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Summary

Between 21st and 23rd September 2010, Oxford Archaeology East were commissioned to carry out an archaeological evaluation and palaeoenvironmental survey across a 2km site east of the village of Sutton St Edmund, on the Cambridgeshire / Lincolnshire border. The investigation consisted of six trenches and hand augered boreholes within the footprint of proposed wind turbines and additional augerholes across the site to map the sediment deposits.

Two undated ditches were recorded, one located within the topsoil, high up in the stratigraphic sequence within Trench 4 and the other at over -2.93m OD at the very base of Trench 3.

The hand-auger cross section revealed a relatively continuous macro-stratigraphy to the deposits in this locality, with a change from a silt dominated horizon to a clay dominated horizon. This change potentially represents a marine regression from outer to inner/peri-estuarine conditions and would have increased the amount of available land for human settlement/utilisation, such as the recorded marine retreat in the Romano-British period, before a further period of marine transgression.

A silt dominated unit identified towards the centre of the site may represent a topographic rise in the landscape, and would have formed a favourable location for human habitation/utilisation.

1 Introduction

1.1 Location and scope of work

1.1.1 An archaeological evaluation was conducted at the proposed site of Treading Wind Farm in the parish of Sutton St Edmund, on the Cambridgeshire/Lincolnshire border. The proposed development site is located on arable land, approximately 7.5km north west of Wisbech and 2km to the east of the village of Sutton St Edmund. Two turbines are located within the Fenland District of Cambridgeshire and four within South Holland district of Lincolnshire (Figure 1).

1.1.2 This archaeological evaluation was undertaken in accordance with a Written Scheme of Investigation prepared by Niall Hammond of Archaeo-Environment Ltd and discussed and approved by the county archaeologists of Lincolnshire and Cambridgeshire County Councils.

1.1.3 The work was designed to assist in defining the character and extent of any archaeological remains within the proposed redevelopment area, in accordance with the guidelines set out in *Planning Policy Statement 5: Planning for the Historic Environment* (Department for Communities and Local Government 2010). The results will enable decisions to be made by Lincolnshire County Council and Cambridgeshire County Council, on behalf of the Local Planning Authority, with regard to the treatment of any archaeological remains found.

1.1.4 The site archive is currently held by OA East and will be deposited in Cambridgeshire County Council Stores in due course.

1.2 Drift geology

1.2.1 The site and adjacent area is underlain by several metres of Holocene (Flandrian) marine alluvium, mapped as tidal flat deposits 1 (BGS sheet 258). These deposits consist of mainly soft, silty clays with numerous root traces which were deposited as part of a salt marsh. These deposits contain a complex network of silt in-filled channels or roddens which are the remnants of tidal creek deposits and are often seen at surface as sinuous ridges. These roddens are marked in definite areas of the site on the geological map, and are clearly seen on various aerial surveys including coverage available through Google Earth (accessed 27.09.2010).

1.2.2 The location of this site on a substantial Holocene sediment stack requires a digression into understanding the Holocene evolution of the Fen basin, and relating this to the archaeological potential of the sediment body. In essence, the archaeological potential of such wetland/alluvial sites is opposite to that of 'normal dryland' archaeological sites.

1.2.3 In the case of dryland archaeology, the geological deposits are laid down in advance of the Holocene, with human activity occurring on top of them and archaeological remains being either cut into them or located in shallow soil profiles above them. In this sense the geology is chronologically static and does not interact in a stratigraphic sense with the archaeological remains.

1.2.4 The situation on wetland sites is the opposite, with episodes of human activity interspersed by burial and erosion of sediments. Therefore, the sediment body (or geology) is stratigraphically, chronologically and spatially interacting with the human

activity. Archaeological remains can be cut into or be buried by the sediment body, in a generally vertically accreting sediment wedge. Preservation of organics is common, in both ecofactual and artefactual materials. As a consequence, wetland zones provide a much richer archaeological and palaeoenvironmental resource than equivalent dryland archaeological sites. As the body is vertically and laterally accreting conventional methods of archaeological prospection are ineffective in such environments, such as aerial photography, fieldwalking and shallow geophysical survey, e.g. gradiometry. Instead, archaeological prospection needs to understand sediment stratigraphy and use this to predictively model the distribution of archaeological resources based on the identification of geomorphological features, such as areas of buried higher topography, palaeochannels and buried land surfaces.

1.3 Holocene evolution of the Fenland basin

1.3.1 The evolution of the Holocene (Flandrian) sediment body in the Fens is relatively complex and is composed of three main geomorphic zones, being the dryland (or landward) fringe, the marine (or seaward) zone, and the freshwater riverine zones. Within these different zones and a product of their geomorphology are six Holocene events (French 2003):

- Channel peats
- Limited marine incursion
- Basal peat
- Fen clay marine incursion
- Upper peat
- Upper silt marine incursion

1.3.2 Not all events are represented in every sequence and there is often localised confusion in application of this macro-stratigraphic overview of the Fenland sequence. In particular Wheeler and Waller (1995) have described the problems of terminology in lithological and chronostratigraphic correlation throughout the Fen. This report will give a generalised overview of the Holocene succession derived from French (2003, 134 - 141) and then highlight the problems of terminology discussed by Wheeler and Waller (1995).

1.3.3 Since the end of the Pleistocene, there have been rising sea levels around the British Isles. These rising sea levels have caused more of the seaward fen edge to come under marine influence, with associated impeded drainage over the Fens. This has caused more overbank deposition of sediment through freshwater flooding, and associated marsh formation. All these factors have contributed to a vertically accreting sediment stack.

1.3.4 The Fenland early Holocene dryland environment supported a mixed deciduous woodland dominated by lime. Throughout the first half of the post glacial period sea levels rose, reaching its present height by the first millennium BC. At the deepest levels of the Fen (c. -7 to -9m OD) a eutrophic peat forms, as early as the 6th to 5th millennium BC, in response to rising water levels. The peat is dominated by wood/reed. An example of this early basal peat is recorded by Shennan (1986) at Tydd St Giles at -9.1m OD, with a date of 7690+/- 400 BP.

1.3.5 However, except for the lowest levels of the Fens, the Mesolithic saw dryland vegetation dominate. The end of the Mesolithic witnesses an increasing marine influence, with minor marine incursions and deposition of marine silts. By the 4th millennium BC until the end of the 3rd millennium BC there is the onset of the main

body of peat formation. This is common lithological unit throughout the Fens and is coincident with rising base water levels.

1.3.6 Above this peat body is a marine incursion that resulted in the deposition of the Fen Clay or the Barroway Drove Beds. This lithological unit is estimated to have been deposited over a long period dated, starting in the later Neolithic or third millennium BC. Although a basic and commonly referred to unit, the Barroway Drove Beds (or Fen Clay) is not a single unit and has localised variations, making lithostratigraphic correlations between sites difficult.

1.3.7 The maximum extent of the Barroway Drove Beds is well established and does not occur above -1.0m OD. The earliest dates for the Fen Clay are c. 4860 cal. BC, with a continuation until. c. 2075 cal BC, with the end date of deposition consistent across the Fens. This Barroway Drove Beds clay represents the marine transgression, of a brackish/salt marsh environment or coastal reed swamp, dissected and drained by tidal creeks.

1.3.8 From the Late Neolithic/Early Bronze Age, there is a seaward extension of freshwater conditions, overlapping with the period of Fen Clay deposition, resulting in peat formation. This is the upper peat unit, and is correlated with rising base water levels. It is thought to be the reason that for the abandonment of many archaeological sites, such as Flag Fen. The development of this upper peat is initially associated with alder and willow carr, but with continued rising water levels it is succeeded by Sedge Fen and open water conditions.

1.3.9 There is a second marine transgression recorded through the formation of The Upper Barroway Drove Bed, which occurs in the north and north west of the fen. It is dated to the later Bronze Age (late 2nd early 1st millennium BC). This deposit is recorded as a grey silty clay, but is more sticky with more silt. The deposition of this deposit is associated with a tidal creek system.

1.3.10 A further phase of marine influence is recorded in the north east of the fens around the Iron Age/1st millennium BC, but in the south there is the deposition of an upper peat unit, above the Barroway Drove Beds. In the southern half of the Fens at the same point is the formation of an upper peat bed, with the development of some meres in the landscape.

1.4 The Nomenclature of the Holocene sediments

1.4.1 Whilst the broad sequence of events throughout the Holocene is understood, there has been considerable debate over the number, type and date of the main lithologies. The reason for this is multi-faceted and a summary is given below of the main sequences (Table 1), their authors and date of publication, derived from Wheeler and Waller (1995).

