species has not been confirmed within the substation area; check surveys to be undertaken prior to construction to confirm absence	no evidence of badger activity in the vicinity of the substation; given the extent of alternative habitat available and the temporary nature of the activity, it is unlikely that the integrity of the badger population will be adversely affected	surveys will be undertaken before construction to confirm the continued absence of setts in the construction area; if they are present, an appropriate plan will be developed for avoidance or sett closure. following completion of construction works, the affected areas will be reinstated	*not significant*

Table 7.43 | **Significance of impact to habitats and species for Docking Shoal cable installation following Lincs**

Description of feature	Proposed activity	Unmitigated impact of activity on feature	Impact of activity on integrity or conservation status of feature	Mitigation	Significance of residual impacts
Habitats					
intact hedges	cable installation: construction activities resulting in loss of sections of species-poor hedgerow	adverse impact extent: approx 100 m magnitude: total loss within those sections affected duration: temporary complexity: direct frequency: completed in 2 years reversibility: reversible confidence: certain	the impact will be on isolated hedges, so no fragmentation is predicted; hedges can be replanted following completion of works	affected hedges will be reinstated on completion of works clearance during the bird breeding season will be avoided to minimise impacts on breeding birds that use this habitat (eg tree sparrow)	*not significant*
Species					
non-breeding farmland birds	cable installation: construction activities resulting in temporary loss of small areas of hedgerow and grassland margins of limited importance for non-breeding farmland birds	adverse impact extent: approx. 100 m of hedge and small areas of grassland magnitude: temporary loss of feeding habitat duration: temporary complexity: direct frequency: completed in 2 years reversibility: reversible confidence: certain	temporary loss of habitat will reduce foraging opportunities, although the magnitude of this effect will be low due to the relatively small extent of the impact an effect on the integrity of the assemblage is unlikely considering the availability of alternative breeding and foraging opportunities	affected hedges and grassland would be reinstated on completion of works	*not significant*
breeding marsh harrier	cable installation: construction activities resulting in disturbance to nesting birds	adverse impact extent: potential nesting sites within arable fields adjacent to onshore cable route magnitude: potential abandonment of breeding attempt if works conducted during breeding season duration: temporary complexity: direct frequency: completed in 2 years reversibility: irreversible confidence: unlikely	if this species is present, the worst-case scenario would be nest abandonment and failure to breed in that season	as a precaution, cable routes will be cleared before the start of the breeding season to deter breeding activity in areas where disturbance would be likely during construction	*not significant*
breeding Montagu's harrier	cable installation: construction activities resulting in disturbance to nesting birds	No impact predicted at this stage as species has not been confirmed breeding within the survey area; check surveys to be undertaken prior to construction to identify presence	if this species is confirmed to be breeding in the survey area, the worst-case scenario would be nest abandonment and failure to breed in that season	as a precaution, cable routes will be cleared before the start of the breeding season to deter breeding activity in areas where disturbance would be likely during construction	*not significant*

Description of feature	Proposed activity	Unmitigated impact of activity on feature	Impact of activity on integrity or conservation status of feature	Mitigation	Significance of residual impacts
tree sparrow	cable installation: construction activities resulting in temporary loss of habitat for tree sparrow	adverse impact extent: maximum of 32 m of hedge and small areas of grassland magnitude: temporary loss of feeding habitat duration: temporary complexity: direct frequency: completed in 2 years reversibility: reversible confidence: certain	temporary loss of habitat will reduce foraging opportunities, although the magnitude of this effect will be low due to the relatively small extent of the impact an effect on the integrity of the population is unlikely considering the availability of alternative foraging opportunities	affected hedges and grassland would be reinstated on completion of works	*not significant*
barn owl	cable installation: construction activities resulting in temporary loss of habitat for foraging barn owl	adverse impact extent: small pockets of habitat loss magnitude: small loss of foraging habitat duration: temporary complexity: direct frequency: completed in 2 years reversibility: reversible confidence: likely	temporary loss of habitat will reduce foraging opportunities, although the magnitude of this effect will be low due to the relatively small extent of the impact an effect on the integrity of the population is unlikely considering the availability of alternative foraging opportunities	affected habitats (hedges and grassland) would be reinstated	*not significant*
inter-tidal onshore birds	cable installation: construction activities will result in some temporary loss of habitat along with potential disturbance from construction activities	adverse impact extent: arable fields along near shore cable route magnitude: temporary habitat loss and disturbance along installation route duration: temporary frequency: completed in 2 years reversibility: reversible confidence: likely	temporary habitat loss and disturbance within the near shore agricultural area is unlikely to adversely affect the integrity of the onshore waterbird assemblage the magnitude of this effect will be low due to the variations in suitability of arable land for birds arising from normal agricultural practices and the extent of alternative habitats within the survey area (salt marsh) and wider area	affected habitats (arable fields) would be reinstated	*not significant*
great crested newt	cable installation: construction activities could result in some loss and fragmentation of terrestrial habitat	no impact predicted at this stage as species has not been confirmed within the survey area; surveys to be undertaken in 2007 to confirm absence of this species from the remaining ponds	if the species is confirmed to be within the survey area, the worst-case scenario would be a small proportion of terrestrial habitat loss	given the poor pond habitat and the distance from the works, any impacts on newts, if present, are likely to be limited; any impacts would be offset by appropriate mitigation	*not significant* based on current information

Description of feature	Proposed activity	Unmitigated impact of activity on feature	Impact of activity on integrity or conservation status of feature	Mitigation	Significance of residual impacts
bat	cable installation: construction activities will result in some loss and fragmentation of foraging habitat	adverse impact extent: breaches of approximately 32 m at field boundaries along the cable routes magnitude: temporary fragmentation duration: temporary complexity: indirect frequency: completed in 2 years reversibility: reversible confidence: certain	temporary breaches of linear features (including hedges) may result in the fragmentation of foraging flight lines the magnitude of this impact is low due to the limited use of the area by bats	temporary screens will be placed across breaches to maintain integrity of flight lines affected hedges and grassland would be reinstated on completion of works	*not significant*
water vole	cable installation: construction activities could result in the loss of water vole habitats (wet ditches)	no impact predicted at this stage as species has not been identified within the construction area; check surveys to be undertaken prior to construction to confirm absence	drain culverts will be installed in larger ditches given the extent of wet ditch habitats within the survey area (and wider area), the combined loss of these small sections is not considered to be significant; however, construction activities have the potential to directly kill or injure water voles if found to be present	surveys to confirm absence of water voles will be carried out before construction; if water voles are present, steps will be taken to relocate potentially affected animals a detailed mitigation plan will be developed, in agreement with Natural England, prior to commencement of construction activities	*not significant*
otter	cable installation: construction activities could result in breaks in continuity of otter dispersal habitat (wet ditches)	no impact predicted at this stage as species has not been identified within the construction area	cable installation across the ditches could cause habitat fragmentation his effect will be localised as ditches will be crossed sequentially; the crossing of larger ditches will involve the installation of a short length of culvert over which cables will be laid	culverts will ensure that flows are maintained, and are considered to be sufficiently short that otters will readily pass within/over/around them	*not significant*
brown hare	cable installation: construction activities may potentially disturb leverets	adverse impact extent: arable fields along cable route magnitude: temporary habitat loss and disturbance along installation route duration: temporary complexity: indirect frequency: completed in 2 years reversibility: reversible confidence: unlikely	construction activities are unlikely to affect adult brown hares as they will avoid areas affected by construction activities; however, leverets are vulnerable to disturbance and construction could result in death or injury if forms are damaged or disturbed	as a precaution, cable routes will be cleared prior to the commencement of the breeding season to deter breeding activity in areas where disturbance would be likely during construction	*not significant*

Table 7.44 | **Significance of impact to habitats and species for Race Bank cable installation following Docking Shoal and Lincs**

Description of feature	Proposed activity	Unmitigated impact of activity on feature	Impact of activity on integrity or conservation status of feature	Mitigation	Significance of residual impacts
Habitats					
intact hedges	cable installation: construction activities resulting in loss of sections of species-poor hedgerow	adverse impact extent: approx 150 m magnitude: total loss within those sections affected duration: temporary complexity: direct frequency: completed in 3 years reversibility: reversible confidence: certain	the impact will be on isolated hedges, so no fragmentation is predicted hedges can be replanted following completion of works	affected hedges will be reinstated on completion of works clearance during the bird breeding season will be avoided to minimise impacts on breeding birds that use this habitat (eg tree sparrow)	*not significant*
Species					
non-breeding farmland birds	cable installation: construction activities resulting in temporary loss of small areas of hedgerow and grassland margins of limited importance for non-breeding farmland birds	adverse impact extent: approx. 150 m of hedge and small areas of grassland magnitude: temporary loss of feeding habitat duration: temporary complexity: direct frequency: completed in 3 years reversibility: reversible confidence: certain	temporary loss of habitat will reduce foraging opportunities, although the magnitude of this effect will be low due to the relatively small extent of the impact an effect on the integrity of the assemblage is unlikely considering the availability of alternative breeding and foraging opportunities	affected hedges and grassland would be reinstated on completion of works	*not significant*
breeding marsh harrier	cable installation: construction activities resulting in disturbance to nesting birds	adverse impact extent: potential nesting sites within arable fields adjacent to onshore cable route magnitude: potential abandonment of breeding attempt if works conducted during breeding season duration: temporary complexity: direct frequency: completed in 3 years reversibility: irreversible confidence: unlikely	if this species is present, the worst-case scenario would be nest abandonment and failure to breed in that season	as a precaution, cable routes will be cleared before the start of the breeding season to deter breeding activity in areas where disturbance would be likely during construction	*not significant*

Description of feature	Proposed activity	Unmitigated impact of activity on feature	Impact of activity on integrity or conservation status of feature	Mitigation	Significance of residual impacts
breeding Montagu's harrier	cable installation: construction activities resulting in disturbance to nesting birds	no impact predicted at this stage as species has not been confirmed breeding within the survey area; check surveys to be undertaken prior to construction to identify presence	if this species is confirmed to be breeding in the survey area, the worst-case scenario would be nest abandonment and failure to breed in that season	as a precaution, cable routes will be cleared before the start of the breeding season to deter breeding activity in areas where disturbance would be likely during construction	*not significant*
tree sparrow	cable installation: construction activities resulting in temporary loss of habitat for tree sparrow	adverse impact extent: maximum of 50 m of hedge and small areas of grassland magnitude: temporary loss of feeding habitat duration: temporary complexity: direct frequency: completed in 3 years reversibility: reversible confidence: certain	temporary loss of habitat will reduce foraging opportunities, although the magnitude of this effect will be low due to the relatively small extent of the impact an effect on the integrity of the population is unlikely considering the availability of alternative foraging opportunities	affected hedges and grassland would be reinstated on completion of works	*not significant*
barn owl	cable installation: construction activities resulting in temporary loss of habitat for foraging barn owl	adverse impact extent: small pockets of habitat loss magnitude: small loss of foraging habitat duration: temporary complexity: direct frequency: completed in 3 years reversibility: reversible confidence: likely	temporary loss of habitat will reduce foraging opportunities, although the magnitude of this effect will be low due to the relatively small extent of the impact an effect on the integrity of the population is unlikely considering the availability of alternative foraging opportunities	affected habitats (hedges and grassland) would be reinstated	*not significant*
inter-tidal onshore birds	cable installation: construction activities will result in some temporary loss of habitat along with potential disturbance from construction activities	adverse impact extent: arable fields along near shore cable route magnitude: temporary habitat loss and disturbance along installation route duration: temporary frequency: completed in 3 years reversibility: reversible confidence: likely	temporary habitat loss and disturbance within the near shore agricultural area is unlikely to adversely affect the integrity of the onshore waterbird assemblage the magnitude of this effect will be low due to the variations in suitability of arable land for birds arising from normal agricultural practices and the extent of alternative habitats within the survey area (salt marsh) and wider area	affected habitats (arable fields) would be reinstated	*not significant*
great crested newt	cable installation: construction activities could result in some loss and fragmentation of terrestrial habitat	no impact predicted at this stage as species has not been confirmed within the survey area; surveys to be undertaken in 2007 to confirm absence of this species from the remaining ponds	if the species is confirmed to be within the survey area, the worst-case scenario would be a small proportion of terrestrial habitat loss	given the poor pond habitat and the distance from the works, any impacts on newts, if present, are likely to be limited; any impacts would be offset by appropriate mitigation	*not significant* based on current information

Description of feature	Proposed activity	Unmitigated impact of activity on feature	Impact of activity on integrity or conservation status of feature	Mitigation	Significance of residual impacts
bat	cable installation: construction activities will result in some loss and fragmentation of foraging habitat	adverse impact extent: breaches of approximately 50 m at field boundaries along the cable routes magnitude: temporary fragmentation duration: temporary complexity: indirect frequency: completed in 3 years reversibility: reversible confidence: certain	temporary breaches of linear features (including hedges) may result in the fragmentation of foraging flight lines the magnitude of this impact is low due to the limited use of the area by bats	temporary screens will be placed across breaches to maintain integrity of flight lines affected hedges and grassland would be reinstated on completion of works	*not significant*
water vole	cable installation: construction activities could result in the loss of water vole habitats (wet ditches)	no impact predicted at this stage as species has not been identified within the construction area; check surveys to be undertaken prior to construction to confirm absence	drain culverts will be installed in larger ditches given the extent of wet ditch habitats within the survey area (and wider area) the combined loss of these small sections is not considered to be significant; however, construction activities have the potential to directly kill or injure water voles if found to be present	surveys to confirm absence of water voles will be carried out before construction; if water voles are present, steps will be taken to relocate potentially affected animals a detailed mitigation plan will be developed, in agreement with Natural England, prior to commencement of construction activities	*not significant*
otter	cable installation: construction activities could result in breaks in continuity of otter dispersal habitat (wet ditches)	no impact predicted at this stage as species has not been identified within the construction area	cable installation across the ditches could cause habitat fragmentation this effect will be localised, as ditches will be crossed sequentially; the crossing of larger ditches will involve the installation of a short length of culvert over which cables will be laid	culverts will ensure that flows are maintained, and are considered to be sufficiently short that otters will readily pass within/over/around them	*not significant*
brown hare	cable installation: construction activities may potentially disturb leverets	adverse impact extent: arable fields along cable route magnitude: temporary habitat loss and disturbance along installation route duration: temporary complexity: indirect frequency: completed in 3 years reversibility: reversible confidence: unlikely	construction activities are unlikely to affect adult brown hares as they will avoid areas affected by construction activities; however, leverets are vulnerable to disturbance and construction could result in death or injury if forms are damaged or disturbed	as a precaution, cable routes will be cleared prior to the commencement of the breeding season to deter breeding activity in areas where disturbance would be likely during construction	*not significant*

Cumulative Impacts

7.6.82 The potential impacts arising from the construction, operation and decommissioning of Lincs, Docking Shoal and Race Bank have been considered alone and together, and *no* significant cumulative impacts have been identified.

7.6.83 An assessment of National Grid's proposed works at Walpole Marsh substation in order to provide a connection for the wind farms (see Appendix A2.14) has not identified any likely significant effect, although the need for further surveys of great crested newt is also noted in that document.

7.6.84 No cumulative effects are predicted as a result of the proposed extension to Sutton Bridge Power Station.

Conclusions

7.6.85 The habitats that would be affected as a result of the proposed developments are not of significant value to nature conservation. No statutory or non-statutory designated sites would be affected by the development proposals. All the habitats that would be affected by the proposals are common and widespread, and are therefore of less than local importance.

7.6.86 Potential impacts to individual bird species, bird communities and bird assemblages occurring within the study area have been identified. However, it is considered that the implementation of mitigation for these valued ecological receptors will result in an impact of *no* significance.

7.6.87 No effects on badgers, otters or water voles are expected as a result of the development proposals. Badgers have been recorded in the wider areas but are absent from the construction corridor and its zone of influence. Water voles have been recorded outside of the construction corridor but are absent from areas where the development will occur. No evidence of otter has been identified in the study area and, accordingly, no impacts are expected for this species. It is considered that potential negative impacts to brown hare occurring in the study area can be offset with appropriate mitigation.

7.6.88 Potential negative impacts to foraging bats could occur as a result of temporary breaches of hedges and ditches, which may result in the fragmentation of foraging flight lines. Surveys have identified that the use of the study area by bats is low, and it is considered that the implementation of temporary screening across breaches of habitat to maintain connectivity will result in *no* significant impact.

7.6.89 In addition, bats could potentially be affected by tree-trimming works around the substation (if required), and only if those trees provide appropriate roost potential. No bat roosts have been confirmed in surveys to date. If any mature trees are identified for removal, those having roost potential will be re-surveyed prior to removal and, if bats are found, mitigation will be determined in consultation with Natural England.

7.6.90 Two ponds to the east of the study area could not be surveyed or access was refused. It is therefore possible that, if access is again denied in 2007, newt mitigation may be required as a precautionary measure, following consultation with Natural England, before construction can begin.

