









Treading Wind Farm

engena

prepared on behalf of

WindVentures

January 2011

Non-Technical Summary Volume 1

PREFACE

This Non-Technical Summary (NTS) provides a summary of the key findings of the Environmental Impact Assessment for the proposed six turbine Treading Wind Farm.

This NTS is presented in two sections. The first section introduces the key concepts of wind energy, the process of Environmental Impact Assessment (EIA) and describes the proposed development. This is Section A.

The second section describes the key methodologies and findings of the EIA. Important paragraphs which denote the residual impacts of the development following any proposed mitigation measures are highlighted with a light grey box. This is Section B.

If further detail is required on any of the topics noted in this NTS, please refer to the full environmental statement, figures booklet and visualisations.

Copies of these are held at Fenland District Council, Fenland Hall, County Road, March, Cambridgeshire, PE15 8NQ and South Holland District Council Offices, Priory Road, Spalding, PE11 2XE, as well as Long Sutton Library and Wisbech Library.

Details of how to purchase either a printed or CD copy of the entire document are provided on Page 4 of this document.

CONTENTS

1 Preface

3 Non - Technical Summary A : The Proposal

31 Non - Technical Summary B : The Findings of the EIA

85 Appendix 1 : Energy Calculations

CONTENTS

NON-TECHNICAL SUMMARY A : THE PROPOSAL

Contents

4	Introduction
5	Climate Change and Wind Energy
9	Regional Studies
12	Elements of a Modern Wind Farm
15	The Concept of Environmental Impact Assessment (EIA)
15	EIA and Wind Farms
15	The Process of Undertaking an EIA
16	The Applicant
16	The Location
17	The Proposal
20	The Site Layout
22	Site Selection
23	The Developer's Site Selection Philosophy
26	Layout Evolution

INTRODUCTION

A.1 This Non-Technical Summary forms Volume One of a four-volume, five-part Environmental Statement which describes the Environmental Impact Assessment (EIA) for the proposed Treading Wind Farm and presents the findings and conclusions, as detailed in **Table A.1** below.

NO.	DOCUMENT	TITLE	CONTENTS
1	Volume 1	Non-Technical Summary	summarises the proposal and the key conclusions of the EIA for the non-technical reader
2	Volume 2	Written Statement	presents the full technical and professional assessments of the EIA
3	Volume 2	Appendices	presents the appendices referred to in the written statement
4	Volume 3	Figures	presents the figures referred to in the written statement
5	Volume 4	Visualisations	presents the visualisations referred to in the Landscape and Visual Assessment (LVA)

Table A.1 - The Environmental Statement

A.2 The Environmental Impact Assessment aims to provide a thorough, independent and objective assessment of the proposal identifying its anticipated significant impacts.

A.3 Please note that this document is a summary of the **key** issues and findings identified by the Environmental Impact Assessment. For full details of all the findings of the studies involved in the Environmental Impact Assessment of this project, as well as full details of the methodologies used in these studies, please refer to Volume 2, the Written Statement (and the accompanying appendices) and where needed Volumes 3 & 4.

A.4 In addition to the Environmental Statement the developer, Wind Ventures, has submitted an independent Planning Appraisal of the site, which summarises the Planning Policy context of the development.

A.5 Printed copies of all four volumes in addition to the Planning Appraisal are available at Fenland District Council, Fenland Hall, County Road, March, Cambridgeshire, PE15 8NQ and South Holland District Council Offices, Priory Road, Spalding, PE11 2XE, as well as Long Sutton Library and Wisbech Library. Additional printed copies can be purchased at a cost of £500 +VAT. Digital versions on CD-ROM can also be purchased at a cost of £10 + VAT. To order copies, please contact Engena Ltd at: The Old Stables, Bosmere Hall, Creeting St Mary, IP6 8LL.

CLIMATE CHANGE AND WIND ENERGY



A.6 Scientific opinion has now converged on the appreciation that human activity, including the burning of fossil fuels, is changing the earth's climate.

A.7 This conclusion is highlighted in the findings of the International Panel on Climate Change Fourth Report, 2007, which draws together the knowledge of over 2 500 expert reviewers, and 800 contributing authors from 130 countries (IPCC, 2007). This report clearly delineates those changes in our environment caused by natural events (such as volcanic eruptions) from human induced changes. The report concludes with 90% certainty that global warming over the past 50 years is caused by human activity.

A.8 The IPCC predict that warming of approximately 0.2°C per decade will occur if human activity continues along its current path. However, if it were possible to maintain greenhouse gas emissions at year 2000 levels then the climate would warm at a lesser 0.1°C per decade due to the slow response of the oceans (IPCC, 2007).

A.9 Although the impacts of climate change are likely to be felt at a local level, the reduction of these impacts and the adaption of the human population to climate change, is clearly a global issue which requires international co-operation. It is against this backdrop that the Kyoto Protocol was formulated. The Kyoto Protocol attempts to tackle the problem of global warming 'at its source' and legally binds 183 ratified nations, including China, India, Australia, Russia and the European Community to reduce 'greenhouse gas' emissions associated with global warming.

A.10 International climate change policy has since filtered down through both European, national and regional levels in the UK as a means to practically implement the required changes in our way of life. One of the key changes identified within European and hence national policy has been the need to increase the use of renewable energy.

A.11 In January 2008 EU member states were allocated individual renewable energy targets in a Proposal Directive which was then formulated into Directive 2009/28/EC of the European Parliament and Council (European Parliament, 2009). The United Kingdom was allocated 15% of energy to be derived from renewable sources by 2020. The BBC reported that '*at 15% the UK target is lower than the EU average, but means it would have to achieve the biggest increase of any country - because it is starting from such a low base'* (BBC, 2008).

A.12 It is important to note that this renewable energy target is a percentage of energy, rather than a percentage of electricity supply. As renewable electricity technologies are further advanced than non-electricity generating technologies, such as transport, it is expected that there will be increased pressure upon renewable electricity sources to contribute further to the energy target over and above their electricity target.

A.13 The UK's electricity supply is currently generated by a mix of coal, nuclear, gas and hydro (in Scotland and Wales) power stations with many coal and nuclear stations due for, or in the process of decommissioning. Oil fired stations, a sub-sea inter-connector cable to France and an increasing number of renewable energy plants (landfill gas, wind energy and a small amount of small scale river hydro plants and biomass) supplement the dominant electricity sources.

A.14 To deliver renewable technologies in the UK, the 'Renewables Obligation' was introduced in 2002 as the UK's support scheme for large-scale renewable electricity generation. This obligation legally binds electricity supply companies (such as nPower, Scottish Power etc.) to supply 10% of their retailed electricity from renewable sources by 2010, and 15% by 2015. On 1 April 2010, the obligation was expanded and extended to 2037, to allow it to deliver close to 30% renewable energy or more by 2020.

A.15 For every MWh of electricity generated, from qualifying renewable sources, a Renewables Obligation Certificate (ROC) is issued to the generator. An electricity supplier has three choices to meet their obligation for any given year:

- acquiring ROCs through purchase of the energy generated by a renewable energy project;
- paying a 'buy-out' price (for 2009/10 this is £37.19/MWh); or
- a combination of the two.

A.16 If a supplier chooses to pay the 'buy-out' price, then this is paid into a central buy-out fund. At the end of each twelve month obligation period the buy-out fund is then shared proportionally between the compliant suppliers according to the number of ROCs they hold.

A.17 Through this method, renewable technologies are privately funded and built, with the renewables obligation acting as a market mechanism for the sale (and thus technological implementation) of renewable energy.

A.18 The UK Renewable Energy Strategy, calculates the cost of a 30% target would be £7 to the average domestic bill in 2015 and £17 to the average bill in 2020 (if the cost of fossil fuel is sustained at 2008 prices).

A.19 Due to the decommissioning of current aged plant it must be remembered that there is a requirement for new generation capacity on the UK electricity system. **Plate A.1** illustrates the generation mix in 2009 shown together with three projected generation mixes by 2020 given differing reactions to current policy (BERR, 2009). The level of policy delivery is said to be low, central or high depending on the level of emissions reductions. Economic growth is based on Treasury Budget forecasts and also labelled as low, central or high, as are the level of projected fossil fuel prices.

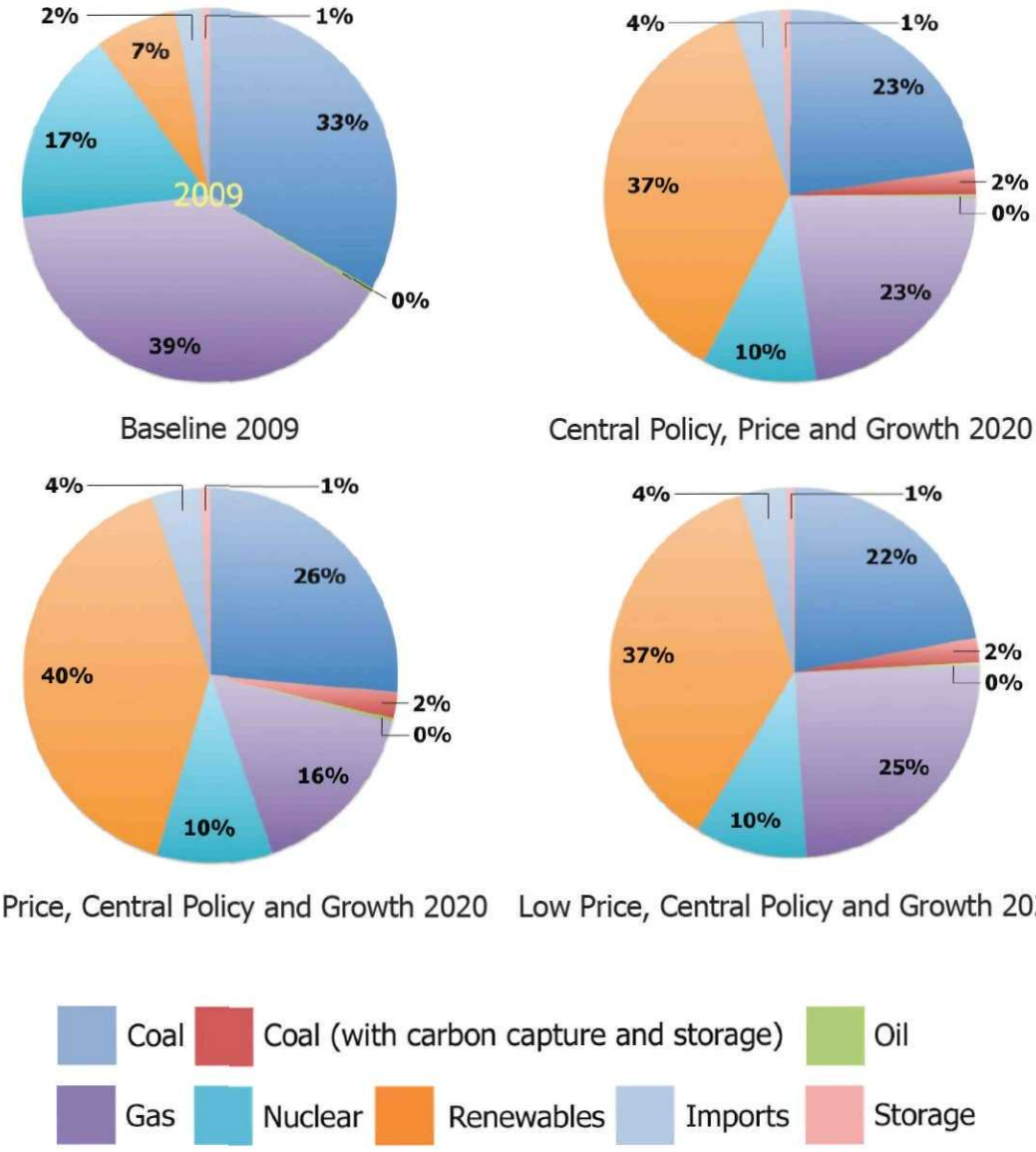


Plate A.1 – Central Policy Energy Scenarios of the Low Carbon Transition Plan (BERR, 2009)

A.20 As indicated in **Plate A.1**, nuclear energy is predicted to contribute 10% of the nation's electricity by 2020 under all scenarios. Given the timescales to plan, design, certify and construct new nuclear plant, the next generation of reactors are not expected to contribute until 2021 and beyond. This plant will replace existing gas and coal capacity. It is clear that even with a strong push to increase the nation's nuclear capacity, renewables are expected to provide the largest new-build contribution to the electricity supply.

A.21 At present there are seven major technologies available for the production of renewable energy in the UK. These are biomass, landfill gas, onshore wind, offshore wind, wave power, solar power and tidal power. Each of these technologies are at differing stages of maturity/development and each have both advantages and disadvantages associated with their deployment.

A.22 The use of each of these options is discussed in detail in **Chapter 2** of **Volume 2** in light of the maturity of each technology, its availability for deployment and its potential level of production.

A.23 As is clear through this discussion and is recognised in the recent Renewable Energy Strategy, onshore wind provides both the largest contribution to renewable energy in the UK at present and wind energy (both offshore and onshore) is expected to make by far the greatest contribution to upcoming targets.

A.24 This is illustrated in **Plate A.2**. This plate is based upon statistics derived in the Digest of UK Energy Statistics produced by BERR and presented in the UK Renewable Energy Strategy published by DECC in July 2009.

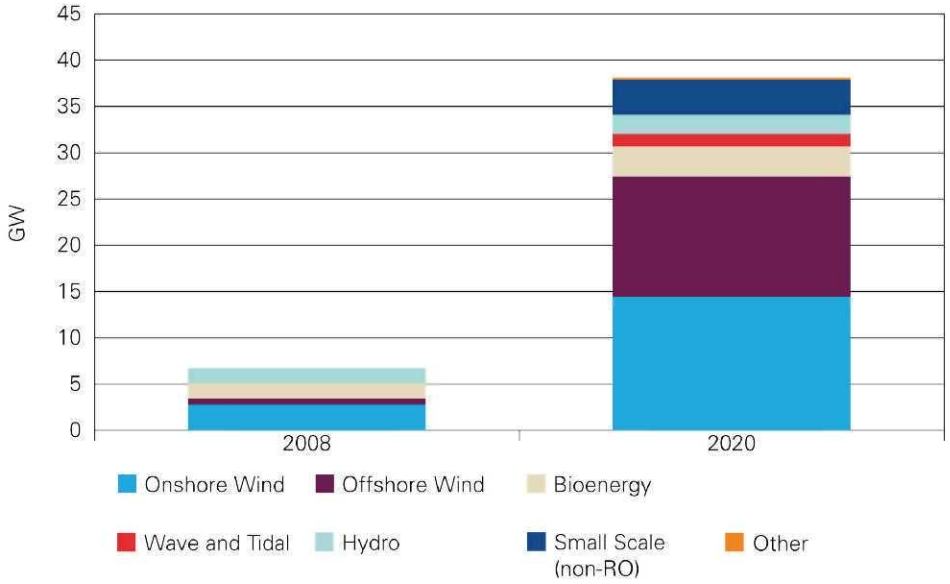


Plate A.2 – Renewable Energy Generation Mix (BERR, 2008) as published in the UK Renewable Energy Strategy (DECC, 2009)

A.25 In the Renewable Energy Strategy and subsequent National Renewable Energy Action Plan, the Government expects the UK contribution to renewable energy by 2020 to translate to an extra 3 000 offshore wind turbines, and an extra 4 000 onshore wind turbines, compared to current levels.

A.26 This shows that the need for onshore wind does not diminish with time and it continues to be as important to CO_2 reduction delivery as offshore. This is a particularly important point when considered against national and regional targets for wind energy.

REGIONAL STUDIES

A.27 Immediately following the establishment of the Coalition Government on the 12th May 2010, the Secretary of State for Communities and Local Government issued a letter (dated 27th May 2010) to all planning authorities indicating his intention to abolish Regional Spatial Strategies (RSS) (DCLG, 2010). It was stated that this intent should be a material consideration in the determination of planning applications, but it did not remove the RSS from the Development Plan.

A.28 On 10th November 2010, the Secretary of State's decision to revoke the Regional Strategies (RS) was quashed by the High Court following a challenge by Cala Homes (2010 EWHC 2866). Following this decision, guidance notes issued by the Planning Inspectorate state:

'*Until any further announcement is made and/or legislation to formally repeal or revoke RS is implemented, the Cala decision means that RS is part of the development plan on an ongoing basis.*

The Secretary of State has made clear that the proposed abolition of RS remains a Government commitment that Inspectors should continue to take into account as a material consideration where relevant to their casework' (PINS, 2010).

A.29 Following the High Court decision, Cala Homes sought judicial review of the statements by the Secretary of State and the Chief Planner that the intention to revoke Regional Strategies should be a material consideration in planning determinations. In giving permission to make a claim for judicial review, the Court stayed the effect of those statements pending determination of the claim. The intention to revoke is therefore no longer a material consideration.

A.30 As such, the remainder of this document is drafted on the current basis that the Regional Strategies still form part of the Development Plan.

A.31 The Treading Wind Farm site spans the boundary between the East of England region and the East Midlands region. The two most western turbines are in Lincolnshire and the East Midlands region; whilst the remaining turbines are in Cambridgeshire and the East of England region.

East of England

A.32 The current East of England Plan (GO-East, 2008) references targets based upon the report produced for the East of England Sustainable Development Round Table (EESDRT) This report, entitled 'Making Renewable Energy a Reality - Setting a Challenging Target for the Eastern Region' was undertaken by ESD and published in 2003. This established that the East of England as a whole should be able to produce 14% of its electricity from renewables by 2010, with Cambridgeshire able to produce 9% of by renewable sources by 2010. 290GWh of this Cambridgeshire contribution is expected to be from onshore wind as shown below in **Table A.2**.

COUNTY	PERCENTAGE OF COUNTY'S ELECTRICITY THAT WOULD BE PROVIDED BY RENEWABLE ENERGY (EXCLUDING OFFSHORE WIND)	GWh ELECTRICITY FROM ONSHORE WIND
Bedfordshire	13	170
Cambridgeshire	9	290
Essex	9	478
Hertfordshire	3	96
Norfolk	17	419
Suffolk	12	273

Table A.2 – 2010 Renewable Energy Targets from the EESDRT

2.33 In the context of the regional targets referenced in the East of England Plan, there is presently no 2015 target. As such, although 2010 has now passed, the 2010 target has been referenced here. Whilst the regional targets identified by the EESDRT do not form policy, they do identify the potential contribution that each County can make to the overall target. The EESDRT expect 9% of Cambridgeshire's electricity to be supplied by renewable energy by 2010 of which onshore wind is expected to produce 290GWh per annum.

A.34 Based upon the calculations provided in **Appendix 1.1**, the **four turbines on the Fenland District side of the Treading Wind Farm would represent an opportunity to meet 6% of the 290GWh onshore regional target**.

2.35 Clearly, the Cambridgeshire sub-regional 2010 target as proposed by the East of England Sustainable Development Round Table has been met. However, sub-regional targets were not adopted within the East of England Plan, so the site must be considered in the context of the regional targets. In line with the requirements of PPS22, the targets were revised upwards within Placing Renewables in the East of England. This document did not propose sub-regional targets, so again this development must be considered within the overall context of the regional target.

East Midlands

2.36 The Regional Spatial Strategy (RSS) for the East Midlands, The East Midlands Regional Plan (GO-EM, 2009) states:

2.37 *'Although the regional targets are ambitious, they are considered to be achievable and should be treated as a minimum. To achieve the targets, however, there will need to be a complete change in attitude in current planning practice. Local planning authorities need to accept that far more energy generation schemes using innovative renewable technologies need to be accepted if renewable energy targets are to be achieved.'*

A.38 **Table 2.5** summarises the renewable energy targets set out within the East Midlands Regional Plan (GO-EM, 2009).

ONSHORE WIND					
TARGET FOR 2010 GWh/y	TARGET FOR 2010 MWe	TARGET FOR 2020 GWh/y	TARGET FOR 2020 MWe	INDICATIVE TARGET FOR 2026 GWh/y	INDICATIVE TARGET FOR 2026 MWe
319	122	460	175	460	175

Table 2.5 - Onshore Wind Targets from RSS

2.39 In the context of Regional Targets the **two turbines on the South Holland District side of the Treading Wind Farm would represent an opportunity to meet 3.4% of the onshore wind regional target for 2010 and 2.3% of the onshore wind regional target for 2020.**

ELEMENTS OF A MODERN WIND FARM

A.40 A modern wind farm consists of a few key elements as illustrated in the aerial photograph shown in **Plate A.3** below.