1.4.2 The most widespread scheme adopted was that of Gallois (1979) and subsequently modified by a number of other workers. There is a problem of terminology within the Fen sediment stratigraphy, caused by variability of local systems, and the effects of correlating stratigraphy based on lithology, when it represent localised depositional environments.

1.4.3 The original Gallois system recognised four main lithological members, which has subsequently been sub divided by further researchers. The basal unit is a peat unit, below the Barroway Drove Beds. The Barroway Drove Beds consist of very soft and

wet inter-laminated clays with silts, with occasional animal burrows. The Upper member of the Barroway Drove Beds are considered more silty than the lower member of the Barroway Drove Beds. Within this body of the Barroway Drove beds are several peat deposits, with a lower leaf of the Nordelph peat in the Barroway Drove Beds and a middle Peat. The middle peat sub-divides the lower member of the Barroway Drove Beds.

1.4.4 In this system the upper leaf of the Nordelph Peat is stratigraphically above the Barroway Drove Beds (the same as the Upper peat) and causes rooting and rhizomes in the top of the clastic Barroway Drove Beds. The Nordelph peat has a formation dated to c. 4000 – 2000BP. Above the Nordelph Peat are the Terrington Beds, consisting of finely laminated, dull. slightly reddy brown clays and pale brown silts. It includes the present day saltmarsh deposits and similar deposits on reclaimed land. It has probably been deposited since the Romano-British period.

1.4.5 Whilst macro-stratigraphic structure across the region is important, it should not be confused with micro-stratigraphic detail of individual sites and boreholes. This preceding discussion of terminology sets a context for the Treading Wind Turbine Site, but does not define its position within the lithological, chronological or stratigraphic development of the Fen basin.

<table>
<tr><th>Skertchly (1877)</th><th>Godwin and Clifford (1938)</th><th>Gallois (1979)</th><th>Wyatt (1984); Horton (1989); Horton and Aldiss (1992).</th></tr>
<tr><td rowspan="2">Fen Silt</td><td>Upper silt</td><td>Terrington Beds</td><td>Terrington Beds</td></tr>
<tr><td rowspan="2">Upper peat</td><td rowspan="2">Nordelpth Peat</td><td rowspan="2">Upper leaf of the Nordelph Peat</td></tr>
<tr><td rowspan="7">Peat</td></tr>
<tr><td rowspan="6">Fen Clay</td><td rowspan="6">Barroway Drove Beds</td><td>Upper member of the Barroway Drove Beds</td></tr>
<tr><td>Lower leaf of the Nordelph Peat bed</td></tr>
<tr><td>Lower member of the Barroway Drove Beds</td></tr>
<tr><td>Middle Peat</td></tr>
<tr><td>Lower member of the Barroway Drove Bed</td></tr>
<tr><td>Lower Peat</td><td>Lower Peat</td><td>Lower Peat</td></tr>
</table>

Table 1: The main lithologies of the Holocene sediment stack in the Fen basin (after Wheeler and Waller, 1995).

1.5 Solid Geology

1.5.1 The drift deposits overlie rocks of the Jurassic Corallian Group which compromise the undifferentiated mudstones of the West Walton Beds and the clays of the Ampthill Clay.

1.6 Topography

1.6.1 The site is located on largely flat reclaimed fen land with an elevation between approximately -1m and +1m OD. The site is divided by a number of human-made drains, principally the Treading Drain running north-north-east to south-south-west

which feeds into the Lady Nunns old Eau which is aligned north-to-south. Several minor roads surround the site which is crossed by several wide, rough, surfaced farm tracks.

1.7 Archaeological and historical background

1.7.1 A search was carried out of both Cambridgeshire and Lincolnshire's Historic Environment Records and the National Monuments Record. Fourteen records/sites are located within the vicinity of the wind farm site, however, the only record located within the development footprint was a post-medieval duck decoy pond (CHER 8422, not illustrated).

1.7.2 The majority of the other records/sites are located to the east and south on marginally higher ground. Most of the identified sites (other than post-medieval listed buildings) are sub-surface crop or parch mark features identified from aerial photographs. As such, they are undated but in form they appear to be enclosures of likely late prehistoric or Romano-British date. One sub-surface scatter of Romano-British pottery has been recorded immediately outside of the eastern boundary of the site.

1.7.3 Prehistoric activity from the Mesolithic to Bronze Age is known from the wider area, but there are no specific sites close to the proposed development area. During the Roman period, the sea was in gradual retreat, and the newly exposed land provided a valuable area for population expansion. People settled on the drying silts and on the naturally silted creek banks (roddons). The economy not only relied on crop and live stock production, but also recognised that the coastal silt lands provided opportunities for making salt from sea-water. This industry prospered until about AD 250 and there are many Roman settlements and salt-making sites (salterns) known in the area. Approximately 4km to the south of the development site, excavations at Throckenholt Farm, Parson Drove in 1993 provided evidence of extensive Romano-British settlement.

1.7.4 The development site lies to the west of the "Roman Bank", a large sea defence, most likely late Anglo-Saxon in date which provided a sea defence from flooding, and was a significant factor in the gradual but more permanent reclamation of the land behind it to the west. Reclamation continued into the 13th and 14th centuries, in part directed by monastic land ownership, as did salt production with excavated examples of medieval salterns known from Parson Drove to the south of the development site and at Tydd St Mary to the north-east.

1.7.5 To the north of Gedney Dyke, the land was only reclaimed from the sea after 1660 and it was the 17th century which marked the beginning of substantial land drainage funded by merchant adventurers. These were often designed by Dutch engineers such as Cornelius Vermuyden, who drained 450 acres of saltmarsh at nearby Tydd St Mary, while around 7000 hectares were drained in 1660 between Gedney and Moulton a few kilometres to the north east of the development site. Further drainage improvements have taken place on the site during the 19th and 20th centuries with deep straight drains supplementing the more meandering Lady Nunns Old Eau, and a steam-powered pumping engine was installed to the north-west by the time of the 1st Edition Ordnance Survey map (*c*.1880s).

1.8 Acknowledgements

1.8.1 The authors would like to thank Niall Hammond of Archaeo-Environment Ltd on behalf of Wind Ventures who commissioned and funded the archaeological work. The project was managed by Aileen Connor. Taleyna Fletcher carried out the evaluation and on-site

survey using a Leica GPS and Dr Chris Carey of Oxford Archaeology carried out the hand auger survey and assessment. Dr Carey was assisted by John Diffey.

2 Aims and Methodology

2.1 Aims

2.1.1 The objectives of the evaluation and hand auger survey were:

- To identify the presence of any sub-surface archaeological or palaeoenvironmental features across site.
- To provide a macro-stratigraphic overview of the site lithology and relate to this to palaeoenvironmental and archaeological potential through the definition of depositional environments and geomorphological features.
- To assist with the design and positioning of the proposed turbines.
- To establish the need for any further detailed investigation and recording within the foot print of the development.

2.2 Archaeological Evaluation Methodology

2.2.1 Machine excavation was carried out under constant archaeological supervision with a 360º excavator using a toothless ditching bucket. The site survey was carried out by the author using a Leica 1200 GPS.

2.2.2 Spoil, exposed surfaces and features were scanned with a metal detector. All metal-detected and hand-collected finds were retained for inspection, other than those which were obviously modern. All archaeological features and deposits were recorded using OA East's *pro-forma* sheets. Trench locations, plans and sections were recorded at appropriate scales and colour and monochrome photographs were taken of all relevant features and deposits. Four samples were taken for environmental analysis from the excavation areas, three from layers and one from an undated feature.

2.2.3 In addition to the machine excavation, hand auguring was also conducted at each trench location and at points inter-mediate between the trenches, to form a site cross-section across the site. Samples of the Holocene sediment stack were taken for palaeoenvironmental analysis.

2.2.4 Site conditions were good with little rain.

3 RESULTS

Cut numbers will be displayed in **bold** text, all other contexts in normal text. Hand augured holes were undertaken at the location of each of the trenches and numbered accordingly. The results are presented fully in section 4 of the report. The location of all trenches (Tr) and augur holes (AH) is given in Figure 1.

3.1 Trench 1 (AH1)

3.1.1 Trench 1 measured 9.5m in length, 2.0m wide and was oriented east to west (Figure 2). This trench was excavated to a total depth of 2.0m and was sufficiently stepped out on all sides to allow for safe access/egress (Plate 1). This trench contained eight distinct sediment layers (described below) (Figure 3, Section 1). No archaeological features were discovered in this trench.