7.6.91 No other protected species were recorded as occurring within the study area.

7.6.92 It is therefore concluded that the overall impact of the proposed cable installation and substation development on the ecology of the study area, taking account of mitigation measures proposed, would be *not* significant.

7.7 Transport and Traffic

Introduction

7.7.1 This chapter assesses the potential direct and indirect impacts of the proposed onshore works of Lincs, Docking Shoal and Race Bank offshore wind farms with respect to traffic generation. This assessment is based on a worst-case scenario and is in keeping with the 'Rochdale Envelope' approach.

7.7.2 Potential impacts arising from the proposed developments are identified and assessed according to the methods identified below. Potential impacts arising from the construction, operation and decommissioning of the onshore cables and substations for each of the wind farms are considered. In addition, the cumulative effects arising from the construction of all three wind farms and other relevant committed developments are also considered.

7.7.3 Where potentially significant effects are predicted, appropriate mitigation is proposed.

Assessment of Effects

7.7.4 A phased approach was used to complete the assessment, which considered the proposed use of the site and was completed in accordance with best practice procedures.

7.7.5 The first phase combined a desk-based study of available data with a site visit. This outlined key issues that would need to be considered in the second phase of the assessment. The second phase involved reference to the IEMA (1993) *Guidelines for the Environmental Assessment of Road Traffic and the Design Manual for Road and Bridges* environmental assessment guidance (The Stationery Office 1994).

7.7.6 This included establishing the baseline position in terms of traffic flows, review and summary of the traffic that would be associated with the construction of the

Centrica wind farms, and compilation and review of relevant committed development traffic generation data and predictions of impact magnitude and effect and assessment of the potential cumulative traffic impacts of the proposed Centrica wind farms and the identified committed developments, without the inclusion of any mitigating measures that may already be incorporated into, or that are required for, the given development. As such, this approach considers the 'worst-case' scenario for the construction and operational phases, and is intended to identify the potential magnitude of any likely impacts.

7.7.7 The significance of potential effects has been assessed in light of recognised thresholds of significance from published guidance, as set out below.

7.7.8 The environmental effects of traffic have been assessed according to guidance contained in the following principal sources.

- *Guidance Notes No. 1. Guidelines for the Environmental Assessment of Road Traffic.* The Institute of Environmental Assessment, March 1993.
- *The Design Manual for Roads and Bridges. Volume 11 – Environmental Assessment*. Department of Transport *et al.* June 1993 (and updates).
- *Guidance on the Methodology for Multi Modal Studies, 2000*. DETR, updated on the DfT WebTAG site (www.webtag.org.uk), June 2003.

7.7.9 Previous research, reviewed in IEMA (1993), has identified the most discernible environmental impacts of traffic as noise, severance, pedestrian safety and intimidation. Generally, people cannot perceive changes in traffic noise of less than 3 dB(A) and such a change requires broadly a doubling or halving in the traffic level. More recently, guidance has looked at the potential for significant effects from traffic noise as a result of changes of 1 bB(A); these are equivalent to increases in traffic flow of 25 per cent or decreases of 20 per cent and have been perceptible in some circumstances when changes in traffic flow were sudden. Other effects, such as the delay experienced in crossing a road, can also be manifest at changes of 30 per cent in traffic flow. The times of day and year that changes in traffic are experienced and the proportion of heavy goods vehicles (HGV) can also influence the significance of effects.

7.7.10 The Institute of Environmental Management and Assessment (IEMA) Guidelines (IEA1993) provide guidance on the geographical extent of environmental assessment, which is likely to prove necessary in relation to increases in traffic flow as follows:

7.7.11 'Rule 1: include highway links where traffic flows will increase by more than 30 per cent (or the number of heavy goods vehicles will increase by more than 30 per cent)

7.7.12 Rule 2: include any other specifically sensitive areas where traffic flows have increased by 10 per cent or more.'

7.7.13 In accordance with the above guidance, the full list of attributes considered for this assessment of the environmental effects of traffic is considered below.

Noise

7.7.14 Extensive research has been completed regarding the effects of road traffic on noise and its perception. Traffic noise can be calculated using a long established method set out in the *Calculation of Road Traffic Noise* (CRTN) (DoT 1988). The approach used is to look at the noise levels exceeded for 10 per cent of a given period of time (L10), typically 1 hour or 18 hours. Two commonly used significance criteria for noise are:

- where noise levels exceed an absolute threshold of 18 hour L10 of 68 dB(A)
- where noise levels change by + or –3 dB(A)

7.7.15 It is recognised that sudden changes of traffic flow leading to changes of + or –1 dB(A) may also be perceptible in some circumstances. The changes in traffic flow required to produce such changes in traffic noise have been discussed above (see paragraph. 7.7.9).

7.7.16 In some circumstances, further consideration is necessary for night-time noise. It is unlikely that noise will occur during night-time periods as a result of traffic associated with the Walpole cable laying and substation construction, as construction activities will largely be undertaken during daytime working hours. Construction activities are unlikely to be required at night; however, there may be occasional activities which extend outside normal working hours. These will be agreed with the relevant planning authority beforehand.

Vibration

7.7.17 New developments that require heavy vehicles often give rise to concerns from local residents about the possible damage to property resulting from vibration. However, numerous studies that have investigated this topic have so far been unable to show that traffic induced ground-borne vibration results in structural damage to buildings (IEMA 1993). Surface damage, such as minor cracking of plaster, may possibly occur at high exposure sites (ie existing heavily trafficked roads with poor surfaces and subgrade conditions), but is unlikely to be distinguishable from cracking due to other causes (DoT 1993).

7.7.18 Ground-borne vibration is much less likely to be a cause of disturbance to occupiers than airborne vibration. Studies of disturbance from airborne vibration have found that the percentage of people bothered by airborne vibration is similar, although slightly lower, to that for noise.

7.7.19 The impact of airborne vibration effects from traffic is generally restricted to unscreened buildings within 40 m of the route in question.

Visual Effects

7.7.20 Although, in some exceptional cases, high-sided vehicles can cause visual effects by blocking important views or creating intrusion into scenic views, this effect is not considered likely in this case and this issue is not considered further here.

Severance

7.7.21 'Severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery. The term is used to describe a complex series of factors that separate people from places and other people. Severance can also result from difficulty in crossing a heavily trafficked road…' (IEMA 1993).

7.7.22 The guidance indicates that severance effects are considered 'slight' in cases that include:

- pedestrian 'at-grade' (surface level) crossings of new roads carrying below 8,000 vehicles per day (annual average daily traffic (AADT)) (DoT 1993)
- changes of traffic flow of less than 30 per cent (IEMA 1993)

Driver Delay

7.7.23 Where highways affected by new development are at or near capacity, the traffic associated with new development can cause or add to vehicle delays. Other sources of delay for non-development traffic can include:

- the site entrance – where there will be additional turning movements
- on the highways passing the site – where there is likely to be additional traffic and the flow might be affected by additional parked cars
- at other key intersections along the highway – which might be affected by increased traffic
- at junctions – where the ability to find gaps in the traffic may be reduced thereby lengthening delays

Pedestrian Delay

7.7.24 Highly trafficked roads and changes to the volume or speed of traffic may affect the ability of people to cross roads. Research has shown a two-way vehicle flow of 1,400 vehicles per day equates to a ten second delay in pedestrians crossing a road with no crossing facilities (IEMA 1993).

Pedestrian Amenity

7.7.25 This term is defined as the relative 'pleasantness' of journeys and can be affected by traffic flow, composition, noise and air pollution. The guidance suggests a threshold for significance where traffic flow, or its lorry component, is halved or doubled (IEMA 1993).

7.7.26 Pedestrian amenity also covers what is referred to as 'fear and intimidation' within the IEMA guidelines. There are no commonly agreed thresholds for estimating levels of fear and intimidation, but this impact is considered dependent on the volume of traffic, its HGV component, its proximity to people, or the lack of protection or segregation from traffic influenced by factors such as footway width.

Accidents and Safety

7.7.27 It is possible to estimate the effects of increased traffic on accidents and safety from existing accident records, national statistics, the type and quantity of traffic generated, journey lengths and the characteristics of the routes in question.

Hazardous Loads

7.7.28 Some developments may involve transporting hazardous loads by road, such as special wastes, toxic materials and chemicals. As the proposed will not involve the transportation of hazardous loads, this issue is not considered further.

Air Pollution

7.7.29 Road transport is a significant source of air pollutants in the form of particulates (eg PM10) and nitrogen dioxide (NO_2). Relatively sizeable changes in traffic are required to bring about significant changes in air quality and, consequently, changes in traffic flows by less than ten per cent may be 'scoped out' ((DETR 2000) TAG Unit 3.3.3, 1.3.2). Temporary changes in traffic flow over short periods are also unlikely to have significant effects on local air quality strategy objectives.

Dust and Dirt

7.7.30 Certain types of development, notably quarrying and the transport of quarried materials, can give rise to dust and dirt problems. The impact normally depends to a large extent on the management practices adopted at the site in question, such as vehicle sheeting and wheel washing. As the proposals will involve neither quarrying nor the transportation of quarried materials, this issue is not considered further here.

Ecological Effects

7.7.31 The ecological effects of the direct works associated with the project are considered in Chapter 7.6. In some cases it is also necessary to consider the ecological effects of transport, eg where there are pollution or spillage risks from transport, or if road widening, realignment or improvement may have effects beyond the development site (IEMA 1993).

Significance of impacts

7.7.32 The likely significance of potential impacts is assessed as indicated in Table 7.45.

Table 7.45 | **Criteria for evaluating the significance of potential impacts**

Significance	Example description
major adverse	large temporary percentage increase in traffic flows resulting in substantial adverse effects on driver delay, pedestrian amenity, noise etc.
moderate adverse	moderate temporary percentage increase in traffic flows resulting in moderate adverse effects on driver delay, pedestrian amenity, noise etc.

Significance	Example description
minor adverse	local change to traffic flow movements resulting in slight adverse effects on driver delay, pedestrian amenity, noise etc.
negligible	no appreciable change to traffic flow movements
minor beneficial	local reduction in traffic flow movements resulting in slight beneficial effects on driver delay, pedestrian amenity, noise etc.
moderate beneficial	moderate temporary reduction in traffic flow movements resulting in moderate beneficial effects on driver delay, pedestrian amenity, noise etc.
major beneficial	substantial temporary reduction in traffic flow movements resulting in substantial beneficial effects on driver delay, pedestrian amenity, noise etc.

Assumptions

7.7.33 This section considers the traffic movements likely to be associated with the construction of the substation and cable laying, the likely impacts on the local highway network and the potential cumulative effects associated with the National Grid and Sutton Bridge committed developments.

Construction Traffic Movements

7.7.34 Consulting engineers, Mott Macdonald, were commissioned by Centrica to prepare the conceptual design of the onshore substation and associated works in order to inform the consents process. Further information supplied by Centrica outlines workforce numbers required for the drilling and cable-laying phases.

Construction Programme

7.7.35 The programme for construction of the onshore substation and associated connection work is outlined in Chapter 5.

7.7.36 Table 7.46 sets out the daily heavy goods vehicle (HGV) movements associated with the construction of the substation and the estimated time-frame relating to each activity.

7.7.37 Note: an allowance of an additional 10 per cent in HGV movements should be made for the delivery of other materials such as reinforcing steel, drainage pipes, pre-cast fire barrier wall units, structural steelwork, cladding and fencing.

7.7.38 In addition to the vehicle movements shown in Table 7.46, the following daily HGV movements are also expected:

- Directional drilling and cable pulling activities, transformer delivery and beach joint pit construction during the Lincs construction phase – 4–6 daily HGV movements
- Removal of material excavated from cable trench – 47 daily HGV movements
- Delivery of trench backfill material – 47 daily HGV movements

Table 7.46 | **Estimated number of deliveries during substation construction**

Phase	Activity	Approx. number of deliveries	Lorries per day	Anticipated date/ duration
Lincs	removal of excavated material	248	8–11	over a 3-week period and a 2-week period during year 2
	delivery of Type 1 Fill for site compound	225	8–11	over a 6-week period during year 2
	delivery of chippings	56	7–10	over a 3-week period during year 2
	delivery of ready-mix concrete	168	Up to 5	over a 10-week period during year 2
	miscellaneous (delivery of piles, civil materials, electrical equipment)	50	up to 2	during year 2
Docking Shoal	miscellaneous (delivery of piles, civil materials, electrical equipment)	50	up to 2	during year 3
Race Bank	miscellaneous (delivery of piles, civil materials, electrical equipment)	50	up to 2	during year 4

7.7.39 The above is based on the worst-case scenario and is in keeping with the Rochdale Envelope approach. It is therefore assumed that the cables will be buried using open trenching techniques rather than the cable ploughing methodology as outlined in Chapter 5. Execution of the open trenching operation assumes that all excavated material from the cable trench would be removed from the site and all trench backfill material would be delivered to the site in different vehicles.

7.7.40 This scenario is highly unlikely to occur as it is likely that a large proportion of the excavated material would be kept on site and used to backfill the trench. At this stage this proportion is not known, as the properties, and therefore suitability for backfill, of the soil are unknown.

7.7.41 The following key assumptions have been made in the preparation of this assessment.

1. Access routes to the site for the construction workforce, heavy vehicles and abnormal loads will be agreed with the local authorities and specified and enforced by Centrica, principal contractors and sub-contractors.

2. The agreed access route from the primary road network will be the Class III minor roads from the north and south of Walpole.

7.7.42 During the connection of Docking Shoal and Race Bank wind farms, approximately 120 daily HGV movements in total are expected for each construction period. This is also a worst-case scenario, given the same assumptions with regard to the removal and delivery of excavated and backfill cable trench materials.

7.7.43 The overall movements for the three projects are likely to include the following:

- HGV deliveries for the full construction period peakingt at 124 movements per day but averaging approximately 120 movements during the majority of the period. These movements would include HGVs associated with the works required for the Lincs, Docking Shoal and Race Bank connections at the National Grid substation.
- Vehicle movements associated with site personnel would average 30 light vehicle movements throughout the construction period and would generally remain constant.
- The site workforce involved in earthworks and access construction is estimated to be approximately 50 staff per day. There will be approximately seven staff undertaking the directional drilling, and it is expected that four staff will be required for micro-tunnelling. In total, it is expected that there will be a maximum of 61 staff within the area at any given time.

7.7.44 See Chapter 5 for a description of the construction programme.

7.7.45 Construction work is likely to be undertaken during normal working hours Monday to Friday, with occasional activities extending outside these hours.

7.7.46 The amount of traffic generated by a construction workforce at a remote site is commonly reduced on a trips-per-head basis by the order of 40 per cent (ie 0.6 trips per head of workforce) by car sharing among staff and by transport provided by the contractors. When special measures are introduced, 'trip rates' of below 0.6 per head have been achieved.

7.7.47 In this case it has been assumed that special measures such as a shuttle service and car sharing will be provided to minimise the impact of the workforce. For the purposes of trip generation, it has been assumed that with the implementation of these special measures approximately 0.6 trips per head of workforce would be generated.

7.7.48 On this basis, 50 site personnel a day would generate approximately 30 vehicular movements per day. For assessment purposes it has been assumed that the level of site personnel trips would remain constant throughout the construction period.

7.7.49 During cable pulling, approximately two HGV movements for cable delivery would be expected at the beginning and at the end of the activity. To ensure a robust assessment, it has been assumed that there would be two HGV movements a day throughout this activity.

7.7.50 Once the construction of the substation and cable-laying operation is complete, the effect on the local road system will be minimal. There will be no permanent staffing needed at the substation, but access will be required from time to time for routine maintenance.

7.7.51 National Grid's proposed works at Walpole Marsh substation and the extension of Sutton Bridge Power Station are likely to be constructed concurrently with the construction of the Centrica connections. Table 7.48 summarises the cumulative vehicle movements associated with these developments and with the Centrica-generated traffic movements.

Predicted Changes in Traffic

7.7.52 The environmental implications of introducing additional demands on the transport infrastructure are assessed and, where appropriate, potential mitigation measures are outlined and the significance of any remaining residual impacts determined.

7.7.53 The greatest environmental effects relating to traffic occur when the traffic generated by the development is at its greatest. Table 7.48 identifies that the greatest number of trips will occur in year 2 of the construction of the Centrica substations, together with National Grid's extension of Walpole Marsh substation and the proposed extension of Sutton Bridge Power Station. As a consequence, this assessment will focus on year 2 as a worst case for the purpose of this assessment.

7.7.54 National Road Traffic Forecast (NRTF 1997) low-growth factors have been applied to the existing traffic flows in order to achieve a common base year for the assessment. Table 7.47 summarises the predicted base year traffic flows.

