

CHAPTER 10: MISCELLANEOUS

INTRODUCTION

- 10.1 This chapter provides an assessment of the following issues:
- hydrology;
 - transport and access;
 - aviation; and
 - shadow flicker.
- 10.2 Each assessment considers the following changes to the permitted scheme:
- *Amending the onsite access track along two sections within the Development Site and an allowance for micro-siting as set out in **Figure 3.1**;*
 - *Relocating and increasing the footprint of the onsite substation, including relocating the temporary construction compound to an area of existing hardstanding, providing temporary auxiliary crane pad areas and an underground cabling corridor from the turbines to the onsite substation as set out in **Figure 3.1**; and,*
 - *Amending the turbine rotor diameter from 90m, as indicated on the consented Site Edged Red plan (4038_A0085_03), to a maximum rotor diameter of up to 103m and a 10 metre radius micro-siting allowance around each turbine location where onsite constraints allow as set out in **Figure 3.1**.*
- 10.3 **Chapter 3: Details of the Variation** provides further details of these amendments.
- 10.4 Where no longer relevant from the original Environmental Statement (ES), baseline conditions have been established through consultation with relevant bodies, site visits and desk study for this Variation of Consent ES. Potential effects of the proposed amendments have been identified and assessed. If appropriate, suitable mitigation measures have been identified.
- 10.5 The broad criteria for sensitivity, magnitude of impact and significance is set out in **Chapter 4**. Whilst these miscellaneous issues are considered relevant for inclusion within the Environmental Statement they are either not significant, or any mitigation which is required eliminates any potential effect. Therefore, these issues have been covered within this single chapter and no criteria have been developed to assess sensitivity or magnitude of change.

HYDROLOGY

- 10.6 This Addendum to the hydrology, hydrogeological and geological assessment provided in the original ES has been updated in the form of a revised Flood Risk Assessment (see **Appendix 10.1: Revised Flood Risk Assessment**).
- 10.7 Other hydrological and geological effects have been considered where relevant in the revised Flood Risk Assessment in relation to the proposed amendments set out in **Chapter 3** of this Variation of Consent application. These are:
- abstractions;
 - impediment to flows;
 - erosions and sedimentation;
 - groundwater and drainage;
 - chemical pollution and disposal of foul water; and
 - geology.
- 10.8 Whilst new guidance exists through the NPPF and National Policy Statements, and previously relevant guidance such as PPS23 and PPS25 have been replaced, these do not have any additional implications for hydrology and geology that are not also assessed within the Addendum to Flood Risk Assessment (FRA) presented in **Appendix 10.1**.
- 10.9 The baseline and assessment of effects presented in the original ES with regards to the above hydrological and geological considerations have not changed discernibly with this Variation of Consent application. Therefore, the original assessment of effects set out in paragraphs 9.74 – 9.98 of the original ES still apply. **Table 10.1** presents the original assessment of effects and is reproduced overleaf for completeness.
- 10.10 Where relevant, the implications of the amended site infrastructure, such as the substation, substation cabling route and amendments to the access track, have been considered within the revised FRA.

Mitigation

- 10.11 Likewise, mitigation measures are as described within the original ES and as conditioned within the existing consent which is presented in **Appendix 1.1**.

Residual significance

- 10.12 Taking into account the proposed mitigation measures, no significant additional environmental impacts have been identified during the course of this review.
- 10.13 The effects on geology, hydrology and hydrogeology from the proposed development have been assessed as **not significant** in identified aspects (see **Table 10.1** overleaf).
- 10.14 A revised Flood Risk Assessment has been completed (see **Appendix 10.1**) that concludes that the revised plans do not introduce any significant change that would impact overland flow conveyance through the site.

Table 10.1: Significance of Effects (reproduced from the Original ES)

Stage of development	Feature (Receptor)	Sensitivity of receptor	Description of Potential Effect	Before Mitigation		Summary of Mitigation	After Mitigation					
				Magnitude of change	Significance before mitigation		Magnitude of change	Positive/Negative	Direct/Indirect /Secondary/ Cumulative	Short/ medium/ long term	Permanent/ Temporary	Residual Significance
Geology/Groundwater												
Construction/ Operation	Geology	Low	Disruption of local geological features from deep (2.85m) turbine excavations and maximum 20m piles.	Minimal change	Negligible - Minor	The excavations and piles are predicted to be within the topsoil and superficial geology. No mitigation required.	Minimal change	Negative	Direct	Long term	Permanent	Negligible - Minor
Construction/ Operation	Groundwater	Low	Chemical pollution: Leaching of hydrocarbons, chemicals and cement to groundwater.	Very low-low	Minor	Oil/ chemicals stored in 110% bund, drip trays, refuelling within designated area. Provision of spill kits on site and trained staff. Temporary sanitation facilities maintained by licensed operators.	Minimal change	Negative	Direct	Short term	Permanent	Negligible-Minor
Abstractions												
Construction/ Operation	Groundwater	Low	Potential for leaching of concrete. Spillages and leakages during storage or routine maintenance.	Very low-low	Minor	Very small amounts of chemicals will be present on site during maintenance visits only. Operational phase will comprise small-scale routine activities.	Minimal change	Negative	Direct	Short term	Permanent	Negligible-Minor
Flooding												
Construction/ Operation	Surrounding land	High	Development (land take) and increased hardstanding may exacerbate flooding in downstream areas.	Very low-low	Moderate	Land use will remain largely rural. Use of sustainable urban drainage systems (SUDS) where appropriate.	Minimal change	Negative	Indirect	Medium term	Temporary	Minor-Moderate