- Topsoil (101) was a brown grey silty clay. It measured 0.31m in thickness and did not contain any obvious inclusions.
- Below the topsoil was a thick deposit of alluvium (102). This layer was a light grey, silty clay with pockets of silty orange sand. It measured 0.80m in thickness and did not contain any obvious inclusions.
- Below 102 was a deposit of a clayey, mid-greyish brown coloured alluvium with frequent light yellow staining caused by decayed organic material (103). This layer had a maximum thickness of 0.14m and contained no other obvious inclusions. This sealed layer 104.
- Layer 104 was a light bluish grey, soft, silty clay with a maximum thickness of 0.16m. There were no obvious inclusions within this layer. This layer sealed 105.
- Layer 105 was a thin deposit of a rich reddish brown peaty clay. It measured 0.05m in thickness and other than visible evidence of decayed plant remains, there were no other obvious inclusions. A 10 litre sample was taken (sample number 1) which contained organic plant remains (reeds) and a few insect fragments (Appendix A). Beneath this was layer 106.
- Layer 106 was the same as 104; a light bluish grey, soft, silty clay with a maximum thickness of 0.26m. There were no obvious inclusions within this layer. This layer sealed 107.
- Layer 107 was a thin band of crushed shell measuring approximately 0.07m thick. A 10litre sample was taken (sample number 2) which contained ostracods, shell fragments and snails. Beneath this was layer 108.
- Layer 108 was a deep greyish blue, organic-rich deposit of silty clay. It measured 0.20m in thickness to the base of trench and the limit of excavation.

3.2 Trench 2 (AH2)

3.2.1 Trench 2 measured 10m in length, 2.0m wide and was oriented east to west (Figure 2). This trench was excavated to a total depth of 2.40m and was sufficiently stepped out on all sides to allow for safe access/egress. This trench contained six distinct layers (described below) (Figure 3, Section 2; Plate 2). No archaeological features were recorded within this trench.

- Topsoil (201) was a brown grey silty clay Ap. It measured 0.44m in thickness and did not contain any obvious inclusions.

- Below the topsoil was a thin deposit of pale creamy yellow decayed organic material within a firm brown clay (202). This deposit measured 0.09m thick and did not contain any obvious inclusions. Beneath this layer was 203.
- Layer 203 was a thick deposit of alluvium. This layer was a light grey, silty clay deposit with pockets of silty orange sand. It measured 0.46m in thickness and did not contain any obvious inclusions. This layer was above 204.
- Layer 204 was a thick deposit of pale orange sandy silt. This layer had a maximum thickness of 0.70m and contained no other obvious inclusions. This sealed layer 205.
- Layer 205 was a light greyish brown silty clay with a maximum thickness of 0.64m. There were no obvious inclusions within this layer. This layer sealed 206.
- Layer 206 was a light bluish grey, soft, silty clay with a maximum thickness of 0.20m, revealed to the base of the trench. There were no obvious inclusions within this layer.

3.3 Trench 3 (AH3)

3.3.1 Trench 3 measured 8.50m in length at the base following collapse at the eastern end, 2.0m wide and was oriented east-to-west (Figure 2). This trench was excavated to a total depth of 1.80m and was sufficiently stepped out on all sides to allow for safe access/egress. This trench contained six distinct layers (described below) (Figure 3, Section 3). A possible undated ditch was recorded in the base of this trench (**308**).

- Topsoil (301) was a brown grey silty clay. It measured 0.38m in thickness and did not contain any obvious inclusions.
- Below the topsoil was a thick deposit of alluvium (302). This layer was a light grey silty clay with pockets of silty orange sand. It measured 0.72m in thickness and did not contain any obvious inclusions. Below this was 303.
- Layer 303 was a thin band of dark grey brown silty clay which contained a number of whole and broken cockle shells. It measured 0.06m in thickness and did not contain any other obvious inclusions. A 10 litre sample was taken (sample number 3) which contained waterlogged seeds of nettle (*Urtica dioica*) (Appendix A). Beneath this was layer 304.
- Layer 304 was a deposit of a light grey silty clay with pockets of silty orange sand. This layer measured 0.24m thick and did not contain any obvious inclusions. This sealed layer 305.
- Layer 305 was a thin band of crushed shell measuring approximately 0.04m thick. Beneath this was layer 306.
- Layer 306 was a light bluish grey, soft, silty clay with a maximum thickness of 0.34m until the base of the trench. There were no obvious inclusions within this layer. The trench was not excavated any further as a possible archaeological feature was recorded at this level.
- Ditch **308** was linear in plan, orientated north-east to south-west, continuing beyond the trench edges. It was excavated in a single slot which revealed moderately sloping edges and a concave base with a maximum width of 0.35m and depth of 0.14m (Figure 2, Section 7). It was filled by 307, a mid brown grey silty clay with no obvious inclusions. No dating evidence or environmental samples could be retrieved due to the depth of the trench and collapse caused by instability of the edges, despite stepping.

3.4 Trench 4 (AH4)

3.4.1 Trench 4 measured 10m in length, 2.0m wide and was oriented east-to-west (Figure 2). This trench was excavated to a total depth of 2.40m and was sufficiently stepped out on all sides to allow for safe access/egress. This trench contained seven distinct layers (described below) (Figure 3, Section 4; Plate 3). An undated ditch (**409**) was recorded in this trench. Positioned quite high in this stratigraphic sequence, this ditch was cut into/just below the topsoil (Plate 4).

- Topsoil (401) was a very dark, reddish brown, clayey peat deposit. It measured 0.44m in thickness and did not contain any obvious inclusions.
- Below the topsoil was a thick deposit of alluvium (402). This layer was a light grey, clayey deposit with pockets of silty orange sand. It measured 0.58m in thickness and did not contain any obvious inclusions. Below this was 403.
- Layer 403 was a thick deposit comprising several soft, sandy flood silt layers each slightly different in colour, but all a variant of a light orangey colour with a lens/layer of peat within it. It measured 0.74m in thickness and did not contain any other obvious inclusions. Beneath this was layer 404.
- Layer 404 was a deposit of soft orange silt. This layer measured 0.25m thick and did not contain any obvious inclusions. This sealed layer 405.
- Layer 405 was a light grey silty deposit with no obvious inclusions measuring approximately 0.10m thick. Beneath this was layer 406.
- Layer 406 was a thin deposit of a rich reddish brown peat. It measured 0.03m in thickness and other than visible evidence of decayed plant remains, there were no other obvious inclusions. Beneath this was layer 407
- Layer 407 was a light bluey clayey silt and fine sand. This layer measured 0.30m in thickness and did not contain any obvious inclusions, however this was not the full extent of the deposit as the trench was not excavated any further.
- Ditch **409** was linear in plan, orientated north-west to south-east, continuing beyond the trench edges. It was excavated in a single slot which revealed moderately sloping edges and a concave base with a maximum width of 0.50m and depth of 0.15m (Plate 4). It was filled by 408, a mid brown peaty clay fill with no obvious inclusions. A single 10 litre sample was taken for analysis. This sample contained a single charred grain and two charred plant stems (Appendix A).

3.5 Trench 5 (AH5)

3.5.1 Trench 5 measured 9m in length at the base (following some collapse at the western end), 2.0m wide and was oriented east-to-west (Figure 2). This trench was excavated to a total depth of 2.32m and was sufficiently stepped out on all sides to allow for safe access/egress. This trench contained five distinct layers (described below) (Figure 2, Section 5).

- Topsoil (501) was a very brown grey silty clay. It measured 0.44m in thickness and did not contain any obvious inclusions.
- Below the topsoil was a thick deposit of alluvium (502). This layer was a light grey, silty clay with pockets of silty orange sand. It measured 0.88m in thickness and did not contain any obvious inclusions. Below this was 403.

- Layer 503 was a layer of crushed shell measuring approximately 0.18m thick. Beneath this was layer 504.
- Layer 504 was a thick deposit of alluvium. This layer was a light grey silty clay deposit with pockets of silty orange sand. It measured 0.56m in thickness and did not contain any obvious inclusions. Below this was 505.
- Layer 505 was a mid greyish blue, very organic-rich deposit of soft, moist clay. It measured 0.36m in thickness, to the bottom of the trench.

3.6 Trench 6 (AH6)

3.6.1 Trench 6 measured 10m in length, 2.0m wide and was oriented east-to-west (Figure 2). This trench was excavated to a total depth of 2.30m and was sufficiently stepped out on all sides to allow for safe access/egress. This trench contained five distinct layers (described below) (Figure 2, Section 6 and plate 5).