Table 7.47 | **Predicted weekday 2008 base traffic flows**

	AM Peak (8am–9am)		PM Peak (5pm–6pm)		12-hour (7am–7pm)	
	Total vehicles	HGVs	Total vehicles	HGVs	Total vehicles	HGVs
A47 St Johns Highway (1)	1,744	280	1,558	152	14,066	2,976
A1101 Wisbech Road (2)	554	112	402	54	6,004	1,151
A17 Sutton Bridge (3)	1,298	268	1,446	165	14,095	2,787

1. NRTF low-growth factor 2006–2008: 1.023
2. NRTF low-growth factor 2001–2008: 1.095
3. NRTF low-growth factor 2005–2008: 1.037

Table 7.48 | **Cumulative traffic movements**

Project	Activity	YEAR 1												YEAR 2												YEAR 3											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ma	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
LINCS	Removal of excavated material	-	-	-	-	-	-	-	-	-	-	-	-	-	300	-	-	196	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Delivery of type 1 fill for sub-station	-	-	-	-	-	-	-	-	-	-	-	-	-	-	225	225	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Directional drilling	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	12	12	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-
	Transformer delivery	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
	Delivery of chippings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Delivery of ready-mix concrete	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	84	84	84	84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Miscellaneous	-	-	-	-	-	-	-	-	-	-	-	-	-	8	14	14	14	14	14	14	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Removal of excavated trench material	-	-	-	-	-	-	-	-	-	1031	1031	1031	1031	1031	1031	1031	1031	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Delivery of trench backfill material	-	-	-	-	-	-	-	-	-	1031	1031	1031	1031	1031	1031	1031	1031	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Onshore cabling	-	-	-	-	-	-	-	-	-	80	80	80	80	80	80	80	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Construct beach joint pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cable pulling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4	-	-
	Total HGVs	0	0	0	0	0	0	0	0	0	2142	2142	2142	2142	2452	2381	2493	2436	110	210	198	8	0	0	0	2	0	0	0	0	0	0	5	4	4	0	0
DOCKING SHOAL	Removal of excavated trench material	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	-
	Delivery of trench backfill material	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	-
	Onshore cabling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	80	80	80	80	80	80	80	80	80	80	80	-
	132kv Substation works - miscellaneous	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	14	14	14	14	14	14	8	-
	Construct beach receiving pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	20	-	-	-
	Cable pulling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total HGVs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2372	2372	2372	2372	2380	2386	2386	2386	2486	2406	2386	2380	0

Project	Activity	YEAR 1												YEAR 2												YEAR 3											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ma	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
RACE BANK	Removal of excavated trench material	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1146
	Delivery of trench backfill material	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1146
	Onshore cabling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80
	132 kv substation works - miscellaneous	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Construct beach receiving pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cable pulling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total HGVs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2372
Centrica	Monthly HGVs	-	-	-	-	-	-	-	-	-	2142	2142	2142	2142	2452	2381	2493	2436	110	210	198	8	0	0	2372	2374	2372	2372	2380	2386	2386	2386	2491	2410	2390	2390	2372
	Monthly site personnel	-	-	-	-	-	-	-	-	-	600	600	600	600	600	600	600	600	800	800	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
	Total monthly vehicle movements	0	0	0	0	0	0	0	0	0	2742	2742	2742	2742	3052	2981	3093	3036	910	1010	798	608	600	600	2972	2974	2972	2972	2980	2986	2986	2986	3091	3010	2990	2980	2972
	Daily HGV movements	-	-	-	-	-	-	-	-	-	107	107	107	107	123	119	125	122	6	11	10	0	0	0	119	119	119	119	119	119	119	119	125	121	120	119	119
	Daily site personnel movements	-	-	-	-	-	-	-	-	-	30	30	30	30	30	30	30	30	40	40	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	Total daily Centrica movements	0	0	0	0	0	0	0	0	0	137	137	137	137	153	149	155	152	46	51	40	30	30	30	149	149	149	149	149	149	149	149	155	151	150	149	149
National Grid committed development	Monthly HGV movements	250	380	170	280	120	130	20	20	70	170	200	200	820	750	590	270	120	200	200	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Daily HGV movements	13	19	9	14	6	7	1	1	4	9	10	10	41	38	30	14	6	10	10	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Daily site personnel	42	42	42	42	42	42	42	42	42	42	42	42	84	84	84	42	42	42	42	42	42	42	42	42	-	-	-	-	-	-	-	-	-	-	-	-
	Total daily National Grid movements	55	61	51	56	48	49	43	43	46	51	52	52	125	122	114	56	48	52	52	45	42	42	42	42	0	0	0	0	0	0	0	0	0	0	0	0
Sutton Bridge committed development	Daily HGV movements	-	-	-	-	-	-	50	50	50	50	50	50	50	50	50	50	50	50	50	50	100	100	50	50	50	50	50	50	50	50	50	50	50	50	50	50
	Daily site personnel	-	-	-	-	-	-	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	Total daily National Grid movements	0	0	0	0	0	0	450	450	450	450	450	450	450	450	450	450	450	450	450	450	500	500	450	450	450	450	450	450	450	450	450	450	450	450	450	450

Project	Activity	YEAR 1												YEAR 2												YEAR 3											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ma	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Total cumulative movements (Centrica + National Grid + Sutton Bridge)	Total daily HGV movements	13	19	9	14	6	7	51	51	54	166	167	167	198	210	199	188	178	66	71	62	100	100	50	169	169	169	169	169	169	169	169	175	171	169	170	169
	Total daily site personnel movements	42	42	42	42	42	42	442	442	442	472	472	472	514	514	514	472	472	482	482	472	472	472	472	472	430	430	430	430	430	430	430	430	430	430	430	430
	Total daily movements (all traffic)	55	61	51	56	48	49	493	493	496	638	639	639	712	724	713	660	650	548	553	534	572	572	522	641	599	599	599	599	599	599	599	605	601	600	599	599

7.7.55 Tables 7.49, 7.50 and 7.51 set out the maximum daily construction traffic flows associated with the Centrica development, alone and cumulatively with the Sutton Bridge and National Grid committed developments, and the likely impacts these would have on base 2008 traffic flows.

Table 7.49 | **Maximum daily construction traffic movements and percentage impacts on A47**

Forecast 2008 traffic flows		Development traffic flows			Percentage increase	
Total	HGV	Development	Total vehicles	HGV	Total	HGV
14,066	2,976	Centrica only	152	122	1.1%	4.1%
		Centrica, Sutton Bridge and Walpole extensions	724	210	5.1%	7.1%

Table 7.50 | **Maximum daily construction traffic movements and percentage impacts on A1101 Wisbech Road**

Forecast 2008 traffic flows		Development traffic flows			Percentage increase	
Total	HGV	Development	Total vehicles	HGV	Total	HGV
6,004	1,151	Centrica only	152	122	2.5%	10.6%
		Centrica, Sutton Bridge and Walpole extensions	724	210	12.1%	18.2%

Table 7.51 | **Maximum daily construction traffic movements and percentage impacts on A17 Sutton Bridge**

Forecast 2008 traffic flows		Development traffic flows			Percentage increase	
Total	HGV	Development	Total vehicles	HGV	Total	HGV
14,095	2,787	Centrica only	152	122	1.1%	4.4%
		Centrica, Sutton Bridge and Walpole extensions	724	210	5.1%	7.5%

7.7.56 Tables 7.49 to 7.51 demonstrate the following effects of the proposed traffic flows during construction.

Traffic associated with onshore works for Lincs, Docking Shoal and Race Bank only

- Neither the total traffic movements nor the HGV movements alone are likely to have any significant effects on the primary route network (ie A17 and A47 and A1101), since the 12-hour generated traffic from the site represents a maximum increase of only 2.5 per cent on the A1101 12-hour flow for the year 2008, which is indiscernible and well within day-to-day variation.
- In terms of the A17 and A47, the volume of total traffic likely to be generated during working hours on average for onshore construction represents an immaterial increase over the 12-hour period since this is within the suggested 30 per cent threshold set out in IEMA guidelines. It is therefore unlikely that any significant environmental impact would occur as a result of the Centrica proposals.
- The predicted maximum increase in HGVs occurs on the A1101 Wisbech Road, where a 10.6 per cent increase is predicted during a typical weekday. This is

within the suggested 30 per cent threshold set out in IEMA guidelines. Any impacts associated with the HGV development-related traffic are therefore not considered to be significant. It is also recognised that it is unlikely that all construction and personnel vehicles would use the A1101; therefore this is a worst-case assessment.

- Any impacts associated with the development will be over a temporary period in the context of the overall construction period.

Combined Centrica, National Grid and Sutton Bridge Developments

- In terms of the cumulative impact of the proposed and committed developments, the total volume of traffic generated during construction would peak at approximately a 12.1 per cent increase in total traffic and 18.2 per cent increase in HGV traffic along the A1101 Wisbech Road.
- The existing total traffic flow will be expected to increase by more than 10 per cent only on the less trafficked roads in the vicinity of Walpole substation, and only when the construction workforce generates the maximum likely traffic movements during the typical peak traffic hours. Construction workforce peak hours generally do not coincide with typical network peak traffic hours.

7.7.57 The above assessments demonstrate that, during the majority of the construction period, the level of traffic generated is unlikely to have any discernible environmental impact, being within accepted thresholds. Nonetheless, it is recognised that the routes via Walpole Bank, King John Bank and Grange Road/East Bank, in particular through Walton, are likely to be perceived as sensitive to changes in traffic flow. Further analysis of such impact is set out below, along with an assessment of the physical attributes of the route with regard to the proposed construction vehicle types.

Geometric Assessment

7.7.58 An assessment has been undertaken on the roads along Routes 1–4 to establish their ability to accommodate two-way vehicle movements (refer to Appendix A2.10 for details on assessed routes). Figure 7.6 provides an indicative illustration of locations along these routes where two-way HGV movements may experience difficulty passing each other, and also where an HGV and a car may experience difficulty passing each other. This follows on from RPS Transport's *Access Route Assessment Report JNL5651-01* (see Appendix A2.10).

7.7.59 The assessment has been based upon guidance provided in DB32 Residential Roads and Footpaths, published by the Department of Transport (Second Edition April 1992). In summary, DB32 suggests that a minimum carriageway width of 5.5 m is required to accommodate two-way HGV movements, and that a minimum of 4.8 m is required to accommodate an HGV and a car. These widths relate to straight sections of carriageway. On bends, greater widths are sometimes required. Figure 7.6 shows locations where the existing road width is unlikely to be sufficient for opposing vehicles to pass safely.

7.7.60 Figure 7.6 identifies that there are ten locations where an HGV and a car may experience difficulty passing each other. At the majority of these, forward visibility is such that vehicles are able to see each other sufficiently in advance to allow one vehicle to receive priority while the other vehicle could wait safely on the adjoining carriageway. Furthermore, the height of a driver in an HGV is considerably greater than the height in private cars (approximately 1.5–2.0 m), and thus the forward visibility for HGV drivers would generally be greater.

7.7.61 It should be noted that there have been no injury accidents recorded at these locations over the three-year period preceding 1 March 2006. Where it is considered that a car and HGV may have difficulty passing each other, passing places will be created, providing there are sufficient verge widths at either side to allow for the safe passage of vehicles.

7.7.62 Having regard to the frequency of vehicle movements during construction (defined above), it is not considered that any noticeable effect will occur, although localised widening will be provided at minor junctions.

Abnormal Loads

7.7.63 The largest components of the proposed substations are the 132 kV/400 kV transformers.

7.7.64 Assessment of the transportation of transformers up to maximum weights of 150 T (Lincs) and 275 T (Docking Shoal and Race Bank) has been undertaken and is summarised within RPS Transport reports *Transformer Access Route Assessment (JNL5651-03)* and *Addendum to Transformer Access Route Assessment (JNL5651-04)* (Appendix A2.11) respectively.

7.7.65 The route proposed and assessed for the delivery of the transformers from the A47 is as follows:

- from the A47 turn left at roundabout onto B198
- turn right (north) onto Lynn Road
- turn left (west) onto School Road
- turn right (west) onto Mill Road
- continue northwards towards Walpole substation

7.7.66 The first of these assessments identifies that contraflow movements would be required at one location, and minor widening or reinforcement measures and temporary street furniture removals would be required at three locations along the route, to enable the transportation of transformers up to a maximum weight of 150 T (for Lincs). The assessment also identifies that the required areas of widening would be contained within highway land.

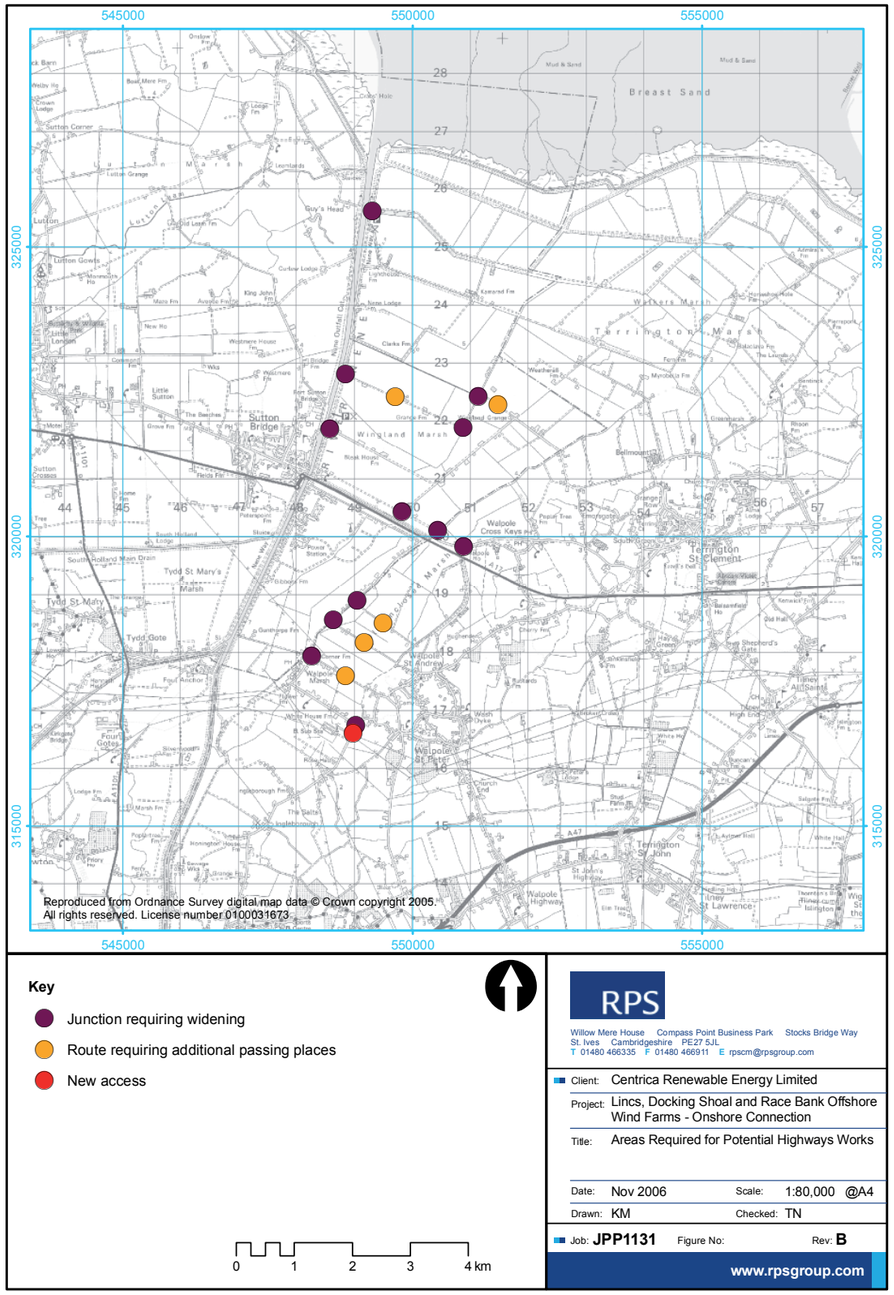


Figure 7.6 | Areas required for Potential Highways works

7.7.67 The second assessment considers the transportation of transformers up to a maximum weight of 275 T (for Docking Shoal and Race Bank). This assessment identifies that a contraflow movement would be required at one location, widening at four locations, three or four of which would require third party land and street furniture removals at a minimum of two locations to enable the transportation of transformers up to a maximum weight of 275 T.

Assessment of Effects

Noise

7.7.68 Construction traffic increases over 12- or 18-hour days are predicted to be considerably less than 25 per cent of existing traffic, which is normally required to cause a 1 dB(A) increase in traffic noise. No significant adverse noise impacts are likely. Any perceptible noise impacts are only likely to occur during limited periods of the construction programme when bulk deliveries are required. These will only occur during limited periods of the day and therefore the overall noise effects of construction traffic will be of *negligible* significance.

Vibration

7.7.69 Adverse impacts from ground-borne or airborne vibration are unlikely in the absence of significant effects from construction traffic noise. With regard to the HGV traffic generated during parts of the construction programme, vibration impacts could occur at properties closest to the highway where the road surface is poor. Areas of poorly maintained carriageway can result in airborne vibration effects, which may be of concern to local residents. The existing carriageways through Walpole and Walton are generally maintained to a good level. The likelihood of airborne vibration from this source is therefore small and unlikely to be significant. Ground-borne vibration induced by traffic has not been conclusively linked to structural damage despite a number of research studies. With regard to the predicted traffic flows it is not considered that ground-borne vibration will reach significant levels as the absolute volume of traffic is low. The overall vibration effects will be of *negligible* significance.