Stage of development	Feature (Receptor)	Sensitivity of receptor	Description of Potential Effect	Before Mitigation		Summary of Mitigation	After Mitigation					
				Magnitude of change	Significance before mitigation		Magnitude of change	Positive/Negative	Direct/Indirect /Secondary/ Cumulative	Short/medium/long term	Permanent/Temporary	Residual Significance
Water Quality												
Operation	Local drainage channels, South Forty Foot Drain, River Witham	Low	Spillages and leakages during storage or routine maintenance.	Very low-low	Minor	Very small amounts of chemicals will be present on site during maintenance visits only. Operational phase will comprise small-scale routine activities.	Minimal change	Negative	Direct	Short term	Temporary	Negligible-Minor
Construction	Local drainage channels, South Forty Foot Drain, River Witham	Low	Sediment entrained runoff from excavations and infrastructure construction reaching off-site surface water courses. Risk to downstream resources.	Very low-low	Minor	During construction, use of silt traps, pumping water to natural soakaways and/ or use of mobile siltbuster units, use of silt fences, mats and/ or geotextiles around construction activities	Minimal change	Negative	Direct	Short term	Temporary	Negligible-Minor
Fisheries and Recreation												
Operation/ Construction	Local drainage channels, South Forty Foot Drain, River Witham	Low	As water quality above.	Minimal	Negligible - Minor	As water quality above.	Minimal change	Negative	Direct	Short term	Temporary	Negligible - Minor
Decommissioning	Effects arising from decommissioning are anticipated to be similar to the construction effects as described above.											

TRANSPORT AND ACCESS

Introduction

10.15 This Addendum to the Transport and Access assessment provided in the original ES has been updated to take account of the potential effects that the proposed amendments could have on the overall scheme. The significance of the potential effects after mitigation is then assessed. The assessment is based upon the number of vehicle movements required for 22 turbines and with maximum dimensions of 50.2m blade length as a worst case scenario.

Policy

10.16 Since the original ES was submitted the relevant national guidance presented in 'Planning Policy Guidance 13: Transport' has been replaced. Guidance is provided by its replacement, the 'National Planning Policy Framework' (2012).

10.17 In the original ES, the assessment of environmental effects was also carried out in accordance with specific transportation and road traffic guidance. Accordingly, the proposed amendments are also considered against the relevant guidance, including:

- Guidelines for the Environmental Assessment of Road Traffic (1993), Institute of Environmental Assessment;
- Volume 11 of the Design Manual for Roads and Bridges (2009), Highways Agency;
- Guidance on Transport Assessments (2007), jointly published by the Department for Communities and Local Government & Department for Transport; and
- Circular 2/07: Planning and the Strategic Road Network, Department of Transport.

10.18 The Guidelines for the Environmental Assessment of Road Traffic suggests that two broad rules can be used as a screening process to delimit the scale and extent of the assessment. These are:

- Rule 1: Include highway links where traffic flows would increase by more than 30% (or the number of HGV's would increase by more than 30%); and,
- Rule 2: Include any other especially sensitive areas where traffic flows would increase by 10% or more.

10.19 The 30% threshold is based upon research and experience of the environmental effects of traffic, with less than a 30% increase generally resulting in imperceptible changes in the environmental effects of traffic. At a simple level, the Guidance considers that projected changes in traffic flow of less than 10% create no discernible environmental effect. However, the second threshold as set out in Rule 2 ensures that potential impacts on sensitive areas as defined in the IEA Guidelines (1993) are assessed.

10.20 Sensitivity of a road can be defined by the user groups, such as school children and the elderly. A 'sensitive' area may be adjacent to a school, nursing home, located where residential properties front the road, or where pedestrian activity is high. There are no sensitive areas through which the

proposed access route would go. The proposed access route remains the same in this Variation of Consent application as for the original ES.