ADDITIONAL ELEMENTS
A permanent meteorological mast to monitor wind behaviour and to provide a baseline against which to measure turbine performance.
A temporary construction compound providing welfare facilities for site staff and equipment storage areas, during construction / decommissioning.

Plate A.3 - Elements of a wind farm

SITE ACCESS TRACKS: The access tracks have the appearance of vernacular farm tracks with a crushed stone running surface, but are constructed to carry the weight of the heaviest turbine elements and the cranes for turbine erection and decommissioning.

CABLES: The high voltage power export cables and ancillary services run in underground conduits following the site access tracks, to the substation.

HARDSTANDINGS: These hardstandings provide stable areas for cranes during turbine erection and for any turbine maintenance during the lifetime of the project. These have the same appearance as the access tracks.

SUBSTATION: Wind farms generally connect to the local electricity distribution network at 11kV or 33kV. The substation houses the isolation switches and metering equipment to allow for this connection.

A.41 Modern wind turbines are three-bladed in design with the rotor up wind of the tower. The primary elements of such a turbine are shown in **Plate A.4** below.



THE BLADES:

The blades are connected to the hub by a pitch drive system which angles the blades in response to the variations in wind speed to optimise the energy capture. Under low wind speed conditions the blades pitch into the wind whilst in high wind conditions, the blades pitch out of the wind. The hub is connected to a low speed shaft which passes into the nacelle. **Please note that in the UK blades are not required to be painted red.**

THE NACELLE:

The nacelle contains the gearbox (where necessary, see **Paragraph A.38-A.39**), the generator, cooling systems, part of the electrical control system and the yaw drive, which rotates the nacelle in response to changes in the wind direction to ensure the rotor is always pointing directly into the wind to capture the maximum amount of energy.

THE TOWER:

The tower is constructed from sections of welded rolled steel and typically has a 4m diameter at the base and a 2m diameter at the top. Electrical and telecommunication cables pass down the centre of the tower to its base where power electronics and a transformer link the system to the power export cables.

Plate A.4 - Elements of a modern wind turbine
(photograph of a REpower MM92 2.05MW wind turbine)

A.42 The electrical generator, which is housed in the nacelle, will utilise one of two systems dependent upon the make of turbine. In a typical turbine the rotor drives a low speed shaft, which subsequently drives a high speed shaft in the generator through a gearbox (**Plate A.5**).

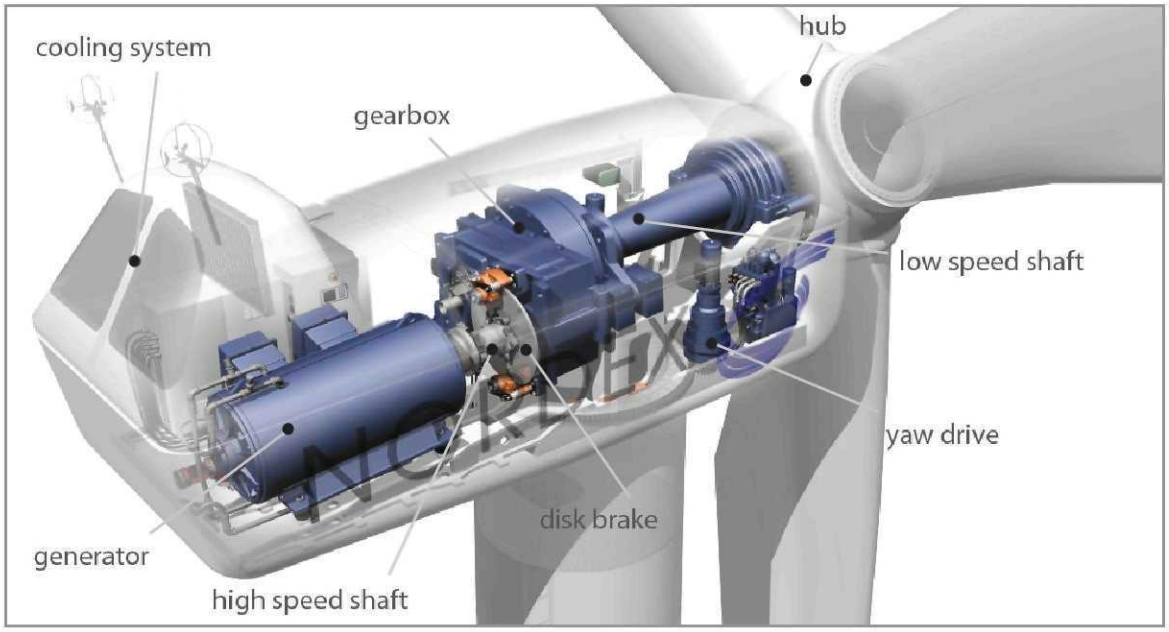


Plate A.5 - A typical generator system (image courtesy of Nordex plc.)

A.43 Other turbines, such as those manufactured by Enercon, operate a direct drive system, where by the rotating blades directly turn a multipole generator without the need for a gearbox (**Plate A.6**).

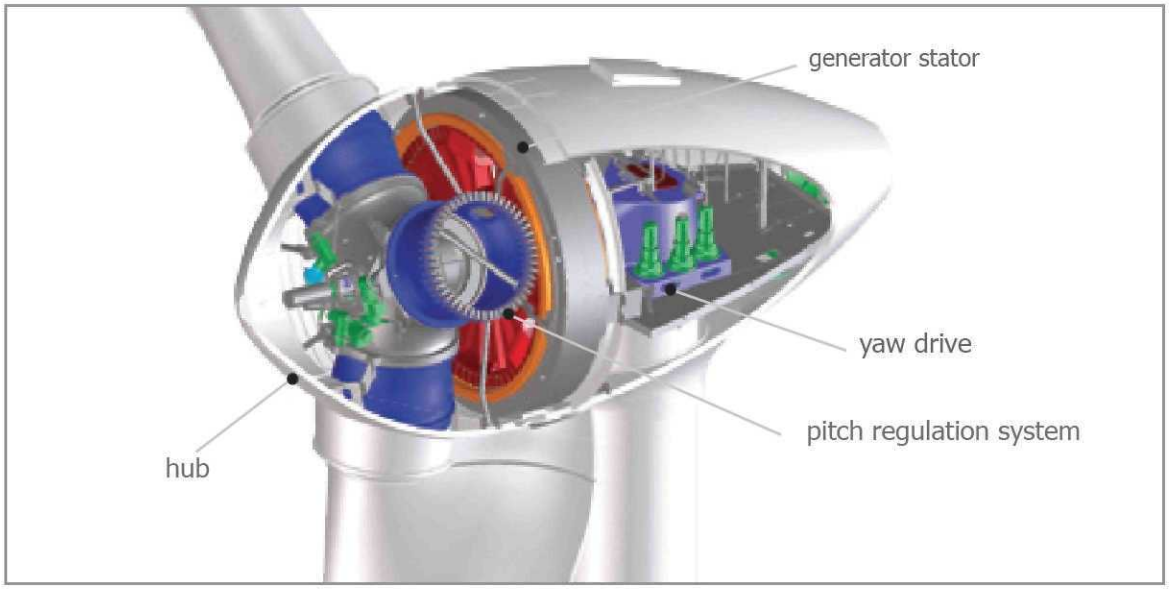


Plate A.6 - A direct drive generator (image courtesy of Enercon plc.)

THE CONCEPT OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

A.44 Environmental Impact Assessment (EIA) is a process by which a development is assessed in terms of its likely impact upon the baseline environment, to enable decision makers to determine the acceptability of a development prior to its approval.

A.45 This baseline environment may include the population, fauna, flora, soil, water, air, climatic factors, material assets (including the architectural and archaeological heritage), landscape and the inter-relationship between the above factors.

A.46 Environmental impacts, both positive and negative can be classified in terms of their significance according to relevant best practice guidelines and methodologies, and it is those impacts classified as significant which an EIA is intended to identify (EIA regulations, 1999).

A.47 Once significant impacts have been determined, an EIA will propose avoidance and mitigation strategies which may be applied to avoid, reduce, remedy or compensate for the predicted significant effects. The predicted residual impacts on the development are assessed on the basis that these strategies are applied.

EIA AND WIND FARMS

A.48 As large developments, the majority of modern wind farms undertake environmental impact assessment prior to submission of a planning application, the exact scope of which is determined with the Local Planning Authority through a Scoping Process.

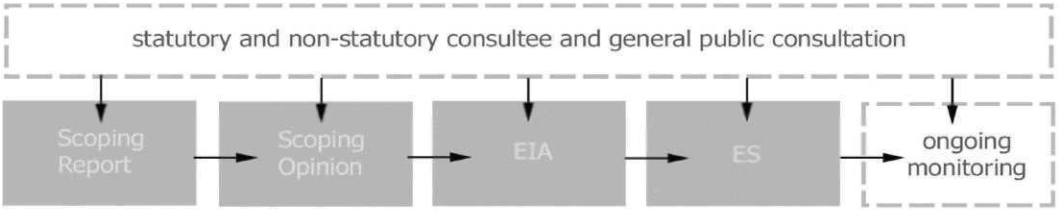
A.49 However, the need for any specific wind farm development to undertake EIA is governed by Schedule 2.3 (i) of the EIA Regulations. Whereby;

'*Local planning authorities are required to screen applications for the need for EIA where the development involves the installation of more than 2 turbines of the hub height of any turbine or height of any other structure exceeds 15 metres.*' (ODPM, A Companion Guide to PPS22, 2004).

A.50 It was acknowledged by the developer that an EIA would be required for this project and as such the application was not screened for the need for an EIA.

A.51 As part of the EIA, the findings of the studies involved are formulated into an Environmental Statement (ES) document, which constitutes **Volume 2** of this application, for review by all relevant parties.

THE PROCESS OF UNDERTAKING AN EIA



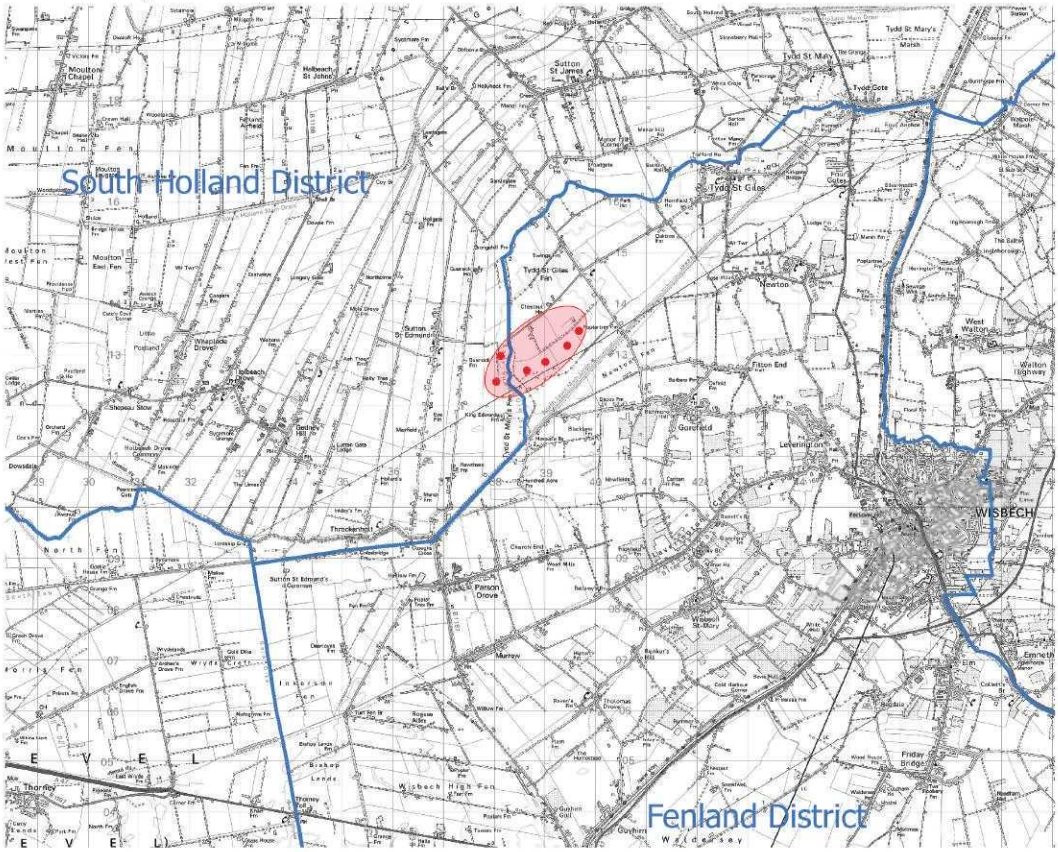
THE APPLICANT

A.52 The Treading Wind Farm is proposed by Wind Ventures Limited, a part of the Brook Henderson Group. For the purposes of this Environmental Statement, the applicant is referred to as Wind Ventures.

A.53 Wind Ventures is actively developing a portfolio of small to medium-sized wind energy projects, across the United Kingdom. Wind Ventures have a number of sites at various stages of the planning process and other sites undergoing feasibility studies. The aim of the company is to develop sustainable wind energy projects that benefit landowners and local communities while contributing towards the UK's achievement of local and national renewable energy targets.

THE LOCATION

A.54 The proposed development would be situated on farm land 1km east of the village of Sutton St. Edmund, Lincolnshire, and 6km north-west of the town of Wisbech, Cambridgeshire. The location of the site is shown in **Plate A.7**.



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Plate A.7 - Site Location

THE PROPOSAL

A.55 The Treading Wind Farm proposal is for six wind turbine generators, a permanent meteorological mast and ancillary infrastructure.

A.56 Given the fast moving market the availability of particular models of wind turbine changes from time to time and as such it is not possible to specify precisely which manufacturer and model of turbine will be available should the project be granted planning permission.

A.57 However, it is proposed by the developer that all of the six proposed wind turbines will have a rated capacity of 1.8 to 3MW and a maximum height to tip of 126m.

A.58 For the purposes of this Environmental Impact Assessment, assessments have been based upon the REpower MM92, 2.05MW wind turbine. This model has a hub-height of 80m, and a rotor diameter of 92m. When a blade is in its uppermost vertical position, in line with the tower, the overall height to tip will be 126m (**Plate A.8**).

A.59 As detailed in **paragraph A.51** the exact make and model of turbine will not be selected until the pre-construction phase of the project. The rotor diameter and hub height combination of the selected turbine will be within this overall tip height of 126m.

A.60 Should the proposal be granted planning consent, the model of turbine chosen for the site will have to match or better the environmental performance of the turbine on which the assessments, comprising the EIA, are based.

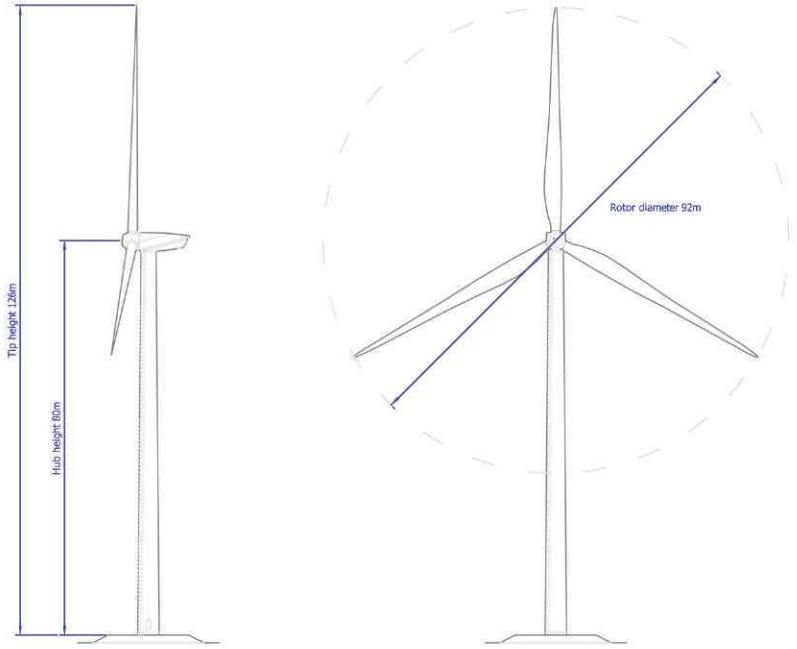


Plate A.8 - Typical REpower MM92 Turbine Dimensions (1:1 500)

A.61 The proposed operational lifetime of the project is 30 years following which the wind farm would be decommissioned, unless a fresh planning permission was granted for its retention by the deciding planning authority.

The expected electricity production

A.62 As detailed in full in **Appendix 1**, the six (6) REpower MM92 wind turbines of the Treading Wind Farm are anticipated to generate an annual average of approximately 27 200 MWh of electricity (to 3 s.f. net of anticipated power losses) considering a 25.2% capacity factor. This would meet the equivalent average annual electricity needs of over 5 540 Fenland homes.

A.63 The electricity generated by the scheme will be consumed within an area surrounding the wind farm's electrical distribution network connection point and so is likely to supply dwellings within either Fenland District, South Holland or both. For the purposes of illustrating what the generated electricity may power, analysis has been made of the equivalent number of dwellings in Fenland District Council which may be powered by the scheme.

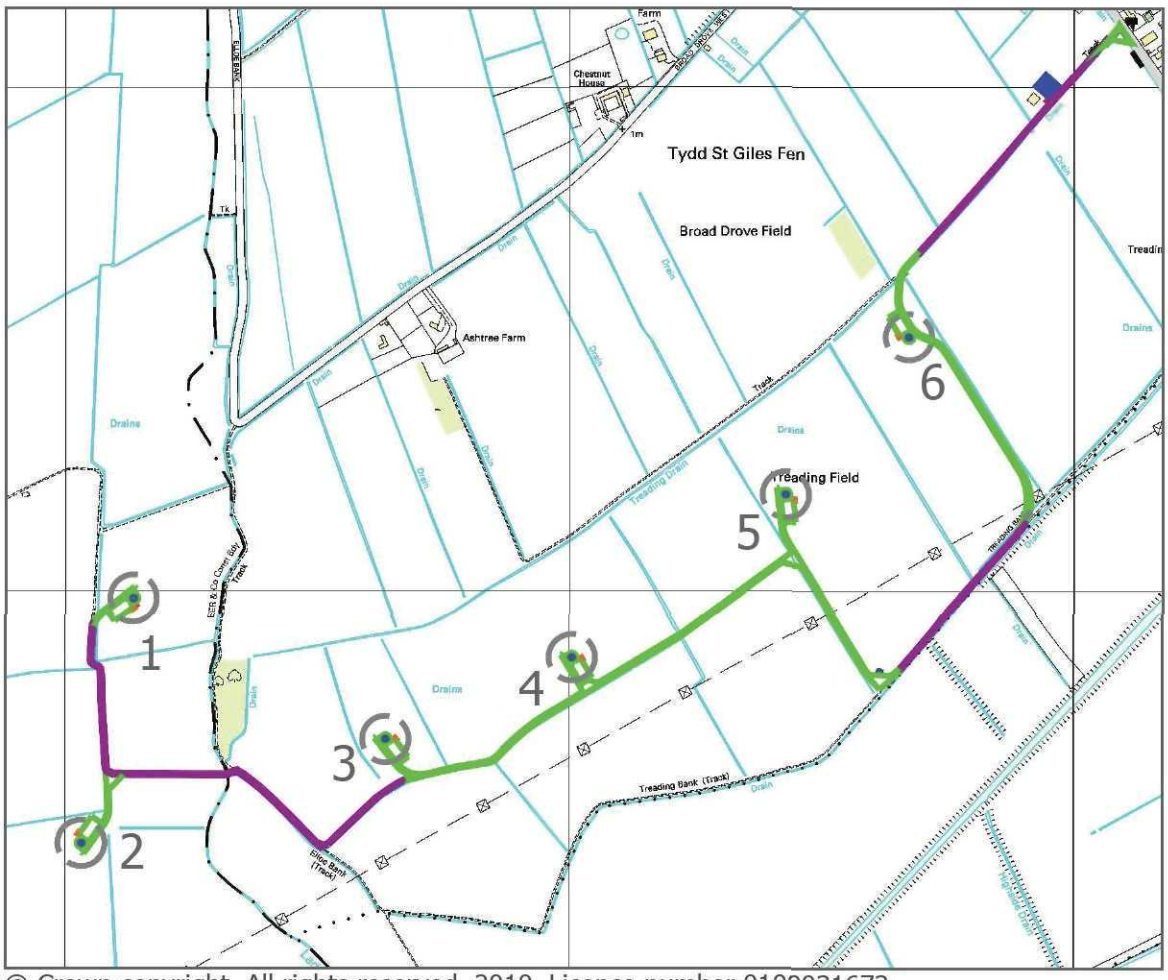
A.64 5 540 homes corresponds to 15.7% of the total number of homes in Fenland District and would thereby constitute a significant commitment by both Fenland and South Holland District Councils toward the National UK target of 10% of electricity supply from renewable energy by 2010, and 15% by 2015 (which may also be increased to a 30-35% target by 2020 following the UK Renewable Energy Strategy Consultation of June 2008).