- Topsoil (601) was a brown grey silty clay Ap. It measured 0.48m in thickness and did not contain any obvious inclusions.
- Below the topsoil was a thick deposit of alluvium (602). This layer was a light grey silty clay with pockets of silty orange sand. It measured 1.02m in thickness and did not contain any obvious inclusions. Below this was 603.
- Layer 603 was a layer of dark grey brown silty clay which contained a number of whole and broken cockle shells. It measured 0.18m in thickness and did not contain any other obvious inclusions. Below this was 604.
- Layer 604 was a thick deposit of alluvium. This layer was a light grey silty clay deposit, measuring 0.55m in thickness and did not contain any obvious inclusions. Below this was 605.
- Layer 605 was a mid greyish blue, very organic-rich deposit of soft, moist clay. It measured 0.08m in thickness, however this was not the full extent of the deposit as the trench was not excavated any further.

3.7 Hand augured cross section, Figure 4 (Plate 6)

3.7.1 The hand auger cross-section describes a tripartite sediment system within the development area (Figure 4). The upper sediment body represents a ploughzone, with an Ap horizon *c*.0.3m deep across the site. Beneath this is a second clay dominated horizon, composed of a number of different silty clay units. This varies in depth between 0.5 – 5m. This unit is deepest at the west and east of the site, but becomes notably shallower in the middle of the transect.

3.7.2 Beneath this clay dominated horizon is a silt dominated horizon, again formed by several different units. This rises significantly in the centre of the transect (site) around trench 4. This unit was not bottomed by hand auger.

3.7.3 This basic stratigraphy was seen across the site, with the one exception of a sand/silt dominated area in the centre of the transect around trench 4. This unit is distinct in colour and has a higher sand content than the silt unit beneath it. It potentially represents a silt/sand filled palaeochannel within the clay dominated horizon.

3.7.4 The hand auguring other than revealing this macro-stratigraphic overview realised frequent organic remains in the silty clay dominated horizon. Localised variation was consistently recorded in the silt and clay dominated units, with often thin laminations occurring in larger sediment bodies. All of the trenches were excavated through the

ploughzone, into the clay dominated sediments and most of the trenches encountered the underlying silt dominated horizon. Of key important to understanding the site is the nature and date of the different sediment bodies and understanding the depositional environments they represent.

3.8 Finds Summary

3.8.1 No finds were recovered during the evaluation.

3.9 Environmental Summary

3.9.1 Four bulk samples were taken for environmental analysis; three were from layers and one from an undated ditch in Trench 4. The results are presented in Appendix A.

4 Discussion, Conclusions and Reccomendations

4.1 Discussion and Conclusions

4.1.1 The results of the trenching did not reveal any substantial archaeological remains, although two distinct linear features were investigated they, however, remain undated. The level at which the features were encountered is significant. Ditch **409** was located very high in the stratigraphic sequence of trench 4 and is likely to be post-medieval in date. In order to date ditch **308,** either further investigation is required or further analysis to include dating of the peat layer encountered across the site which would at least provide an "earlier than" date.

4.1.2 The British Geological Survey describe the drift geology as Tidal Flat deposits 1 (BGS sheet 258), not differentiating between the Barroway Drove Beds and the Terrington Beds. If the clay dominated horizon is a member of the Barroway Drove Beds, then deposition of the silty clay sediment units would date from the later Neolithic onwards, within a marine or peri-marine environment. The height of the silty clay deposit is potentially too high for the top of the Barroway Drove Beds at *c.* 0 - 1m OD, so there is the possibility it represents a member of the Terrington Beds.

4.1.3 The dating of the formation of the clay and the silt dominated horizons is key in ascertaining the archaeological potential of the site. The cross-section reveals a relatively continuous macro-stratigraphy to the deposits in this locality, with the change from a silt dominated horizon to a clay dominated horizon.

4.1.4 The reason for this sediment change is unclear, but it represents a change in deposition environment from a mid energy system depositing the silts, to a lower energy system depositing the clays. The change between the two units potentially represents a marine regression from outer to inner/peri-estuarine conditions. This would have increased the amount of available land for human settlement/utilisation, such as the recorded marine retreat in the Romano-British period, before a further period of marine transgression. The dating of the peat layer in trench 1 (context 105) will allow a proxy date to be gained for deposition of this upper sediment body.

4.1.5 Although the dating of these sediment units is a key issue, the landscape at the depth of impact is clearly one where there is some level of human activity. Of the two cut features linear [409] is clearly an anthropogenic ditch (interpreted through morphology) and shows some utilisation of this landscape. However, this could represent land use post dating the reclamation.

4.1.6 The second key issue is the silt dominated unit in the middle of the site, as represented by trench 4 and in the hand auger transect (the yellow dominated sediment block, Figure 4). This area of the site is notably different and it potentially represents a topographic rise in the landscape, toward the centre of the site.

4.1.7 If this is a topographic rise in the landscape, caused by variation in the underlying solid geology mudstone, this will have formed a favourable location for human habitation/utilisation, due to it standing above the localised wetland. Such locations often have rich archaeological records, such as low altitude terraces next to extant floodplain. The BGS sheet (superficial geology 158) adds evidence to this hypothesis, with trench 4 sat approximately equidistant between two channels, one to the east and one to the west.

4.1.8 Whilst the dating of the macro-sediment stratigraphy is a key aim in defining the archaeological potential of the site, the potential for archaeological remains within the

footprint of the turbine locations, to the depth of impact, is low, based on the evaluation results. The archaeological features that were detected are undated and of these [409] could represent a ditch that post-dates reclamation. However, further work should be undertaken on understanding the depositional environment and dating the sequence. In particular the Romano-British deposits, previously identified as a sub-surface scatter of pottery recorded on the eastern boundary of the site, should be correlated with sediment stratigraphy on the site on the basis of altitude and lithology. This will further help define the archaeological potential of the site.

4.1.9 Overall the site displayed a good to moderate preservation of macro-ecofactual materials such as wood, shell, *etc.* It is interpreted, based on the field inspection, that the quality of preservation will be high enough within the peat and clay dominated units to undertake palaeoenvironmental analysis such as diatom, pollen and ostracod counts.

4.2 Recommendations, by Dr Chris Carey, Oxford Archaeology South

4.2.1 The following recommendations are given for the assessment of sediment sequence at Treading Windfarm:

a) Dating the clayey peat layer in Trench 1 (context 105).

b) Some limited assessment of diatoms, ostracods and foraminifera to determine the depositional environment of the clay dominated horizon sampled through the gouge auger.

c) Some initial characterisation of the mollusc samples as a further environmental proxy.

d) Integration of the site sediment stratigraphy with the previous work undertaken at Tydd St Giles (Shennan 1986) and correlation of the sediment stratigraphy with the pottery scatter on the eastern boundary of the site.

f) If further work is required on sequencing the sediment stratigraphy electrical resistivity survey can be used to provide electro-conductivity cross sections, which can be integrated with previous phases of the borehole data.

Appendix A: Environmental Remains

By Rachel Fosberry

A.1 Introduction and Methods

A.1.1 Four bulk samples were taken from features within the evaluated areas of the site in order to assess the quality of preservation of plant remains and their potential to provide useful data as part of any further archaeological investigations.

A.1.2 Ten litres of each sample were processed by tank flotation for the recovery of charred plant remains, dating evidence and any other artefactual evidence that might be present. The flot was collected in a 0.3mm nylon mesh and the residue was washed through a 0.5mm sieve. Both flot and residue were allowed to air dry. The dried residue was passed through 5mm and 2mm sieves and a magnet was dragged through each resulting fraction prior to sorting for artefacts. Any artefacts present were noted and reintegrated with the hand-excavated finds. The flot was examined under a binocular microscope at x16 magnification and the presence of any plant remains or other artefacts are noted on Table A1. Identification of plant remains is with reference to the Digital Seed Atlas of the Netherlands (Cappers *et al* 2006) and the authors' own reference collection.

A.2 Quantification

A.2.1 For the purpose of this initial assessment, items such as seeds, cereal grains and small animal bones have been scanned and recorded qualitatively according to the following categories

= 1-10, ## = 11-50, ### = 51+ specimens

A.2.2 Items that cannot be easily quantified such as charcoal, magnetic residues and fragmented bone have been scored for abundance

+ = rare, ++ = moderate, +++ = abundant

A.3 Results

The results are recorded on Table A1.