Visual Effects

7.7.70 No significant visual effects from construction traffic are likely to arise. The overall effect will be *negligible*.

Severance

7.7.71 No significant effects from severance are likely to arise as a result of construction traffic. In terms of total traffic movements, Tables 7.49, 7.50 and 7.51 show that the estimated typical traffic generation during construction of the Centrica proposals, Walpole and Sutton Bridge extensions equates to a maximum increase of only 10.3 per cent. This is not considered to be perceptible and therefore the overall effect will be of *negligible* significance.

Driver Delay

7.7.72 The existing route does not suffer from significant congestion. The most likely constraint on the relevant sections of the network will be the grid-like unclassified

roads of Goose's Lane, Follens Road, French's Road and Marsh Road and Garners Lane, but significant queuing or waiting does not presently exist here, even during the morning and evening peak-hour periods. Construction traffic movements will be spread across the working day, and no significant effects on driver delay are likely to arise as a consequence of regular or periodic constraints on highway capacity along the minor road approach or its junctions.

7.7.73 Construction staff and deliveries will be provided with adequate off-road parking at the Walpole substation site and no indirect effects on highway capacity are likely.

7.7.74 It is expected that the B198, Lynn Road, School Road, Mill Road and Walpole Bank will need to be temporarily closed during the transformer deliveries. These closures will be short-term to minimise the impact on driver delay. In addition, delivery will be arranged outside of local peak traffic hours. The overall impact on driver delay will be of *minor* significance.

Pedestrian Delay

7.7.75 No significant effects on pedestrian delay are likely to arise as a result of construction traffic. Increases in traffic along the A17 are typically 1.1 per cent (5.1 per cent cumulative), which would not have a perceptible impact upon delay. The overall effect would be of *negligible* significance.

Pedestrian Amenity

7.7.76 A doubling or halving of the lorry component of traffic flow adjacent to pedestrian routes is a suggested threshold for effects on pedestrian amenity. During the periods identified for the main bulk deliveries, this threshold might be exceeded for the less trafficked part of the route and moderate adverse impact may arise. It should be noted, however, that the construction period is only temporary, and that if bulk deliveries were required then this would occur for only short time periods. In any event, there is very little pedestrian activity along the routes to the north of the Walpole substation and, where pedestrian activity is considered high, eg through Walton, existing footways are provided on both sides of the carriageway.

7.7.77 Most of the factors that are thought to determine fear and intimidation, namely the volume of traffic, its proximity to people and the effect of protection between traffic and people, will not be significantly affected by the construction traffic generated by the proposals. There is some pedestrian activity along School Road, and it is acknowledged that there may be a perceived effect outside Marsh High School. There are footways on both sides of the road outside the school, and consultations will be held with the local education authority, should it be necessary to schedule work outside the school during peak hours.

7.7.78 It is recognised that bulk deliveries may become perceptible, but it is not considered that there will be a continual impact upon fear and intimidation. As previously described, this will only be temporary and should be taken into consideration when considering the magnitude of any impact. Furthermore, if bulk deliveries were required, during a 12-hour period it is considered that this increase would not be easily perceptible. The overall effects are likely to be of *minor adverse* significance, although if bulk deliveries are required, the effects could increase to *moderate adverse* significance.

Accidents and Safety

7.7.79 Observed injury accidents along Routes 1–4 are detailed in Section 6.7. The estimated traffic generation will not significantly alter the traffic composition and, assuming that no improvements to the road network occur, it is reasonable to assume that the observed accident rate should remain constant. Given the estimated increase in traffic flow associated with construction, it is estimated that, over the three-year construction period, the likelihood of increasing the number of injury accidents could arise. This is not considered to represent a significant increase and, in addition to safety measures being implemented, the majority of vehicle movements would be scheduled during off-peak periods if required by the local highway authorities. The impact upon accidents and safety would be of *negligible* significance**.**

Air Quality

7.7.80 Due to the minimal increase in HGVs, no significant effects from air pollution are likely to arise as a result of construction traffic. The overall effect on air quality strategy objectives would be of *negligible* significance.

Dust and Dirt

7.7.81 No significant effects from dust and dirt are likely to arise as a result of construction traffic. The contractor will provide appropriate sheeting, wheel cleaning and vehicle management measures on site to ensure that dust and dirt is kept to a minimum. The overall effect would be of *negligible* significance.

Ecological Effects

7.7.82 No significant additional effects from transport on ecology are likely to arise as a result of construction traffic. Some minor widening works will be required at three junctions, but this will be temporary and the areas will be reinstated subsequent to the transformer delivery. The overall effect will be of *negligible* significance.

Cultural Heritage

7.7.83 No significant effects on features of cultural heritage or conservation areas are likely to arise as a result of construction traffic. The overall effect will be of *negligible* significance.

Effects at Sensitive Receptors

7.7.84 There are a number of residential properties through Walton and Walpole. The assessments have demonstrated that there will be *no* significant impact resulting during the construction period under the above categories. Residential properties and schools are especially sensitive; however, the impacts remain the same, ie of *negligible* significance, and are unlikely to be perceived. It should be noted that the estimated increase in traffic flow along School Road past the sensitive receptors could potentially exceed the 10 per cent threshold given in the IEMA guidelines during bulk delivery periods.

Summary of Assessment

7.7.85 A summary of the assessment of effects of construction traffic is presented in Table 7.52.

Table 7.52 | **Summary of traffic and transport assessment**

Issue assessed	Impact assessment			Comments
	Lincs	Docking Shoal	Race Bank	
noise	negligible	negligible	negligible	–
vibration	negligible	negligible	negligible	conclude visual assessment of highway condition
visual effects	negligible	negligible	negligible	–
severance	negligible	negligible	negligible	–
driver delay	minor	minor	minor	road closures during transport of abnormal loads
pedestrian delay	negligible	negligible	negligible	–
pedestrian amenity (fear and intimidation)	moderate to minor adverse	moderate to minor adverse	moderate to minor adverse	temporary during peak heavy goods deliveries and through Walton due to HGV movements at peak periods
accidents and safety	negligible	negligible	negligible	no evident accident problem
hazardous loads	negligible	negligible	negligible	–
air pollution	negligible	negligible	negligible	–
dust and dirt	negligible	negligible	negligible	assumes appropriate vehicle management
ecological effects	negligible	negligible	negligible	
heritage and conservation	negligible	negligible	negligible	
summary	minor adverse to negligible	minor adverse to negligible	minor adverse to negligible	perceptible impacts will be restricted to pedestrian amenity during peak delivery periods only

Mitigation

7.7.86 A package of measures to monitor and control the effects of construction traffic will be agreed with the local authority in advance of the commencement of construction. The above assessments indicate that the only effect of the proposals relates to pedestrian amenity. The following measures have been identified to mitigate the predicted effects as well as being considered good practice construction management:

- Agreed haulage routes enforced by Centrica, the local authorities, principal and subcontractors and management of HGV movements to reduce potential for HGV conflicts
- Liaison with developers at Sutton Bridge and Walpole extension in the scheduling of bulk deliveries and the delivery of abnormal loads
- Road sweeping at site and easement entrances
- All vehicles to be parked off-road
- Sheeting and cleaning of vehicles
- Temporary road markings and signage at site entrance and along route, particularly at Lynn Road/B198 and Marsh High Primary School in accordance with Chapter 8 of the *Traffic and Road Signs Manual by the Department for Transport (DfT): Roadworks and Temporary Situations (2006) Part 1 Design (Published: 30 June 2006)* and *The Traffic Signs (Amendment) Regulations and General Directions 2005 (TSRGD) by the DfT*
- No ready-mix or Type 1 fill material vehicles allowed to leave or arrive at the site during school drop-off or collection times
- Public liaison and monitoring, in particular with local councils, to alert and agree periods of intense activity
- Recording vehicle arrivals and managing spread of delivery times with suppliers
- Temporary or permanent improvements to carriageway widths and junctions.

7.7.87 The following monitoring procedures will be adopted during construction to ensure that any impacts are kept to a minimum:

- Record vehicle numbers, types and times and reschedule as necessary
- Public liaison with local authority, school board and residents

7.7.88 If necessary, and subject to monitoring and public liaison, it may be possible to schedule deliveries and departures to avoid local events to reduce any possible impacts.

Residual Impacts

7.7.89 With the above mitigation measures, the residual impacts of traffic and transport would be of *minor adverse* to *negligible* significance.

Cumulative Impacts

7.7.90 The assessment of the cumulative impact of constructing the National Grid extension and Sutton Bridge power station extension identifies that there would be no significant impact along the strategic routes in the area. Where there is the possibility of bulk and abnormal deliveries occurring simultaneously, Centrica will liaise with the local authority, National Grid and Sutton Bridge personnel as appropriate to define a more suitable delivery schedule.

Conclusions

7.7.91 The main potential effects of traffic and transport for the onshore works are likely to be restricted to certain periods of the construction programme when bulk materials such as fill and concrete are being delivered. The effects are predicted to be:

- Temporary and restricted to the peaks during the construction period
- Not significant or perceptible in respect of visual effects, severance, pedestrian delay, hazardous loads, air pollution, ecological effects, cultural heritage, noise, driver delay, accidents and safety
- Impacts of *moderate* to *minor adverse* significance might arise in relation to temporary and local effects on pedestrian amenity through Walpole or at sensitive receptors along the route, such as Marsh High School.

7.7.92 With the implementation of appropriate mitigation it is predicted that the residual impacts of traffic and transport will be of *minor adverse* to *negligible* significance.

7.8 Flood Risk and Coastal Defences

Introduction

7.8.1 This chapter assesses the potential direct and indirect impacts of the proposed onshore works of Lincs, Docking Shoal and Race Bank offshore wind farms with respect to flood risk and coastal defences.

7.8.2 Potential impacts arising from the proposed developments are identified and assessed according to the methods identified below, which take account of both the sensitivity of relevant features of the area and the likely magnitude of effects. Potential impacts arising from the construction, operation and decommissioning of the onshore cables and substations for each of the wind farms are considered. Cumulative effects arising from the construction of all three wind farms and other relevant projects are also considered.

7.8.3 Where potentially significant effects are predicted, appropriate mitigation is proposed.

Assessment of Effects

7.8.4 A phased approach was used to complete the assessment, which considered the proposed use of the site and was completed in accordance with best practice procedures.

7.8.5 The first phase combined a desk-based study of available data and reports, with a site visit. This outlined key issues that would need to be considered in the second phase of the assessment. The second phase involved further desk-based study and incorporation of aspects from other studies, including aspects of a Flood Risk Assessment (FRA) that has been produced for the proposed development (see Appendix A2.12). The latter included a review of the surface-water drainage strategy for the development works. Predictions of impact magnitude and effect assess the potential impacts of any development, without the inclusion of any mitigating measures that may already be incorporated into, or that are required for, the given development. As such, this approach considers the 'worst-case' scenario for the construction and operational phases, and is intended to identify the potential magnitude of any likely impacts.

7.8.6 The magnitude of potential impacts has been evaluated, as indicated in Table 7.53.

Table 7.53 | **Magnitude of potential impacts**

Magnitude	Example description
High	High change in flood risk
Medium	Medium change in flood risk
Low	Low change in flood risk
Negligible	No discernible change in flood risk

7.8.7 Information about the likely significance of potential impacts is assessed as indicated in Table 7.54 below.

Table 7.54 | **Criteria for evaluating the significance of potential impacts**

Significance	Example description
Major adverse	Substantial flooding and/or change to flow characteristics of watercourse
Moderate adverse	Severe temporary flooding and/or change to flow characteristics of watercourse
Minor adverse	Local flooding or change to flow characteristics of watercourse
Negligible	No appreciable change to flooding and flow characteristics of watercourse
Minor beneficial	Local reduction in flooding or improvement to flow characteristics of watercourse
Moderate beneficial	Moderate reduction in flooding and/or improvement to flow characteristics of watercourse
Major beneficial	Substantial reduction in flooding and/or change to flow characteristics of watercourse

Assumptions

Installation of onshore circuits

7.8.8 Chapter 5 outlines the methods for installing onshore circuits. Those aspects of relevance to the assessment of potential effects on flood risk and coastal defences are outlined briefly below.

Cable Landfall and Seawall Crossing

7.8.9 Marine cables will pass through pre-installed ducts beneath the main coastal flood defences. An installation depth of at least 5 m beneath the embankment toe has been assumed. Ducts may be installed at depths greater than 5 m without having an adverse effect on calculated electrical ratings. It is assumed that the duct installation depth would not exceed 15 m. Based on a 5 m cable-separation distance, a corridor width of up to 50 m will be required in order to allow the cables to pass under the coastal defences without having an adverse affect on cable ratings.

7.8.10 A directional drilling rig will be located on farmland inland from, but adjacent to, the coastal flood defences. The site for the drilling rig would require an area of around 25 m x 25 m, and would need to be prepared to ensure that a total weight of 40 tonnes could be safely taken.

7.8.11 The rig would drill seawards under the coastal defences and salt marsh and into the inter-tidal region for a distance of about 500 m. A greater distance is impractical due to the duct installation and cable-pulling tension. Bore separation would be 5 m at the landward end and 50 m at the seaward end. Drilled bores will have a depth of between 10 m and 15 m. Bentonite, a natural alkaline lubricant, will be used to assist the drilling process.

Inland

7.8.12 The proposed construction methodology aims to account for the requirements of the Environment Agency and the King's Lynn Consortium of Internal Drainage Boards (KLCIDB) for the crossing of flood defences and internal watercourses, as outlined in the FRA (Appendix A2.12). Open trenches are to be used for most of the landward route, with trenchless cable laying used to pass obstacles such as major roads, large drains, or coastal and inland defences. Horizontal directional drilling will be the probable methodology, with an arc being drilled between two points to pass beneath an obstacle.

7.8.13 Cables are buried at a depth of 1,250 mm in farmland in accordance with standard UK practice. This is considered deep enough to prevent damage from ploughing. When cables are buried in roads, the cables do not have to be buried as deep, and 1,100 mm is the UK standard. Where large roads are crossed (eg A17) using trenchless (ie drilling) methods, ducts will be installed at least 2,000 mm below the road surface, depending on the road construction and location of other services. Several flood defences from various stages of reclamation works lie between the coastal landfall and the existing Walpole Marsh substation. These defences will need to be negotiated, with cables pulled under the defences through pre-installed ducts using directional drilling. The cable route will also require crossing of ditches and drains, potential impacts on these are considered in Chapter 7.9.

Substation construction

7.8.14 The onshore circuits will be connected to the grid at the existing Walpole Marsh substation. Connection will require the construction of new substations for each of the wind farms (these will be located immediately adjacent to one another) as well as an extension to the existing 400 kV substation owned and operated by National Grid. The extension works that National Grid will be required to undertake are described briefly in Chapter 5 and in more detail in Appendix A2.14. These works will increase the built footprint of the electrical substation over areas of bare ground, and will include some areas of hard-standing and built form within the land take.

Existing Drainage System

7.8.15 Surface water run-off drains through privately owned and maintained ditches around the perimeter of the existing substation site and proposed extension area. Surface waters then drain via channels across agricultural fields to the north and south of the substation. These drain surface waters west to join a southwesterly flowing King's Lynn Consortium of Internal Drainage Boards maintained channel, approximately 2.25 km to the west. Surface waters are released to the River Nene from Ingleborough Pumping Station at a rate that has been pre-agreed with the Environment Agency.

Changed Land use

7.8.16 The total land area identified for the Centrica extension works is approximately 20,200m^2. The proposed extension works requires about 200m^2 of hard-standing, 14,400m^2 of free-draining rock surface cover and 5,600m^2 of soft landscaping around the surrounds. The land area identified for the National Grid extension works is approximately 30,250m^2. The proposed extension works requires approximately 1,450m^2 of hard-standing surface, 305m^2 of new built area, 22,380m^2 of free-draining rock surface cover and 6,115m^2 of soft landscaping around the surrounds through mitigation planting.

7.8.17 The cumulative land area for the substation extension is therefore around 50,450m^2, with the majority of this (73 per cent) assumed to be a free-draining rock cover. This material is used for non-structurally bearing surface areas beneath the substation framework. However, this represents a worst-case scenario, since it is possible that some of this area will not be covered with free-draining rock, and instead will be left bare.

7.8.18 The alteration to the surface water run-off regime as a consequence of extending the substation can be determined based on the land-use change over the combined Centrica and National Grid site areas. Run-off coefficients are applied to each land-use type to produce an averaged run-off coefficient for the whole site in the pre-development area (40 per cent) compared to the run-off coefficient in the post-development area (46 per cent).

Assessment of Potential Effects

7.8.19 A number of effects to the outlined regimes have been considered, including potential construction, operational and decommissioning effects to flood risk and coastal defences that would result from the proposed inland cable installation and substation extension.