A.65 Wind turbines are rated in terms of their potential maximum generation. For six REpower MM92 wind turbines, each rated at 2.05MW, the maximum generation of the proposed wind farm is 12.3MW.

A.66 The wind farm will generate this maximum generation from the turbine's 'rated wind speed' of 12.5m/s (28.0mph), until (for most wind turbines) wind speeds of 24m/s (53.7mph) when the wind farm is shut down for safety reasons. Up to wind speeds of 12.5m/s, the wind farm will generate varying amounts of electricity according to the wind conditions.

A.67 The expected electricity production figure above is based upon a 'capacity factor' of 25.2%. The 'capacity factor' is a figure which reflects the anticipated production of the wind farm against the rated capacity, taking into account the variability of the wind. Prior to construction commencing, the final choice of turbine and a long term correlated wind analysis, using data captured on site, will provide the capacity factor for the Treading Wind Farm. For the purposes of this Environmental Statement the measured East of England Regional capacity factor of 25.2% has been utilised (DTI, 2010).

A.68 The displacement of electricity generated from fossil fuels by generation from the proposed development would offset the emission of a significant quantity of pollutants, particularly carbon dioxide, into the atmosphere as discussed in depth in **Appendix 1**. This reduction in emissions would contribute to the national and international reductions required under the obligations of the legally binding Kyoto Protocol.



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Proposed turbine location with external transformer (orange)

Upgraded access track

New access track

Temporary construction compound (blue) and 33kV substation (red)

Meteorological mast

33kV substation (red)

Plate A.9 - Site Layout (1:15 000)

THE SITE LAYOUT

The Turbine Foundations

A.69 The foundations for the proposed turbines will be a reinforced concrete slab foundation or concrete pile hybrid foundation. This will be specifically designed for each turbine location dependant upon the results of the detailed geophysical survey undertaken as part of the pre-construction detailed project design. A typical reinforced concrete slab foundation is shown in **Plate A.10**.



Plate A.10 - Typical Wind Turbine Raft Foundation

The Site Access Tracks

A.70 Access across the site is required during construction, through operation and finally during the decommissioning of the site at the end of the wind farm's operational life. Wherever possible, the layout of access tracks has followed the routes of the existing runways to minimise land-loss and impacts on ecological habitat. New tracks follow field boundaries where possible to minimise the impacts on farming practices. Areas of new track will have a crushed stone running surface, laid over a stone sub-surface which itself lies on top of a geotextile membrane. A typical access track is shown in **Plate A.11**.

A.71 The tracks need to remain in place through the lifetime of the project to facilitate access for routine maintenance, and also for the potential occasion when a large turbine component (such as a blade) requires repair or replacement.



Plate A.11 - Typical New Site Access Track

The Hardstandings Areas

A.72 Hardstanding areas are required for the use of cranes during erection and decommissioning but will be left in place for the lifetime of the project in case of repair. These will have a similar outward appearance to the access tracks shown in **Plate A.11**.

The Substation

A.73 To connect to the local electricity distribution network for the export of power generated, a link must be made between the wind farm's electrical distribution network cables and the local electricity distribution network through appropriate protection equipment (e.g. fuses), isolation switches and metering equipment. These elements constitute the site's substation.

A.74 Two typical 11kV substations are proposed for this project, as the connection to the network may be to both the east and west of the site. These would appear as a small single storey freestanding building, of approximately 4.6m by 5.6m, as illustrated in **Plate A.12**.



Plate A.12 - Typical Substation

SITE SELECTION

A.75 In considering industry best practices the following technical and commercial criteria are important to the successful development of a wind farm:

- Wind Resource – whilst at the site selection stage there may only be approximate estimates of wind resource, a combination of map analysis and the results of computer models will be used to determine a feel for wind speeds and direction;
- Electrical Connection – consideration will be made of the nearest potential connection points to the local electricity network;
- Road Access – a desktop analysis and site visit will be undertaken to determine an initial view on whether access would be possible for the turbine delivery vehicles. This analysis is usually based upon the longest component, the turbine blade;
- Land Availability – consideration of the likely size of a site will be made to help assess its commercial viability. Additionally, the landowner(s) must support the development and be prepared to enter commercial negotiations;
- Turbine Spacing – the wind turbines need to be spaced far enough apart to ensure that whatever the wind direction, the energy losses and turbine wear through wake effects are minimised; and
- Existing land use – it is important to work with the landowner to ensure that plant and equipment are positioned such that they compliment existing and future planned activities.

THE DEVELOPER'S SITE SELECTION PHILOSOPHY

A.76 The Treading Wind Farm is proposed by Wind Ventures Limited. Wind Ventures follow a strict site selection process, whereby areas of land with the potential for wind farm development are assessed in terms of local environmental and technical constraints to determine their suitability for wind farm development.

A.77 The Treading site was viewed by the developer to provide a suitable balance between those needs of a wind farm which make development both technically and economically viable and the wish of the developer to minimise any potential impacts of the proposal on the local environment.

A.78 The specific site design further evolved through the Environmental Impact Assessment process, whereby any impacts identified by the specialist assessment team were mitigated for where possible through alterations in the site design.

A.79 Those specific constraints acknowledged by the developer during their initial site selection and design processes are discussed in the following sections.

Environmental Considerations

A.80 In selecting a potential site the developer considered the proximity to designated sites, including;

- Ramsar sites;
- Areas of Outstanding Natural Beauty;
- Scheduled ancient monuments;
- Registered parks and gardens;
- National nature reserves;
- Special areas of conservation;
- Special protection areas;
- Sites of special scientific interest; and
- Ancient woodlands.

A.81 The location of these sites, where present, in relation to the proposal is detailed in **Figure 3.1, Volume 3**. Data for these designations was obtained from the Multi-Agency Geographic Information for the Countryside (MAGIC) database.

A.82 The impact of the proposal on these designated features and those further afield are detailed in **Section B** Landscape and Visual Assessment, Cultural Heritage and Historic Landscape and Ecology, and in detail in the corresponding chapters of **Volume 2**.

Technical Considerations

A.83 The potential Treading Wind Farm was considered against several technical parameters outlined as follows:

- Proximity to Roads and Public Rights of Way: As per the safety guidelines of the PPS22 Companion Guide (ODPM, 2004), the developer applied a constraint of tip height from local roads, and also added an additional 10% buffer. This equated to a clearance of 139m, as based on the REpower MM92 wind turbine considered within this Environmental Statement.
- Proximity to field drains: All on-site drainage ditches, both those operated by the Internal Drainage Board and those that local landowners are responsible for, are cleared by at least 9m, as per the normal requirements of the Internal Drainage Board. To account for the foundation diameter, a 20m clearance has been assumed.
- The developer also assumed a separation of at least tip height (126m) from local public rights of way, to prevent blade oversail, as described in the PPS22 Companion Guide, and 200m from the bridleway, as suggested by both Cambridgeshire and Lincolnshire County Councils' Rights of Way officers.
- Proximity to Infrastructure: In accordance with guidelines described in PPS22, Engena consulted on all infrastructure including water pipes, sewage pipes, gas pipes and high voltage overhead lines. There is a 132kV overhead power line to the south of the site, and also a high pressure gas pipeline. Negotiations with National Grid who oversee the operation of the gas main, concluded that so long as no turbine was within 120m of the pipe, then they were satisfied that the infrastructure would not be affected. E.on Central Networks asked for a separation of tip height plus 10% which is equivalent in this case to 138m from their overhead 132kV electricity lines. Copies of consultations are included within **Appendix 15.1, Volume 2**.
- Aviation: As detailed in **Chapter 16**, Aviation, the developer undertook negotiations with the Ministry of Defence, to determine how the project would be accommodated within the existing military aviation interest and activities in the area. National Air Traffic Services; the Civil Aviation Authority; and Fenland Aerodrome were also consulted.
- Telecoms: The proximity of telecommunications links can form a key design consideration, with consultation undertaken with each neighbouring telecoms link operator. Further details of the consultations undertaken on utilities and telecoms are detailed in **Chapter 15**.

Localised Considerations

A.84 The developer implemented an initial 650m buffer around any local residential property prior to undertaking the environmental impact assessment, under the assumption that this would avoid the potential for significant noise and visual effects, which limited the land available for development.

A.85 Where possible, given all other constraints, the site is designed to allow the turbines to rest as close as possible to existing site access and tracks, allowing minimal impact on existing arable farming activities on the site, as well as maximising the use of existing farm tracks.

Needs of a Wind Farm

A.86 In accordance with the site selection criteria well established within the industry, the potential site was assessed against the practical needs of a wind farm development.

A.87 Wind Resource: Site specific wind data was not available at the time of site selection. At the point of site selection, the developer utilised the NOABL (Non-Orthographic Adiabatic Boundary Layer) wind speed database published by BERR. This database is used only to provide an indication of potential wind speeds across the site, and is limited to 45m. NOABL indicated a potential average wind speed of 6.3m/s at 45m. A temporary 70m meteorological mast is installed on the site to verify wind speeds for financing and turbine selection purposes. There is sufficient wind resource for a viable wind farm project.

A.88 Access: As detailed in initial studies undertaken by R. Collett & Sons (Transport) Limited, the chosen site allows for access of both the heaviest and longest elements of the proposed site via specially designed long vehicles. Further details of the proposed transport routes, including consultation with County Highways are discussed further in **Chapter 8, Volume 2**.

A.89 Local electricity distribution network connection: Initial electrical distribution network connection options have been assessed by Grid Connection. Provisional assessments indicate that it would be possible to connect the wind farm development to an existing 33kV overhead line to the north of the site. As such the Environmental Impact Assessment has been based upon the use of a 33kV onsite substation, from which the local electricity distribution network operator will be responsible for providing cabling to the chosen connection point at 33kV into the local grid. Further details of this potential grid connection option are provided in **Chapter 6**.

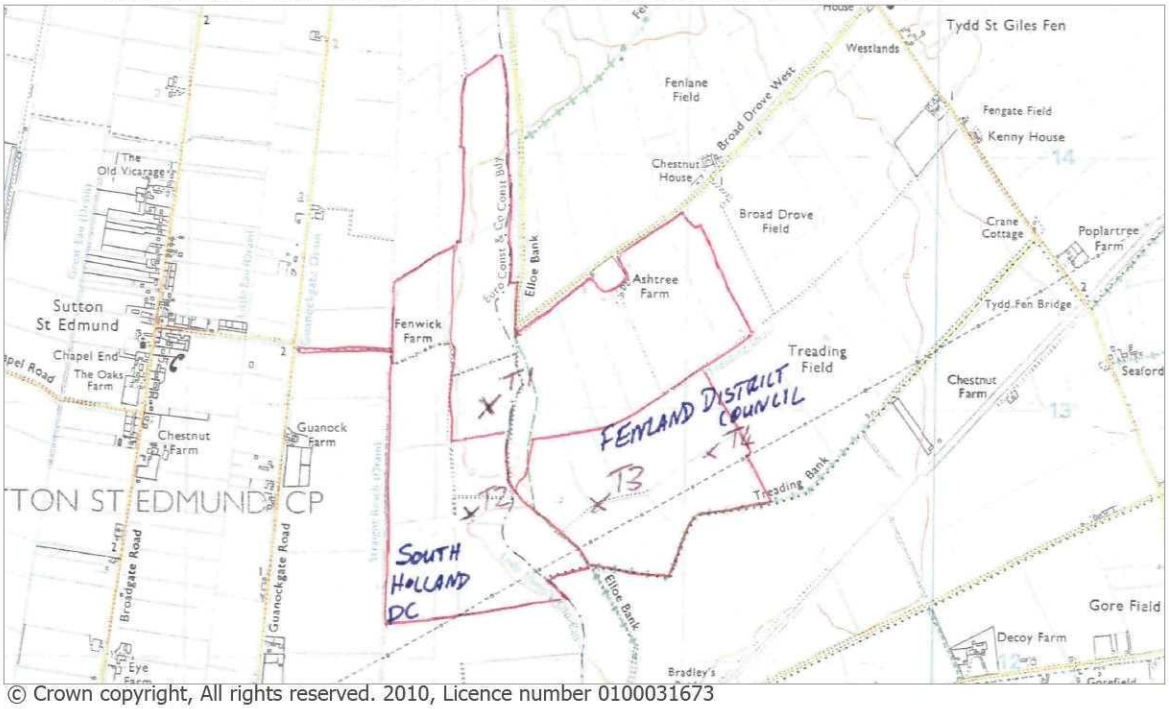
A.90 Land Availability: The developer has formed a close working relationship with the landowners of the site at Treading. The landowners support the installation of a wind farm on their land, and their combined landholding provides enough room for the six turbine proposal.

A.91 Turbine Spacing: Turbines were spaced to allow for a turbine spacing of five rotor diameters against the prevailing wind direction (south-westerly) and four rotor diameters across the prevailing wind direction. This spacing has been applied across the entire layout to minimise energy losses and turbine wear through wake effects. For the REpower MM92 wind turbine, this separation equates to a downwind spacing of 460m and a crosswind spacing of 368m.

LAYOUT EVOLUTION

A.92 As the Environmental Impact Assessment progressed, more information was learned about the site and surrounding area. A detailed and iterative site design process was followed throughout allowing mitigation to be incorporated within the design which evolved to avoid or reduce the significance of identified impacts at each stage of the development process. The site was originally scoped for four turbines with a tip height of up to 132m, but subsequently was altered first to five and then to six turbines with a tip height of up to 126m after more land became available. Prior to the Environmental Impact Assessment, both the initial concept site layout design at Scoping and the updated design when more land became available are illustrated in **Plate A.13** and **Plate A.14**.

A.93 The site was scoped without a particular turbine brand stated, so that one could be chosen after assessment that would be most suitable for the site.

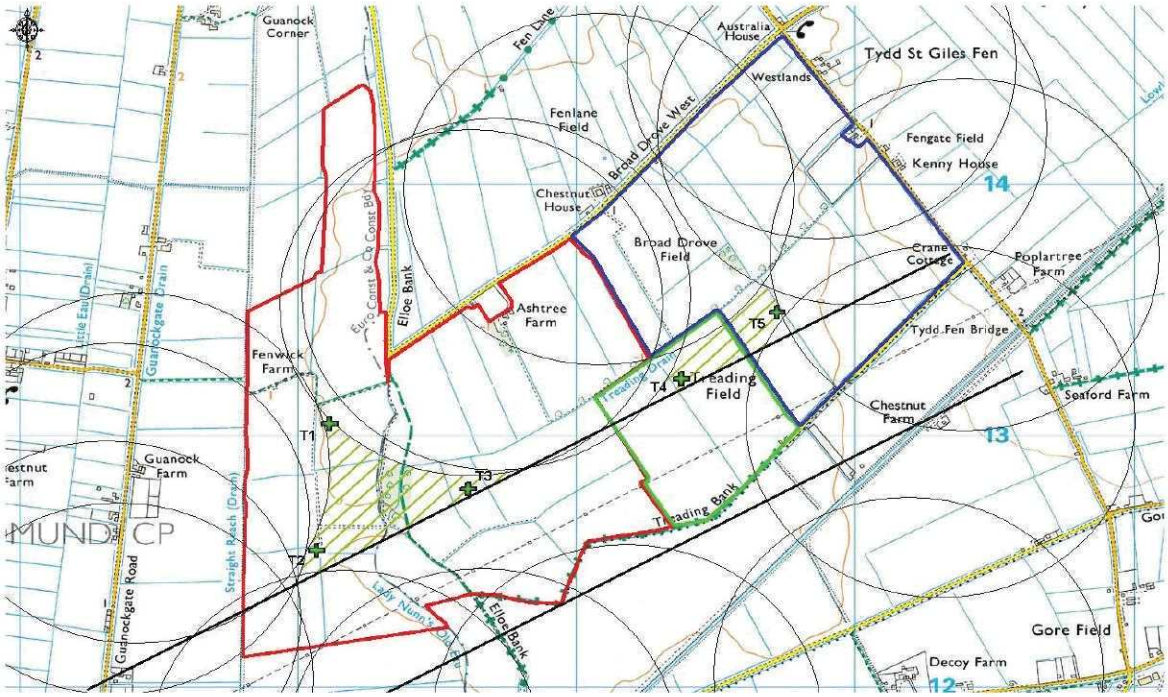


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Plate A.13 - Site Layout at Scoping

A.94 The EIA progressed on the six turbine layout. The site design was further refined to fully apply the criteria above.

A.95 Grid connection studies indicated a potential connection route to the circuit running from Spalding. As such the onsite substation was located towards the north of the site, adjacent to the temporary construction compound.



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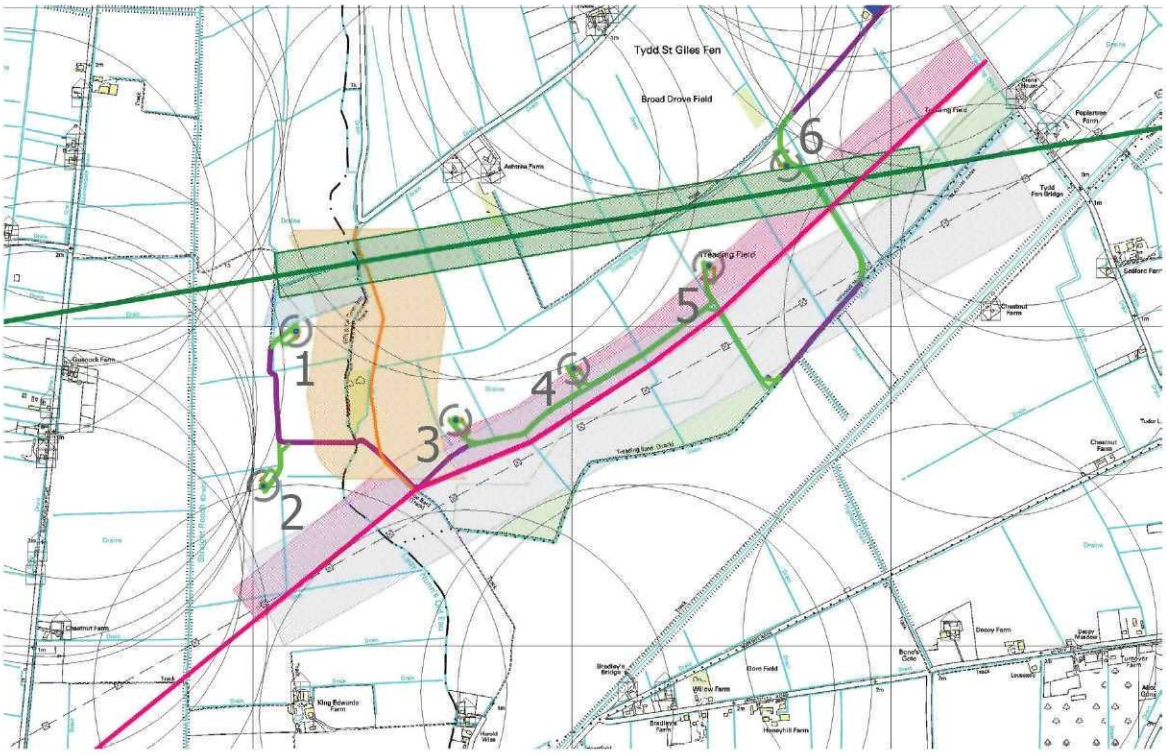
Plate A.14 - Post-Scoping Layout, 5 turbines, 92m rotor diameter

A.96 As described in **Chapter 6**, a permanent meteorological mast will be required to verify wind farm production and provide wind data in the event of an unforeseen shut down. In accordance with international standards, the permanent meteorological mast should be located between two and four rotor diameters from at least one turbine to allow power performance tests to be undertaken. As such, the mast was located south-east of Turbine 5.

A.97 Further adjustments were made to the layout during Environmental Impact Assessment as further information was collected about the site. In particular, following the gas pipeline location, the array was adjusted to ensure full compliance with the guidance offered by National Grid on proximity to high pressure gas mains.

A.98 Detailed grid connection studies determined the potential for an offsite connection to the local electricity distribution network at 33kV both to the eastern and western sides of the site. As such two substations are located on-site with one adjacent to a farm building toward the north-east of the site, and one at the base of Turbine 1. The substations are located as close as possible to the connection points, whilst still being accessible to Eon personnel. These locations also allow one of the substation buildings to be integrated into the existing farm buildings.