Consultation

10.21 No further consultation has been considered with respect to Lincolnshire County Council's Highways department or the Highways Agency, on the basis that:

- there have been no significant changes to the baseline information since the original ES assessment was carried out;
- no changes are proposed to the access route to site;
- no change is proposed to the site entrance;
- there will be no discernible increase in the predicted number of traffic movements to and from site overall; and
- there are only minimal changes to the results of the Swept Path Analysis due to the increase in blade length from 44m to a maximum 50.2m.

Methodology

10.22 The general approach to the assessment of effects outlined in **Chapter 4: Consultation & Scope** and the Environmental Impact Assessment (England) Regulations 2011 have been followed in order to identify environmental effects which are significant in terms of the EIA Regulations. The assessment therefore focuses on:

- potential effects on local roads and the users of those roads; and
- potential effects on land uses and environmental resources fronting those roads including the relevant occupiers and users.

10.23 The significance of potential effects has been assessed in light of recognised thresholds of significance from the published guidance (as discussed below). In this context there is a need to differentiate between impacts on the operation of the highway network that would fall within the scope of a Traffic Assessment, and environmental impacts that fall within the scope of this statement.

10.24 The three phases of the proposed development are: construction, operation and decommissioning. All will be assessed individually for their level of significance as this will allow any required mitigation measures to be tailored to the needs of that phase of development.

10.25 Given the temporary, short term, nature of the transport/access effects, no criteria have been established for defining the magnitude of change or sensitivity. As mentioned in **paragraph 10.22**, where predicted traffic flows fall below recommended threshold criteria, effects are deemed as insignificant.

10.26 The M62, M18, A1(M), A1 sections of road being considered for the delivery of the turbine components are classed as trunk roads and are the responsibility of the Highways Agency.

- 10.27 The A17 section of road considered for the delivery of the turbine components is classed as County Distributor Road and is the responsibility of the Local Highways Authority, Lincolnshire County Council. Historical data has been examined for these roads to determine their current usage and if there are likely to be any adverse traffic impacts.
- 10.28 Due to a lack of available information and the uncertainty around the commencement of the start of the construction process, it has not been possible to assess whether there are any cumulative transportation aspects which may occur if major infrastructure projects are under construction in the same time frame and are utilising the same road network for deliveries. However, when commencing the construction of the site any such projects would be considered.
- 10.29 Swept path analysis has been completed on any locations on the delivery route identified as “pinch points” as shown in **Figure 10.1: Proposed Access Route**. The swept path assessments provided in **Figures 10.2 to 10.5** have been produced allowing for the maximum turbine blade dimensions of 50.2m.

Baseline Conditions

Access onto site

- 10.30 The complete access route to the Heckington Fen Wind Park remains unchanged from the original ES. **Figure 10.1** shows the intended route.
- 10.31 Updated traffic count data from the Department for Transport (2013)¹ shows that the average daily flow of traffic on the A17 between the junction with the A153 (Sleaford) and the junction with the A1121 (Swineshead Bridge) is approximately 16,745 vehicle movements per 24 hour period. Of these movements 2,139 (12.8%) are categorised as Heavy Goods Vehicles.
- 10.32 Access to the site from the A17 will remain unchanged, with all vehicle components able to use the site entrance proposed in the original ES. **Figure 10.5** indicates that even with the larger blade length, the site entrance can accommodate delivery of the largest components. Some additional blade oversail may occur with the largest components but the blade carrier vehicle would comfortably remain on the proposed track at all times, and any slight blade oversail will be on land within the development site where there are no obstacles present.
- 10.33 A site survey undertaken by Ecotricity for the original ES confirmed that all components could be delivered to site on the proposed route from Goole Port onto the M62, M18, A1(M), A1 and A17. This intended route remains unchanged.

Component delivery

- 10.34 Despite the proposed changes to the candidate turbines that form part of this Variation of Consent application, the delivery of the turbine components and associated cranes is anticipated to be the

same as that described in the original ES. For clarity, the table below indicates the turbine components to be transported to site and the vehicles used for the maximum 22-turbine layout.

Table 11.1: Turbine Components

Component	No. Per Turbine	Total No. of components	Transporters (Max. Dimensions)	No. of Trucks
Blades	3	66	Truck (1 blade per truck, weight approx. 35ton)	66
Nacelle and Generator	2	44	Semi – low loader (weight approx. 84ton)	44
Steel Tower Sections	3	66	Each tower section on 1 low-loader. (weight approx. 35ton + tower weight)	66
TOTAL		176		176