Potential Construction Effects

7.8.20 As discussed in the Project Description, the cables will be installed through ducts beneath the coastal defences. During this activity there is a very low probability that destabilisation of coastal defences, with the potential loss of structural integrity and potential failure may occur. Although the potential impact is low in probability, it would of course have a high magnitude. As coastal sea defences are considered to be a feature of very high importance, any adverse effect on the integrity of this feature is considered to be a potential impact of *major adverse* significance. It is proposed that drilling and the insertion of ducts for Lincs, Docking Shoal and Race Bank be completed in a single operation. Prior to the implementation of this approach, a detailed methodology, incorporating an assessment of ground conditions, will be adopted.

7.8.21 Surface water run-off is currently conveyed to the Nene by internal drainage infrastructure, as outlined in more detail in the FRA (Appendix A2.12). The construction procedure adopted for crossing these internal drains may impact the surface-water run-off regime. Impermeable areas may cause increased surface-water run-off in the area, which may adversely affect the localised risk of flooding. As effects are expected to be localised of low magnitude, this is considered to be a potential impact of *minor adverse* significance for Lincs, Docking Shoal and Race Bank. The construction of the three projects will increase the magnitude of potential impacts, but, due to the localised nature of effects (all three projects will take place in very similar locations), significant cumulative impacts are not anticipated.

7.8.22 Site clearance and preparation will be required prior to the commencement of cable laying and substation construction. In addition, a number of temporary construction compounds and laydown areas will be required during the construction of the Lincs substation (Figure 5.17) and the Docking Shoal and Race Bank substations (Figure 5.18), which would act as a temporary storage site and a centre of operation. Temporary construction laydown areas will be required along the cable route (Figure 5.14), capable of taking the weight of the cable drums, and a mobile crane for offloading. A temporary working area will be required for the directional drilling rig on the farmland adjacent to the coastal flood defence. In order to pull the cable into the trenches, a hard-standing area capable of taking three drums of cable would be needed at the joint bays. Site access tracks or haul roads may also be required to access certain sections of the cable route. All areas will be reinstated at the end of the construction period, where required. These areas may have, however, a temporary adverse effect on the surface water run-off regime during the construction phase and thus, potentially, on local flooding and water quality in the area. The potential impact is considered to be of *minor adverse* to *moderate adverse* significance for Lincs, Docking Shoal and Race Bank. Many of these construction compounds and laydown areas will be shared between projects, thus minimising the cumulative effect of the projects.

Potential Operational Effects

7.8.23 Alterations to the rate and conveyance of surface waters as a consequence of the substations and, to a lesser extent, along the cable route, may impact upon local flood risk. However, the amount of permanent hard-standing in the development is not likely to be high; hence, the impact here is considered to be *minor adverse* to *moderate adverse* significance. The risk of flooding is based on an assessment of the completed substation area for all three wind farms, including National Grid's extension to the existing 400 kV substation (FRA, Appendix A2.12).

7.8.24 Mineral oil is to be used in the substation transformers for insulation and cooling purposes. In the event of a failure or rupture, the leaked oil could cause considerable environmental damage, although the amount of oils in the transformers is limited. The design of the substation incorporates appropriate bunding and oil-traps to prevent accidental release of oil to nearby watercourses, ditches or drains. It is considered that there is no significant risk of pollution arising from the operation of the substation and no further mitigation is required. Consequently *no* impact is predicted for Lincs, Docking Shoal and Race Bank, alone or together.

7.8.25 The substations will not be permanently manned, and it is anticipated that staff will only be required onsite periodically for maintenance visits. The operation of the substations will not appreciably increase the exposure of people working in an area of high flood risk. Furthermore, the substation is already in use, with a flood management plan in operation, and, as such, this impact is considered to be *of negligible* significance. As the substations for Lincs, Docking Shoal and Race Bank will be managed together, this assessment applies to all three wind farms collectively.

Potential Decommissioning Effects

7.8.26 If electrical cables are left *in situ* post operation, there will be no decommissioning impacts. However, if cables are to be removed post operation, the impacts during decommissioning will be similar to the impacts outlined during construction. The methodology will be agreed with the relevant authorities prior to decommissioning.

Mitigation

Construction Effects

7.8.27 An agreed methodology for drilling beneath the coastal defences, inland flood defences and major internal drains will be agreed. The prior assessment of the physical characteristics of the flood defences will determine key properties, particularly of the coastal defences, and so ensure that there will be no adverse impacts resulting from the cable installation. The Environment Agency should re-inspect the flood defences on completion of the installation works, and any damage that may have been caused should be repaired to reinstate the defences. The significance of this

impact, with inclusion of appropriate mitigation and any required post-construction repair works, is therefore considered to be *negligible*.

7.8.28 An agreed construction methodology, with all relevant consents, would be adopted to prevent any short-term damage to the internal drainage network, with drains returned to pre-installation conditions. In order to ensure that adverse effects from construction works do not occur in the instance of a flood, most works will be halted at times of high flood risk. Measures to prevent excessive flows of surface water run-off, and also to restrict the influx of pollutants (oils, chemicals, silt, etc.) from the construction works into drains and associated watercourses, will include silt traps and petrol interceptors to protect the water quality from hard-standing run-off water, and bunding at watercourse crossings, as detailed in the FRA (Appendix A2.12). Surface water attenuation measures, such as ponds and ditches, will be used at the substation to reduce the run-off rate to receiving watercourses, as also outlined in the FRA. The significance of these impacts, with inclusion of appropriate mitigation measures, is therefore considered to be *negligible*.

7.8.29 Temporary construction compounds and laydown areas required during the construction phase will be appropriately located so as to minimise impacts upon their surrounds. The location of hard-standing areas will need to ensure that any proposed loading upon these areas will not adversely affect surrounding features (ie watercourses, flood defences) and also ensure that any increase in surface water run-off from present levels is attenuated with appropriate mitigation measures (ie ponds, ditches). The significance of these impacts, with inclusion of appropriate mitigation, is considered to be *negligible*.

Operational Effects

7.8.30 An agreed operational methodology, with all relevant consents, will be adopted to prevent any long-term damage to the internal drainage network. To prevent adverse effects during the operational phase in the instance of a flood, operations will be potentially halted at times of high flood risk. Measures would be incorporated, where necessary, to attenuate flows of surface water run-off in excess of those at present, and also to restrict the influx of pollutants (petrochemicals, silt, etc.) during the operational phase into drains and associated watercourses. The significance of these impacts, with inclusion of appropriate mitigation measures, is considered to be *negligible*.

7.8.31 The permanent hard-standing area required during the operational phase is generally associated with the extension of Walpole substation, and thus will need to be located beside the existing substation. There will be a need to ensure that any increase in surface water run-off from present levels is attenuated, with appropriate mitigation measures where required (ie ponds, ditches). These will also need to ensure that silt traps and petrol interceptors are installed to protect water quality. The condition and size of the drainage ditches around the substation, including those that are privately owned, should be checked prior to development and regularly maintained. The significance of these impacts, with inclusion of appropriate mitigation, is therefore considered to be *negligible*.

7.8.32 As outlined in the FRA (Appendix A2.12), an alternative to providing the required surface water attenuation for the changed use of land would be to pay a one-off development contribution fee to the KLCIDB. This fee would fund any modifications that would be required to the consortium-maintained drainage network as a consequence of increased surface water run-off. A partial agreement would also be an option, whereby a certain volume of the required attenuation is provided within the development, and with the remaining attenuation requirement covered by a development contribution to the King's Lynn Consortium of Internal Drainage Boards. Furthermore, an agreement would need to be reached with the private riparian owners for the use of their drains. The significance of impacts, after consultation with the riparian owners and with the development of consortium-maintained internal drains (through an agreement concerning the development contribution), is therefore considered to be *negligible*.

Decommissioning Effects

7.8.33 If there is no requirement to remove the installed works, there are not anticipated to be any impacts to flood risk or coastal defences, and so no requirement for mitigation measures. However, if there is a need to remove aspects of the development, it is likely that the risk and probable mitigatory measures will be similar to those that are outlined in the construction and operational phases.

Residual Effects

Construction Effects

7.8.34 Although coastal flood defences protect the area, there is the possibility that flooding may impact upon the construction of the cable route by events with a higher return period than the design standard (ie greater than a 1-in-200 year return period event). Areas that are at particular risk are those located beside the coastal flood defences, and the activities that are required in bringing offshore cable inland. However, the use of tide and flood prediction systems will minimise the probability of such an event impacting any ongoing construction activities.

7.8.35 The construction of the proposed cable route should have no impact on the existing flood defences, since horizontal directional drilling at depths well below the defences is chosen as the preferred construction technique, implemented according to an agreed methodology following more detailed site investigations. Horizontal directional drilling is also proposed for passing cables beneath major internal drains. There may be some residual impacts prior to the reinstatement of hard-standing areas, or with any deposited soil materials.

7.8.36 The construction of the cable route in proximity to minor drainage ditches may temporarily reduce short-term fluvial flood defence capacity and exacerbate local flooding. However, shallow trenching depth, short construction time and appropriate timing of installation will minimise possible impacts. This will be addressed in the construction method statement, which will be submitted to the Environment Agency and the KLCIDB for prior approval.

7.8.37 Presuming that all relevant consents are applied for and attained prior to the development works, that agreed construction and operational methodologies are adhered to, and that all temporarily changed land use is reinstated at the end of the construction period, there are not anticipated to be any residual effects to flood risk or coastal defences from the construction phase of this development.

Operational Effects

7.8.38 Presuming that all relevant consents are applied for and attained prior to the development works, that agreed construction and operational methodologies are adhered to, and that all temporarily changed land use is reinstated at the end of the construction period, there are not anticipated to be any residual effects to flood risk or coastal defences during the operational phase of this development.

Decommissioning Effects

7.8.39 If there is no requirement to remove the installed works, there are not anticipated to be any residual decommissioning effects to flood risk or coastal defences. However, if there is a need to remove aspects of the development, it is likely that the risk will be similar to that as outlined in the operational and construction phases. An appropriate methodology will be agreed with the relevant authorities prior to any required decommissioning works.

Summary of Effects

7.8.40 Table 7.55 summarises the predicted impacts of the Lincs proposal, Table 7.56 summarises the predicted impacts of the Docking Shoal proposal and Table 7.57 summarises the predicted impacts of the Race Bank proposal. It can be seen from these tables that all residual effects are considered to be of *negligible* significance.

Table 7.55 | **Summary of Effects – Lincs**

Potential effect	Pre-mitigation effect	Mitigation requirement	Residual effect
Construction			
Installation of ducts beneath flood defences and drains	Major adverse	An agreed construction methodology adopted, including relevant consents, with prior assessment of underlying hydrogeology and soils to inform construction works	*Negligible*
Cable crossing of drains and potential risk of drain pollution and flood risk	Minor adverse	An agreed construction methodology adopted, with oil interceptors and bunding to prevent drain pollution, and working practices to reduce flood risk	*Negligible*
Effect of temporary hard-standing areas on surface water run-off rates and potential risk of drain pollution	Minor adverse to Moderate adverse	Implementation of temporary mitigation to protect watercourses, including oil interceptors and silt traps to maintain water quality in drains, and ditches and ponds to attenuate surface water run-off rates, where required	*Negligible*
Operation			
Effect of hard-standing areas on surface water run-off regime and flood risk	Minor adverse to Moderate adverse	Implementation of permanent mitigation, including oil interceptors and silt traps to maintain water quality in drains, and ditches and ponds to attenuate surface water run-off rates, where required, or one-off payment to KLCIDB	*Negligible*
Leakage of transformer oil from the substation into receiving waters	No impact	Not required	*No* impact
Flood risk to employees of the electrical substation	Negligible	Implementation of a flood management strategy	*Negligible*
Decommissioning			
No effects if left *in situ*; if removed, effects as with construction	Negligible	None required, unless cable or substation removed; then similar mitigation to construction	*Negligible*

Table 7.56 | **Summary of Effects – Docking Shoal**

Potential effect	Pre-mitigation effect	Mitigation requirement	Residual effect
Construction			
Installation of ducts beneath flood defences and drains	This activity will be undertaken during the construction of the Lincs project		
Cable crossing of drains and potential risk of drain pollution and flood risk	Minor adverse	An agreed construction methodology adopted, with oil interceptors and bunding to prevent drain pollution, and working practices to reduce flood risk	*Negligible*
Effect of temporary hard-standing areas on surface water run-off rates and potential risk of drain pollution	Minor adverse to Moderate adverse	Implementation of temporary mitigation to protect watercourses, including oil interceptors and silt traps to maintain water quality in drains, and ditches and ponds to attenuate surface water run-off rates, where required	*Negligible*
Operation			
Effect of hard-standing areas on surface water run-off regime and flood risk	Minor adverse to Moderate adverse	Implementation of permanent mitigation, including oil interceptors and silt traps, to maintain water quality in drains, and ditches and ponds to attenuate surface water run-off rates, where required, or one-off payment to KLCIDB	*Negligible*
Leakage of transformer oil from the substation into receiving waters	No impact	Not required	*No* impact
Flood risk to employees of the electrical substation	Negligible	Implementation of a flood management strategy	*Negligible*
Decommissioning			
No effects if left *in situ*; if removed, effects as with construction	Negligible	None required, unless cable or substation removed; then similar mitigation to construction	*Negligible*

Table 7.57 | **Summary of Effects – Race Bank**

Potential effect	Pre-mitigation effect	Mitigation requirement	Residual effect
Construction			
Landing and installation of cables beneath flood defences and drains	This activity will be undertaken during the construction of the Lincs project.		
Cable crossing of drains, and potential risk of drain pollution and flood risk	Minor adverse	An agreed construction methodology adopted, with oil interceptors and bunding to prevent drain pollution, and working practices to reduce flood risk	*Negligible*
Effect of temporary hard-standing areas on surface water run-off rates and potential risk of drain pollution	Minor adverse to Moderate adverse	Implementation of temporary mitigation to protect watercourses, including oil interceptors and silt traps, to maintain water quality in drains, and ditches and ponds to attenuate surface water run-off rates, where required	*Negligible*
Operation			
Effect of hard-standing areas on surface water run-off regime and flood risk	Minor adverse to Moderate adverse	Implementation of permanent mitigation, including oil interceptors and silt traps, to maintain water quality in drains, and ditches and ponds to attenuate surface-water run-off rates, where required, or one-off payment to KLCIDB	*Negligible*
Leakage of transformer oil from the substation into receiving waters	No impact	Not required	*No* impact
Flood risk to employees of the electrical substation	Negligible	Implementation of a flood management strategy	*Negligible*
Decommissioning			
No effects if left *in situ*; if removed, effects as with construction	Negligible	None required, unless cable or substation removed; then similar mitigation to construction	*Negligible*

Cumulative impacts

7.8.41 The decision to cross the seawall using the HDD technique as a single operation for all three wind farms effectively avoids potential impacts on coastal defences. Potential cumulative impacts arising from the construction of other onshore elements of the three wind farms have been considered, particularly with respect to the opera-

tion of the substation area, and, after mitigation, *no* significant residual impacts are predicted.

7.8.42 No additional cumulative impacts are expected to arise with respect to the construction and operation of National Grid's works at Walpole Marsh substation, nor the extension of Sutton Bridge Power Station.

Conclusions

7.8.43 The potential impacts from the construction and operational phases of the onshore components of the Lincs, Docking Shoal and Race Bank projects, and the significance of these to flood risk and coastal defences have been considered.

7.8.44 The more significant impacts with all three projects are associated with the construction phase. These range from *minor adverse* to *major adverse,* and are associated with the passing of the cable underneath the flood defences and inland drains. The operational impacts range from *minor adverse* to *moderate adverse*, with the more significant impacts associated with the changed surface water run-off regime from hard-standing areas (increased run-off and potential for water pollution). The inclusion of appropriate and adequate mitigation in the development, including attaining all relevant consents, agreeing a construction and operational methodology, and developing a flood management strategy, will reduce the significance of these impacts to *negligible*.

7.9 Hydrology, Hydrogeology, Geology and Soils

Introduction

7.9.1 This chapter assesses the potential direct and indirect impacts of the proposed onshore works of Lincs, Docking Shoal and Race Bank offshore wind farms with respect to hydrology, hydrogeology, geology and soils.

7.9.2 Potential impacts arising from the proposed developments are identified and assessed according to the methods identified below, which take account of both the sensitivity of relevant features of the area and the likely magnitude of effects. Potential impacts arising from the construction, operation and decommissioning of the onshore cables and substations for each of the wind farms are considered. Cumulative effects arising from the construction of all three wind farms and other relevant projects are also considered.

7.9.3 Where potentially significant effects are predicted, appropriate mitigation is proposed.

Assessment of Effects

7.9.4 A phased approach was used to complete the assessment, which considered the proposed use of the site and was completed in accordance with best practice procedures.

7.9.5 The first phase combined a desk-based study of available data and reports, with a site visit. This outlined key issues that would need to be considered in the second phase of the assessment. The second phase involved further desk-based study and incorporation of aspects from other studies, including aspects of the flood risk assessment (FRA) that has been produced for the proposed development (see Appendix A2.12). The latter included a review of the surface water drainage strategy for the development works.