A.99 After bat surveys had been completed on the wind farm site (see **Chapter 13** and associated appendices), it was highlighted that a number of bats were using the field boundary ditches as foraging features. To comply with Natural England's TIN051 bat guidance (Natural England, 2009) four of the turbines were moved away from the ditches. As such, the layout was altered in order to meet this guidance and the following plates detail the final locations of the proposed turbines.



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Vodafone link path and clearance distance (70m)

Bridleway and 200m clearance

Public footpath tip height (126m) clearance

Overhead line and tip height + 20m (146m) buffer

Gas pipe and mast height x 1.5 (120m) buffer

House with 650m separation distance

Byway Open to All Traffic tip height (126m) clearance

Plate A.15 - Final Site Layout Showing Key Design Constraints

A.100 **Plate A.15** shows the layout with the 650m residential property buffer, the area of avoidance for the underground gas pipe and telecommunications links, and separation distances from the bridleway, public footpath and Byway Open to All Traffic (BOAT).

NON - TECHNICAL SUMMARY B : THE FINDINGS OF THE EIA

Contents

32 The Treading Wind Farm EIA Team

33 Construction, Operation and Decommissioning

35 Traffic and Transport

41 Hydrology

45 Landscape and Visual Impact Assessment

50 Shadow Flicker

51 Historic Environment

53 Ornithology

60 Non-Avian Ecology

66 Noise

68 Utilities and Telecoms

70 Aviation

72 Socio-Economics

80 Conclusions

82 References

85 Appendix 1 - Energy Calculations

THE TREADING WIND FARM EIA TEAM

B.1 The Environmental Impact Assessment (EIA) for the Treading Wind Farm has been undertaken by a specialist team, appointed by the developer. This team operates independently from the developer to ensure neutrality.

B.2 The principle project managers are Engena Limited, an independent renewable energy consultancy whose founders have over 718MW of development experience in the UK wind industry. Engena specialise in wind farm site selection, EIA, project planning and construction management. For specific assessments established specialists have been employed. The specialist EIA team for the project is detailed in **Table B.1** below.

SPECIALIST	SPECIALISM
Colletts Transport Limited	Swept Path Analysis of Abnormal Loads
SLR Consulting Limited	Hydrology and Flood Risk Assessments
P D Marsh Limited	Visualisations
E4 Environment Limited	Landscape and Visual Assessment
Archaeo-Environment Limited	Archaeology and Cultural Heritage Assets
Wild Frontier Ecology Limited	Ornithology and Non-Avian Ecology
Hayes McKenzie Partnership Limited	Noise Assessment
BAE Systems plc	Aviation
Osprey Consulting Services Limited	Aviation

Table B.1 - EIA Team

B.3 The Environmental Impact Assessment and Environmental Statement have been produced according to the Town and Country Planning (Environmental Impact Assessment) Regulations 1999, following the identified Scope determined with the Local Planning Authority.

B.4 Throughout, general guidance has been used from the following documents:

- Circular 02/99 Environmental Impact Assessment, DETR 1999;
- Environmental Impact Assessment: guide to procedures, DETR 2000; and
- The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations, The Stationary Office, 1999.

B.5 Individual specialist sections of the assessment and subsequent chapters have been prepared according to the relevant standards and methodologies pertinent to each section, please refer to individual Chapters for details.

B.6 In addition to the Environmental Impact Assessment a planning appraisal of the proposal, was also undertaken by Albro Planning and Environmental.

CONSTRUCTION, OPERATION AND DECOMMISSIONING

B.7 Engena undertook an assessment of the impacts, available mitigation and avoidance measures, and the residual impacts of the construction, operation and decommissioning phases of the proposal. Impacts considered were associated with geology & soils and existing land use.

B.8 The impacts assessed together with the mitigation measures (proposed either through avoidance or a reduction/offset of the impact) are listed below in **Table B.2**.

POTENTIAL IMPACT	MITIGATION MEASURE
CONSTRUCTION & DECOMMISSIONING	
Degradation of in situ soils from vehicle and foot traffic.	Wherever possible, site tracks utilise the existing tracks, and new tracks follow existing field margins and boundaries. Vehicles will be required to keep to these site tracks and the hardstandings. Foot traffic will be kept to made-up surfaces unless absolutely necessary.
Potential for personal injury and damage to machinery and equipment during construction.	All health and safety regulations and best practice guidelines will be followed during the construction of the proposed development to ensure the risks to personal safety and equipment on site is minimised. This includes the British Wind Energy Association Guidelines for Health and Safety in the Wind Energy Industry (2005) which represent best practice. All site work for the Treading Wind Farm would comply with the Construction (Design and Management) Regulations 2007 approved code of practice.

POTENTIAL IMPACT	MITIGATION MEASURE
Materials with potential to be classified as hazardous are most likely to be coolants, oils, fuels and lubricants. Stored and used inappropriately and without considered mitigation, these materials have the potential to represent a risk to health and contamination of local environment.	Fuels and oils kept in the temporary construction and decommissioning compounds will be stored in double-walled containers or lined bunds in accordance with regulations and Environment Agency advice. Any hazardous materials stored or used on site during construction/operation/ decommissioning will be used, stored and disposed of off-site in accordance to regulations and manufacturer/supplier's guidelines. No hazardous materials will be stored on site during the operational phase of the proposed development.
Potential impacts on site geology and soils may occur from the excavation, storage, reuse and disposal of soils, hardstanding areas, substation and meteorological mast foundations and turbine plinths. Significant impacts on soils and otherwise recyclable materials may occur through inappropriate storage or their contamination.	Wastes arising will be used wherever possible in the reinstatement of the site. Any excess stored material will be disposed of off-site in full accordance with Environment Agency guidance to minimise the risk of pollution and degradation of habitats.
Reinstatement of areas with non-locally sourced sub and top soils has the potential to significantly harm the local environment.	Locally sourced top and sub soils will be used in all reinstatement works.
Degradation of excavated soils due to inappropriate storage.	The soils and materials excavated during the construction and decommissioning phases of the proposed development will be stored in accordance with Good Practice Guidelines as published by MAFF, 2000.

POTENTIAL IMPACT	MITIGATION MEASURE
OPERATION	
During the operational phase of the project, no significant direct impact on the existing use of the site is anticipated. There will be a minimal reduction of land available for farming as a result of the turbine bases, hardstandings, new access tracks, substation and meteorological mast base. In total this area represents 7.2Ha.	Mitigation to reduce impacts has been inherent in the design of these various elements and in the design of the site layout.

Table B.2 - Construction, Operation and Decommissioning Mitigation Measures

Predicted residual impacts following mitigation

B.9 There are no significant residual impacts anticipated as a result of the construction, operation and decommissioning activities assessed within this chapter.

B.10 A small amount of farmland will be removed from production, although this will be returned to its former use at the end of the 30-year life of the project.

B.11 Traffic, hydrology, ecological or noise related impacts as a result of the construction, operation and decommissioning of the proposal are assessed within their relevant sections below and their associated chapters in **Volume 2**.

TRAFFIC AND TRANSPORT

The Proposed Delivery Route for Abnormal Loads

B.12 A desktop mapping exercise and driven visual route inspection undertaken by specialist wind turbine hauliers (R. Collett & Sons (Transport) Limited) considered potential routes for the abnormal loads associated with the delivery of turbine components to the site. Three potential routes were considered. It was determined that a route from the A17 passing through Holbeach and a route from the A17 through Fitton End (off the A1101) be discounted because of the requirements for additional land-take required to negotiate corners with the turbine blade loads. As such, a delivery route travelling southbound on the A16 skirting Market Deeping and then east around Peterborough along the A15, A47 and northwards towards the site along the B1187 was considered further instead.

B.13 The potential constraints or 'pinch-points' along the route were identified. Swept path analysis drawings were prepared for these 'pinch points' for the turbine blade (the longest load) by Colletts Transport. These were used to verify that corners were navigable and to identify the potential need for temporary highway modification or temporary street furniture removal. The full proposed delivery route is as follows:

i. From the A16/A17 Roundabout, follow the A16 south over the following junctions where analysis has been undertaken wherever necessary to identify works required to deliver the turbine blades as longest turbine component:

ii. A16/A152 Roundabout (**Volume 3, Figure 8.2**). Analysis identified the requirement to engage manual steering to avoid the central island.

iii. A16/B1180 Roundabout (**Figure 8.3**) - manual steering will be required to avoid central island.

iv. A16/A151 Roundabout (**Figure 8.4**) - manual steering will be required to avoid central island.

v. A16/B1165 Roundabout (**Figure 8.5**) - manual steering will be required to avoid central island.

vi. Continue over new roundabout - no amendments required.

vii. A16/A1073 Roundabout (**Figure 8.6**). Manual steering will be required to avoid central island. Temporary removal of one near-side lamp post will be required for the duration of turbine component delivery.

viii. A16/A15/B1524 Roundabout - no amendments required.

ix. A16/B1525/A15 Roundabout, continue straight on to the A15 - no roundabout amendments required. Continue on the A15 over the following junctions:

x. A15/B1162/B1524 roundabout - no roundabout amendments required.

xi. A15/B1443 Roundabout (**Figure 8.7**) - manual steering will be required to avoid central island.

xii. A15/B1443 Roundabout - no amendments required.

xiii. A15/Davids Lane Roundabout - no amendments required.

xiv. A15/Manor Drive - no amendments required.

xv. A15/A47 Roundabout - no amendments required. Follow the A47 over the following junctions:

xvi. A47/A16 Roundabout - no amendments required.

xvii. A47/A1139 Roundabout - no amendments required.

xviii. A47/A1073 Roundabout (**Figure 8.8**) - manual steering will be required to navigate the roundabout.

xix. A47/B1167 Roundabout (**Figure 8.9**) - manual steering will be required to navigate this roundabout.

xx. A47/B1040 Roundabout (**Figure 8.10**) - manual steering will be required to avoid central island. Temporary removal of one near-side lamp post will be required for the duration of turbine component delivery.

xxi. A47/B1167 Roundabout - no amendments required.

xxii. Left Junction A47/B1187 (**Figure 8.11**) - the splitter islands will need to be temporarily removed in order to facilitate the left turn at this junction.

xxiii. Left Junction B1187/Gull Road (**Figure 8.12**) - road widening will be required to the offside to avoid oversailing private land. Temporary removal of one offside lamp post will be required for the duration of turbine component delivery.

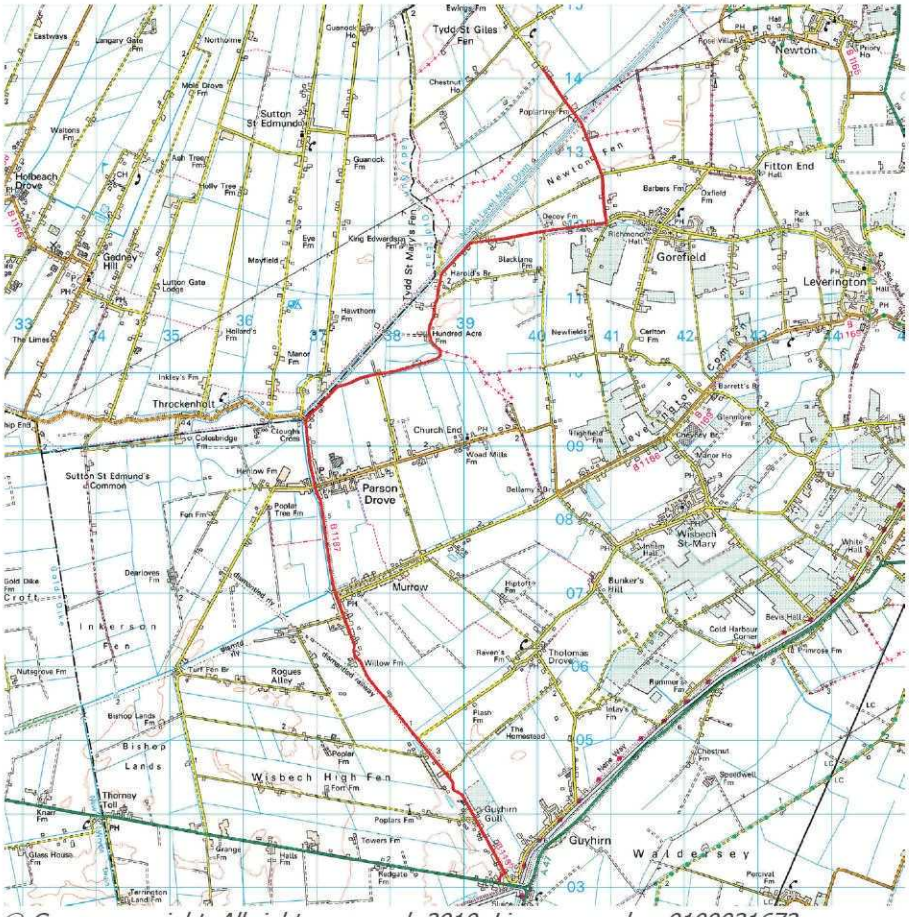
xxiv. Right Junction B1187/Marshalls Bank - no amendments required.

xxv. 'S' bend on Marshalls Bank/Harolds Bank (**Figure 8.13**) - temporary road widening will be required on the offside in order to facilitate navigation of this 'S'-bend. Street furniture on the offside will need to be temporarily removed for the duration of the delivery of the turbine components.

xxvi. Left junction Turnover Bank/Hassock Hill Drove (**Figure 8.14**) - Land-take across private land is required to facilitate navigation of this left turn. An agreement has been reached between the Developer and landowner to this effect, should the project be consented. Turn left into site. **Figure 6.4** shows the modifications required to the existing site entrance at this point.

Proposed Delivery Route for Standard Construction Traffic

B.14 It is proposed that the delivery route for standard construction traffic follows the same approach off the A47 as that proposed for abnormal loads. This route maximises use of the trunk road network and limits traffic through the villages surrounding the site, therefore minimising the potential impact to nearby residences.



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Plate B.1 - Proposed Access Route

Proposed Construction Timetable

Vehicular movements

B.15 There are three principal phases to the construction of a wind farm which are undertaken largely in parallel:

- all site access tracks are built or upgraded and site infrastructure installed;
- turbine, meteorological mast and substation foundations are constructed; and
- the turbines, meteorological mast and substation are erected and the wind farm commissioned.

B.16 **Table B.3** indicates the typical construction programme combined with anticipated vehicular movements. Most of the construction activity is involved with the upgrading of the site access, the installation of new access tracks and the excavation, construction and pouring of turbine foundations. Turbine delivery and erection takes place at the very end of the process, once each of the foundations have cured.

B.17 It can be noted that the most significant traffic volumes occur during the first four months of the construction process. The most significant vehicular movement in any one day is associated with the delivery of the concrete for each wind turbine foundation which must be poured in one continuous pour. As detailed in **Table B.3**, each wind turbine foundation will require approximately 301m^3 of concrete. Assuming that the concrete is supplied in 8m^3 'Redimix' lorries this equates to 38 deliveries in one day for each of the turbine bases (equating to 76 movements for each turbine and 456 in total).

B.18 For the six wind turbines, there will therefore be six days during the construction process where this peak traffic volume will occur. Construction scheduling will mean that these six peak traffic volume days would be non-consecutive.

CONSTRUCTION PHASE	ACTIVITY	TOTAL MOVE-MENTS	PROGRAMME MONTH								
			1	2	3	4	5	6	7	8	9
Mobilisation	Delivery/Removal of plant, equipment and main crane	96	30					18		18	30
	Establish temporary compound, hardstanding and temporary laydown	98	98								
Site access and infrastructure	Upgrade of existing site tracks and construction of new site access tracks and hardstanding areas	2 378	595	594	594	595					
	Installation of meteorological mast	8				6	2				
	Construction of substation	38				10	10	9	9		
	Trench excavation and cable laying	90					45	45			
Construction of turbine foundations	Excavation of foundations	0									
	Rebar and embedments installation	34		17	17						
	Concrete pouring	456		76	152	152	76				
	Concrete curing	0									
Turbine erection	Delivery and erection of wind turbines	106						53	53		
	Internal electrical works and commissioning	0									
Site restoration	Removal of temporary construction compound	98									98
	Reinstatement of site soils and disposal of excess	668								334	334
	Seeding of reinstated areas	0									
	Site access restoration	0									
		4 070	723	687	763	763	133	125	62	352	462

delivery removal

Table B.3 – Typical Construction Programme and Total Monthly Vehicular Movements

Exceptional Loads

B.19 Each turbine is delivered in pre-assembled major component form comprising tower sections, blades, nacelle, hub and control system. These components are then erected on site using cranes.

B.20 The typical components, number of deliveries per turbine and the key component characteristic for transport are also shown in **Volume 2, Appendix 8.1**.

B.21 For the REpower MM92 wind turbine the longest load is the turbine blade at 46m; the widest load is the bottom tower section with a 4.6m width and the heaviest load is the bottom tower section at 62.5 tonnes.

B.22 In order to facilitate turbine erection a heavy duty crane will be required. The REpower MM92 requires a transportable crane plus a tailing crane with a lower lifting and height capacity. The larger crane will be delivered in approximately 18 loads of component parts for assembly on site.

Impact on roads and users

B.23 It has been established that the maximum peak traffic volume will be during the delivery of 'Redimix' concrete deliveries which will take place over a period of one day per foundation using approximately 38 'Redimix' lorries per foundation. This equates to 76 movements over one day per foundation. In the context of the A47, this is well below 10% of average daily vehicular movements. Under the Guidelines for the Assessment of Road Traffic this is not significant.

B.24 Considering the delivery route using the minor road network off of the A47, 76 movements (as associated with the 38 'Redimix' foundation concrete deliveries) over a single day is anticipated to equate to more than 10% of average daily vehicular movements. As such, there are likely to be significant impacts to local traffic as a result of construction works, but only on the six non-consecutive days of foundation pouring.

B.25 With respect to turbine components, as illustrated in **Table B.3**, there will be a total of 106 movements. Turbines will be delivered to site as the foundations and ancillary works are ready. The number of deliveries averages at less than three deliveries per day over a two month period. Whilst three deliveries is anticipated to equate to much less than 10% of average vehicular movements (0700-1900) and less than 30% of average HGV movements (between 0700-1900), leading under the guidelines to insignificant impacts; due to the slow movement of some of the delivery vehicles and their escorts at certain points along the entire delivery route there is the potential to disrupt road users. This will be particularly prominent along the local roads from the point the delivery route leaves the A47. The IEA methodology discusses impact significance in terms of traffic volumes, however, it would not be unreasonable to assume that there is the potential for significant, albeit brief, impacts to occur in terms of local traffic disruption during the period of turbine delivery.

B.26 There is the potential to damage road surfaces through the delivery of aggregates and the delivery of abnormal loads. In addition where the trailer-bed oversails the verge there is potential for damage to the verge.

HYDROLOGY

B.27 SLR Consulting Limited (SLR) prepared a hydrological assessment of the proposed Treading Wind Farm.

B.28 The report presented the current baseline geological, hydrogeological and hydrological site setting including a full characterisation of the existing water environment at the site, against which any potential effects are evaluated. The potential impacts of the proposed development on the local groundwater and surface water environments were then identified with mitigation measures that are likely to be required during the construction, operation and decommissioning of the proposed development detailed. A flood risk assessment was also presented.

Flood Risk Assessment

B.29 Based on the Flood Zone Maps published by the EA, the site is shown to lie within 'high risk' Flood Zone 3a (which represents an annual probability of 0.5% of a flood occurring in any one year). Table D2 of PPS25 sets out that the proposed development is designated as an 'Essential Infrastructure', appropriate in Flood Zone 3a when the Exception Test can be shown to be passed.

B.30 The nature of the land use has been shown to provide wider sustainability benefits to the community that outweigh flood risk. The flood risk issues at the site are manageable and future site occupants can be safeguarded for the lifetime of the development, therefore it is considered that the requirements of the Exception Test are met.

B.31 Following a review of the proposed development plans confirming that changes in land use as a result of the development, the proposed development is duly presented as acceptable with respect to flood risk. Please see **Chapter 9, Volume 2** for full details.

Hydrological Assessment

B.32 The study is mainly concerned with the site area but the water environment within a buffer zone of approximately 2km outside the site has also been included. The likelihood of impacts occurring beyond this distance is also considered, where appropriate.

B.33 The following table, **Table B.4**, provides a summary of the impacts, mitigation measures and residual impacts, determined as a result of the proposal.

B.34 In addition to hydrological and hydrogeological mitigation measures detailed in **Table B.4**, all environmental mitigation measures would be set out within both a Construction Method Statement (CMS) and an Environment Management Monitoring Plan (EMMP), which would be produced prior to the construction of the wind farm.