- 10.35 Each of the abnormal load vehicles will be reduced to standard size for departure. **Figures 10.7 and 10.8** show the dimensions of the largest abnormal loads – the blades and tower section. Please note that the blade delivery lorry is for information only, and shows the largest possible blade length for the proposed turbine. As the largest (GE-103) 51.5m blade length is taken from the centre of the nacelle, the actual size of the blade is slightly smaller at 50.2m. This is indicated on **Figure 10.7**.
- 10.36 Swept path diagrams have been created to illustrate the swept area required for the trailer axles. **Figures 10.2 - 10.5** provide swept path drawings based on all vehicles driving directly in one direction with all steerable trailer equipment operating on ‘auto steering’. However, it should be noted that any trailer with ‘steerable’ axles will also have a ‘manual’ override system, which allows the trailer to be steered independently and controlled by a trailer steerman. This ‘manual’ steering system can override the normal direction of the trailer and has the capacity to increase the degree of steering angle over that normally obtained under the ‘auto-steering’ operation.
- 10.37 Due to the increase in the blade length proposed, and subsequently the blade carriers’ overall length, there will be the following additional effects along the route:
 - **Figure 10.2** – Swept Path Assessment Point 1: some street furniture may be temporarily removed from two roundabouts (potentially up to three lamp posts, a directional sign and a chevron road sign);
 - **Figure 10.3** – Swept Path Assessment Point 2: the route taken around the roundabout now follows the normal clockwise direction rather than anticlockwise in the original ES, however, some street furniture may be temporarily removed (potentially one lamp post and a chevron road sign);
 - **Figure 10.4** – Swept Path Assessment Point 3: no change predicted from the original ES (no street furniture to be temporarily removed); and

¹ Data from Lincolnshire County Council AADF count (2013)
<http://www.dft.gov.uk/traffic-counts/area.php?region=East+Midlands&la=Lincolnshire>

- **Figure 10.5** – Swept Path Assessment Point 4: no change predicted from the original ES other than slight oversail on development site land as described in **paragraph 10.35** above.

10.38 These diagrams highlight that the turbine components can be delivered safely to the site with the potential for a limited amount of street furniture being temporarily removed.

Cranes and support vehicles

10.39 The number of cranes and support vehicles remains the same as presented in the original ES.

Public highway improvements

10.40 There are no changes to the public highway in this Variation of Consent application from the original ES. The design of the site entrance remains unchanged (see Figure 11.10 of the original ES). As conditioned by the original consent, details of the new access will be submitted for approval by the Local Planning Authority.

Public Footpaths & Bridleways

10.41 There are no changes proposed in this ES that would affect the one public footpath running to the north of the site.

Traffic management

10.42 The traffic management procedures required for the development remain unchanged to those described in the original ES. As conditioned by the original consent, a Construction Traffic Management Plan will be submitted for approval by the Local Planning Authority.

Assessment of effects

Construction

10.43 As concluded in the original ES, the M62, M18, A1(M) and A1 are all UK motorways or trunk roads and are therefore subject to large numbers of traffic vehicle movements per day. The additional traffic associated with the construction of this proposal would not result in a 30% increase of HGV vehicles. One swept path analysis has been completed on these roads at the junction between the A1 and the A17 which is shown in **Figure 10.2**. This demonstrates that the blade deliveries can be completed without any permanent alteration to the existing roundabouts at the A1/A17 junction. Some street furniture may need to be temporarily removed. Including the management of police escort for abnormal loads, the magnitude of impact can be considered as **minor**, as concluded in the original ES.

10.44 It is anticipated that the number of HGV movements during the construction phase is likely to remain similar to those presented in Table 11.4 of the original ES. Whilst the substation and temporary construction compound have increased in size, the overall permanent land take has been reduced from 9.90 hectares of arable land to 8.37 hectares. The original ES assessment estimated that a total of approximately 4,764 HGV large vehicle or abnormal load movements will occur over a 52 week construction phase. Whilst there have been a number of changes to the site infrastructure as described in **Chapter 3**, overall the maximum number of turbines has not changed,

and therefore the crane pads, foundations and length of access track have also not altered to any significant degree. For the purposes of this assessment, it is considered reasonable to assume that the indicative vehicle movements to the site during the construction phase, as indicated in Table 11.4 of the original ES, remain appropriate. When these additional vehicle movements are compared against the existing traffic flows along the A17, the additional movements during the construction phase do not exceed a 30% increase in HGV/heavy vehicle flow². The magnitude of impact was considered as **minor** in the original ES, and is considered the same within this assessment.

10.45 Swept path analysis was conducted on the A17 route where potential pinch points were identified. Two swept path assessments have been included showing the roundabout on the A17 leading onto Beckingham Road and Stapleford Lane (**Figure 10.3**) and the A15/A17 roundabout north of Sleaford (**Figure 10.4**). These have shown that both of these roundabouts can be navigated, by the largest abnormal load, with limited impact to the existing infrastructure. Some street furniture may need to be temporarily removed. The magnitude of impact can be considered as **minor**, as concluded in the original ES.