7.9.6 Predictions of impact magnitude and effect assess the potential impacts of any development, without the inclusion of any mitigating measures that may already be incorporated into, or that are required for, the given development. As such, this approach considers the 'worst-case' scenario for the constructional and operational phases, and is intended to identify the potential magnitude of any likely impacts.

The magnitude of potential impacts has been evaluated as indicated in Table 7.58.

Table 7.58 | **Magnitude of potential impacts**

Magnitude	Example description
High	Significant change in environmental conditions likely to cause breaches of statutory objectives or of legislation
Medium	Moderate change in environmental conditions, with or without breaches of statutory objectives or of legislation
Low	Minor change in environmental conditions
Negligible	No discernible change in environmental conditions

7.9.7 Information about the likely significance of potential impacts is assessed as indicated in Table 7.59.

Table 7.59 | **Criteria for evaluating the significance of potential impacts**

Significance	Example description
Major adverse	Severe detrimental affect to local watercourses Permanent flooding or change to flow characteristics of watercourses Permanent reduction in the quality of the surface water resource Permanent adverse impact on aquatic flora or fauna
Moderate adverse	Moderate detrimental effect on local watercourses Severe temporary flooding or change to flow characteristics of watercourses Severe temporary reduction in quality of surface water resources Severe temporary impact on aquatic flora and fauna
Minor adverse	Temporary and minor detrimental effect to local watercourses Moderate local floodinzg adjacent Moderate and reversible local reduction in surface water quality Reversible detrimental effects on aquatic flora or fauna
Negligible	No appreciable impact on humans, aquatic flora and fauna or surface water resources, any minor effects being reversible
Minor beneficial	Minor reduction in risk to humans, animals or plant health Minor localised improvement to the quality of surface water resources or minor reduction in flood risk
Moderate beneficial	Moderate reduction in risk to humans or aquatic fauna and flora Moderate localised improvement to the quality of surface water resources or moderate reduction in flood risk
Major beneficial	Major reduction in risk to humans or aquatic fauna and flora significant localised, or moderate or significant regionalised improvement to the quality of surface water resources Moderate or significant localised or regionalised reduction in flood risk

Potential Effects

7.9.8 A number of effects on the outlined regimes have been considered, including potential construction, operational and decommissioning effects from the proposed cable installation and electrical substation extension.

Potential Construction Effects

7.9.9 It is assumed that the onshore components of the three wind farm projects will be completed in the following order: Lincs (Year 1), Docking Shoal (Year 2) and Race Bank (Year 3). The majority of the construction aspects are associated with the Lincs wind farm. All three phases have a common landfall, with installation of the ducts beneath the coastal defences completed in the first year of construction (Lincs). The Lincs phase also includes the installation of two circuits between the coastal defences and Walpole substation, and the main extension works that are required at the substation for accommodating all three phases and the electrical plant (including transformers, SVCs and busbars) for Lincs. During the second and third years, it is anticipated that the onshore circuits and electrical plant (including transformers, SVCs and busbars) for Docking Shoal and Race Bank respectively will be installed.

Hydrology

7.9.10 Although pollution events resulting from the accidental discharge of fuels, oils or other chemicals used during the construction process are unlikely, they have the potential to significantly affect internal drains (generally of low importance) as well as other receiving waters, including features of much higher importance such as the Nene and the ecologically sensitive estuarine environment of the Wash. As a consequence, potential pollution events associated with the onshore construction works for Lincs, Docking Shoal and Race Bank are considered to be impacts of *major adverse* to *moderate adverse* significance. Cumulative pollution impacts arising from these projects, which will be completed sequentially, are not predicted.

7.9.11 The proposed development will cause temporary physical alterations to the internal drains as a consequence of the crossing of cables through trenching, culvert installation and boring. The temporary disruption of drainage caused by the installation of the onshore circuits Lincs, Docking Shoal and Race Bank are considered to be potential impacts of *minor adverse* significance. Cumulative pollution impacts arising from these projects, which will be completed sequentially, are not predicted.

7.9.12 The significance of the physical alteration on the surface water run-off regime is considered in Section 7.8.

Geology and Hydrogeology

7.9.13 To bring the offshore cable onshore, it is proposed that ducts are inserted beneath the existing coastal defence, a feature of high importance due to its tidal flood protection role. Any adverse effect on the integrity of this flood protection feature would be an impact of *major adverse* significance. The proposed method for crossing this coastal defence is the use of horizontal directional drilling. It is proposed that drilling and the insertion of ducts for Lincs, Docking Shoal and Race Bank be completed in a single operation. Prior to the implementation of this approach, a detailed methodology, incorporating an assessment of ground conditions, will be adopted.

7.9.14 Boring associated with the crossing of drains and the insertion of piles during construction of the substations has the potential to effect the underlying aquifer. This aquifer is recognised as unproductive strata, with the area categorised as a non-aquifer and negligibly permeable, although it is noted that some local land-users hold abstraction licences. The potential for localised effects of construction activities on the local or regional hydrogeology arising from onshore construction works for Lincs, Docking Shoal and Race Bank are considered to be potential impacts of *minor adverse* to *negligible* significance. The construction of the three projects will increase the magnitude of potential impacts but, due to the localised nature of effects (all three projects will take place in very similar locations), significant cumulative impacts are not anticipated.

7.9.15 Installation of cables will involve trench digging and the temporary removal of soil. If this soil has the appropriate thermal resistivity required to achieve the cable ratings, some of it will be replaced. Unsuitable material (eg gravelly, heavy clay) will be replaced by material possessing the required thermal properties. Excess material will be removed from the site and disposed of appropriately (see below). The installation of the onshore circuits and associated back-fill has the potential to interfere with subsurface flow paths. As the land is low-lying, largely flat and of low permeability, and because subsurface water does not form part of a continuous aquifer, impacts are likely to be restricted to local effects on drainage. More significant effects (such as the transportation of pollutants from contaminated land areas) are not predicted in this location. Consequently, potential impacts arising from onshore construction works for Lincs, Docking Shoal and Race Bank are considered to of *minor adverse* significance. The construction of the three projects will increase the magnitude of potential impacts but, due to the localised nature of effects (all three projects will take place in very similar locations), significant cumulative impacts are not predicted.

Soils

7.9.16 If the thermal resistivity of the soil is in line with the design parameters that have been used to calculate the cable ratings, then it can be used to backfill the trenches after installation. Unsuitable material should be replaced with selected materials possessing the required thermal properties. As a larger number of circuits will be installed for Docking Shoal and Race Bank (up to four circuits each) than for Lincs (two circuits), it is envisaged that more material will be removed for those projects than Lincs. Any excess material will be removed from the site and disposed of appropriately, and *no* impact is, therefore, predicted on site due to the dumping of material.

7.9.17 Soils along the proposed route are understood to be unstable beneath a depth of between 1 m and 15 m, because of the sandy soils beneath the silty-clay surface layer. The impact of boring and piling in this soil layer may cause some movement and could be a small risk in the vicinity of the flood defences or other physical structures. The significance of the effect of drilling and boring arising from onshore construction works for Lincs, Docking Shoal and Race Bank is considered to be a potential impact of *minor adverse* significance. The construction of the three projects will increase the magnitude of potential impacts but, due to the localised nature of effects (all three projects will take place in very similar locations), significant cumulative impacts are not predicted.

Potential Operational Effects

Hydrology

7.9.18 There are unlikely to be any additional operational impacts on the hydrology from the laying of the electrical cable route, aside from those outlined in Section 7.8. The use of mineral oil for insulation and cooling purposes in the substation transformers will require the incorporation of bunded areas and oil interceptors in the design. This is necessary so as to avoid environmental damage in the event of a failure or rupture. This follows the assumption that any altered or affected internal drains are returned to pre-development conditions. The risk of pollutant loading to the internal drain or receiving watercourse is very small during the operational phase for Lincs, Docking Shoal and Race Bank, and therefore impacts will be of no more than *minor adverse* significance. No additional cumulative effects are predicted, although there may be benefits arising from the operation of the substations on the same site as this will facilitate effective ongoing environmental management of the three projects.

Geology and Hydrogeology

7.9.19 There are unlikely to be any additional operational impacts on the geology and hydrogeology from the extension of the substation or the laying of the electrical cable route after completion of the construction works. It is possible that the laying of the cable route may continue to affect hydrogeological and subsurface flow paths if it did so during the construction phase. This impact is considered to be of *minor adverse* to *negligible* significance *for* Lincs, Docking Shoal and Race Bank, alone and together.

Soils

7.9.20 There are no operational impacts on soils predicted for any of the projects.

Potential Decommissioning Effects

7.9.21 The impacts arising from decommissioning, if required, are expected to be similar to those arising during construction. An appropriate methodology will be agreed with relevant authorities prior to any decommissioning works.

Mitigation

Construction Effects

7.9.22 Measures will be incorporated to ensure that there are no adverse effects on internal watercourses and drains during the construction phase; these measures will be agreed with the Environment Agency and the King's Lynn Consortium of Internal Drainage Boards before construction begins. Mitigation measures to protect water quality in internal drains will include oil interceptors, silt traps and bunds. These measures are likely to be required for surface water run-off from hard-standing areas and where trenches cross drains. Attenuation measures (such as ponds and ditches) may be required to ensure that there is no significant increase in surface water run-off rates. These measures relate to hard-standing areas and are outlined in the flood risk assessment (Appendix A2.12). The significance of impact after incorporation of these measures is considered to be *negligible*.

7.9.23 An agreed methodology will be adopted for the crossing of drains by open trenches. This methodology will follow the guidelines provided by the Environment Agency and by the King's Lynn Consortium of Internal Drainage Boards, and is described in the flood risk assessment (Appendix A2.12). It includes the return of ditches and field drains to pre-development conditions. The likely significance of impact after incorporation of these mitigation measures is considered to be *negligible*.

7.9.24 A prior assessment of underlying areas for piling and boring will be required. This will determine underlying properties and will help with estimating the likelihood of destabilising flood defences or drastically altering subsurface flow paths. Provided borings and pilings are not installed in areas of identified risk, the likely significance of this is considered to be *minor adverse* on a local scale and *negligible* in the wider area.

7.9.25 Any removed soil and excavated trenches along the route should be checked during construction works to ensure that they are free from sharp stones that could cause cable damage. Selected sand should be used where the soil condition is considered unacceptable, with the use of at least some sand considered to be a necessary precaution. This soil will need to be selected so that it provides the correct electrical rating for the cable installation. So long as these measures are followed, the significance of impacts is considered to be *negligible*.

Operational Effects

7.9.26 A number of mitigation measures will need to be continued from the construction phase into the operational phase, particularly in relation to the substations at Walpole, and any retained hard-standing areas. These mostly concern the inclusion of adequate measures to treat potentially polluted run-off waters from permanent areas of hard-standing (such as bunded areas, oil interceptors and silt traps), attenuation measures to ensure that surface water run-off rates from hard-standing areas do not exceed present levels (ditches and ponds), and continued review of potential impacts of the cable laying on subsurface water flow paths. Standard practices for the containment of oil within substations should be adhered to in the development of the site for the new transformers. These aspects are covered in more detail in the flood risk assessment (Appendix A2.12). With incorporation of these mitigation measures, the significance of these impacts is considered to be *negligible*.

Decommissioning Effects

7.9.27 If cables are left *in situ*, it is unlikely that there will be any impacts from decommissioning. The significance is therefore likely to be *negligible*. However, if cables are to be removed, the likely impacts during decommissioning will be similar to the impacts during construction.

Residual Effects

Construction Effects

7.9.28 With incorporation of adequate mitigation measures, as already outlined, there are unlikely to be any residual effects from the construction phase.

Operation Effects

7.9.29 With incorporation of adequate mitigation measures, as already outlined, there are unlikely to be any residual effects from the operational phase.

Decommissioning Effects

7.9.30 If there is no requirement to remove the installed works, there are not expected to be any residual decommissioning effects on hydrology, hydrogeology, geology or soils. If there is a need to remove aspects of the development, it is likely that the risk will be similar to those outlined above for the construction and operational phases. However, with full consideration of likely impacts and the incorporation of adequate mitigation, there are unlikely to be any residual effects with decommissioning.

Summary of Effects

7.9.31 Table 7.60 summarises the predicted impacts of the Lincs proposal, Table 7.61 summarises the predicted impacts of the Docking Shoal proposal and Table 7.62 summarises the predicted impacts of the Race Bank proposal. It can be seen from these tables that all residual effects are considered to be of *negligible* significance.

Table 7.60 | **Summary of Effects – Lincs**

Potential effect	Pre-mitigation effect	Mitigation requirement	Residual effect
Construction			
Increased pollutant loading to drains	Major adverse to Moderate adverse	Oil interceptors and silt traps included in construction methodology, with bunding for watercourses and hard-standing	*Negligible*
Physical alterations to internal drains	Minor adverse	An agreed construction methodology adopted, with drains reinstated	*Negligible*
Boring beneath coastal flood defences	Major adverse	An agreed construction methodology adopted, with prior assessment of underlying hydrogeology to inform works	*Negligible*
Boring associated with crossing of internal flood defences, internal drains and foundation piles	Minor adverse to Negligible	An agreed construction methodology adopted, with prior assessment of underlying hydrogeology to inform works	*Negligible*
Alteration of subsurface flow paths	Minor adverse	An agreed construction methodology adopted, use of an appropriate backfill	*Negligible*
Disposal of excess soil	No impact	No additional mitigation required	*No* impact
Destabilisation of soils with boring and piling	Minor adverse	An agreed construction methodology adopted, with a prior assessment of underlying soils to inform works	*Negligible*
Operation			
Increased pollutant loading to drains	Minor adverse	Oil interceptors and silt traps included in construction methodology, with bunding for watercourses and hard-standing	*Negligible*
Alteration of subsurface flow paths	Minor adverse	An agreed construction methodology adopted, use of an appropriate backfill	*Negligible*

Table 7.61 | **Summary of Effects – Docking Shoal**

Potential effect	Pre-mitigation effect	Mitigation requirement	Residual effect
Construction			
Increased pollutant loading to drains	Major adverse to Moderate adverse	Oil interceptors and silt traps included in construction methodology, with bunding for watercourses and hard-standing	*Negligible*
Physical alterations to internal drains	Minor adverse	An agreed construction methodology adopted, with drains reinstated	*Negligible*
Boring beneath coastal flood defences	Major adverse	An agreed construction methodology adopted, with prior assessment of underlying hydrogeology to inform works	
Boring associated with crossing of internal flood defences, internal drains and foundation piles	Minor adverse to Negligible	An agreed construction methodology adopted, with prior assessment of underlying hydrogeology to inform works	*Negligible*
Alteration of subsurface flow paths	Minor adverse	An agreed construction methodology adopted, use of an appropriate backfill	*Negligible*
Disposal of excess soil	No impact	No additional mitigation required	*No* impact
Destabilisation of soils with boring and piling	Minor adverse	An agreed construction methodology adopted, with a prior assessment of underlying soils to inform works	*Negligible*
Operation			
Increased pollutant loading to drains	Minor adverse	Oil interceptors and silt traps included in construction methodology, with bunding for watercourses and hard-standing	*Negligible*
Alteration of subsurface flow paths	Minor adverse	An agreed construction methodology adopted, use of an appropriate backfill	*Negligible*

Table 7.62 | **Summary of Effects – Race Bank**

Potential effect	Pre-mitigation effect	Mitigation requirement	Residual effect
Construction			
Increased pollutant loading to drains	Substantial adverse to Moderate adverse	Oil interceptors and silt traps included in construction methodology, with bunding for watercourses and hard-standing	*Negligible*
Physical alterations to internal drains	Minor adverse	An agreed construction methodology adopted, with drains reinstated	*Negligible*
Boring beneath coastal flood defences	Major adverse	An agreed construction methodology adopted, with prior assessment of underlying hydrogeology to inform works	
Boring associated with crossing of internal flood defences, internal drains and foundation piles	Minor adverse to Negligible	An agreed construction methodology adopted, with prior assessment of underlying hydrogeology to inform works	*Negligible*
Alteration of subsurface flow paths	Minor adverse	An agreed construction methodology adopted, use of an appropriate backfill	*Negligible*
Disposal of excess soil	No impact	No additional mitigation required	*No* impact
Destabilisation of soils with boring and piling	Minor adverse	An agreed construction methodology adopted, with a prior assessment of underlying soils to inform works	*Negligible*
Operation			
Increased pollutant loading to drains	Minor adverse	Oil interceptors and silt traps included in construction methodology, with bunding for watercourses and hard-standing	*Negligible*
Alteration of subsurface flow paths	Minor adverse	An agreed construction methodology adopted, use of an appropriate backfill	*Negligible*

Cumulative Impacts

7.9.32 The decision to cross the coastal defences using the HDD technique as a single operation for all three wind farms effectively avoids potential destabilisation impacts and any increased risk from tidal flooding as a consequence of a failure or breach of these defences. Potential cumulative impacts arising from the construction of other onshore elements of the three wind farms have been considered individually in the preceding assessment, and *no* significant cumulative impacts have been identified.