B.35 Whilst the CMS would set out how the development would be constructed, the MMP would set out the additional management and mitigation commitments. These additional commitments would include both specific mitigation measures as well as

proposals for monitoring and emergency procedures. The EMMP would also include a site-specific Pollution Incident Response Plan in order to prevent and mitigate damage to the environment caused by accidents such as spillages and fires. Both plans would be agreed by the Environment Agency prior to works commencing.

Residual Impacts

B.36 An assessment of baseline conditions has been completed and where necessary mitigation measures have been identified to reduce potential impacts associated with the proposed development to acceptable levels.

B.37 An assessment of flood risk has also been undertaken.

B.38 With the incorporation of general site-wide control measures and specific mitigation measures, the significance of the potential residual impacts associated with the proposed development on local groundwater and surface water resources is assessed as near zero to low.

POTENTIAL IMPACT	SPATIAL AND TEMPORAL IMPACT	PROBABILITY OF OCCURRENCE	MAGNITUDE OF IMPACT	SIGNIFICANCE OF IMPACT	MITIGATION MEASURES	MITIGATED PROBABILITY OF OCCURRENCE	MITIGATED MAGNITUDE OF IMPACT	RESIDUAL IMPACT SIGNIFICANCE
GROUNDWATER AND SURFACE WATER QUALITY								
Generation of suspended solids	Local, Short to Long Term	High	Mild	Medium	No direct discharges to groundwater or surface water. Limited storage of soils. SuDS	Low	Negligible to Mild	Near Zero to Low
Spillage of oils, coolants and fuels	Local, Short Term	Medium	Moderate	Medium	Pollution Incident Response Plan, appropriate storage. Strict preventative measures.	Low	Mild to Moderate	Low
HYDROLOGY								
Increase in surface water runoff and discharge rates	Local, Short to Long Term	Medium	Moderate	Medium	Inclusion of SuDS techniques where appropriate.	Negligible	Mild to Moderate	Near Zero

POTENTIAL IMPACT	SPATIAL AND TEMPORAL IMPACT	PROBABILITY OF OCCURRENCE	MAGNITUDE OF IMPACT	SIGNIFICANCE OF IMPACT	MITIGATION MEASURES	MITIGATED PROBABILITY OF OCCURRENCE	MITIGATED MAGNITUDE OF IMPACT	RESIDUAL IMPACT SIGNIFICANCE
Increase in Flood Risk	Local, Short Term to Long Term	High	Severe	High	Setting substation floor levels above existing ground levels. Using flood resilient building techniques. Instigating a Flood Warning System.	High	Negligible	Low
GEOLOGY AND SOILS								
Ground movements and instability of foundations for turbines and buildings	Local, Short Term	Low	Severe	Medium	Targeted specific site investigation and design.	Negligible	Severe	Low

Table B.4 – Summary of Potential Impacts, Mitigation Measures and Residual Effects

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

B.39 A landscape and visual impact assessment (LVA) was undertaken. This chapter, prepared by E4Environment, presents the results of a landscape and visual assessment that has been undertaken to assess the potential effects of the Treading Wind Farm on the landscape character and the visual amenity of the locality.

B.40 The assessment process has been based on the current published guidelines for landscape and visual assessment provided in the Guidelines for Landscape and Visual Assessment 2nd edition (LI/IEMA 2002) and the current published guidelines for character assessment provided in Landscape Character Assessment: Guidance for England and Scotland (SNH&CA, 2002). It also takes account of the Town and Country Planning (Environmental Impact Assessment) (England & Wales) Regulations, 1999 and advice in Planning Policy Statement PPS22 on renewable energy.

B.41 In general terms, the assessment has involved information review, fieldwork observations and photography, and computer-based data processing and analysis. It has been undertaken in several stages:

- The proposal - a review of the visual characteristics of the proposal and the measures that have been incorporated into the design to mitigate the potential landscape and visual effects;
- Landscape and visual context – a review of the existing landscape of the study area, to describe the components of the landscape and to identify the landscape designations, character areas and visual receptors in the study area;
- Visual analysis – a visibility analysis to ascertain the locations in the study area from where the proposal could be visible, and a viewpoint analysis to predict the changes to the views as a result of the proposal from a selection of viewpoints that represent the main visual receptors in the study area. These viewpoint locations were selected in consultation with officers from the Council;
- Landscape assessment – an assessment of the potential effects of the Proposal on landscape fabric, landscape character and landscape designations in the study area;
- Visual assessment – an assessment of the potential effects of the proposal on the visual amenity of the study area; and
- Conclusions – a summary of the landscape and visual assessments and conclusions on the acceptability of the proposal in this locality.

B.42 Full methodology is given in **Appendix 10.1, Volume 2**.

Effects on Landscape Fabric

B.43 Landscape fabric is composed of the physical components of the landscape (e.g. landform, land use, land cover and landscape elements and features). Developments can bring about both direct and indirect effects on landscape fabric. Direct effects occur where changes to the fabric of the landscape arise as the result of physical

disturbance, for example, the loss of landscape elements such as hedgerows, walls and trees. Indirect effects are consequential changes that are separated from the source of the change in a temporal or spatial manner, for example changes in vegetation downstream as the result of modifications to surface water patterns upstream in a catchment area.

B.44 The assessment of effects on landscape fabric considers the existing landscape fabric of the site and the access improvement works associated with the proposed development. In addition, it also considers the predicted effects of the development, and makes a judgement as to whether there is likely to be a significant beneficial or adverse change to landscape fabric.

B.45 There will be some temporary effects on landscape fabric as a result of the construction phase. However, these effects will be relatively localised and short-term and good site management plus reinstatement at the end of the construction phase would minimise the extent and duration of these effects. There will also be some long-term effects on landscape fabric as a result of the development. However, no important, mature, diverse or distinctive landscape components will be lost. Overall, there will not be a significant beneficial or adverse impact on landscape fabric as a result of the development.

Effects on Landscape Character

B.46 Landscape character is composed of physical, biological and social components (such as landform, flora, land use, land cover, landscape elements, field and settlement patterns), combined with aesthetic and perceptual factors (such as colour, form, texture and pattern, sounds, smells, memories, associations, stimuli and preferences).

B.47 The assessment of effects on landscape character considers the existing landscape character of the site and study area and the predicted effects of the development, and assesses the area within which there is likely to be a significant change to landscape character.

B.48 The six wind turbines and the meteorological mast are the main elements of the proposal that would be visible from the surroundings and have, therefore, the potential to affect the landscape character of the site and study area.

B.49 The wind turbines and mast will become one of the defining characteristics of the site landscape. None of the existing key characteristics will be lost but the turbines will introduce tall, moving structures which are not a characteristic of the current site landscape. As a result, the turbines will result in a significant change in the character of the site landscape.

B.50 The site is located within the Fens/ Planned and Drained Fens and Carrlands LCT as the site straddles two Council areas, although these LCTs have broadly the same key characteristics and have been considered as one within this assessment. The character of this LCT would be significantly affected within the vicinity of the proposal. However, overall this is a large LCT and the significant effects on landscape character would be limited to within approximately 3.5km of the nearest turbine.

B.51 Outside of the site, the landscape character of limited parts of the Settled Fens and Marshes/ Wisbech Settled Fen LCT would also be significantly affected as a result of the proposed turbines within approximately 3.5km - 4km of the nearest turbine. No significant effects on landscape character are expected for any other LCTs within the study area. Therefore, significant changes to landscape character would be limited to within approximately 3.5km - 4km of the site.

Effects on Landscape Designations

B.52 There are no national landscape designations within the 20km radius study area, although there are two local landscape designations, as illustrated on **Figure 10.4**. These are:

- The Wash Coastal Conservation Area; and
- The Area of Important Landscape Quality 'Open'.

B.53 It is considered that no significant adverse or beneficial effects on the purposes of the landscape designations within the study area would occur as a result of the proposed development.

Effects on Visual Amenity

Settlements

B.54 Potential significant effects on visual amenity of residents would be limited to within approximately 5.5km of the site. There would be no significant change in the view for residents in Wisbech, March, Whittlesey, Spalding, Holbeach, Crowland, Cowbit, West Walton, Walton Highway, Guyhirn, Moulton East Fen, Whaplode St Catherine, Gedney Broadgate, Gedney, Lutton, Walpole Cross Keys, Walpole St Andrew, Walton Highway, Terrington St John, St John's Fen End, Marshland St James, Emneth Hungate, Emneth, Elm, Outwell, Friday Bridge, Upwell , Westry, Thorney Toll, Thorney, Crowland, Cowbit, Moulton Chapel, Weston Hills, Moulton, Whaplode, Holbeach Clough, Fleet Hargate, Holbeach Hurn, Gedney Dyke, or Lutton. There would also not be a significant change in the view for residents in Tydd St Mary, Tydd Gote, Whaplode Drove or Holbeach St Johns.

B.55 However, there would be views of the proposed turbines from some properties in parts of Sutton St Edmund, Tydd St Giles, Newton, Gorefield, Leverington, Parson Drove, Murrow, Throckenholt, Gedney Hill, Holbeach Drove, Wisbech St Mary, and Sutton St James where a significant change in the view would occur for these residents.

B.56 Residents in other settlements within approximately 5.5km of the nearest proposed turbine may experience a significant change in their view where they gain clear and relatively unobstructed views of the proposed turbines.

Individual Dwellings

B.57 There are a number of individual residential properties within 1km of the site, and where the turbines would be visible, the residents in these properties would

experience a significant change in their view as a result of the proposed turbines.

B.58 There is also the potential for significant changes in the visual amenity of residents in properties with open views of the proposed turbines, up to approximately 5.5km from the nearest proposed turbine. However, the nature of the topography, combined with vegetation and built form across the skyline means that there will be a limited number of residential properties within 5.5km that will gain such open views of the proposed turbines.

Tourist and Recreational Facilities

B.59 There are a number of recreational facilities within the study area, although this assessment has found that visitors to the majority of these facilities should not be significantly affected by the proposed development. However, visitors to the nearest golf courses to the site at Gedney Hill Golf Club and Tydd St Giles Golf and Leisure Estate would experience a significant change in their view where the proposed turbines are clearly visible as full rotor sweeps or complete turbines. In addition, Orchard View Caravan and Camping Park at Sutton St Edmund is the closest camp site to the site where the proposed turbines are expected to be visible from parts of this camp site and so visitors may experience a significant change in their view.

Motorists (A roads, B roads and local roads)

B.60 The addition of the proposed turbines would not have a significant effect on the visual amenity of motorists on any of the A or B-roads in the study area. However, motorists using local roads out to approximately 3km to 3.5km from the nearest proposed turbine would experience a significant change in their view where the six proposed turbines are clearly visible or prominent features. From some parts of these local routes, the turbines may be screened by nearby built form or vegetation. In such locations, the turbines would not be clearly visible or prominent features of the view, and no significant change in the view would occur. Nevertheless, motorists on some of the local routes around the site would experience a significant effect on their visual amenity.

Rail Passengers

B.61 No rail passengers along the two rail lines within the study area would experience a significant change in their view as a result of the proposed turbines.

Walkers, cyclists and horse riders

B.62 Users of those footpaths, byways and bridleways local to the proposal would experience a significant effect on their visual amenity due to the proximity of the proposed turbines.

B.63 Users of the Nene Way, Hereward Way, Macmillan Way and Fen Rivers Way long distance routes would not experience a significant change to their view as a result of the proposed turbines. Similarly, users of SUSTRANs cycle routes 1, 11, 12, 21 and 63 would not experience a significant change in their view.

B.64 Walkers using their right of access to explore areas of open country and registered common land in the study area, defined as Access Land under the CRoW Act 2000, would not experience a significant effect on their visual amenity as a result of the proposed development.

Cumulative Effects

B.65 All existing wind farms within the study area are located at distances of over 13km from the proposed Treading turbines. Fieldwork found no clear, open or proximate views of any existing wind farms from the settlements discussed above. Given this sizeable distance of existing turbines from the proposed site, combined with the layering of vegetation and built form that occurs along the skyline within the study area, it is considered that no significant cumulative effects on residents within these settlements would occur as a result of visibility of the Treading turbines in combination with any existing wind farm.

Conclusion

B.66 It is unlikely that a proposal to site a new wind energy development in the UK would not result in some significant effects on the landscape character and visual amenity of the immediate locality. However, significant effects are not necessarily unacceptably adverse.

B.67 Whilst the proposal would become a defining characteristic of the landscape of the site and immediate locality, wind turbines are a relatively recent addition to our environment and there is no consensus of opinion on the most appropriate types of landscape in which to site the various scales of wind energy development.

B.68 The six proposed wind turbines will become a defining characteristic of the landscape on the site and local area within 3.5km - 4km of the nearest turbine. This area is not within any national or local landscape designations and so the proposed wind turbines would not compromise the purposes of any landscape designations. In terms of the landscape fabric of the site, there will not be any significant effects.

B.69 The geographical extent of the significant effects on visual amenity will be limited to within 5.5km of the nearest turbine (for high sensitivity receptors), to within approx 4.5km of the nearest turbine (for high/medium sensitivity receptors) and to within approx 3.5km of the nearest turbine (for medium sensitivity receptors), but this assumes excellent visibility and that the receptors will be exposed to the change for the first time (see **Appendix 10.1**, **Volume 2** paragraph 99).

B.70 In reality, the prominence of the wind turbines and, therefore, the potential for significant effects on visual amenity will vary with the time of day and year, different weather, lighting and visibility conditions and different wind directions (e.g. the turbines are much less noticeable when the rotors are side on to the observer). Also, receptors tend to become accustomed to change over time.

B.71 The turbines will result in significant changes to views from a number of residential properties, minor roads, local footpaths and bridleways in the locality, but these visual effects will be limited and the turbines will not be overbearing in any of these views.

B.72 In conclusion, the extent of the significant effects is limited, the proposal would have an obvious and directly functional relationship with the nature of the local landscape and, in landscape and visual terms the proposal would be acceptable in this location.

SHADOW FLICKER

B.73 Wind turbines can cast long shadows and when the sun is specifically positioned in the sky with respect to a turbine and the window of a neighbouring dwelling, this shadow may pass through the window of the room. This can cause a drop in light levels which comes and goes with each pass of a blade (whilst the sun is in the specific point in the sky). This potential effect is commonly referred to as 'shadow flicker'.

B.74 For the potential for a shadow flicker effect to exist, a number of factors need to occur coincidentally:

- clear skies and good visibility;
- the sun needs to be low in the sky and in a specific position with respect to a turbine and the window of a property;
- the wind must be blowing sufficiently to turn the wind turbines; and
- the wind must be blowing in a direction such that the rotor is rotating in a plane perpendicular to an imaginary line drawn between the wind turbine, the sun and the property window.

B.75 The companion guide to PPS22 (ODPM, 2004) advises (paragraph 76, Technical Annex B) that shadow flicker can occur within 10 rotor diameter of a turbine. For a 90m rotor as per the Vestas V90 turbine, this equates to a 900m zone around each turbine.

B.76 In addition, for UK latitudes, the zone projected on to the ground in which properties may be affected by shadow flicker is 130 degrees either side of north. In the UK a property to the south of a wind turbine will never be in its shadow.

B.77 Please note;

- A flicker frequency of 13 fps (or 13Hz), as may trigger photosensitive epileptics (please see **Chapter 10, Volume 2** for full details) would correspond to a rotational speed of 260rpm. This is significantly beyond the rotational speed of the proposed turbines which have a peak rotation speed of 15.0rpm.)
- Shadow flicker can not occur outside, although a passing shadow may occur.

Results

B.78 Engena Ltd undertook a shadow flicker assessment for the proposed two turbines. The shadow flicker model established that assuming clear skies, good visibility and specific wind conditions, shadows could be cast on up to 21 properties. This could be by up to three turbines in each case.

B.79 The maximum number of days that any single property has the potential to experience shadow flicker (should the weather conditions be suitable at all times) is 131 days in any year (H25 - Cottesmore from T1 and T2).

B.80 The maximum duration of shadow flicker that could be experienced, per incident, at any property would be 0.95hrs (57 minutes) at H1 - Ashtree Barn.

B.81 However, due to the limited number of hours that a shadow may potentially be cast from the turbines, it is practicable at this site to completely mitigate for the potential shadow effect, by switching off the turbines during potential events, and therefore removing the potential for flicker effects.

B.82 This process would use a sensor to detect sunlight in combination with a reading of wind direction. The wind farm control system would then be programmed to switch off the appropriate turbines during the times of potential effect whenever the conditions for shadow flicker exist. This will be applied should shadow flicker be experienced at any of the identified properties.

B.83 Following mitigation no residential properties will be affected by shadow flicker.

HISTORIC ENVIRONMENT

Introduction

B.84 Historic environment is a broad inclusive term for all aspects of the environment which have been created intentionally or fortuitously by human action over previous centuries. Each individual component of the historic environment such as an archaeological site, an historic building or a designed park is known as an historic asset. **Chapter 11** of the Environmental Statement has been researched and written by Archaeo-Environment Limited (AE), a specialist historic environment consultancy, and provides an assessment of the potential effects of the proposed Treading wind farm upon the historic environment of a defined study area. The assessment considers both potential direct physical impacts and indirect impacts on the setting of both non designated and designated historic assets such as listed buildings and scheduled monuments.

Method of Assessment

B.85 PPS5 (2010) is the current government planning policy statement on the historic environment and has informed the manner in which the assessment of potential impacts on the historic environment has been approached. The assessment has sought through a process of scoping and assessment to identify a comprehensive *range of historic environment assets upon which the proposed wind farm may have* an impact. A wide variety of source material including the Historic Environment Records of Cambridgeshire and Lincolnshire, the English Heritage National Monuments Record, national and local archives, published and unpublished sources together with site survey and evaluation excavation have been used to provide a comprehensive dataset for the study. Specialist local planning authority staff and English Heritage were consulted throughout the assessment process and wherever

possible their insights and requirements for the study and assessment have been taken on board. Historic assets assessed in the study have included all identified historic assets with 2km of the nearest wind turbine, all designated assets within 5km, and designated assets whose significance may lie in long distance views and setting issues up to 15km from the development site. The assessment has been primarily based upon potential impacts on the key aspects of significance as identified in PPS5, namely historic, archaeological, architectural and artistic significance. Further to the assessment of specific historic assets, the broader historic landscape character has been identified and impacts upon it assessed also.

Predicted Impacts

B.86 The impacts of the proposed development on the historic environment will be principally experienced during construction and operation. During construction, areas of sub-surface archaeological deposits identified in pre-application archaeological evaluation work, and which appear to be of local importance within the site, may be disturbed and damaged. A single buried cut feature found on the site of Turbine 3 suggests a limited potential for the recovery of archaeological information of an as yet unknown period, but possibly of Romano-British date. Once operational the wind farm will have an impact on the setting of several historic assets such as distant views of church towers. Such impacts on setting have been carefully assessed and found to be of a minor nature effecting a single or limited view to a small degree, in no case is there any anything more than a slight loss of significance from the limited views affected, and in no case is the ability to understand the historic asset lost. The Fen landscape in the area can historically be seen as one of great change, undergoing phases of inundation and reclamation over perhaps 2000 years, and the Treading site in particular appears to have been reclaimed from marsh as late as 1773.

Proposed Mitigation

B.87 Due to the size of wind turbines, mitigation against any effects on setting is very difficult. While micro-siting the turbines by relocating them a few tens of metres in various directions is an option, no key designed or historic views are in this case being impacted upon and so such an exercise is not warranted.

B.88 With regard to the impact on the limited archaeological deposits identified on the site, then further controlled archaeological investigation of these in advance of any construction work would seem appropriate. A written scheme of investigation should be agreed between developer and planning authority to ensure the scope of such work is reasonable and that it builds upon the objectives of the archaeological regional research frameworks. Further to this in line with PPS5 and providing public access to the historic environment, any scheme of archaeological works should look at public involvement and dissemination of the results on the archaeological work and landscape history of the site to the local community.

B.89 The site contains a limited number of historic landscape features and although there are no identified direct impacts on the Lady Nunn's Eau, Elloe Bank or the alignment of tracks across the site, any construction work should be carefully informed to

safeguard these features and the contribution they bring to the character of the historic landscape.

Conclusions

B.90 In conclusion, the development site itself contains a limited number of historic assets, none of which can be identified as of national importance and requiring designation. The site does have limited potential for containing buried archaeological deposits relating to prehistoric, Roman and medieval land use, the investigation of which will contribute towards regional research frameworks and public understanding of the past. Targeted archaeological excavation in advance of construction to retrieve this information and place it in the public domain will be sufficient mitigation.