10.46 The new access point from the A17 to the site has been assessed for abnormal loads in **Figure 10.5**. The access has been designed to ensure that loads and HGV deliveries can obtain access to the site quickly and efficiently with space for a number of HGVs to pass within the access point and nearby passing point described in **Figure 10.6**. The design of the access point is illustrated in Figure 11.10 of the original ES and remains the same for this application. The construction of the new access point will require an appropriate management plan on the A17 for approximately 2 weeks, as described in Figure 11.9 of the original ES. As conditioned by the original consent, a Construction Traffic Management Plan will be submitted for approval by the Local Planning Authority which will include a management plan for the duration of the construction of the new access from the A17 onto the site. Given the short term nature of this aspect of the project, the magnitude of impact is considered **minor**, as concluded in the original ES.

10.47 The single footpath within the site boundary is not crossed or in the near vicinity of any construction traffic. The magnitude for impact is **no change**, as concluded in the original ES.

Operation

10.48 There is no change in the expected minimal site visits during the operational phase in this application from the original ES.

10.49 Once the turbines are commissioned there will be no further deliveries to the site. There are neither fuels nor wastes to be removed. Additional traffic to the site during the operation will be negligible, comprising of a bi-annual maintenance vehicle and potentially additional visits due to unforeseen circumstances. If it becomes necessary to access the site with large vehicles, the Highways Authority will be informed so that any traffic management system that is required can be approved prior to works taking place.

² Using the maximum daily vehicle movements of 18.32 as presented in Table 11.4 of the original ES the maximum daily increase in HGV vehicles will be an estimated 0.9% based upon on the A17 traffic figures provided in paragraph 10.26.

10.50 These operational traffic levels fall substantially below the 30% increase level and are considered to be **no change**, as concluded in the original ES.

Decommissioning

10.51 It is difficult to predict the transport effects of decommissioning. It is likely that the turbines will be transported from the site in the same form as they arrived. However, prior to decommissioning a further traffic assessment could be undertaken. This would assess the current guidelines for determining significance when calculating increases in traffic flow.

10.52 Due to the difficulty in accurately assessing the decommissioning procedure, and therefore means of transportation and possible routes, it is hard, at this time, to accurately determine the significance of this phase of the development. However, it is estimated that traffic flows will not be greater than during the construction phase. Following the reasoning of the Environmental Assessment of Road Traffic Guidelines, indicating that a 30% increase is significant, it can be concluded that the effects of traffic impacts on the decommissioning process will be **minor**.

10.53 As with the construction phase there is predicted to be limited impact on the A17 infrastructure during decommissioning. Some street furniture may need to be temporarily removed. The magnitude of impact is considered **minor** rather than 'no change' as concluded in the original ES.

10.54 Overall, decommissioning impacts are expected to be short-term and temporary.

Mitigation

10.55 Mitigation will consist of the submission and approval of:

- a Construction Management Plan;
- details of the new access from the A17; and
- a decommissioning and site restoration scheme.

10.56 Approval will be sought from the Local Planning Authority (or relevant authority in the case of the decommissioning and site restoration scheme), as conditioned in the original consent (**Appendix 1.1**).

Residual significance

10.57 In the original ES all impacts resulting from transport and access aspects of the development, including construction, operation and decommissioning, were assessed as **insignificant** or **minor**.

10.58 Within this Variation of Consent application, there are also no significant impacts considered on transport and access.

AVIATION

Introduction

10.59 The proposed amendments to the physical characteristics of the development will not have any additional impact on aviation interests in the vicinity of the Heckington Fen Wind Park.

10.60 As established in the original ES and the consultation with National Air Traffic Service (NATS) and the Ministry of Defence (MoD), a number of concerns were raised with regards to aviation interests in the area. The ES concluded that, subject to mitigation, the impact on MoD and NATS operations would be insignificant.

Conditions

10.61 **Appendix 1.1** details the original consent and conditions attached to the consent. Of relevance to considering aviation interests are Conditions 5 and 6.

10.62 Condition 5 states:

“No development shall commence unless and until a Radar Mitigation Scheme has been submitted to and approved in writing by the Secretary of State, having consulted with the Ministry of Defence and NATS (En Route) plc, to address the impact of wind farm upon air safety.³”

10.63 Ecotricity is seeking a rewording of Condition 5 to allow the development to commence prior to a Radar Mitigation Scheme being submitted and approved, but not prior to the construction of the wind turbines themselves. This would allow Ecotricity to commence site-enabling works, such as the construction of access tracks and foundations, prior to the formal agreement and approval of the Radar Mitigation Scheme.

10.64 Ecotricity is seeking that Condition 5 of the original consent is reworded should the DECC be minded to approve this Variation of Consent application. Ecotricity is proposing the following wording of Condition 5:

“No turbine tower shall be erected unless and until a Radar Mitigation Scheme has been submitted to and approved in writing by the Secretary of State, having consulted with the Ministry of Defence and NATS (En Route) plc to address the impact of the wind farm upon air safety.”