7.9.33 No additional cumulative impacts are expected to arise with respect to the construction and operation of National Grid's works at Walpole Marsh substation, nor the extension of Sutton Bridge Power Station.

Conclusions

7.9.34 The potential impacts from the construction and operational phases of the onshore components of the Lincs, Docking Shoal and Race Bank projects, and the significance of these to hydrology, hydrogeology, geology and soils, have been considered. The more significant impacts are associated with the construction phase, ranging from *negligible* and *minor adverse* to *major adverse* – associated with potential soil movement beneath flood defences with the passing of the cable ducts. There are not likely to be any operational impacts additional to those already identified at the construction phase, with the significance of these generally reduced to *minor adverse.* The inclusion of appropriate and adequate mitigation in the development, including attaining all relevant consents and agreeing a construction and operational methodology, would reduce impact significance to *negligible*.

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Onshore

Chapter 8 | Summary of Impacts

8 Summary of Impacts

8.1 Introduction

8.1.1 The following chapter of the ES presents a summary of the key potential environmental impacts that may arise as a result of the proposed onshore works associated with the proposed Lincs, Docking Shoal and Race Bank offshore wind farm projects. A detailed assessment of potential impacts has been provided in the preceding chapter; therefore, this section is intended to act as a useful reference, whereby the predicted significance of specific potential impacts can be easily found.

8.1.2 Summary impact tables have been created for each wind farm proposal. Where appropriate, the tables are divided further into the following stages of the development: (i) construction/decommissioning; and (ii) operation.

8.1.3 Within each table, a series of headings are used which provide detail on impacts, including the predicted significance. In addition, details are also provided within these tables with regard to proposed mitigation and monitoring measures that, if successfully implemented, could, in turn, reduce the significance of predicted impacts and monitor the actual effects of the activity. The final column in each table also provides an overview of potential cumulative effects.

8.1.4 Due to the different nature of impacts within the physical, biological and human environment, these headings vary slightly between the three tables. However, they generally all include the same information, presented under the headings shown in Table 8.1 below:

Table 8.1 | **Headings of summary impact tables**

Table Heading	Description
Potential Impact	A short summary of the potential impact.
Spatial Extent/Scale	The predicted extent of the effect in question, **Site-specific**, **Local**, **Regional** etc.
Direct/Indirect	Whether it is a **direct** impact or an **indirect** impact
Duration	Whether the impact is **temporary**/**short-term** for the duration of the construction activity or **permanent/long-term**, for the lifetime of the development.
Continuous/Intermittent (physical environment only)	Whether the impact is **continuous** or **intermittent** during the construction/decommissioning phases of the project.
Significance	The predicted significance of the impact. The methods of assigning impact significance vary slightly between various areas addressed in the assessment. However, all predicted impacts are summarised here as either **adverse** or **beneficial** impacts and as **negligible**, **minor**, **moderate** or **major**, a minor adverse impact; a moderate beneficial impact.
Mitigations Monitoring	A summary of mitigation measures proposed (if any) within the main ES and also details of any proposed monitoring.
Cumulative Effect	An overview of any cumulative effects that may arise

8.1.5 This summary is intended only for reference, and the reader is referred to the relevant assessment chapters for a more detailed treatment of the issues summarised here.

Table 8.2 | **Summary of predicted impacts for Lincs Onshore Works**

Activity	Potential Impact	Spatial Extent	Direct / Indirect	Duration	Continuous / Intermittent	Significance of Impact	Mitigation and Monitoring	Cumulative Effect
Cultural heritage								
Construction/decommissioning								
Seawall crossing	Damage to sea banks (18th to 20th century)	Site-specific	Direct	Long-term	Continuous	Negligible	Use of directional drilling technique for seawall crossing.	None anticipated
Installation of onshore circuits and construction of substation	Damage to sites of historical importance	Site-specific	Direct	Long-term	Continuous	Neutral	Avoidance of structures through cable routing and demarcation of exclusion areas for construction works.	None anticipated
	Damage to sites of archaeological importance (including palaeoenvironmental remains and previously unidentified archaeological remains)	Site-specific	Direct	Long-term	Continuous	Minor adverse to negligible	Site visit followed by evaluation if necessary, and further mitigation as appropriate. Geoarchaeological investigation during advanced geotechnical survey, further work as appropriate. Targeted watching brief.	None anticipated
	Effects on the setting of listed buildings, archaeological remains and the wider historic landscape	Wider area	Indirect	Short-term	Intermittent	Minor adverse to negligible	No mitigation required	None anticipated
Operation								
Onshore circuits/ substation	Effects on the setting of listed buildings, archaeological remains and the wider historic landscape	Localised	Indirect	Long-term	Continuous	Negligible	No mitigation required	None anticipated

Activity	Potential Impact	Spatial Extent	Direct / Indirect	Duration	Continuous / Intermittent	Significance of Impact	Mitigation and Monitoring	Cumulative Effect
Landscape and visual								
Construction and operation of onshore circuits and substation	Effects on designated landscapes	Localised	Indirect	Short-term	Intermittent	Negligible	Reinstatement of vegetation along cable route and working areas.	None anticipated
	Effects on landscape character	Localised	Indirect	Short-term	Intermittent	Minor adverse to negligible	Implement substation mitigation planting and landscape management and enhancement of existing boundary vegetation, particularly along Walpole Bank.	None anticipated
	Effects on landscape features within the substation area	Localised	Indirect	Long-term	Continuous	Negligible	Appropriate working methods will be implemented to limit the effect on existing features. Where this cannot be achieved, existing landscape features will be reinstated where appropriate.	None anticipated
	Effects on wider landscape features	Localised	Indirect	Short-term	Intermittent	Minor adverse to negligible	Reinstatement of vegetation along cable route and working areas.	None anticipated
	Visual effects on specific viewpoints	Localised	Direct	Long-term	Intermittent	Minor adverse to negligible	Implement substation mitigation planting.	None anticipated
Socio-economics, tourism and recreation								
Construction/decommissioning								
Installation of onshore circuits and construction of substation	Effects on local businesses	Localised	Indirect	Short-term	Intermittent	Negligible	No mitigation required	None anticipated
	Effects on Peter Scott Walk	Localised	Indirect	Short-term	Intermittent	Low adverse	No mitigation required	None anticipated
	Effects on other features of tourism and recreational importance (including national cycleways)	Localised	Indirect	Short-term	Intermittent	Negligible	No mitigation required	None anticipated
Operation								
Operation of onshore circuits and construction of substation	Effects on local businesses, recreation and tourism	Localised	Indirect	Long-term	Continuous	Negligible	No mitigation required	None anticipated
Noise								
Construction/decommissioning								
Installation of onshore circuits and construction of substation	Construction noise arising from cable installation and substation construction	Localised	Direct	Short-term	Intermittent	Low adverse	Use of appropriate screens and working practices.	Significant cumulative impact with National Grid's extension works not predicted.

Activity	Potential Impact	Spatial Extent	Direct / Indirect	Duration	Continuous / Intermittent	Significance of Impact	Mitigation and Monitoring	Cumulative Effect
Operation								
Substation operation	Noise caused by operation of substation	Localised	Direct	Long-term	Continuous	Negligible	Inclusion of blast walls around transformer and SVC compounds provides noise attenuation; additional features to achieve appropriate noise reductions to be included as required.	Cumulative impact of combined operation of Lincs, Docking Shoal and Race Bank wind farms assessed and significant impact not predicted.
Ecology and nature conservation								
Construction/decommissioning								
Installation of onshore circuits	Crossing of ditches, hedgerows and field margins	Localised	Direct	Short-term	Intermittent	Negligible	Reinstatement of vegetation along cable route and working areas, installation of drain culverts or drilling for crossing of larger ditches.	None anticipated
Operation								
Operation of substation	Disturbance to species	Localised	Direct	Long-term	Continuous	Negligible	No mitigation required	None anticipated
Transport and traffic								
Construction/decommissioning								
Installation of onshore circuits and construction of substation	Increase in traffic levels across highway network	Wider area	Direct	Short-term	Continuous	Minor adverse	Appropriate delivery schedule and limiting movements to avoid local peak hours. A route management strategy will also be implemented.	Construction of substation and Lincs cables will coincide with National Grid's works and proposed extension to Sutton Bridge Power Station. No significant impact predicted.
Operation								
Operation of substation	Increase in traffic levels within Walpole	Site-specific	Direct	Long-term	Intermittent	Negligible	No mitigation required	None anticipated
Flood risk and coastal defences								
Construction/decommissioning								
Seawall crossing	Damage to seawall resulting in increased flood risk	Localised	Direct	Short-term	Intermittent	Negligible	Use of directional drilling technique for seawall crossing, pre-construction surveys and implementation of an agreed installation methodology.	None anticipated

Activity	Potential Impact	Spatial Extent	Direct / Indirect	Duration	Continuous / Intermittent	Significance of Impact	Mitigation and Monitoring	Cumulative Effect
Cable Installation	Increased risk of flooding arising from drain crossings, increase in hard-standing areas and working compounds and areas	Localised	Indirect	Short-term	Intermittent	Negligible	An agreed construction methodology and appropriate working practices to reduce flood risk.	None anticipated
Operation								
Operation of sub-station	Effect of hard-standing areas on surface water run-off regime and flood risk	Localised	Indirect	Long-term	Continuous	Negligible	Implementation of permanent mitigation to attenuate surface water run-off rates where required, or other solution in agreement with IDB.	Flood risk assessment of combined substation area (Lincs, Docking Shoal and Race Bank) together with proposed National Grid extension of Walpole Bank predicted no significant cumulative impact.
Hydrology, hydrogeology, geology and soils								
Construction/decommissioning								
Seawall crossing	Potential destabilisation of sea defences	Localised	Direct	Short-term	Intermittent	Negligible	Use of directional drilling technique for seawall crossing, pre-construction surveys and adoption of approved installation methodology.	None anticipated
Installation of onshore circuits and construction of substation	Pollution of sensitive water bodies	Wider area	Indirect	Short-term	Intermittent	Negligible	Installation of oil interceptors and silt traps included in construction methodology, with bunding for watercourses and hard-standing.	None anticipated
	Alteration of drainage and subsurface flow paths	Localised	Indirect	Long-term	Continuous	Negligible	An agreed construction methodology adopted, use of an appropriate backfill.	None anticipated
Operation								
Operation of sub-station	Pollution of sensitive water bodies	Wider area	Indirect	Long-term	Continuous	Negligible	Oil interceptors and silt traps included in construction methodology, with bunding for watercourses and hard-standing.	None anticipated
	Alteration of drainage and subsurface flow paths	Localised	Indirect	Long-term	Continuous	Negligible	An agreed construction methodology adopted, use of an appropriate backfill.	None anticipated

Table 8.3 | **Summary of predicted impacts for Docking Shoal Onshore Works**

Activity	Potential Impact	Spatial Extent	Direct / Indirect	Duration	Continuous / Intermittent	Significance of Impact	Mitigation and Monitoring	Cumulative Effect
Cultural heritage								
Construction/decommissioning								
Seawall crossing	Damage to sea banks (18th to 20th century)	Seawall crossing addressed in Lincs						
Installation of onshore circuits and construction of substation	Damage to sites of historical importance	Site-specific	Direct	Long-term	Continuous	Neutral	Avoidance of structures through cable routing and demarcation of exclusion areas for construction works.	None anticipated
	Damage to sites of archaeological importance (including palaeoenvironmental remains and previously unidentified archaeological remains)	Site-specific	Direct	Long-term	Continuous	Minor adverse to negligible	Site visit, followed by evaluation if necessary and further mitigation as appropriate. Geoarchaeological investigation during advance geotechnical survey; further work as appropriate. Targeted watching brief.	None anticipated
	Effects on the setting of listed buildings, archaeological remains and the wider historic landscape	Wider area	Indirect	Short-term	Intermittent	Minor adverse to negligible	No mitigation required	None anticipated
Operation								
Onshore circuits/ substation	Effects on the setting of listed buildings, archaeological remains and the wider historic landscape	Localised	Indirect	Long-term	Continuous	Negligible	No mitigation required	None anticipated

Activity	Potential Impact	Spatial Extent	Direct / Indirect	Duration	Continuous / Intermittent	Significance of Impact	Mitigation and Monitoring	Cumulative Effect
Landscape and visual								
Construction and operation of onshore circuits and substation	Effects on designated landscapes	Localised	Indirect	Short-term	Intermittent	Negligible	Reinstatement of vegetation along cable route and working areas.	None anticipated
	Effects on landscape character	Localised	Indirect	Short-term	Intermittent	Minor adverse to negligible	Implement substation mitigation planting and landscape management and enhancement of existing boundary vegetation, particularly along Walpole Bank.	None anticipated
	Effects on landscape features within the substation area	Localised	Indirect	Long-term	Continuous	Negligible	Mitigation implemented during construction of Lincs substation.	None anticipated
	Effects on wider landscape features	Localised	Indirect	Short-term	Intermittent	Minor adverse to negligible	Reinstatement of vegetation along cable route and working areas.	None anticipated
	Visual effects on specific viewpoints	Localised	Direct	Long-term	Intermittent	Minor adverse to negligible	Implement substation mitigation planting.	None anticipated
Socio-economics, tourism and recreation								
Construction/decommissioning								
Installation of onshore circuits and construction of substation	Effects on local businesses	Localised	Indirect	Short-term	Intermittent	Negligible	No mitigation required	None anticipated
	Effects on Peter Scott Walk	Localised	Indirect	Short-term	Intermittent	Low adverse	No mitigation required	None anticipated
	Effects on other features of tourism and recreational importance (including national cycleways)	Localised	Indirect	Short-term	Intermittent	Negligible	No mitigation required	None anticipated
Operation								
Operation of onshore circuits and construction of substation	Effects on local businesses recreation and tourism	Localised	Indirect	Long-term	Continuous	Negligible	No mitigation required	None anticipated
Noise								
Construction/decommissioning								
Installation of onshore circuits and construction of substation	Construction noise arising from cable installation and substation construction	Localised	Direct	Short-term	Intermittent	Low adverse	Use of appropriate screens and working practices.	Significant cumulative impact with National Grid's extension works not predicted.

Activity	Potential Impact	Spatial Extent	Direct / Indirect	Duration	Continuous / Intermittent	Significance of Impact	Mitigation and Monitoring	Cumulative Effect
Operation								
Substation operation	Noise caused by operation of substation	Localised	Direct	Long-term	Continuous	Negligible	Inclusion of blast walls around transformer and SVC compounds provides noise attenuation. Additional features to achieve appropriate noise reductions to be included as required.	Cumulative impact of combined operation of Lincs, Docking Shoal and Race Bank wind farms assessed and significant impact not predicted.
Ecology and nature conservation								
Construction/decommissioning								
Installation of onshore circuits	Crossing of ditches, hedgerows and field margins	Localised	Direct	Short-term	Intermittent	Negligible	Reinstatement of vegetation along cable route and working areas, installation of drain culverts or drilling for crossing of larger ditches.	None anticipated
Operation								
Operation of substation	Disturbance to species	Localised	Direct	Long-term	Continuous	Negligible	No mitigation required	None anticipated
Transport and traffic								
Construction/decommissioning								
Installation of onshore circuits and construction of substation	Increase in traffic levels across highway network	Wider area	Direct	Short-term	Continuous	Minor adverse	Appropriate delivery schedule and limiting movements to avoid local peak hours. A route management strategy will also be implemented.	Construction of substation and Lincs cables will coincide with National Grid's works and proposed extension to Sutton Bridge Power Station. No significant impact predicted.
Operation								
Operation of substation	Increase in traffic levels within Walpole	Site-specific	Direct	Long-term	Intermittent	Negligible	No mitigation required	None anticipated
Flood risk and coastal defences								
Construction/decommissioning								
Seawall crossing	Damage to seawall resulting in increased flood risk	Seawall crossing addressed in Lincs						
Cable installation	Increased risk of flooding arising from drain crossings, increase in hard-standing areas and working compounds and areas	Localised	Indirect	Short-term	Intermittent	Negligible	An agreed construction methodology and appropriate working practices to reduce flood risk.	None anticipated