Sample No.	Context No.	Feature Type	Flot Contents
1	105	Layer	Peat – organic plant remains (reeds), few insect fragments
2	107	Layer	Organic plant remains (reeds), ostracods, shell fragments, snails
3	303	Layer	Organic plant remains (roots and reeds), ostracodes, duckweed seeds, nettle seeds, egg cases, charcoal
4	408	Ditch	Single charred grain, charred stems, duckweed seeds, charcoal

Table A1. Results

Preservation is predominantly by waterlogging although Samples 3 and 4 contained charred plant remains in the form of charcoal and, in Sample 4, ditch fill 408, a single

charred grain and two charred plant stems. Waterlogged seeds of nettle (*Urtica dioica*) are present in Sample 3 (layer 303).

Ostracods occur in samples 2 (layer 107) and 3. Duckweed (*Lemna* sp.) seeds are present in Samples 3 and 4.

A.4 Discussion

A.4.1 The samples from the Fenland Wetland Site have produced a limited assemblage of plant remains, predominantly peat and organic plant remains such as reeds and nettle seeds. Ostracods are small bivalve crustaceans that inhabit the bottom of aquatic habitats such as lakes, ponds and streams. Duckweed only produces seeds when the habitat in which it is growing dries out, which could suggest seasonal wet conditions in these features.

A.5 Further Work and Methods Statement

A.5.1 No further work on this assemblage is required. If further work is planned in this area, environmental sampling should still be considered as these results show that there is potential for the recovery of plant macrofossils.

Appendix B. Bibliography

British Geological Survey		Sheet 158. Sheet 158, v.4 Peterborough. *Superficial geology.*
Cappers, R.T.J., Bekker, R.M. and Jans, J.E.A.,	2006	Digital Seed Atlas of the Netherlands Groningen Archaeological Studies 4, Barkhuis Publishing, Eelde, The Netherlands. www.seedatlas.nl
Hammond, N.	2010	Written Scheme of Investigation for Archaeological and Palaeoenvironmental Evaluation : Treading Wind Farm (Proposed)
Gallois, R.W.	1979	Geological investigations for the Wash Water Storage Scheme. *Institute of Geological Sciences,* Report no. 78/19, 1–74
French, C.	2003	*Geoarchaeology in action. Studies in soil micromorphology and landscape evolution.* London.
Shennan, I.	1986	Flandrain sea level changes in the Fenland I: the geographical setting and evidence of relative sea level change. *Journal of Quarternary Science*, 1, pps 119 – 154.
Wheeler, A. J. and Waller, M. P.	1995	The Holocene lithostratigraphy of Fenland, eastern England: a review and suggestions for redefinition. Geological Magazine, 132, pps. 223 – 233.

APPENDIX C. OASIS REPORT FORM

All fields are required unless they are not applicable.

Project Details

OASIS Number	oxfordar3-83186		
Project Name	Archaeological Evaluation and Paleo-Environmental Survey : Treadiing Wind Farm Site, Sutton St Edmunds. Lincolnshire		
Project Dates (fieldwork) Start	21-09-2010	Finish	23-09-2010
Previous Work (by OA East)	No	Future Work	No

Project Reference Codes

Site Code	XLITWF10	Planning App. No.	n/a
HER No.	n/a	Related HER/OASIS No.	n/a

Type of Project/Techniques Used

Prompt	Planning condition
Development Type	Wind Farm

Please select all techniques used:

☐ Aerial Photography - interpretation	☐ Grab-Sampling	☐ Remote Operated Vehicle Survey
☐ Aerial Photography - new	☐ Gravity-Core	☐ Sample Trenches
☐ Annotated Sketch	☐ Laser Scanning	☐ Survey/Recording Of Fabric/Structure
☒ Augering	☐ Measured Survey	☒ Targeted Trenches
☐ Dendrochronological Survey	☐ Metal Detectors	☐ Test Pits
☐ Documentary Search	☐ Phosphate Survey	☐ Topographic Survey
☒ Environmental Sampling	☐ Photogrammetric Survey	☐ Vibro-core
☐ Fieldwalking	☐ Photographic Survey	☐ Visual Inspection (Initial Site Visit)
☐ Geophysical Survey	☐ Rectified Photography	

Monument Types/Significant Finds & Their Periods

List feature types using the NMR Monument Type Thesaurus and significant finds using the MDA Object type Thesaurus together with their respective periods. If no features/finds were found, please state "none".

Monument	Period	Object	Period
ditch	Uncertain	none	None
	Select period...		Select period...
	Select period...		Select period...

Project Location

County	Lincolnshire	Site Address (including postcode if possible)	
District	South Holland	Site located south of Broad Drove, Tydd St Giles Lincolnshire, PE13 5NU	
Parish	Sutton St Edmund		
HER	Lincolnshire		
Study Area	58.5 ha	National Grid Reference	TF 389 130

Project Originators

Organisation	OA EAST
Project Brief Originator	in discussion woth Cambs CC and Lincolnshire CC
Project Design Originator	Niall Hammond, Archaeo-Environment
Project Manager	Aileen Connor
Supervisor	Taleyna Fletcher

Project Archives

Physical Archive	Digital Archive	Paper Archive
CCC Stores	OA East Offices, Bar Hill	CCC Stores
XLITWF10	XLITWF10	XLITWF10

Archive Contents/Media

	Physical Contents	Digital Contents	Paper Contents
Animal Bones	☐	☐	☐
Ceramics	☐	☐	☐
Environmental	☒	☒	☒
Glass	☐	☐	☐
Human Bones	☐	☐	☐
Industrial	☐	☐	☐
Leather	☐	☐	☐
Metal	☐	☐	☐
Stratigraphic		☐	☒
Survey		☒	☐
Textiles	☐	☐	☐
Wood	☐	☐	☐
Worked Bone	☐	☐	☐
Worked Stone/Lithic	☐	☐	☐
None	☐	☐	☐
Other	☐	☐	☐

Digital Media	Paper Media
☐ Database	☐ Aerial Photos
☐ GIS	☒ Context Sheet
☐ Geophysics	☒ Correspondence
☒ Images	☐ Diary
☒ Illustrations	☒ Drawing
☐ Moving Image	☐ Manuscript
☐ Spreadsheets	☐ Map
☒ Survey	☒ Matrices
☒ Text	☐ Microfilm
☐ Virtual Reality	☐ Misc.
	☒ Research/Notes
	☒ Photos
	☒ Plans
	☒ Report
	☒ Sections
	☒ Survey

Notes:



Plans

Limit of Excavation

Deposit - Conjectured

Natural Features

Sondages/Machine Strip

Intrusion/Truncation

Illustrated Section S.14

Archaeological Feature

Excavated Slot

Cut Number 118

Deposit Number 117

Sections

Limit of Excavation

Cut

Cut Conjectured

Deposit Horizon

Deposit Horizon Conjectured

Intrusion/Truncation

Top Surface/Top of Natural

Break in Section/
Limit of Section Drawing

Step

Cut Number 117

Deposit Number 117

Ordnance Datum 18.45m OD

Sample Number 51

Convention Key

© Oxford Archaeology East

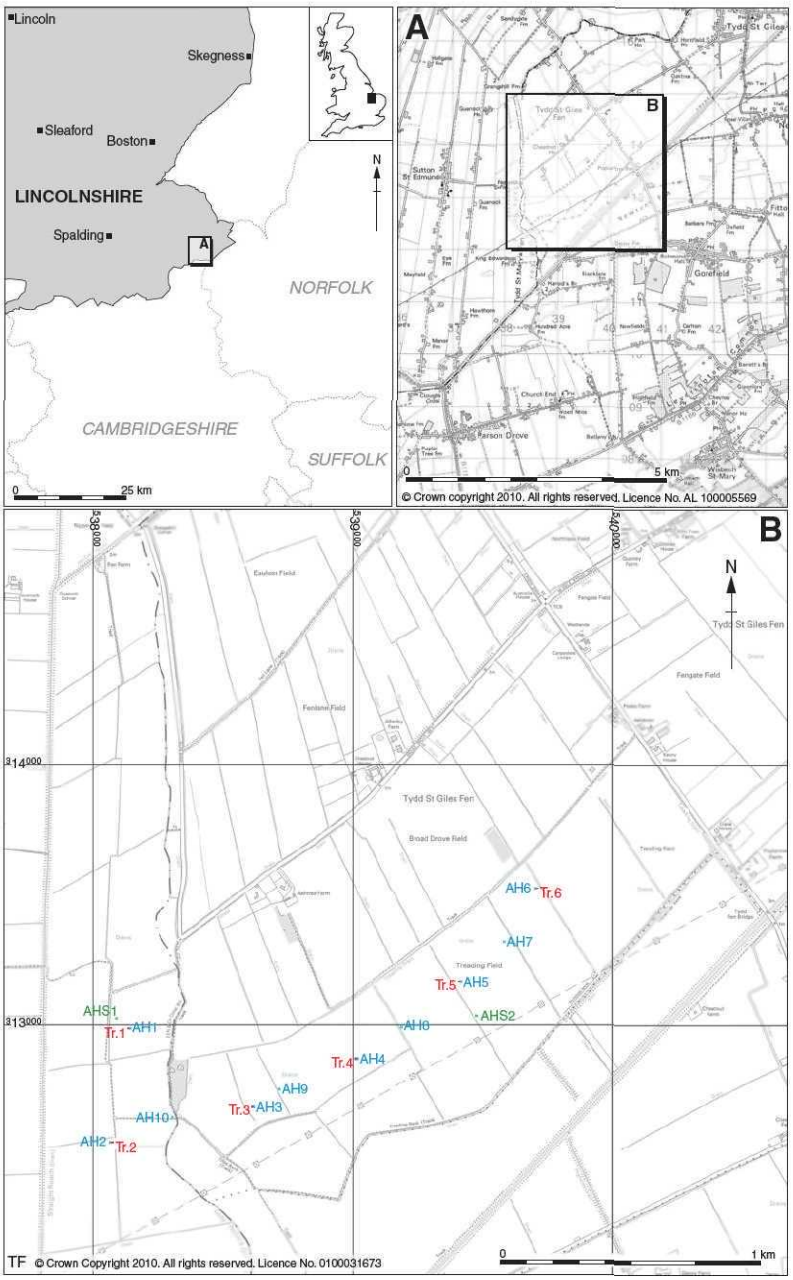


Figure 1: Location of site with trenches (red), auger holes (blue) and sampled auger holes (green)

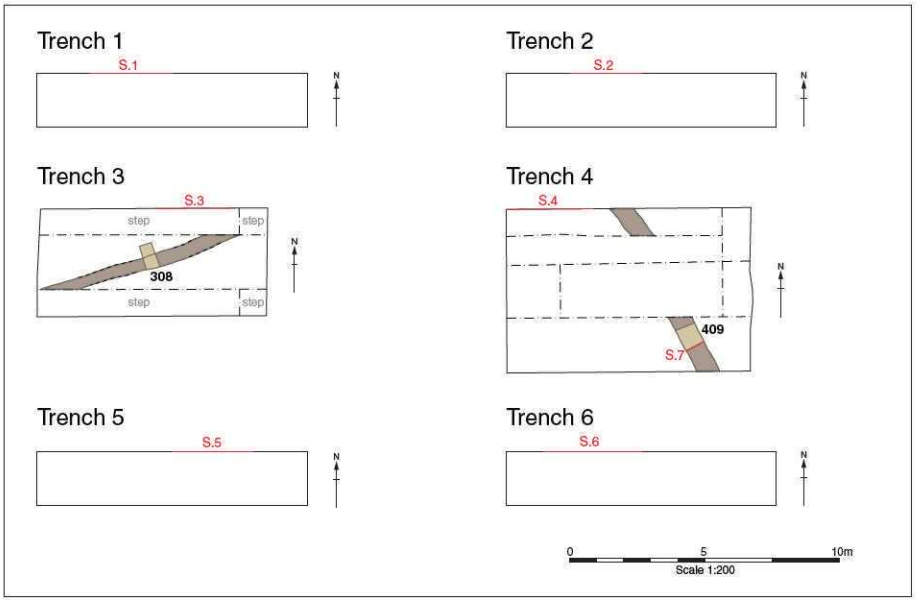


Figure 2: Trench plans

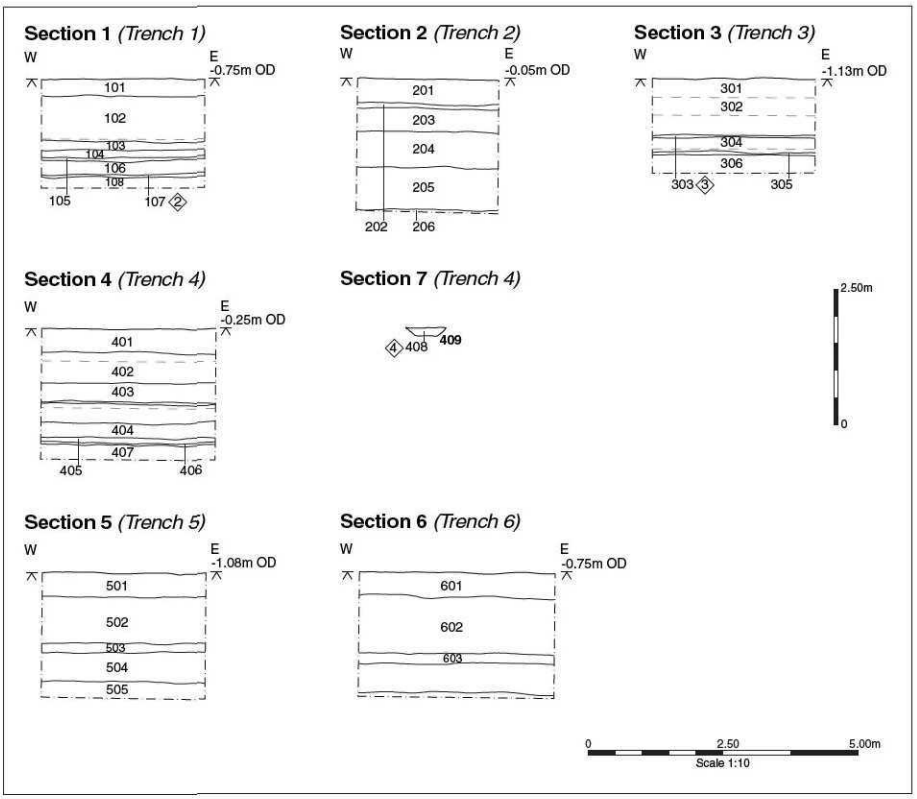


Figure 3: Section drawings

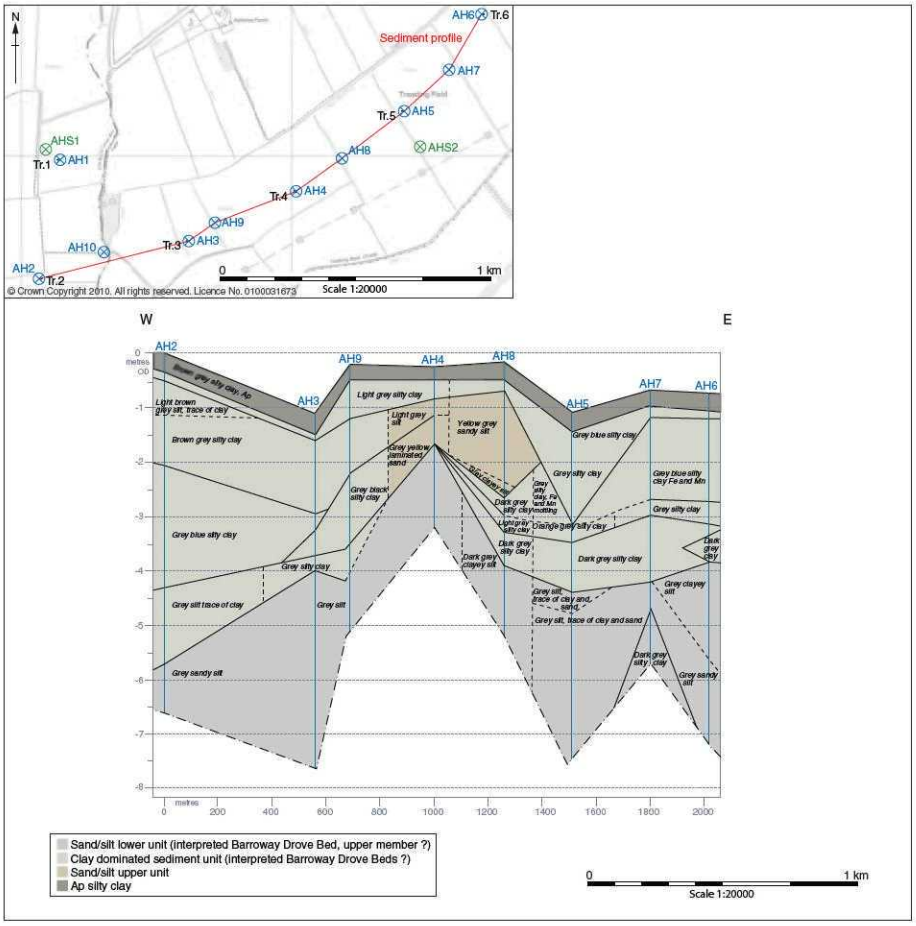


Figure 4: Sediment profile from auger survey



Plate 1: Trench 1



Plate 2: Trench 2

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Plate 3: Trench 4



Plate 4: Ditch **409**, Trench 4



Plate 5: Trench 6



Plate 6: Working shot

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Appendix 11.3 - Scoping Document

Appendix 11.3

Historic Environment; Detailed scoping document sent by AE to heritage bodies 2010-10-4.