³ In this condition, “Radar Mitigation Scheme” means arrangements designed to mitigate the impact of the Development upon:

- (a) The operation of the Watchman Primary Surveillance Radars at RAF Coningsby, RAF Cranwell and RAF Waddington and the air traffic control operations of the Ministry of Defence which are reliant upon those radars; and,
- (b) The operation of the Primary Radar Installation at Claxby and the air traffic management operations operated by NATS (En Route) plc whose effectiveness might otherwise be affected by the Development.

The Radar Mitigation Scheme shall set out the appropriate measures to be implemented to mitigate the impact of the Development on the radar installations and air traffic control and management operations referred to above and shall be in place for the operational life of the Development provided the radar installations remain in operation.

- 10.65 A precedent exists for the above wording of the Radar Mitigation Scheme condition in relation to wind turbines and the impact on Watchman Primary Surveillance Radar and the air traffic control operations of the Ministry of Defence. The Bullamore Wind Park decision notice (08/04984/FUL), issued by Hambleton District Council on 10 December 2010, stated: 'No construction of a wind turbine shall commence unless and until the local planning authority has approved in writing a Radar Mitigation Scheme.'
- 10.66 A copy of the Bullamore decision notice is provided in **Appendix 10.2: Bullamore Wind Farm Decision Notice**. The relevant condition is Condition 7.

Baseline and Assessment of Effects

- 10.67 Consultation has been conducted with both NATS and the MoD on a Radar Mitigation Scheme for Heckington Fen. These discussions are currently ongoing. It is proposed that the DECC consult with the MoD to approve the rewording of Condition 5 as detailed above.
- 10.68 Given that the turbine locations and overall tip height have not changed, there will be no additional effects on aviation interests in the vicinity of Heckington Fen Wind Park.

Mitigation

- 10.69 No further mitigation is proposed in addition to the Radar Mitigation Scheme and aviation lighting requirement as set out in the current consent.
- 10.70 Should the DECC be minded to approve the Variation of Consent application then Ecotricity proposes that Condition 5 is reworded as set out in **paragraph 10.67** and in approval with the MoD.

Residual Significance

- 10.71 There are predicted to be no aviation impacts from the development once mitigation is implemented and as a result of the proposed variations to the consent.

SHADOW FLICKER

Introduction

- 10.72 Shadow flicker is regular or semi-regular variation in light intensity caused when a light source is intermittently interrupted by an obstruction.
- 10.73 Since the original ES was submitted the relevant guidance presented in Companion Guide PPS22: *Renewable Energy* has been replaced. However, the guidance provided by the National Policy Statement for Renewable Energy Infrastructure (EN-3) and the Planning Practice Guidance for Renewable and Low Carbon Energy (2013) identify the same parameters for assessing the likelihood of shadow flicker occurrence and the degree of impact.

Methodology

Guidance

- 10.74 The National Policy Statement for Renewable Energy Infrastructure (EN-3) includes a comprehensive discussion on the likelihood of occurrence of shadow flicker and the degree of impact. The Statement specifically states that the parameters of the impacts of shadow flicker are limited to those receptors within **10 rotor diameters** of a turbine. At greater distances the shadow that is cast is too diffuse to have any impact and long shadows are not cast on their southern side. It states:

*"Research and computer modelling on flicker effects has demonstrated that there is unlikely to be a significant impact at distances greater than ten rotor diameters from a turbine. Therefore if the turbine has 80m diameter blades, the potentially significant shadow flicker effect could be observed up to 800m from a turbine."*⁴

- 10.75 Under the 'Applicant's assessment' section (2.7.66), EN-3 goes on to state that:

*"Where wind turbines have been proposed within 10 rotor diameters of an existing occupied building, a shadow flicker assessment should be carried out by the applicant."*⁵

- 10.76 EN-3 makes no mention of the geometrics of the study area. However, the Planning Practice Guidance for Renewable and Low Carbon Energy (2013) states:

*"that only properties within 130 degrees either side of north, relative to the turbines, can be affected at these latitudes in the UK – turbines do not cast long shadows on their southern side."*⁶

- 10.77 Within the Department of Energy and Climate Change document, an 'Update of UK Shadow Flicker Evidence Base' (March 2011), it states that:

⁴ National Policy Statement for Renewable Energy Infrastructure (EN-3) (2011), para. 2.7.64