Activity	Potential Impact	Spatial Extent	Direct / Indirect	Duration	Continuous / Intermittent	Significance of Impact	Mitigation and Monitoring	Cumulative Effect
Operation								
Operation of substation	Effect of hard-standing areas on surface water run-off regime and flood risk	Localised	Indirect	Long-term	Continuous	Negligible	Implementation of permanent mitigation to attenuate surface water run-off rates where required, or other solution in agreement with IDB.	Flood risk assessment of combined substation area (Lincs, Docking Shoal and Race Bank), together with proposed National Grid extension of Walpole Bank predicted no significant cumulative impact.
Hydrology, hydrogeology, geology and soils								
Construction/decommissioning								
Seawall crossing	Potential destabilisation of sea defences	Seawall crossing addressed in Lincs						
Installation of onshore circuits and substation construction	Pollution of sensitive water bodies	Wider area	Indirect	Short-term	Intermittent	Negligible	Installation of oil interceptors and silt traps included in construction methodology, with bunding for watercourses and hard-standing.	None anticipated
	Alteration of drainage and subsurface flow paths	Localised	Indirect	Long-term	Continuous	Negligible	An agreed construction methodology adopted, use of an appropriate backfill.	None anticipated
Operation								
Operation of substation	Pollution of sensitive water bodies	Wider area	Indirect	Long-term	Continuous	Negligible	Oil interceptors and silt traps included in construction methodology, with bunding for watercourses and hard-standing.	None anticipated
	Alteration of drainage and subsurface flow paths	Localised	Indirect	Long-term	Continuous	Negligible	An agreed construction methodology adopted, use of an appropriate backfill.	None anticipated

Table 8.4 | **Summary of predicted impacts for Race Bank Onshore Works**

Activity	Potential Impact	Spatial Extent	Direct / Indirect	Duration	Continuous / Intermittent	Significance of Impact	Mitigation and Monitoring	Cumulative Effect
Cultural heritage								
Construction/decommissioning								
Seawall crossing	Damage to sea banks (18th to 20th century)	Seawall crossing addressed in Lincs						
Installation of onshore circuits and construction of substation	Damage to sites of historical importance	Site-specific	Direct	Long-term	Continuous	Neutral	Avoidance of structures through cable routing and demarcation of exclusion areas for construction works.	None anticipated
	Damage to sites of archaeological importance (including palaeoenvironmental remains and previously unidentified archaeological remains)	Site-specific	Direct	Long-term	Continuous	Minor adverse to negligible	Site visit, followed by evaluation if necessary and further mitigation as appropriate. Geoarchaeological investigation during advance geotechnical survey; further work as appropriate. Targeted watching brief.	None anticipated
	Effects on the setting of listed buildings, archaeological remains and the wider historic landscape	Wider area	Indirect	Short-term	Intermittent	Minor adverse to negligible	No mitigation required	None anticipated
Operation								
Onshore circuits/ substation	Effects on the setting of listed buildings, archaeological remains and the wider historic landscape	Localised	Indirect	Long-term	Continuous	Negligible	No mitigation required	None anticipated

Activity	Potential Impact	Spatial Extent	Direct / Indirect	Duration	Continuous / Intermittent	Significance of Impact	Mitigation and Monitoring	Cumulative Effect
Landscape and visual								
Construction and operation of onshore circuits and substation	Effects on designated landscapes	Localised	Indirect	Short-term	Intermittent	Negligible	Reinstatement of vegetation along cable route and working areas.	None anticipated
	Effects on landscape character	Localised	Indirect	Short-term	Intermittent	Minor adverse to negligible	Implement substation mitigation planting and landscape management and enhancement of existing boundary vegetation, particularly along Walpole Bank.	None anticipated
	Effects on landscape features within the substation area	Localised	Indirect	Long-term	Continuous	Negligible	Mitigation implemented during construction of Lincs substation.	None anticipated
	Effects on wider landscape features	Localised	Indirect	Short-term	Intermittent	Minor adverse to negligible	Reinstatement of vegetation along cable route and working areas.	None anticipated
	Visual effects on specific viewpoints	Localised	Direct	Long-term	Intermittent	Minor adverse to negligible	Implement substation mitigation planting.	None anticipated
Socio-economics, tourism and recreation								
Construction/decommissioning								
Installation of onshore circuits and construction of substation	Effects on local businesses	Localised	Indirect	Short-term	Intermittent	Negligible	No mitigation required	None anticipated
	Effects on Peter Scott Walk	Localised	Indirect	Short-term	Intermittent	Low adverse	No mitigation required	None anticipated
	Effects on other features of tourism and recreational importance (including national cycleways)	Localised	Indirect	Short-term	Intermittent	Negligible	No mitigation required	None anticipated
Operation								
Operation of onshore circuits and construction of substation	Effects on local businesses, recreation and tourism	Localised	Indirect	Long-term	Continuous	Negligible	No mitigation required	None anticipated

Activity	Potential Impact	Spatial Extent	Direct / Indirect	Duration	Continuous / Intermittent	Significance of Impact	Mitigation and Monitoring	Cumulative Effect
Noise								
Construction/decommissioning								
Installation of onshore circuits and construction of substation	Construction noise arising from cable installation and substation construction	Localised	Direct	Short-term	Intermittent	Low adverse	Use of appropriate screens and working practices.	Significant cumulative impact with National Grid's extension works not predicted.
Operation								
Substation operation	Noise caused by operation of substation	Localised	Direct	Long-term	Continuous	Negligible	Inclusion of blast walls around transformer and SVC compounds provides noise attenuation. Additional features to achieve appropriate noise reductions to be included as required.	Cumulative impact of combined operation of Lincs, Docking Shoal and Race Bank wind farms assessed and significant impact not predicted.
Ecology and nature conservation								
Construction/decommissioning								
Installation of onshore circuits	Crossing of ditches, hedgerows and field margins	Localised	Direct	Short-term	Intermittent	Negligible	Reinstatement of vegetation along cable route and working areas, installation of drain culverts or drilling for crossing of larger ditches.	None anticipated
Operation								
Operation of substation	Disturbance to species	Localised	Direct	Long-term	Continuous	Negligible	No mitigation required	None anticipated
Transport and traffic								
Construction/decommissioning								
Installation of onshore circuits and construction of substation	Increase in traffic levels across highway network	Wider area	Direct	Short-term	Continuous	Minor adverse	Appropriate delivery schedule and limiting movements to avoid local peak hours. A route management strategy will also be implemented.	Construction of substation and Lincs cables will coincide with National Grid's works and proposed extension to Sutton Bridge Power Station. No significant impact predicted.
Operation								
Operation of substation	Increase in traffic levels within Walpole	Site-specific	Direct	Long-term	Intermittent	Negligible	No mitigation required	None anticipated

Activity	Potential Impact	Spatial Extent	Direct / Indirect	Duration	Continuous / Intermittent	Significance of Impact	Mitigation and Monitoring	Cumulative Effect
Flood risk and coastal defences								
Construction/decommissioning								
Seawall crossing	Damage to seawall resulting in increased flood risk	Seawall crossing addressed in Lincs						
Cable installation	Increased risk of flooding arising from drain crossings, increase in hard-standing areas and working compounds and areas	Localised	Indirect	Short-term	Intermittent	Negligible	An agreed construction methodology and appropriate working practices to reduce flood risk.	None anticipated
Operation								
Operation of substation	Effect of hard-standing areas on surface water run-off regime and flood risk	Localised	Indirect	Long-term	Continuous	Negligible	Implementation of permanent mitigation to attenuate surface water run-off rates where required, or other solution in agreement with IDB.	Flood risk assessment of combined substation area (Lincs, Docking Shoal and Race Bank), together with proposed National Grid extension of Walpole Bank predicted no significant cumulative impact.
Hydrology, hydrogeology, geology and soils								
Construction/decommissioning								
Seawall crossing	Potential destabilisation of sea defences	Seawall crossing addressed in Lincs						
Installation of onshore circuits and substation construction	Pollution of sensitive water bodies	Wider area	Indirect	Short-term	Intermittent	Negligible	Installation of oil interceptors and silt traps included in construction methodology, with bunding for watercourses and hard-standing.	None anticipated
	Alteration of drainage and subsurface flow paths	Localised	Indirect	Long-term	Continuous	Negligible	An agreed construction methodology adopted, use of an appropriate backfill.	None anticipated
Operation								
Operation of substation	Pollution of sensitive water bodies	Wider area	Indirect	Long-term	Continuous	Negligible	Oil interceptors and silt traps included in construction methodology, with bunding for watercourses and hard-standing.	None anticipated
	Alteration of drainage and subsurface flow paths	Localised	Indirect	Long-term	Continuous	Negligible	An agreed construction methodology adopted, use of an appropriate backfill.	None anticipated

Onshore

Chapter 9 | Terms and Abbreviations

Terms and Abbreviations

ABPmer	ABP Marine Environmental Research Ltd
ACD	above chart datum
ADCP	acoustic Doppler current profiler
AGDS	acoustic ground discrimination survey
AGLV	Area of Great Landscape Value
AILQ	Area of Important Landscape Quality
AIS	air-insulated switchgear
ALE	Abnormal Load Engineering
AMS/AMSL	above mean sea level
AOD	above ordnance datum
AONB	Area of Outstanding Natural Beauty
ATC	automatic traffic count
B	magnetic
BAP	Biodiversity Action Plan
BGS	British Geological Survey
BP	before present
BTO	British Trust for Ornithology
BWEA	British Wind Energy Association
CAA	Civil Aviation Authority
CBD	Convention on Biological Diversity
CCI	Countryside Character Initiative
CCW	Countryside Council for Wales
CD	chart datum
CEFAS	Centre for Environment, Food and Aquaculture Science
CEH	Centre for Ecology and Hydrology
CMACS	Centre for Marine and Coastal Studies
CNE	Central East Networks
COWRIE	Collaborative Offshore Wind Research into the Environment
CPA	Coastal Protection Act
CREL	Centrica Renewable Energy Limited
CRoW	Countryside and Rights of Way
CRSA	cable route study area
cSAC	candidate Special Area of Conservation
CSL	Central Services Laboratory
CWS	County Wildlife Sites
Defra	Department for Environment Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions
DfT	Department for Transport
DoE	Department of the Environment
DPD	Development Plan Documents
DSA	data search area
DTI	Department of Trade and Industry
DTM	Digital Terrain Modelling
E	electric
EA	Environment Agency
EFTA	European Free Trade Association
EH	English Heritage
EIA	environmental impact assessment
EMF	electromagnetic field
EN	English Nature
EPA	Environment Protection Authority
EPR	ethylene propylene rubber
EQS	Environmental Quality Standard
ES	Environmental Statement
ESFJC	Eastern Sea Fisheries Joint Committee
ESS	Environmentally Sustainable Systems
FEPA	Food and Environment Protection Act
FRA	flood risk assessment
GC–MS	gas chromatography – mass spectrometry
GIS	Geographical Information System
GIS	Gas Insulated Substation
GPS	Global Positioning System
GSA	Guide to Best Practice in Seascape Assessment
GW	Greater Wash
HAT	highest astronomical tide
HDD	horizontal directional drilling
Hs (m)	significant wave height (metres)

HS&E	health, safety and the environment
HSE	Health and Safety Executive
HVDC	high-voltage direct current
IALA	International Association of Lighthouse Authorities
ICES	International Council for the Exploration of the Sea
IDB	Internal Drainage Board
iE	induced electric
IEA	Institute for Environmental Assessment
IEC	International Electrotechnical Commission
IEMA	Institute of Environmental Management and Assessment
IMD	Index of Multiple Deprivation
ind.	Individuals
IPCC	Intergovernmental Panel on Climate Change
ISQC	Interim Sediment Quality Criteria
JNCC	Joint Nature Conservation Committee
KLCIDB	King's Lynn Consortium of Internal Drainage Board
KLHC	King's Lynn Harbour Conservancy
KLWNBC	King's Lynn and West Norfolk Borough Council
LAT	Lowest Astronomical Tide
LB	Listed Building
LCA	Landscape Character Area
LCC	Lincolnshire County Council
LDD	Local Development Document
LDF	Local Development Framework
LDS	Local Development Scheme
LID	Lynn and Inner Dowsing
LNR	Local Nature Reserve
LPA	Local Planning Authority
MCA	Marine and Coastguard Agency
MCC	manual classified count
mCD	metres, relative to chart datum
MDL	minimum detection level
MHWS	mean high water spring
MLW	mean low water
MLWM	mean low water mark
mODN	metres, relative to ordnance datum, Newlyn
MSL	mean sea level
NCC	Nature Conservation Committee
NFFO	National Federation of Fishermen's Organisations
NGT	National Grid Transco
NMR	National Monuments Record
NNR	National Nature Reserve
Non-SPEC	Species not of European Conservation Concern
O&M	operation and maintenance
OBS	optical back-scatter
OD	ordnance datum
ODN	ordnance datum, Newlyn
ODPM	Office of the Deputy Prime Minister
OFGEM	Office of Gas and Electricity Markets
OHL	overhead line
PAH	polycyclic aromatic hydrocarbons
PAX	passengers
PEXA	Practice and Exercise Area
PFU	plaque-forming units
PO	producer organisation
PPG	Planning Policy Guidance
PPS	Planning Policy Statement
PPV	Peak Particle Velocity
PSA	particle size analysis
pSPA	potential Special Protection Area
PTS	permanent threshold shift
RB	Registered Battlefield
RBD	River Basin District
RBMP	River Basin Management Plan
RES	Regional Economic Strategy
RNLI	Royal National Lifeboat Institution
ROV	remotely operated vehicle
RPaGs	Registered Parks and Gardens of Special Historic Interest
RPG	Regional Planning Guidance
RSPB	Royal Society for the Protection of Birds
RSS	Regional Spatial Strategy
SAC	Special Area of Conservation
SAM	Scheduled Ancient Monuments

SCI	Sites of Community Importance
SDRT	Sustainable Development Round Table
SEA	Strategic Environmental Assessment
SHDC	South Holland District Council
SNH	Scottish Natural Heritage
SOA	Super Output Area
SoS	Secretary of State (for Trade and Industry)
SPA	Special Protection Area
SPEC	Species of European Conservation Concern
SPL	sound pressure level
SSC	suspended sediment concentration
SSSI	Site of Special Scientific Interest
SVA	Seascape and Visual Assessment
SVC	Static Var Compensation
Tm (s)	time (seconds)
TTS	temporary threshold shift
UKCIP	UK Climate Impacts Programme
UKCS	UK Continental Shelf
UKHO	UK Hydrographic Office
UKOOA	UK Offshore Operators Association
UNEP	United Nations Environment Programme
UNFCC	United Nations Framework Convention on Climate Change
UXO	unexploded ordnance
VDV	vibration dose values
VER	valued ecological receptor
VP	Vantage Point
W&C Act	Wildlife and Countryside Act
WAS	Wetland Advisory Servive
WeBS	Wetland Birds Suvey
WMO	World Meteorological Organization
WQTAG	Water Quality Technical Advisory Group
WTG	wind turbine generator
WWT	Wildfowl & Wetlands Trust
XLPE	cross-linked polyethylene
ZTV	zone of theoretical visibility
ZVI	zone of visual influence

LINCS OFFSHORE WIND FARM

Environmental Statement Volume Two: Onshore

DOCKING SHOAL OFFSHORE WIND FARM

Environmental Statement Onshore Works

RACE BANK OFFSHORE WIND FARM

Environmental Statement Onshore Works

January 2007

centrica energy

Produced in association with

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Preface

This Environmental Statement has been prepared by the RPS Group Plc on behalf of Centrica (Lincs) Ltd, Centrica (DSW) Ltd and Centrica (RBW) Ltd in support of the following applications for an offshore wind farm off the Lincolnshire coast and associated onshore works at Walpole, Norfolk:

Application	Lead Authority
Volume 1: Offshore Works Lincs Offshore Wind Farm Centrica (Lincs) Ltd ('Centrica')	
Section 36 and Section 36A of the Electricity Act 1989	The Department of Trade and Industry (DTI)
Section 95 of the Energy Act 2004*	The Department of Trade and Industry (DTI)
Food and Environment Protection Act 1985 Part II	The Department for Environment, Food and Rural Affairs (Defra)
Section 34 of the Coast Protection Act 1949	The Department for Environment, Food and Rural Affairs (Defra)
Food and Environment Protection Act 1985 Part II – disposal of dredged material*	The Department for Environment, Food and Rural Affairs (Defra)
Volume 2: Onshore Works Lincs, Docking Shoal and Race Bank Offshore Wind Farms Centrica (Lincs) Ltd, Centrica (DSW) Ltd and Centrica (RBW) Ltd ('Centrica')	
Town and Country Planning Act 1990 – Section 57 Centrica (DSW) Ltd and Centrica (RBW) Ltd	King's Lynn and West Norfolk Borough Council and South Holland District Council
Deemed Planning Permission under section 90 of the Town and Country Planning Act 1990 (sought as part of the section 36 application) Centrica (Lincs) Ltd	The Department of Trade and Industry (DTI)
Land Drainage Act 1991 – Section 23*	Environment Agency
Water Resources Act 1991 – Section 109*	Environment Agency
Bye-Laws under Water Resources Act 1991 Schedule 25 – Sea Defences*	Environment Agency

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Copies of this Environmental Statement are available on request and are charged at £5 for a DVD and £250 for a hardcopy. To obtain a copy please contact: Centrica (Lincs) Limited, 3 The Square, Stockley Park, Uxbridge, UB11 1BG.

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An electronic version of the Non-Technical Summary is available to download from the Centrica website: www.centrica.co.uk/renewables.

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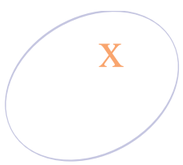
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