TREADING WIND FARM (Proposed)

CAMBRIDGESHIRE/LINCOLNSHIRE BORDER

SCOPING DOCUMENT

PROJECT OUTLINE AND METHODOLOGY FOR HISTORIC ENVIORNMENT COMPONENT OF ENVIRONMENTAL ASSESSMENT.

Project AE 0088-2010

Archaeo-Environment Ltd

On behalf of

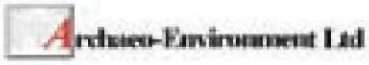
WindVentures

engena

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Registered number 04727850

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2.0 Location and project description

3.0 Scope of EIA study

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Figure 2: Proposed Treading Wind Farm showing development and archaeological features.

Figure 3: Proposed locations of view points for the production of visualisations

TREADING WIND FARM (Proposed)

CAMBRIDGESHIRE/LINCOLNSHIRE BORDER

1.0 INTRODUCTION

1.1 This document has been produced for the purpose of consultation and scoping regarding the historic environment issues of the a proposed wind farm at Treading on the border between Lincolnshire and Cambridgeshire, the proposed site is to the east of the village of Sutton St.Edmund, and spans the border between the counties of Lincolnshire and Cambridgeshire (districts of South Holland and Fenland respectively).

1.2 The proposed wind farm falls under the EU Environmental Impact directive as enacted in English law through the *Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999*. Historic environment will therefore be considered along with a number of other topics arrived at through a screening process in an Environmental Impact Assessment (EIA), the results of which will be presented in an Environmental Statement (ES), to support the planning application in due course.

1.3 This document has been sent to the county archaeologists of Lincolnshire and Cambridgeshire, to the English Heritage East Midlands and East of England offices, and to the conservation officers of Fenland and South Holland district councils. To provide them with an opportunity to identify any concerns or particular issues they feel need addressing prior to completion of the EIA and submission of a planning application.

1.4 This document is concerned solely with historic environment issues, where the historic environment is seen as the interrelated totality of buried and upstanding archaeological remains, historic buildings and structures, designed landscapes, historic battlefields, historic landscape character and cultural and artistic associations. This encompasses both statutorily protected assets such as listed buildings, scheduled monuments and conservation areas; as well as non statutorily protected assets such as sites noted on the relevant county historic environment record.

1.5 The EIA process will consider both direct impacts on the historic environment resource of the proposed development site and related areas; and also indirect impacts such as the setting of heritage assets such as listed buildings, conservation areas and important identified historic views.

1.6 This document while primarily a scoping exercise also contains preliminary information on initial investigations regarding the site.

2.0 LOCATION AND PROJECT DESCRIPTION

The principal elements of the proposed development scheme comprise 6 wind generator turbines, associated hard standings, access roads into the site and between the wind turbines, an anemometry mast, a switchgear building, underground electricity cables and a temporary construction compound.

2.1 The proposed Treading Wind Farm is centred some 7.5km to the north west of Wisbech, and 2 Km to the east of the village of Sutton St.Edmund (Figure 1). The turbines and associated infrastructure, (centred at TF 389 130), span the boundary between two counties Cambridgeshire and Lincolnshire, and two district councils Fenland and South Holland.

2.2 The land upon which the proposed wind farm will be located is arable land with two small stands of trees, and located on either side of the Lady Nunn's Old Eau drain.

2.3 Drift Geology

The available geological information for the application site and adjacent area indicates that the site is underlain by several metres of Flandrian marine alluvium, the Barroway Drove Beds. These deposits consist of mainly soft, silty clays with numerous root traces which were deposited as part of a salt marsh. These deposits contain a complex network of silt in-filled channels or 'roddens' which are the remnants of tidal creek deposits and are often seen at surface as sinuous ridges. These roddens are marked in definite areas of the site on the geological map, and are clearly seen on various aerial surveys including coverage available through Google Earth[1].

2.4 Solid Geology

The available geological information for the area indicates that locally the drift deposits overlie rocks of the Jurassic Corallian Group which comprise the undifferentiated mudstones of the West Walton Beds and the clays of the Ampthill Clay. Little borehole data is available in the area so the thickness of the sequence is unknown.

2.5 The wind farm site is located on largely flat reclaimed fen land with an elevation between approximately -1m and +1m OD. The site is divided by a number of manmade drains principally the Treading Drain running NNE to SSW which feeds into the Lady Nunn's Old Eau which is aligned north to south. Several minor roads surround the site which is crossed by several wide, rough, surfaced farm tracks and one public right of way running north to south along Elloe Bank which follows the east side of the Lady Nunn's Old Eau.

2.6 A single significant stand of plantation trees with some natural regeneration adjacent to the PROW at Elloe Bank together with a smaller rectangular plantation and hedge row to the east are the only features to relieve a largely level and open area where field boundaries are largely formed by deeply incised and straight drains. With these

[1] Accessed 2010-8-11

exceptions the area is entirely under arable cultivation for a mixture of wheat, beans and rape.

2.7 The precise choice of turbines has yet to be decided upon, but at present it is proposed to use 6 wind generator turbines (with a hub height of up to 80m and blade tip of 125m) as well as ancillary equipment, onsite infrastructure and a new site access arrangements (Figure 2). The foundations for the turbine bases will be dependent upon topographical, geotechnical and hydrological conditions, but it is anticipated that the foundations will be a reinforced concrete gravity structure. This will involve the excavation and removal of soils within an area of up to 20m by 20m to a depth of up to 2.0m below ground level. The excavated material would be separated into top soil and sub soil and temporarily stored around the foundations for re-use as backfill upon completion of construction. A reinforced concrete foundation approximately 18m by 18m by up to 1.75m would then be constructed on top of the excavated level.

2.9 Access tracks to the site and between the turbine bases would utilise some existing farm tracks with a degree of upgrading, and require the construction of short lengths of additional track (figure 2). It is not anticipated track construction will require excavation below the existing cultivation horizons.

2.10. A metrological mast will be erected on site also within the area of the turbines requiring foundations but of a significantly smaller size than the turbines.

2.11 The single storey electrical switchgear building would be located adjacent to the proposed access road at the north east corner of the site.

2.12 The temporary construction compound would be located adjacent to the electrical switch gear building. This would involve the excavation of soil within this area to a depth of up to 0.2m, the excavated material being replaced with graded and compacted stone. The excavated material would be temporarily stored around the compound for reuse. Again as with tracks elsewhere across the site this excavation will be within the already disturbed cultivation horizons.

3.0 SCOPE OF EIA STUDY

The study will involve four related components;

1. Desk based/documentary study
2. Site walkover survey
3. Assessment of setting and views
4. Archaeological Evaluation

3.1 *Desk based study*: A full range of historic environment data will be searched and will utilise as a minimum;

- Historic Environment Records for Cambridgeshire & Lincolnshire
- National Monuments Record
- Aerial Photographic collections

- Fenland Collection (Wisbech)
- Wisbech Museum
- Environment Agency LIDAR data
- Historic Mapping
- Conservation Area appraisals
- Listing/scheduling/designation documentation.

A search has already been made of the Cambridgeshire, and Lincolnshire Historic Environment Records and the National Monuments Record. Historic environment assets recorded within the close vicinity of the development footprint are listed in Appendix 1 and indicated on Figure 2. Each of these have been allocated an individual 'site' number (their relevant Cambridgeshire, Lincolnshire and National Monuments Record numbers are included within Appendix 1)

A total of 14 sites are located within the vicinity of the wind farm but only one is located within the development footprint (Site1). The majority of the sites are located to the east and south on marginally higher ground. Most of the identified sites, apart from a smattering of post medieval listed buildings, are sub surface crop or parch mark features identified from aerial photographs. As such they are undated but in form they appear to be enclosures of likely late prehistoric or Romano-British date, and one surface scatter of Romano-British pottery has been recorded immediately outside of the eastern boundary of the site (Site 2).