B.91 The historic landscape character of the site is one of change, having undergone several alterations over the last two millennia, but is now largely of late 18th or early 19th century character, when the former marsh was finally drained and turned over to agriculture. The Lady Nunn's Old Eau and the parallel Elloe Bank, are features of some considerable antiquity and value to the significance of the historic landscape character. Both have remained constants as the landscape around them has changed over perhaps a thousand years and neither are threatened either physically or in terms of setting by the proposed development.

B.92 By virtue of their size the proposed turbines will have an impact on the wider historic landscape character and some aspects of significance of specific historic assets within it. This assessment has however found no instances of severe or major detrimental impact on historic assets and from an historic environment perspective the site appears well chosen, within a broader landscape of change and not in direct competition with important heritage assets whose setting may provide them with considerable historic significance.

ORNITHOLOGY

B.93 Wild Frontier Ecology Ltd undertook an assessment of the potential impacts of the construction, operation and decommissioning phases of the Treading Wind Farm on ornithological receptors (Please see **Chapter 12, Volume 2** for the full report.)

B.94 In line with the EIA Regulations, the assessment set out and identified:

- Planning policy and legislative context for the development;
- Methodology and scope of the assessment, including evaluation criteria;
- The baseline ecological environment and value of ecological receptors;
- The likely effects of the proposal on valued ecological receptors;
- The significance of these effects;
- Potential ecological mitigation measures which may be applied to the proposal; and
- The residual effects of the proposal on valued ecological receptors, following mitigation.

Surveys

B.95 Consultations with relevant bodies, including Scoping Opinions from NE, RSPB and BCNPWT (listed in **Table 12.1** and **Appendices 5.2** and **5.3**), the likely requirements for ornithological field survey were identified as:

- Breeding bird surveys using Common Birds Census techniques;
- Vantage point surveys to industry best practice using Scottish Natural Heritage (SNH) guidelines; and,
- Mapping and assessment of bird flight paths.

B.96 Throughout the survey process, particular attention was paid to bird species with elevated protection status (e.g. Annex I or Schedule 1), BoCC Red and Amber-listed species, and UK BAP and LBAP Priority Species.

B.97 Vantage point surveys covered all land within 500 metres of each of the six proposed wind turbine locations, as specified by Scottish Natural Heritage (2005). Surveys were carried out between November 2009 and October 2010 over a range of weather conditions and times of day.

B.98 The site was surveyed for breeding birds in two sections, a western (surveyed 2009) and an eastern (surveyed 2010), to take account of the addition of the three easternmost turbines after the initial breeding bird surveys had been undertaken in Spring / Summer 2009. The survey used an abbreviated version of the methodology detailed by the BTO for use in their Common Birds Census (CBC) (Gilbert *et al.* 1998) which recommends ten surveys conducted between April and June.

B.99 The site was assessed for potential Barn Owl nesting sites during the Phase 1 habitat survey, and during the breeding bird surveys. Barn Owl was in the list of target species for the vantage point surveys, some of which were undertaken in early mornings and towards evening as requested by the consultees.

B.100 Following the survey work, receptors of parish value and greater were carried through to full impact assessment. The list of ornithological receptors taken forward to full impact assessment is:

- The Nene Washes and The Wash SPAs;
- Wintering and migrant waders (Golden Plover and Lapwing);
- Birds of prey (Merlin, Peregrine, Marsh Harrier, Hen Harrier, Buzzard and Kestrel);
- Little Egret;
- Grey Heron;
- BoCC Red and Amber-listed breeding birds (Dunnock, Linnet, Reed Bunting, Skylark, Whitethroat, Yellowhammer, Mallard and Yellow Wagtail); and,
- Barn Owl.

B.101 The impacts on each of these receptors, pre-mitigation, are listed in **Table B.6** below.

ORNITHOLOGICAL RECEPTOR	POTENTIAL EFFECT	MAGNITUDE OF EFFECT	PROBABILITY OF EFFECT	SCALE OF EFFECT	SIGNIFICANCE OF EFFECT
Nene Washes SPA; The Wash SPA	Indirect effects on qualifying features	Neutral	Near-certain	NA	Not significant
Golden Plover	Turbine collision	Minor negative	Unlikely	Parish	Not significant
	Disturbance from construction or operation	Minor negative	Unlikely	Parish	Not significant
Lapwing	Turbine collision	Minor negative	Probable	District	Not significant
	Disturbance from construction or operation	Minor negative	Probable	District	Not significant
Little Egret	Turbine collision	Intermediate negative	Extremely unlikely	District	Not significant
	Disturbance from construction or operation	Neutral	Probable	District	Not significant
Grey Heron	Turbine collision	Minor negative	Unlikely	Local/ parish	Not significant
	Disturbance from construction or operation	Minor negative	Unlikely	Local/ parish	Not significant
Marsh Harrier	Turbine collision	Intermediate negative	Extremely unlikely	District	Not significant
	Disturbance from construction or operation	Minor negative	Unlikely	District	Not significant

ORNITHOLOGICAL RECEPTOR	POTENTIAL EFFECT	MAGNITUDE OF EFFECT	PROBABILITY OF EFFECT	SCALE OF EFFECT	SIGNIFICANCE OF EFFECT
Hen Harrier	Turbine collision	Neutral	Probable	Parish	Not significant
	Disturbance from construction or operation	Minor negative	Extremely unlikely	Parish	Not significant
Buzzard	Turbine collision	Minor negative	Probable	Local/ parish	Not significant
	Disturbance from construction or operation	Minor negative	Probable	Local/ parish	Not significant
Kestrel	Turbine collision	Intermediate negative	Probable	Local/ parish	Not significant
	Disturbance from construction or operation	Neutral	Probable	Local/ parish	Not significant
Peregrine	Turbine collision	Intermediate negative	Extremely unlikely	Parish	Not significant
	Disturbance from construction or operation	Neutral	Probable	Parish	Not significant
Merlin	Turbine collision	Intermediate negative	Extremely unlikely	Parish	Not significant
	Disturbance from construction or operation	Neutral	Probable	Parish	Not significant
BoCC Red and Amber-listed breeding birds	Turbine collision	Minor negative	Unlikely	Local/ parish	Not significant
	Disturbance from construction or operation	Minor negative	Probable	Local/ parish	Not significant

ORNITHOLOGICAL RECEPTOR	POTENTIAL EFFECT	MAGNITUDE OF EFFECT	PROBABILITY OF EFFECT	SCALE OF EFFECT	SIGNIFICANCE OF EFFECT
Barn Owl	Turbine collision	Intermediate negative	Extremely unlikely	Local/ parish	Not significant
	Disturbance from construction or operation	Minor negative	Unlikely	Local/ parish	Not significant

Table B.6 - Significance of Effects on Ornithological Receptors Pre-mitigation

Mitigation

B.102 Mitigation is compelled where significant negative effects to valued ecological receptors are assessed as probable or certain. This assessment has found that the effects on valued ornithological receptors are not significant under the terms of the EIA regulations.

Precautionary measures for red and amber listed breeding birds

B.103 Avoidance measures are proposed for possible effects which, although not predicted to be significant, may affect valued ecological receptors in a way that would be preventable. Avoidance measures to prevent nest destruction and/ or disturbance of BoCC Red and Amber-listed breeding birds will be applied.

- Earthworks and other ground disturbance involved in construction of new access tracks and turbine bases (including tracking of vehicles off prepared surfaces and vegetation clearance not normally associated with farming), will be either conducted outside of the window from 1st March – 1st August or else supervised on-site by a suitably qualified ecologist.
- Pre-construction survey checks will be undertaken to identify nest sites as these may change. Where nests are identified, buffer zones will be established.
- Construction materials will not be stored or deposited in valued bird nesting habitats.

Precautionary measures for Kestrel

B.104 Kestrel favour foraging over areas of rough grass which support small mammals. These would include grass field margins. To lower the risk of collision to hovering kestrels, all such field margin habitats should be displaced, and rotor swept areas should be kept as free as possible of vegetation favourable to small mammals by cultivation.

Site Biodiversity Enhancements

B.105 The enhancement suggested in the ecology chapter, relating to more favourable conditions for water voles in the ditch network on site, would also benefit red and amber listed farmland birds in providing further suitable nesting and foraging habitat.

B.106 Providing enhancements for birds is to negotiate a balance between attracting sensitive birds on site, and therefore increasing potential collision risks, and providing benefits for those species. In this case, enhancements for kestrel have not been proposed as this could potentially raise risk levels.

B.107 In order to further enhance the site for nesting farmland species, particularly skylark and yellow wagtail, skylark plots are proposed for two fields on the site not occupied by turbines. These plots should be inserted at a rate of 2 per hectare, should measure 20 square metres, and be inserted in to winter cereal crops in rotation. These can be funded under Stewardship agreements, and have been proven to raise skylark breeding success by 50%.

Assessment of Cumulative Effects

B.108 Cumulative impacts merit consideration when more than one development is anticipated to impact the same population of a species of conservation concern (Percival 2007). Given the limited duration of wind farm construction impacts, at least in lowland England, cumulative impacts are probably restricted to potential operational effects.

WIND FARM SITE	NUMBER OF TURBINES	STATUS	PROXIMITY TO PROPOSED TREADING WIND FARM
Gedney Marsh	6	Operational	19.0km NW
Holbeach Marsh	8	Submitted	16.3km N
The Grange	7	Consented	9.3km NE
Deeping St Nicholas	8	Operational	17.8km W
French Farm	2	Consented	10.5km SE
Nutsgrove Farm	7	Consented	7.9km SW
Wryde Croft resubmission	6	Consented	9.0km SW

WIND FARM SITE	NUMBER OF TURBINES	STATUS	PROXIMITY TO PROPOSED TREADING WIND FARM
Coldham Ext.	7	Consented	12.1km SE
March Sewage Works	1	Consented	14.5km SE
Long Hill Road	1	Operational	15.5km SE
March Landfill	2	Submitted	14.0km S
Floods Ferry	9	Submitted	17.5km S
Foundry Way	1	Consented	16.3km SW
Glass Moor	8	Operational	17.4km SW
Stags Holt Extension	1	Consented	18.4km SW
Whittlesey	1	Operational	20.1km SW
McCains Food	3	Operational	20.8km SW
Ransonmoor Phase II	5	Operational	22.0km S

Table B.7 - Wind farm projects within 25km of the proposed development site

B.109 While cumulative avoidance effects can effectively be discounted as they are only effective at distances well under 1km, there is the potential for wide-ranging bird species to suffer cumulative collision mortality impacts from several developments. Based on the RenewableUK online UK Wind Energy Database (RenewableUK 2010), there are eighteen operational, consented or submitted wind turbine developments identified within a 25km radius of the proposed Treading development.

B.110 The most collision sensitive species within the study site is identified as Kestrel. Realistically, with the closest other turbines at 7.9km away, cumulative risks to individual birds are unlikely. However each wind turbine development does have the potential to affect birds within its own locality, and cumulatively that could impact on the regional population. While a small number of wind farm fatalities are likely, they are not predicted in the numbers that would be expected to have significant population effects.

Conclusions

B.111 Following consultation with relevant consultees, extensive ornithological surveys took place at the site of the proposed wind farm. These surveys were formulated, scoped and designed on the basis of the results of the desk-based assessment and associated consultations. The surveys conducted included VP monitoring of wintering birds and raptors and a site breeding bird census.

B.112 Seven bird species of elevated statutory conservation status were found to be present on the study site, namely: Golden Plover, Hen Harrier, Marsh Harrier, Peregrine, Merlin, Little Egret and Barn Owl. A number of other bird species listed as birds of conservation concern were also recorded.

B.113 The potential magnitudes and probabilities of effects on the various bird species and the Nene Washes and The Wash SPAs were assessed, with no significant negative-effect risks identified.

B.114 Measures to avoid minor adverse effects to BoCC Red and Amber-listed breeding birds during the construction and decommissioning phases have been identified and proposed.

B.115 In summary, no significant impacts from the proposed Treading Farm Wind Farm on valued ornithological receptors are expected.

NON-AVIAN ECOLOGY

B.116 Wild Frontier Ecology Ltd undertook an assessment of the potential impacts of the construction, operation and decommissioning phases of the Treading Wind Farm on non-avian receptors (Please see **Chapter 13, Volume 2** for the full report.)

B.117 The results of the initial scoping desk-based study and consultation exercise focused attention on those ecological receptors most likely to be affected by the development. These receptors included protected and BAP species of mammals, amphibians and habitats. Consequently, field surveys were undertaken for bats and other protected mammals, amphibians and habitats (including plant species).

B.118 This Ecological Impact Assessment was carried out according to the 'Guidelines for Ecological Impact Assessment' produced by the Institute of Ecology and Environmental Management (IEEM) (2006), which is recognised as current best practice.

Phase 1 Habitat Survey

B.119 Extended Phase 1 habitat surveys were carried out on 24th June 2010, covering all land within 500m of the proposed turbines. The methodology used was based on the Joint Nature Conservancy Council guidelines for habitat survey (JNCC, 2010). The habitat survey was extended to include an evaluation of the site in terms of rare or protected species presence, and the compilation of a plant species list.

B.120 Incidental observations of non-protected mammals and their field signs were also

recorded, as were other potential site features such as invertebrates. Incidental observations of flora and fauna were made during other field visits to the site, in addition to during the habitat survey.

Mammal Surveys

B.121 Protected mammal signs and appropriate habitats were surveyed for during the extended Phase 1 habitat survey, and also on 19th November 2010 specifically for Badger. Incidental evidence indicating probable presence of Water Vole was noted during the Phase 1 habitat survey and are therefore known to be present on site.

B.122 The study site was sampled for bat activity using manual transects and automated static monitoring stations. The manual transects were conducted using both Batbox Duet (coupled with Creative Zen V MP3 recording devices) and Anabat SD1 frequency division bat detectors. The automated static surveys used Anabat SD1 bat detectors that were positioned close to the final turbine positions.

B.123 Manual transect surveys were performed on: 25th May 2010; 24th June 2010; 27th July 2010; 24th August 2010; 16th August 2010; 30th September 2010; and, 26th October 2010. Automated static surveys were performed on: 1st-4th June 2010; 16th-19th August 2010; and, 30th September-5th October 2010.

B.124 For each bat echolocation registered during the surveys, the location of the registration, the species of bat, and the number of echolocation 'passes' were noted.

B.125 All surveys were recorded for later sonogram/spectrogram analysis to confirm the full range of species encountered and to refine the speculation of the bat activity exhibited. Batbox Duet recordings were analysed using BatScan 9 software, and the Anabat SD1 recordings were analysed using AnalookW software.

B.126 The methodology for the bat surveys is detailed in full in **Appendix 13.3, Volume 2**.

B.127 No other mammal species were the target of specific surveys, but incidental records of other species were noted.

Herpetofauna Surveys

B.128 The desk study and early visits to the study site confirmed that potential Great Crested Newt breeding habitats (i.e. standing water) was absent within the 500m buffer area. The ditches within the site were either moderately flowing or dry when visited during the Great Crested Newt breeding period. No Great Crested Newt records within 2km of the development were returned by either the Cambridgeshire and Peterborough Biological Records Centre or the Lincolnshire Biodiversity Partnership. Consequently Great Crested Newt surveys were not undertaken.

B.129 The Phase 1 survey identified the presence of only arable habitats of limited suitability for reptiles, and no reptile records were returned within 2km of the study area. Consequently reptile surveys were not undertaken.

Invertebrates

B.130 The Phase 1 habitat survey confirmed a lack of exceptional habitats, and so no surveys were conducted expressly for invertebrates.

Results

B.131 Pre-mitigation impacts on non-avian receptors, anticipated as a result of the proposed Treading Wind Farm are detailed in **Table B.8** below.

VALUED ECOLOGICAL RECEPTOR	GEOGRAPHICAL SCALE OF RECEPTOR IMPORTANCE	TYPE OF IMPACT	MAGNITUDE OF POTENTIAL IMPACT	PROBABILITY OF IMPACT	SIGNIFICANCE
Nene Washes SPA; SAC; Ramsar; SSSI	International	Construction and operation effects on non-ornithological ecological receptors	Neutral	Certain	Not significant
The Wash SPA	International	Discussed within Ornithology Chapter			
Nathusius' Pipistrelle	District	Collision during operation	Intermediate negative	Extremely unlikely	Not significant
		Disturbance during operation	Minor negative	Extremely unlikely	Not significant
Myotis sp.	District	Collision during operation	Intermediate negative	Extremely unlikely	Not significant
		Disturbance during operation	Minor negative	Extremely unlikely	Not significant
Badger	Local/Parish	Construction	Minor negative	Unlikely	Not significant
		Operation	Neutral	Certain	Not significant
Common Pipistrelle	Local/Parish	Collision during operation	Minor negative	Unlikely	Not significant
		Disturbance during operation	Minor negative	Extremely unlikely	Not significant

VALUED ECOLOGICAL RECEPTOR	GEOGRAPHICAL SCALE OF RECEPTOR IMPORTANCE	TYPE OF IMPACT	MAGNITUDE OF POTENTIAL IMPACT	PROBABILITY OF IMPACT	SIGNIFICANCE
Soprano Pipistrelle	Local/Parish	Collision during operation	Minor negative	Extremely unlikely	Not significant
		Disturbance during operation	Minor negative	Extremely unlikely	Not significant
Brown Long-Eared Bat	Local/Parish	Collision during operation	Minor negative	Extremely unlikely	Not significant
		Disturbance during operation	Minor negative	Extremely unlikely	Not significant
Water Vole	Local/Parish	Construction	Minor negative	Probable	Not significant
		Operation	Neutral	Certain	Not significant
Hedgerow	Local/Parish	Construction	Neutral	Certain	Not significant
		Operation	Neutral	Certain	Not significant

Table B.8 - Summary of Potential Impacts Prior to Mitigation

Proposed Mitigation and Habitat Enhancement

B.133 Mitigation is proposed where significant effects to valued ecological receptors are assessed as probable or certain. Mitigation is also required for impacts which, by affecting statutorily protected species, may be illegal.

B.134 The deliberate design of the wind farm layout to provide 50m buffer distances between all turbine blades and their nearest linear features (in compliance with Natural England Technical Information Note TIN051) has mitigated the potential for significant effects to bats which was identified at the scoping stage. No other potential significant effects have been identified by this study.

B.135 Further avoidance measures have been identified which should reduce the potential for negative impacts of the proposal on other valued ecological receptors, and/or provide positive impacts via habitat enhancements.

Water Vole

B.136 All access tracks would be spaced a minimum of 4m from ditches and water courses. Due to the seasonality of the ditches in terms of both the water presence and cutting of vegetation, a pre-construction survey of all suitable habitats within 50m of all newly proposed watercourse crossings would be performed to establish a contemporary assessment of the Water Vole presence or lack thereof. This survey would be followed by an assessment as to whether or not a disturbance licence will be required from Natural England. Appropriate exclusion and habitat manipulation techniques may be required to prevent the possibility of Water Voles and their burrows being harmed by construction activities. Translocation of Water Voles is very unlikely to be required.

Badger

B.137 The status of the possibly defunct outlier Badger sett identified within 30 metres of the track layout will be checked prior to construction. Should it be found to be occupied (either recently or currently), mitigation measures will be proposed. Possible foraging disturbance during construction would be minimised by avoiding any earth moving works at night. Any trenches or cavities created during construction would be covered during the night or provisioned with adequate escape boards to prevent animals from getting trapped.

Site Biodiversity Enhancements

B.138 The ditches at Treading currently offer only marginal habitat for Water Voles. These ditch habitats could be improved to benefit the Water Vole population by altering the management regime. In particular, vegetation cutting should be undertaken in mid-July to mid-September, with the flail cutters set high to retain 10-15cm of vegetation. Cutting only one side of each ditch in each year would also create more heterogeneity in the habitat available for Water Voles. This improvement of habitat for Water Voles would more than compensate for the small loss of sub-optimal habitat due to the creation of new ditch crossings.

Ongoing Management of the Proposal Area

B.139 The study area is expected to remain as an arable farm during and following wind farm construction, with no significant changes as a result of the proposed development.

Conclusions

B.140 Extensive ecological surveys were undertaken at the site of the proposed Treading Wind Farm. These surveys were formulated, scoped, and designed on the basis of the results of the desk based assessment and associated consultations. These investigations focused primarily on designated wildlife sites, UK Lincolnshire and Cambridgeshire BAP priority habitats, Badgers, Bats and Water Voles.