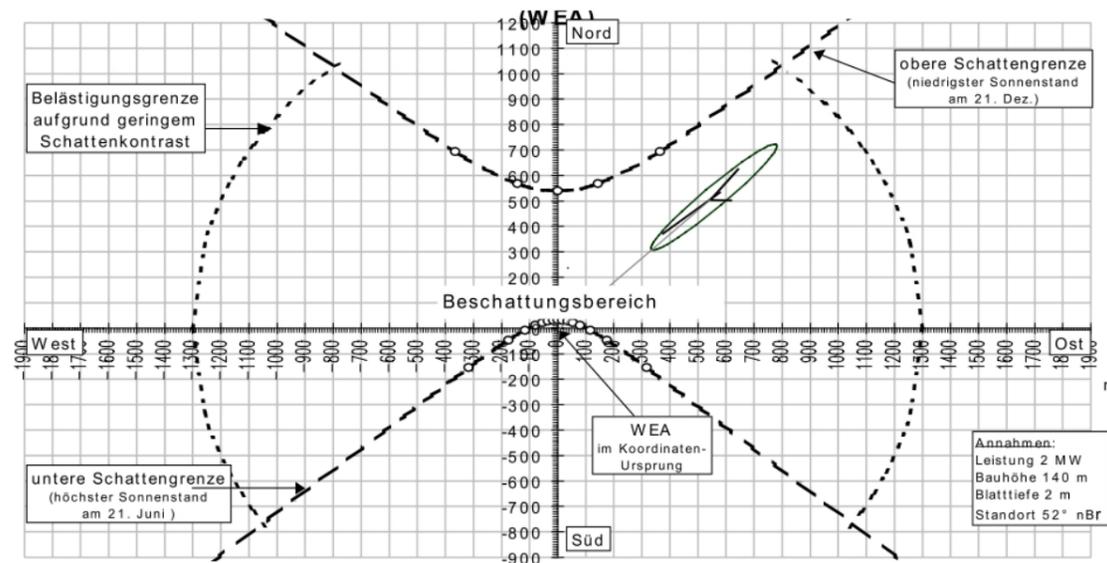
⁵ National Policy Statement for Renewable Energy Infrastructure (EN-3) (2011), para. 2.7.66

⁶ Department for Communities and Local Government, 'Planning practice guidance for renewable and low carbon energy', July 2013

'Both German guidance (2002) and Verkuiljen & Westra (1984) provide figures demonstrating the azimuth extent of the shadow flicker zone. The concept of limiting the assessment to within 130 degrees either side of north is not contested (nor are any alternative methodologies proposed) in any guidance documents or academic literature.'

10.78 It is therefore widely accepted that long shadows are not cast by wind turbines on their southern side due to the location of the UK in the Northern Hemisphere. **Plate 10.1** shows the potential shading area of a large wind turbine. The dashed lines to the north represent the shadow limit on 21st December and the dashed lines to the south represent the shadow limit on 21st June. The dotted lines to the east and west show the limit of impact due to shadow contrast. It can be seen that the shading area is symmetrical due to the path of the sun.

Plate 10.1: Possible shading area of a large wind turbine.



10.79 Although there is no guidance within the Scottish or English planning system on what criteria should be used to determine the significance of impact of shadow flicker, Wind Energy Development Guidelines published by the Irish Department of Environment, Heritage and Local Government (2006) states:

*"It is recommended that shadow flicker at neighbouring offices and dwellings within 500m should not exceed 30 hours per year or 30 minutes per day."*⁷

⁷ The shadow flicker recommendations are based on research by Predac, a European Union sponsored organisation promoting best practice in energy use and supply which draws on experience from Belgium, Denmark, France, the Netherlands and Germany.

Assessment Methodology

10.80 The assessment of shadow flicker has been conducted using *WindFarm* Version 4.1.2.3. This accurately predicts where shadows might be cast by the proposed turbines over the course of a year and calculates maximum possible durations of occurrence.

10.81 The shadow flicker assessment has assumed the following scenario:

- Windows always directly face the turbines having dimensions 1m x 1m with 2m above ground level and a depth of 0.1m.
- Wind direction is always parallel to the turbine-sun-receptor alignment. In short, this means that a turbine will always face the receptor and therefore cast the widest shadow.
- There is no screening of light or shadow from clouds, hedges, trees, houses and other visual obstacles that in actuality may intervene between sensitive receptors and proposed turbine positions.
- Minimum sun height 2 degrees.
- Calculations from height above ground level of viewer 1.7m.

10.82 The assessment has assumed a worst case scenario in which the maximum theoretical shadow flicker may occur and is therefore an over estimation in probability of effects. It should also be noted that for effects to occur in rooms within which shadows are cast, they need to be occupied, with blinds or curtains open and views to the wind turbine unobstructed.

10.83 It is considered that residential properties are of **high sensitivity** to potential shadow flicker effects.

Baseline

10.84 Two residential properties were identified as being within 10 rotor diameters of a turbine (the candidate GE-103 turbine with a rotor diameter of 103m was used as a worst case scenario for this assessment) and therefore as having the potential to be affected by shadow flicker.