B.141 A number of non-avian protected species were confirmed to be present within a 500m buffer area around the proposed turbines, most notably five species of bat, Water Vole and Badger. The impact risks to the various protected species were assessed by (a) using the survey data collected; (b) by referring to the available compilation of relevant ecological studies; and (c) by considering the amelioration of risk potential afforded by following conservation guidelines for wind farm planning. Potentially significant pre-mitigation impacts were not identified as a credible concern for any protected species.

B.142 Given the design of the wind farm and the implementation of mitigation measures, the construction and operation of the proposed development is deemed unlikely to result in negative ecological impacts beyond a minor magnitude for some species at the Parish/Local geographic scale. The magnitudes and probabilities of these potential impacts are not sufficient to expect that the proposed development poses a significant risk to the conservation status of any of the faunal species or habitats recorded within the focus area of this assessment. Therefore the development of the Treading Wind Farm is predicted to have no significant impacts on valued ecological interests.

NOISE

B.143 The Hayes McKenzie Partnership Ltd. undertook a construction and operational noise impact assessment for the proposed Treading Wind Farm.

B.144 The assessment has been carried out according to the recommendations of ETSU-R-97, The Assessment and Rating of Noise from Wind Farms, as referred to in Planning Policy Statement 22, Renewable Energy, as the methodology by which noise from wind farms should be assessed.

B.145 For day-time hours, ETSU R-97 states that the noise limits are 35 - 40 dB(A) or 5 dB(A) above the prevailing background as measured during quiet day-time periods, whichever is greater. The actual value within the 35 - 40 range should depend on the number of dwellings in the vicinity; the effect of the limit on the number of kWh generated; and the duration of the level of exposure.

B.146 For night-time periods the noise limit is 43 dB(A) or 5 dB(A) above the prevailing night-time background, whichever is the greater. The 43 dB(A) lower limit is based on a sleep disturbance criteria of 35 dB(A) with an allowance of 10 dB(A) for attenuation through an open window and 2 dB(A) subtracted to account for the use of L_{A90} rather than the L_{Aeq}.

B.147 Where the occupier of a property has some financial involvement with the wind farm, the day and night-time lower noise limits are increased to 45 dB(A) and consideration can be given to increasing the permissible margin above background. These limits are applicable up to a wind speed of 12m/s measured at 10m height on the site.

B.148 Quiet day-time periods are defined as evenings from 1800-2300 plus Saturday afternoons from 1300-1800 and Sundays from 0700-1800, which are referred to as the amenity hours. Night-time is defined as 2300-0700.

B.149 Construction noise was also considered, as detailed in full in **Chapter 14, Volume 2**.

Operational Noise Assessment

B.150 An assessment of the noise impact of the proposed Treading Wind Farm has been carried out. Baseline noise levels were measured at six locations representative of the nearest residential locations to the proposed turbine. At one of the six locations, the equipment failed and data is only usable from five. Turbine noise levels were predicted based on warranted sound power level data for a REpower MM92 wind turbine.

B.151 The assessment has been carried out by comparing the predicted noise levels with noise limits described in ETSU-R-97, Assessment and Rating of Noise from Wind Farms, the published recommendations of the Working Group on Noise from Wind Turbines, as referred to in PPS22, Renewable Energy.

B.152 The night-time assessment shows that the predicted turbine noise levels, at the nearest residential locations to the site, are below the night time noise limits under all conditions by a margin of at least 3.5 dB.

B.153 The daytime assessment shows that the predicted turbine noise levels, at the nearest residential locations to the site, are below the lower daytime noise limits by a margin of at least 1 dB and below background noise levels for wind speeds above 7m/s.

Construction and Decommissioning Noise Assessment

B.154 The construction details and plant requirements for this site will not be known until a later stage when more detailed assessment of the ground conditions and other requirements have been carried out. It is anticipated, however, that noise from on site construction plant will not exceed the criterion described at any residential property. Noise impact from construction traffic movements may, however, be significant where they pass properties not currently subject to significant levels of traffic noise.

B.155 Although noise levels from construction will be below the 67 dB L_{Aeq} significance criterion based on the Department of the Environment Advisory Leaflet (AL) 72, Noise Control On Building Sites, there will be periods when noise generated by track works, or other construction activities, may be audible at properties close to the associated construction activity. For all activities, everything possible will be done to reduce noise levels albeit with due regard to practicality and cost as per the concept of 'best practicable means' as defined in Section 72 of the Control of Pollution Act 1974.

UTILITIES AND TELECOMS

B.156 Engena Limited undertook an assessment of the proposed Treading Wind Farm and the potential impacts on existing utility infrastructure and telecommunications systems.

B.157 The assessment included;

- Identification of microwave telecommunication and radio telemetry links crossing or near to the site boundary;
- Identification of utility infrastructure in proximity to the site;
- Identification of television and telecommunications fixed link signal transmissions in proximity to the proposed turbine development site;
- Plotting of identified links and utility infrastructure to determine which crossed the site boundary or re proximate to the proposed site;
- Consultation with telecommunication and infrastructure operators and service providers where potential impacts were anticipated; and
- Consultation with the owners and operators of the electricity, gas and water networks.

Microwave Telecommunication Links

B.158 Formal pre-planning consultation with OfCom and individual link network operators identified the paths of two microwave telecommunication links within proximity of the site boundary. Details of these microwave telecommunication links are listed in **Table B.10**.

LINK OPERATOR	OFCOM LINK ID
BT	0789825/1
Vodafone Ltd.	0509020/1

Table B.10 - Microwave Telecommunication Links

B.159 A detailed consultation process was followed with the two link operators for each of the identified links. During this process separation distances between the link

centre-line and turbine components was requested by each link operator to ensure that the development could be accommodated with no adverse effects to their systems. They were also informed of any layout changes during the EIA process.

B.160 Following this process, both link operators found their links to be a suitable clearance distance from the proposed wind turbines to avoid any potential impacts.

B.161 Copies of the correspondence from those operators can be found within **Volume 2, Appendix 15.1**.

Radio Telemetry Systems

B.162 Formal pre-planning consultation with Atkins Ltd., JRC and Anglian Water Services identified no UHF radio telemetry links nearby.

Utility Services

B.163 Consultations with National Grid in September 2009 highlighted a gas transmission pipeline near to the development area. Following consultations with National Grid (**Appendix 15.2**), the implementation of a 'buffer zone' was agreed, where no turbine would be sited closer to the pipeline than one and a half times the turbine hub height. For this project this corresponds to a distance of 120m. This constraint was duly applied to the design of the site.

B.164 In addition consultations with Geodesys Land and Property Information, who advise on behalf of Anglian Water, identified no water or sewer pipes within the development area (**Appendix 15.2**).

B.165 E.on Central Networks were consulted in December 2009 with regard to the 132kV overhead electricity line which exists towards the south of the site. E.on Central Networks requested a separation of turbine tip height plus 10% from the overhead 132kV electricity lines. For this site this is equivalent to 138m. This constraint was applied to the site during its design.

Terrestrial Television

B.166 Terrestrial television reception can be reflected and scattered by turbine towers and by movement of wind turbine blades. Reception may be affected in any direction within 500 metres of a turbine and up to 5km immediately behind a turbine (BBC and also ITC, 1992). Properties local to and within the site may experience an adverse effect to their terrestrial television service.

B.167 BBC Research and Development provide an assessment tool for guidance to wind farm developers, the BBC Windfarm Tool (BBC, 2007). The output of the tool provides a rough estimate of the number of dwellings that may suffer terrestrial television interference caused by the installation of the proposed wind turbines.

B.168 For the Treading Wind Farm the BBC Windfarm Tool advised that there are no homes which may be affected by the proposal for which there is no alternative off-air service and 2 530 homes for which there may be an alternative off-air service.

B.169 Any adverse effects with regard to terrestrial television reception interference can

be resolved through technical solutions that will be agreed between the developer and South Hollland and Fenland District Councils.

B.170 The specific effects can only be assessed and resolved once the entire site has been constructed and is operating as individual turbines can actually improve signal reception at individual dwellings as well as degrade received signals.

B.171 Should the site be consented, then it is likely that it will be fully constructed following the 2011 digital switchover. The terrestrial digital signal is more robust than the analogue signal and less susceptible to the secondary signal interference caused by reflections of the TV signal. The mitigation measures identified may therefore be unnecessary in reality.

Residual Impacts

B.172 The proposed Treading Wind Farm is expected to have no significant effect on existing, known microwave telecommunication links or radio telemetry links in the area.

B.173 Following mitigation there are no anticipated residual impacts on electricity, gas or water distribution and transmission networks as a result of the proposal.

B.174 Following mitigation, if necessary, there are no predicted residual impacts associated with terrestrial television interference.

AVIATION

B.175 Wind Ventures Limited undertook an assessment of potential impacts from the proposed Treading Wind Farm on aviation interests, both civil and military. This process included consultation with the Ministry of Defence and Civil Aviation Authorities as described in PPS22 and the accompanying companion guide (ODPM, 2004).

Civil Aviation

B.176 In accordance with the CAA advice provided during the scoping process, Fenland Aerodrome were consulted about the proposed development.

B.177 Fenland Aerodrome was consulted by way of letters dated 18th November 2008 (**Appendix 16.1.9**) and in summer 2009. No response was received and a follow-up telephone call was not returned.

B.178 Fenland Aerodrome does not operate a radar system, and as such no impacts on such systems are considered.

B.179 To cause a physical obstruction, the development would need to penetrate the Obstacle Limitation Surface (OLS). CAP 168, Licensing of Aerodromes (CAA, 2007), describes the requirements for an OLS through the establishment of a number of protected surfaces. For the purposes of this assessment the following surfaces have been considered:

- Inner Horizontal Surface;
- Conical Surface; and
- Outer Horizontal Surface.

B.180 This places the turbines outside the OLS by 4100m and therefore no significant impacts are expected.

Military Aviation

B.181 Defence Estates has identified a potential negative impact from the Treading turbines on the Primary Surveillance Radar (PSR) at RAF Cottesmore.

National Air Traffic Services

B.182 The Developer commissioned BAE Systems plc to undertake a pre-planning assessment of the potential aviation impacts including interference to NATS/NERL installations. The assessment concluded that the proposed development is 87km from, and within line of sight of, the NATS Claxby radar installation. The BAE System report indicated that the airspace directly above the turbines was uncontrolled and mainly used for military aviation.

B.183 The developer concluded, therefore, that the operational impact on the provision of air traffic services was unlikely to be significant.

B.184 The developer also noted that several wind farms, closer and similarly visible, had been approved and some had been constructed in the area generally between Claxby and the Treading site without objection from NATS/NERL – e.g. Gedney Marsh and Bicker Fen Wind Farms.

Mitigation

B.185 It was proposed, to provide RAF Cottesmore with a radar infill from the radar at RAF Marham, whose radar cannot see the proposed wind farm. Regrettably, the proposed mitigation measure of an infill radar feed from the radar at RAF Marham to the radar system at RAF Cottesmore did not meet the DE requirements (**Appendix 16.2, Volume 2**) as it did not provide enough low level coverage.

B.186 An alternative mitigation scheme (**Appendix 16.3, Volume 2**) has now been proposed by Osprey Consulting Services Limited (Osprey) utilising a holographic radar in the vicinity of the wind farm and patching in its feed to the DE radar at RAF Cottesmore.

B.187 Defence Estates (DE) has responded to the proposal for mitigation of the RAF Cottesmore PSR, dated 10 December 2010, in which they accept the Osprey mitigation proposal and have provided draft proposals for Planning Conditions (**Appendix 16.5, Volume 2**).

Residual Impacts

B.188 Following implementation of the proposed mitigation measures, no significant impacts on either civil or military airfields are anticipated. No lighting of turbines has been requested.

SOCIO-ECONOMICS

B.189 This section considers the socio-economic effects of the proposed Treading Wind Farm in the context of the recognised global imperative for renewable energy.

B.190 As the effects of climate change are now being experienced at all levels – global, national, regional and local, the socio-economic effects of the proposal are assessed at global, national, regional and local levels.

B.191 Through the analysis of planning policy, PPS22 (England and Wales), it was concluded that material consideration should be given to the environmental benefits and those economic benefits which are derived directly from the construction and operation of the scheme.

B.192 The assessment goes on to review a range of factors outside of the scope of the speciality-specific assessments of this Environmental Statement. The principal effects considered were:

- employment;
- public attitudes, housing prices and tourism;
- electricity production;
- energy balance;
- air pollution; and
- greenhouse gases.

Employment

B.193 The socio-economic assessment considered the employment opportunities offered by the wind industry at an international, national and regional level across the full range of the development, manufacturing, construction and operation. It was established that both globally and nationally the industry sustains a significant number of jobs both directly, and indirectly. In 2004, the European Wind Energy Association stated that wind employed 90 000 to 100 000 people internationally. In the same year, the DTI stated that the wind industry employed 5 500 people in the UK alone.

B.194 The UK Renewable Energy Strategy (DECC, 2009) cited a report produced for the European Commission entitled Employ RES. This stated that by 2020 employment by the renewable energy sectors will be around 2.8 million across Europe (European Commission, 2009).

B.195 On a local level, should the site be consented, the construction and similarly the decommissioning of the proposed Treading Wind Farm would have the potential to benefit the local economy through the award of construction contracts and associated sub-contracts.

B.196 Suitably qualified and experienced local industry sectors would have the opportunity to be involved in areas of work including:

- Civil engineering design;
- Geotechnical ground investigations;
- Civil works (access track construction, wind turbine foundations, substation building, cable trenching);
- Onsite electrical network design;
- Onsite 'contestable' electrical network installation and commissioning;
- Aggregate supply;
- Haulage; and
- Plant hire.

B.197 As well as direct contracts, the construction and operation phase will also benefit local business and the economy through the supply chain.

B.198 This represents a positive impact by way of benefits to the local economy.

B.199 The total estimated construction cost for the Treading Wind Farm is estimated to be approximately £12 million, of which the balance of plant estimate is expected to be approximately £3 million.

Public Attitudes

B.200 The UK populace now have over 19 years experience of operating wind farms, with this growing markedly in recent years. Many public attitude surveys have been carried out by the industry, government and independent bodies (i.e. NOP, BBC, The Times, MORI , DTI and TNS, see **Chapter 17**, **Volume 2**).

B.201 The NOP World Survey undertaken for the British Wind Energy Association sets the overall view to the general questions regarding wind power:

- *80% agree that wind farms are necessary so that we can produce renewable energy to help us meet current and future energy needs – only 8% disagree.*
- *62% agree wind farms are necessary so that we can produce renewable energy – what they look like is unimportant* (NOP, 2005).

B.202 This typifies the surveys that have been undertaken on a national basis.

B.203 For opinions of the operational phase, studies have been undertaken by the Scottish Executive and the DTI. MORI were commissioned by the Scottish Executive in 2003 to determine the views of those living proximate to ten wind farms across Scotland. These sites varied in size from nine to 46 wind turbines. The survey was structured to gauge public attitudes at varying distances from each site – up to 5km, 5-10km and 10-20km.

B.204 It was discovered that those surveyed valued the areas they lived in because of the peacefulness, scenery, rural isolation and friendly people. However, they viewed the downfalls of their area to be amenities, poor public transport and lack of jobs. Only 0.3% spontaneously gave the nearby wind farm as a negative aspect to the area in which they lived. It is important to note that people valued the peacefulness, scenery and rural isolation of their locality whilst their locality hosted an operational wind farm (MORI, 2003).

B.205 Of those who lived in the immediate area before the wind farm site was developed, it was found that they thought that they would experience negative impacts on landscape (27%), construction traffic (19%) and construction noise (15%). The survey states in actual terms that *'only 12% say the landscape has been spoiled, 6% say there were problems with additional traffic, and 4% say there was noise or disturbance from traffic during construction'* (MORI, 2003).

B.206 MORI also found that people living closest to wind farms tend to be the most positive about them with 44% of those within 5km stating that the wind farm has actually had a positive impact, compared with 16% of those living 10-20km away. 65% of those living within 5km also supported a 50% expansion of their local wind farm development and those who see the turbines on a day-to-day basis tend to be most favourable towards them (MORI, 2003).

B.207 More recently, the GfK NOP Social Research renewable energy awareness survey (DECC, 2009) found that those living near to a renewable energy development were more likely to be happy to live within 5km of a wind power development compared with those who did not (79% compared to 58%).

Housing Prices

B.208 Very clearly the effect of any development on house prices in the immediate surrounding area is not a planning issue and should not be considered as such. However, this is often an issue which is raised by concerned members of the general public.

B.209 The Sustainable Development Commission discussed this within their report 'Wind Power in the UK' (SDC, 2005), and highlighted a study produced by the Royal Institution of Chartered Surveyors (RICS). The RICS survey contacted surveyors who had experience of wind farm developments in their locality. The survey identified that 60% of respondents felt that a reduction had occurred during the planning process, with prices recovering during the operational period. This suggests that wind farms in general become more acceptable as communities become habituated to them. The study goes on to state that 40% of respondents found no negative impact, and so concluded that it is too early to say categorically that wind farms have a negative impact on property values.

B.210 A further study (Dent/Sims, March 2007) published by the Royal Institute of Chartered Surveyors (RICS) attempted to determine the effects of wind farms on house pricing in Cornwall. The research, proved inconclusive and could not find a relationship between the proximity of wind farms and property prices.

B.211 The Sustainable Development Commission also considered a study undertaken by

the Scottish Executive into public attitudes to wind farm developments. As well as considering the general views of local residents to wind farm developments, the Scottish Executive considered the anticipated and actual impacts of wind farm developments in their area. It was found that only around 2% of respondents felt that house prices had been affected.

Tourism

B.212 There is now a wealth of wind energy experience around the United Kingdom in areas which receive high concentrations of visitors such as Cornwall, Cumbria Wales and Scotland, where visitor numbers have continued to increase since wind farm development commenced. Surveys consistently demonstrate that tourists do not stay away from areas which play host to wind farm development.

B.213 One of the most recent and significant studies into wind farms and tourism was undertaken by the Scottish Executive and entitled the 'Economic Impacts of Wind Farms on Scottish Tourism' (Scottish Executive, March 2008), in light of Scotland's target of 50% renewable energy by 2020.

'*The study looked at potential impacts if all planned onshore wind farms are approved but we know that not every wind farm application, either through the planning system or under the Electricity Act, will receive consent.*' The study concludes:

Three quarters of tourists surveyed for the study into the Economic Impacts of Wind Farms on Scottish Tourism felt wind farms had a positive or neutral effect on the landscape. 97 per cent of tourists in the sample said wind farms would have no impact on their decision to visit Scotland again.'

B.214 In some areas wind farms can become tourist attractions in their own right, such as the Ecotricity turbine at Swaffham, Norfolk, which with its viewing platform has become an iconic development for the town.

B.215 Wind farms which have public footpaths crossing the site, allow open access all year round, with no fencing around the structures which prevents access to the site. Those with no public footpaths tend to open on occasion for visitors to experience the development in close proximity. The British Wind Energy Association organise an annual wind farm open day every August Bank Holiday. The 2006 Wind Weekend attracted an estimated 12 500 visitors.

Electricity Production

B.216 Based upon the average capacity factor for the East of England (DECC, 2010) and the REpower MM92 2.05MW wind turbine, the development would generate 27 200 MWh (net) of electricity (to 3 s.f.), meeting the average annual electricity needs of the equivalent of 5 540 homes in Fenland District (to 3 s.f.) (see **Appendix 1.1** - Energy Calculations).

B.217 The figures used to calculate the annual home equivalent figures are based upon conservative recommendations by the British Wind Energy Association (Ford, 2005), the Department of Energy and Climate Change, Energy Trends Statistics (DECC, 2010) and 2001 Census data from England, Wales, (Office of National Statistics,

2001) Scotland (General Register Office for Scotland, 2001) and Northern Ireland (Northern Ireland Statistics and Research Agency, 2001).

B.218 The figure used in the calculation for the Capacity Factor of the wind turbines is based upon the average Capacity Factor figure for the East of England averaged across the years 1998-2010 of 25.2%, as supplied by the DECC (DECC, 2010).

B.219 The electricity produced corresponds to the equivalent electricity consumption of 5540 homes in Fenland District, which is 15.7% to 1 d.p. of the total number, and would thereby constitute a significant commitment by both councils toward the UK target of 15% of electricity supply from renewable energy by 2015.

Energy Balance

B.220 As a form of renewable energy generation, it is particularly important to consider the lifetime energy balance of onshore wind. All generation technologies have energy consumption associated with their development, manufacture, construction, operation and decommissioning. The energy balance can be defined as the time the plant must operate to generate as much energy as is used in its entire life cycle – from extraction of raw materials for manufacturing and construction to decommissioning and disposal.