10.85 Both properties would potentially be affected by shadow flicker for no more than 30 hours per year as indicated in **Figure 10.9**.

Planning Policy

10.86 There is no local or regional policy which relates specifically to shadow flicker, however **Policy C5** of the North Kesteven Local Plan does look to protect the amenities of other land users.

Assessment of effects

10.87 There are two residential properties within the area that could potentially be affected by shadow flicker. This is shown graphically in **Figure 10.9**.

10.88 The occurrence of shadow flicker will be reduced in practice by a number of factors, including cloud cover, times when turbines are not turning and the orientation of the hub and rotors.

- 10.89 Data from the closest Met Office station at Waddington (15km north-west of the site) indicates that over the course of any given year, 34% of the total number of daylight hours are categorised as bright sunshine hours. In winter, when shadow flicker is more likely to occur at properties close to the 10 rotor diameter distance, this drops to 23%.
- 10.90 Both properties are very close to the 10 x rotor diameter distance, and over 1km from the nearest turbine. At this distance any potential shadow flicker effect is likely to be extremely diffuse, and may not be perceptible.
- 10.91 Given the low level of potential shadow flicker, limited to significantly less than 30 hours a year at the two properties which is further mitigated by the distances between the two properties and the nearest turbine, it is considered that the magnitude of impact would be **minimal** and that there would be an overall **minor adverse** effect prior to mitigation.
- 10.92 The original ES determined the magnitude of impact as 'no change', as no properties were within the 10 rotor diameter distance of a turbine (the original candidate V90 turbine with a rotor diameter of 90m was used in that assessment).

Mitigation

- 10.93 Mitigation measures can be implemented to ameliorate the effects of shadow flicker on individual residential properties. The National Policy Statement for Renewable Energy Infrastructure (EN-3) describes the implementation of a mitigation scheme if deemed appropriate:

*'Where the possibility of shadow flicker exists, mitigation can be enforced through the use of conditions.'*⁸

Proposed Mitigation Scheme

- 10.94 The assessment has shown that there is potential for up to a maximum of 30 hours of shadow flicker at two residential properties, although in practice this is likely to be less than 10 hours a year of diffuse shadow flicker effect given the distances involved. Ecotricity is happy to propose the following procedure should the Local Planning Authority feel it necessary to follow the precautionary principle.
- 10.95 The following procedures can be used to mitigate against any potential nuisance caused by shadow flicker once a complaint has been received either by the Local Planning Authority (LPA) or by Ecotricity (using a contact telephone number held at the Wind Park or lodged with the LPA).
- 10.96 Ecotricity will ask the complainant to keep a log of dates and times when shadow flicker is occurring, for a period of two weeks, and then submit it to Ecotricity. The turbine manufacturers are able to produce for an individual property a twelve month shadow flicker calendar detailing when shadow flicker may potentially occur on a minute by minute basis. The information from the complainants' log will be cross-checked with the theoretical dates/times of shadow flicker and an engineer will be sent by Ecotricity to the affected property/ies, to verify that shadow flicker effects

are indeed occurring. Ecotricity will advise the LPA of the date and time of the engineer's visit should a Council officer wish to attend. The arrangements for the engineer's visit will depend on the availability of the occupier and the appropriate weather conditions being in place.

- 10.97 Once shadow flicker effects have been established as occurring, the turbines can then be automatically shut down when shadow flicker is affecting the individual property. This is achieved by:
- a photocell which monitors the intensity of sunlight being fitted as standard to the turbine tower;
 - based upon the known trajectory of the sun and rotation of the earth, specialist industry standard software WindPRO is used to calculate the number of times during the year when shadow flicker will occur, assuming that there is sufficient intensity of sunlight to cause a shadow from each of the turbines, windows of affected properties face the turbine, and there are no significant obstructions between the house and the turbine. The software differentiates between each turbine, enabling only the turbine(s) which are causing the shadow flicker effects to be shut down.
 - the software within the Supervisory Control System of each individual turbine is programmed with the times throughout each day when shadow flicker may, in theory, occur. During this period the turbine(s) will automatically shut down if there is sufficient light intensity, as measured by the photocell, to create a shadow flicker effect.
 - if there is insufficient light to cause shadow flicker, the turbine will continue to operate during periods when shadow flicker is theoretically possible.
- 10.98 This shadow flicker mitigation is currently implemented at turbines operated by Ecotricity, including the Ecotech Turbine in Norfolk.

Residual Significance

- 10.99 The effects of shadow flicker can be fully mitigated. The resulting impact will be **not significant**.

Proposed Monitoring

The results of the Shadow Flicker Assessment show that two residential receptors have the potential to be affected from the proposed development. If incidences of shadow flicker occur, the above mitigation scheme will be implemented.

⁸ National Policy Statement for Renewable Energy Infrastructure (EN-3) (2011), para. 2.7.71