B.221 In order to provide an appreciation of the potential energy payback for the Treading Wind Farm a report produced by Danish engineering firm Elsam for wind turbine manufacturer Vestas can be considered. The report 'Life Cycle Assessment of offshore and onshore sited wind farms' (Elsam, 2004) produced a Life Cycle Assessment of a Vestas V80 wind turbine generator. The Vestas V80 is of similar size and scale to the REpower MM92 wind turbine generator and is therefore an appropriate comparison. Based upon the principles of European Standards ISO14040-14043 Elsam calculated that the total life cycle energy consumption of an onshore Vestas V80 wind turbine is 3 635 850kWh (3 636MWh). For their study site, they calculated that the energy balance would be 7.7 months.

B.222 The conservative calculations for the annual average generation for a REpower MM92 2.05MW at the Treading Wind Farm estimates an annual production per turbine of 4 525 MWh. The energy balance for the Treading Wind Farm is therefore estimated to be (in years):

= total lifecycle energy use / annual generation

= 3 636/4 525

= 0.80yrs (to 3 s.f.) or 9.6 months.

B.223 It can therefore be concluded that after 9.6 months of operation, the Treading Wind Farm would be energy neutral – all of the energy used in its lifetime through development, manufacture, construction, operation, future operation and future decommissioning and disposal will have been offset. Thereafter the development would be energy positive. Each subsequent unit of power generated can therefore be considered as being without any associated carbon emissions. This is a significant benefit of wind power generation and of the proposed Treading Wind Farm, and is not replicated by any fossil fuel or combustion based power generation technology.

Air Pollution and Greenhouse Gases

B.224 The principal polluting gases associated with the power generation industry, excluding carbon dioxide, are nitrogen dioxide and sulphur dioxide. These gases, when combined with atmospheric water form nitric and sulphuric acid respectively and can fall as acid rain damaging built structures and ecosystems. In recent years the installation of Flue Gas Desulphurisation (FGD) plant on many coal fired power stations has reduced the output of sulphur dioxide, however, the energy required by the FGD plant and reduction in plant efficiency whilst decreasing sulphur emissions, increases carbon dioxide emissions per unit of electricity generated.

B.225 The Treading Wind Farm will produce no emissions at source and the proposed wind farm will have no effect on local air quality. However, as a clean renewable technology, the wind farm will contribute to the reduction of pollutant emissions on a national and regional scale through offsetting emissions.

Offsetting Emissions

B.226 Different organisations have historically made differing assumptions for calculating the emissions offset by wind energy generation, varying in their view of the power generation technology that is actually offset. For carbon dioxide these assumptions range from 860g/kWh (based upon coal generation) to 355g/kWh (based upon gas generation).

B.227 A recent Advertising Standards Authority (ASA) adjudication sought advice from National Grid as to the most appropriate figure to be used in such offset calculations. wIt was established that '*a more accurate emissions factor for wind power lay between the two figures* [given above] *taking account of the variations throughout the year*' this is because the generation technology most likely to be offset (marginal plant) changes throughout the year according to fuel prices, wholesale energy prices and demand (ASA, 2007). Following this ASA adjudication, the ASA undertook an examination of the CO_2 offsetting issue, and consulted the British Wind Energy Association, Defra and Dr Stephen Peake of The Open University.

B.228 The ASA presented an advisory note to BWEA in September 2008 explaining the outcome of this examination. It was determined that '*it is not possible to calculate an exact figure for the carbon saving associated with wind power into the National Grid or for any future projection.*' This is due the variable and dynamic nature of the electricity system where, on a half hourly basis different types of power plant are brought on and off line, where load varies on an instantaneous basis and fuel and running costs are a complex mix of long term contracts and spot market prices - all of these elements are subject to change and shifts over the 25 year life of the project.

B.229 In addition (for the same reasons), where a 'static' figure for CO_2 offsetting is used, it was determined that it would be inappropriate to use this figure to calculate the total CO_2 offset during the entire operational life of the project because of the variances outlined above. As such, it has been recommended that the BWEA, in conjunction with Dr Stephen Peake explore the feasibility of establishing a 'dynamic baseline' methodology through the use of published quarterly historic fossil mix

averages correlated against quarterly wind output. This would reflect inter-seasonal variations and longer term annual trends and would be updated periodically. A representative methodology is now being established by BWEA.

B.230 In the meantime, the ASA recommend the use of a simple static CO_2 offset figure for wind generation of 430g CO_2/kWh. This is the figure used by Defra for Climate Change Levy Agreements and the UK Emissions Trading Scheme and is based upon the fuel mix for 1998-2000 ('Energy Projections for the UK' (DTI, 2005)). The ASA state that this will '*most likely understate the benefits of wind energy*.'

B.231 In the absence of the dynamic baseline methodology, the simple static figure alongside the full range of historic recognised offset assumptions are considered within this Environmental Statement.

B.232 On this basis, it can be concluded that the potential annual carbon dioxide offset could presently be between 9 640 tonnes per annum and 23 400 tonnes per annum, again equating to the avoidance of the emission of significant volume of carbon dioxide (all figures to 3 s.f.).

The Renewables Obligation

B.233 The Renewables Obligation is one of the key national climate change policies and this legally binds electricity suppliers to source 10% of their electricity from renewables by 2010 and 15% by 2015 (with a further expansion to around 30% by 2020 due by 2010 as highlighted in the UK RES). The percentage of electricity which suppliers are expected to provide from renewable sources is gradually increased on an annual basis to reach these targets.

B.234 As described in **Chapter 2**, **Volume 2**, the Climate Change supplement to PPS1 clearly states that Planning Authorities should '*not require applicants for energy development to demonstrate either the overall need for renewable energy and its distribution, nor question the energy justification for why a proposal for such development must be sited in a particular location*.' (DCLG, 2007). Indeed, justification of the Renewables Obligation, as with the impact upon house prices is not a planning consideration and cannot be a material consideration to this planning application.

B.235 However, as analysed in full in **Chapter 17**, **Volume 2**, when one considers that the cost of energy forms 66% of our overall electricity bill (OFGEM, 2008), consumers are primarily exposed to fluctuations in the cost of gas and coal over any other component, such as the ROC mechanism. When one considers the effect of this rise in prices against the cost of environmental initiatives including the Renewables Obligation, it can be argued that the Renewables Obligation is negligible in cost when compared to the 'risk' fluctuations in the prices of coal, oil and gas (see **Plate B.3**). Clearly the greater reliance we place upon indigenous energy sources such as wind energy, the less the consumer is exposed to these rapidly changing power station fuel costs. It is therefore concluded that increased generation through the Renewables Obligation will have a small but positive benefit to consumers in the long term.

B.236 A recent article (New Scientist, 2010) examined the effect of wind turbines upon

electricity prices and concluded that *'when there is little or no wind, prices on the market are normal; when a lot of wind power is available, it has a moderating effect on prices. The result is that, over time, bills are lower than if wind power were not present, even taking into account the cost of the support regime.'*

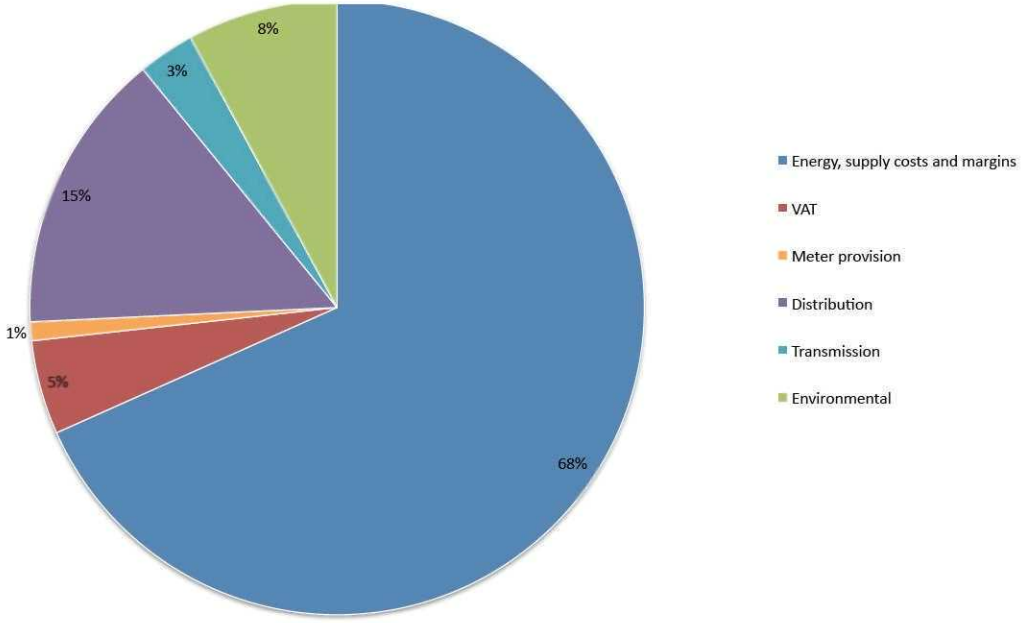


Plate B.3 - Breakdown of Electricity Bills (OFGEM, 2009)

Local Community Impacts

B.237 Wind farm proposals, as with any major development, can be controversial within the local community hosting the scheme. Whilst opinion surveys have consistently indicated that those opposing such schemes tend to be in the minority, with the majority either in favour or not committing either way, differences of opinion can cause conflict within a community during the planning process.

B.238 However, where wind farm developments have been consented, evidence appears to demonstrate that those who were against or had reservations over the project at proposal stage, have a change of mind following construction of the site. Please see **Chapter 17**, **Volume 2** for full details.

Community Benefits

B.239 The latest planning guidance in Scotland states that community benefits provided by the developer should not be a material consideration in the planning process.

B.240 Despite this, if approved, the wind farm development will bring further significant benefit to the local community through a package of community benefits to be provided by the Developer, Wind Ventures.

B.241 Wind Ventures Limited wishes to ensure that those living in the wind farm vicinity receive some benefit from the wind farm. To this end, it will set up a community fund from revenue from sales of electricity generated by the wind farm and will subscribe

an amount of £2,500 per MW of capacity installed per full year of generation. The application is based upon a wind farm of 12.3MW capacity. As stated in **Paragraph 1.2**, turbines with an installed capacity of 2-3MW will fit the approved tip height. If approval is given, then the annual income of the community fund would be between £30 000 (six 2MW turbines) and £45 000 (six 3MW turbines).

B.242 Wind Ventures will review the amount paid to the community fund every five years and will increase the amount in line with the Consumer Price Index (CPI).

B.243 If the planning application for the wind farm is approved, Wind Ventures will discuss with the community how this fund should best be spent. One option which can be arranged is, for example, for 50% of the income to be spent to reduce the electricity bills of the nearest 50 dwellings to the wind farm. Wind Ventures has agreed with the 'Green Energy Supplier' LOCO2 that the fund could contribute for example £200 pa per dwelling for say the first 5 years to reduce the bills of these dwellings provided that the owners chose to be supplied by LOCO2. The balance of the fund income would remain to be spent by the parish councils of Gorefield, Sutton St Edmund, Newton and Tydd St Giles.

B.244 Another alternative could be for the parish councils of Gorefield, Sutton St Edmund, Newton and Tydd St Giles to manage the expenditure of the whole fund for those projects which they felt to be of most benefit – e.g. village hall repairs and equipment provision, computers for local schools, facilities for youth entertainment, energy usage reduction equipment to assist the most needy.

B.245 It is also the developer's intention that the community fund should draw upon local goods and services where possible, thereby adding further local economic benefit.

B.246 In addition to the community benefits package provided by Wind Ventures, a recent Government White Paper entitled 'Local growth: realising every place's potential' (HM Government, 2010) ensures that the business rates that would be paid by the wind farm stay within the local area, creating further benefit to the local community:

'The Government recognises that communities hosting renewable energy installations play a vital role in meeting a national need for secure, clean energy, and believes that it is right that these communities should be rewarded for the contribution such installations make to ensure the UK has a secure supply of energy and reduces CO2 emissions from energy. We will therefore ensure that those local communities that host renewable energy projects are rewarded by allowing them to keep the business rates they generate.'

CONCLUSIONS

B.247 In the process of the Treading Wind Farm Environmental Impact Assessment, a wide range of potential impacts have been considered, utilising the skills and expertise of individual independent specialists to assess the proposals.

B.248 The assessment has identified significant impacts, which the developer has sought to address wherever possible through avoidance, best practice, and considered

design and development methodologies.

B.249 Those significant effects which could not be addressed through avoidance, have been identified and addressed through offsetting mitigation methods. Following the application of mitigation, the residual impacts of the development have then been identified.

B.250 It is the opinion of Engena that those significant residual impacts identified through this Environmental Impact Assessment and as reported in this Environmental Statement are not necessarily adverse, and are localised to the site and immediate environs. Whilst it is for the Officers and Members of Fenland and South Holland District Councils to determine the balance between impacts and benefits, it is the professional opinion of Engena that these levels of impacts do not differ from those at successful operating wind farms and are acceptable. The developer has sought to balance the positive socio-economic benefits of wind farm developments, against potential impacts identified throughout the Environmental Impact Assessment, and has aimed to reduce these impacts through careful site design and mitigation measures.

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APPENDIX 1 - ENERGY CALCULATIONS

The following calculations are based on data provided by the Department for Energy and Climate Change (DECC), and the 2001 Census.

Calculations are based on six turbines with a generation capacity of 2.05MW. The total wind farm installed capacity is therefore 12.3MW.

Calculation Notes:	rated turbine capacity (MW)	= 2.05
	capacity factor*	= 0.252
	number of hours in a year	= 8 760

(i) Predicted Electricity Produced by the Treading Wind Farm

Annual Average Electricity Produced

= rated capacity x capacity factor x hours in a year

= 2.05 x 0.252 x 8 760

= 4 525MWh per turbine (to 3 significant figures)

Therefore, the anticipated average annual electricity produced by six turbines would be **27 200MWh** (3 s.f.).

Annual Average Household Equivalent

The electricity generated by the scheme will be consumed within an area surrounding the wind farm's electrical distribution network connection point and so is likely to supply dwellings within either Fenland District, South Holland or both. For the purposes of illustrating what the generated electricity may power, analysis has been made of the equivalent number of dwellings in Fenland District Council which may be powered by the scheme.

= annual average electricity produced / annual
Fenland district average domestic electricity consumption**

= 27 152 / 4.899

= **5 540 households** (3 s.f.)

*Capacity Factor: A constant which takes into account the intermittent nature of wind, the availability of wind and the array losses (energy lost due to one turbine being in the wake of another) compared with the full load plate rating of the generator. 25.2% is the average capacity factor for the East of England and this has been used for the whole site, as the site lies on a boundary between the East of England (4 turbines) and the East Midlands regions (2 turbines), (1998-2009) (DECC, 2010).

**Stated figure is taken from 'Sub-national authority electricity consumption statistics' published by the Department of Energy and Climate Change (DECC, 2010).

The district of Fenland consists of 35 192 households (from the 2001 Census). The Treading Wind Farm will therefore be able to meet up to the equivalent average annual electricity needs of **15.7%** (to 3 s.f.) of Fenland District's homes.

(ii) Emissions Offset Calculations

Based upon the wind energy calculations discussed earlier, the anticipated average annual electricity produced by six turbines with a rated capacity of 2.05MW and a capacity factor of 25.2%, would be 27 200 MWh (to 3 s.f.).

The generation of renewable electricity in this way will offset electricity generated from other sources. Different organisations have differing assumptions for calculating the emissions offset by wind energy generation, depending upon the power generation technology that is actually offset. For carbon dioxide these assumptions range from 860g/kWh (based upon coal generation) to 355g/kWh (based upon gas generation).

A recent Advertising Standards Authority (ASA) adjudication sought advice from National Grid as to the most appropriate figure to be used in such offset calculations. It was established that

A more accurate emissions factor for wind power lay between the two figures [given above] *taking account of the variations throughout the year. This is because the generation technology most likely to be offset (marginal plant) changes throughout the year according to fuel prices, wholesale energy prices and demand* (ASA, 2007).

Following this ASA adjudication, the ASA undertook an examination of the CO_2 offsetting issue, and consulted the British Wind Energy Association, Defra and Dr Stephen Peake of the Open University.

The ASA presented an advisory note to BWEA in September 2008 explaining the outcome of this examination. It was determined that '*it is not possible to calculate an exact figure for the carbon saving associated with wind power into the National Grid or for any future projection*.' This is due to the variable and dynamic nature of the electricity system where, on a half hourly basis different types of power plant are brought on and off line, where load varies on an instantaneous basis and fuel and running costs are a complex mix of long term contract and spot-market prices – all of these elements subject to change and shifts over the 25-year life of the project.

In addition (for the same reasons), where a 'static' figure for CO_2 offsetting is used, it was determined that it would be inappropriate to use this figure to calculate the total CO_2 offset during the entire operational life of the project because of the variances introduced above. As such, it has been recommended that the BWEA, in conjunction with Dr Stephen Peake explore the feasibility of establishing a 'dynamic baseline' methodology through the use of published quarterly historic fossil mix averages correlated against quarterly wind output. This would reflect inter-seasonal variations and longer term annual trends and would be updated periodically. A representative methodology is now being established by BWEA.

In the meantime, the ASA recommend the use of a simple static CO_2 offset figure for wind generation of 430g CO_2/kWh. This is the figure used by Defra for Climate Change Levy Agreements and the UK Emissions Trading Scheme and is based upon the fuel mix for 1998-2000 ('Energy Projections for the UK' (DTI, 2005). The ASA state that this will '*most likely understate the benefits of wind energy*.'

In the absence of the dynamic baseline methodology, the simple static figure alongside the full range of historic recognised offset assumptions are considered within this Environmental Statement.

Emissions Offset Previously Advised by the BWEA:
Until the ASA judgment, the British Wind Energy Association assumed that electricity from wind turbines replaces the output of coal-fired power stations. This assumes that nuclear plants and gas fired plants operate at 'base load' and the output of such power stations varied as little as possible.

Nuclear plants operate at base-load, as do almost all gas plants. It is the output from coal-fired plants which is adjusted to meet the electricity demand on the system. In other words, most 'load following' is carried out by coal-fired plants. (BWEA, 2005)

BWEA calculations for emissions offsets used typical emissions from a coal-fired plant. For CO_2 this was 860g CO_2/kWh.

On this basis the level of carbon dioxode offset for the proposed wind energy project is calculated (in tonnes) as follows:

CO_2 = (Annual Average Electricity Produced (kWh) x 860)/1 000 000
= **27 152 496** x 860/1 000 000
= **23 400** tonnes (to 3 s.f.)

Emissions Offset Published by the SDC:

The Sustainable Development Commission considered the potential contribution of wind energy out to 2020 (SDC, 2005). They considered that it is unrealistic to assume that wind power would displace nuclear energy, and most likely that electricity associated with coal generation would be displaced in the short to medium term. For the purposes of their report the SDC assumed that wind would displace electricity generated predominantly by gas-fired plant by 2020, stating that this could be assumed as conservative as they expect that some coal plant will still be operating in 2020.

On this basis the SDC considered an emissions displacement figure for carbon dioxide of:
355g CO_2/kWh
Using this figure, the annual average carbon dioxide displacement for the Treading Wind Farm equates (in tonnes) to:

CO_2 = (Annual Average Electricity Produced (kWh)x 355)/1 000 000
= 27 152 496 x 355/1 000 000
= **9 640 tonnes per annum** (to 3 s.f.)

Even considering this second lower figure, a significant volume of carbon dioxide would be displaced by the Treading Wind Farm, providing a meaningful contribution to the both the Government's renewable energy targets, and the United Kingdom's commitment under the Kyoto Protocol.

Emissions Offset according to the ASA:

As stated above, it was established by the ASA that 'a more accurate emissions factor for wind power lay between the two figures taking account of the variations throughout the year' as the generation technology most likely to be offset (marginal plant) changes throughout the year according to fuel prices, wholesale energy prices and demand (ASA, 2007). Until a dynamic baseline model is produced, the ASA recommend the use of the 430g CO_2/kWh figure utilised by Defra for CCL Agreements and emissions trading.

Using this figure, the annual average carbon dioxide displacement for the Treading Wind Farm equates (in tonnes) to:

CO_2 = (Annual Average Electricity Produced (kWh)x 430)/1 000 000
= 27 152 496 x 430/1 000 000
= **11 700 tonnes per annum** (to 3 s.f.)

As stated above the ASA believe that this current figure will most likely underestimate the emissions offset.

On this basis, it can be concluded that the potential annual carbon dioxide offset could presently be between 9 640 tonnes per annum and 23 400 tonnes per annum, again equating to the avoidance of the emission of significant volume of carbon dioxide (all figures to 3 s.f.).

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