The nearest listed building is Honeyhill Farmhouse (Grade II), just under 1km to the south of the development boundary, other listed buildings and the nearest conservation areas at Parsons Drove and Levington are over 1km from the nearest turbine.

3.2 *Walk Over Survey:* The site is largely under arable cultivation and while a full field walking survey will not be undertaken as part of the pre-determination evaluation (see 3.4 below), the site will be walked over in detail to identify any previously unrecorded archaeological sites and identifiable surface artefact material.

3.3 *Setting & Views*: All designated heritage assets within a 10km radius of the site will be identified. Heritage assets and their settings should only be judged on relevant characteristics o designation and significance. Therefore impact on setting will only be considered in so far as the proposed development contributes to or detracts from the special architectural, historic and archaeological interest of a site.

The proposed approach is focused and appropriate and will not research or visit every heritage asset within the ZTV as this would require many hundreds of hours work, much of which would be nugatory.

We will visit and research **all** designated assets within a 2km radius of the nearest turbine and within the ZTV.

We will visit all Conservation Areas (and those Grade I and II* listed buildings not in Conservation Areas), all Scheduled Monuments and Historic Parks and Gardens within 5km of the development proposal.

We will visit and research any heritage assets which may have designed views over a considerable area towards the development site and up to 15km from the nearest turbine

We will use this fieldwork and research to identify a number of visualisations in order to help predict the impact of the proposal. Visualisations will be presented as either wire frame or photomontage. Provisionally the following have been identified as positions for visualisations for both Landscape and Historic Environment issues within the EIA. The positions of these are shown on Figure 3.

LVIA no	Viewpoint location	NGR	NGR	Distance (km)	Bearing from WF	Historic Environment
1	Cross Drove near Crane House	540387	313699	0.6	E	Assess any affect on views of the Church tower Grade II* listed.
2	Sutton St Edmund	536803	312845	1.3	W	
3	B1166 Parsons Drove	538190	308815	3.6	S	Incorporates Important view from within the conservation area identified in Conservation Area Appraisal
4	B1169 Leverington Common	542352	309831	4.3	SE	
5	Roman Bank, sustrans route	544123	312787	4.9	SE	Important view point from publically accessible section of The Seabank. Alternative location 27 below) also to considered
6	B1167 by New South Eau	533219	308924	5.9	SW	
7	B1168 Holbeach St Johns	534661	318307	6.2	NW	
8	A47 SW of Wisbech	543436	306381	7.7	SE	
9	Nene Way Tydd St Marys Marsh	547161	318924	9.1	NE	

LVIA no	Viewpoint location	NGR	NGR	Distance (km)	Bearing from WF	Historic Environment
10	Nene Way near Guyhirn Corner	538461	302087	10.4	S	
11	B1166 Great Postland	527505	311717	10.6	W	
12	Holbeach, Hall Gate	535063	324433	11.7	NNW	
13	B1167 Thorney	529342	304163	12	SW	
14	Weston Hills	528290	321238	12.7	NW	
15	Marshland St James, Whalpole Highway	551639	308619	12.9	SE	
16	West Fen	536002	296979	15.5	S	
Viewpoints specifically identified for heritage purposes						
17	Providence House	529666	314188	8.4	NW	Scheduled Ancient Monument Settlements and medieval boundary earthworks.
	Medieval Crosses all SMs					
18	St.Ives Cross; Sutton St.James	538931	318164	3.8	NE	
19	Boundary Cross, Old Fen Dyke	538103	317292		NE	
20	Boundary Cross, Manor Hill	540783	317113		NE	
21	White Cross	541872	318579		NE	
22	Red House bridge	539647	319492	3.7	N	Setting of Sutton St.James Tower Grade II*).

LVIA no	Viewpoint location	NGR	NGR	Distance (km)	Bearing from WF	Historic Environment
23	Tretton Bridge	542787	316784	4.1	NE	Setting of Tydd St.Giles Tower Grade II*).
24	Makinder Farm/Pear tree Cottage	531169	310667	7.8	SW	Gedney Hill (4.6 KM) Setting of Listed Buildings to the west at Gedney Hill including the Church Tower (Grade II*) and SM Li285
25	Broadgate Road, north of Sutton St Edmund	537107	315104	2	WNW	View of wind farm site from the North to include Guanock House and garden, Grade II but nearest LB.
26	Roman Bank,	544885	311102	4.9	SE	Variation or alternative to 5 (above) including both Seabank and with Cherry Tree barrow in the foreground with the spire of Leverington Church within the conservation area between the view point and the wind farm

3.4 *Evaluation:* While initial data collation has not indicated any specific archaeological sites within the development boundary, discussions with the county archaeologists for Lincolnshire and Cambridgeshire have concluded that the site is of some archaeological potential. A written scheme of investigation (WSI) was agreed and a scheme of evaluation has been carried out during September 2010.

The agreed pre-determination evaluation consisted of:

- The excavation of six evaluation trenches each 10m x 2m and a maximum of 2m in depth on the site of each proposed turbine.
- A palaeo-environmental investigation by means of auger survey of the depositional sequences and other deposits within the area of the development.
- A post excavation assessment and interim report
- Scientific analysis of finds
- Production of final report and archive

At the time of preparation of this document results were largely negative. The report will be incorporated into the ES in due course and as appropriate a scheme of mitigation proposed to accompany the development should it be approved.

Date: October 4th 2010

Text: Niall Hammond

Illustrations: Archaeo-Environment

APPENDIX 1

ARCHAEOLOGICAL SITES WITHIN 1 Km OF PROPOSED WIND FARM (Figure 2).

Sites within the boundary of the development site are shaded grey.

HER numbers are prefixed with C for Cambridgeshire, L for Lincolnshire and NMR for National Monuments Record.

Project Number	HER No.	Grid Ref E	Grid Ref N	Classification	Historic Period	Statutory Designation
1	C8422	53840	31270	Duck Decoy Pond of 1749.	Post Med	none
2	L22309	53777	31313	Romano-British Pottery Scatter	Iron-Age-Roman	none
3	L22307	53766	31178	Possible settlement, enclosure & artefact scatter	Iron-Age-Roman	none
4	L22330	53820	31195	'Straight Reach' possible enclosure & artefact scatter	Undated	none
5	L22331	53805	31155	'Willow Bank' Enclosure	Undated	none
6	L22303	53771	31383	Guanock Cottage	Undated	none
7	L20505	53770	31457	Guanock House site of medieval monastic grange and moat	Medieval	LB Grade II
8	L20506	53660	31412	Crop mark Linear enclosure	undated	none
9	L22306	53646	31328	Cropmark enclosure	Undated	none
10	L20507	53721	31457	Linear undated feature possible drain or drove	undated	none
11	NMR-DLi6558	537766	31465	Guanock House	Post medieval	LB Grade II

Project Number	HER No.	Grid Ref E	Grid Ref N	Classification	Historic Period	Statutory Designation
12	NMR DLi3648	53682	31323	Church of St.Edmund		LB Grade II
13	NMR DLi 6557	5368	31320	Headstone in graveyard of church of St.Edmund	Post medieval	LB Grade II
14	C48117	53956	31180	Honeyhill Farm House	Post medieval	LB Grade II

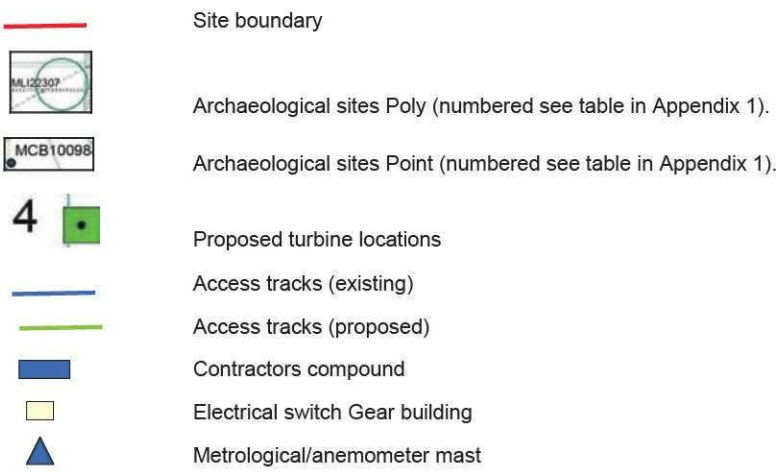
Figures.

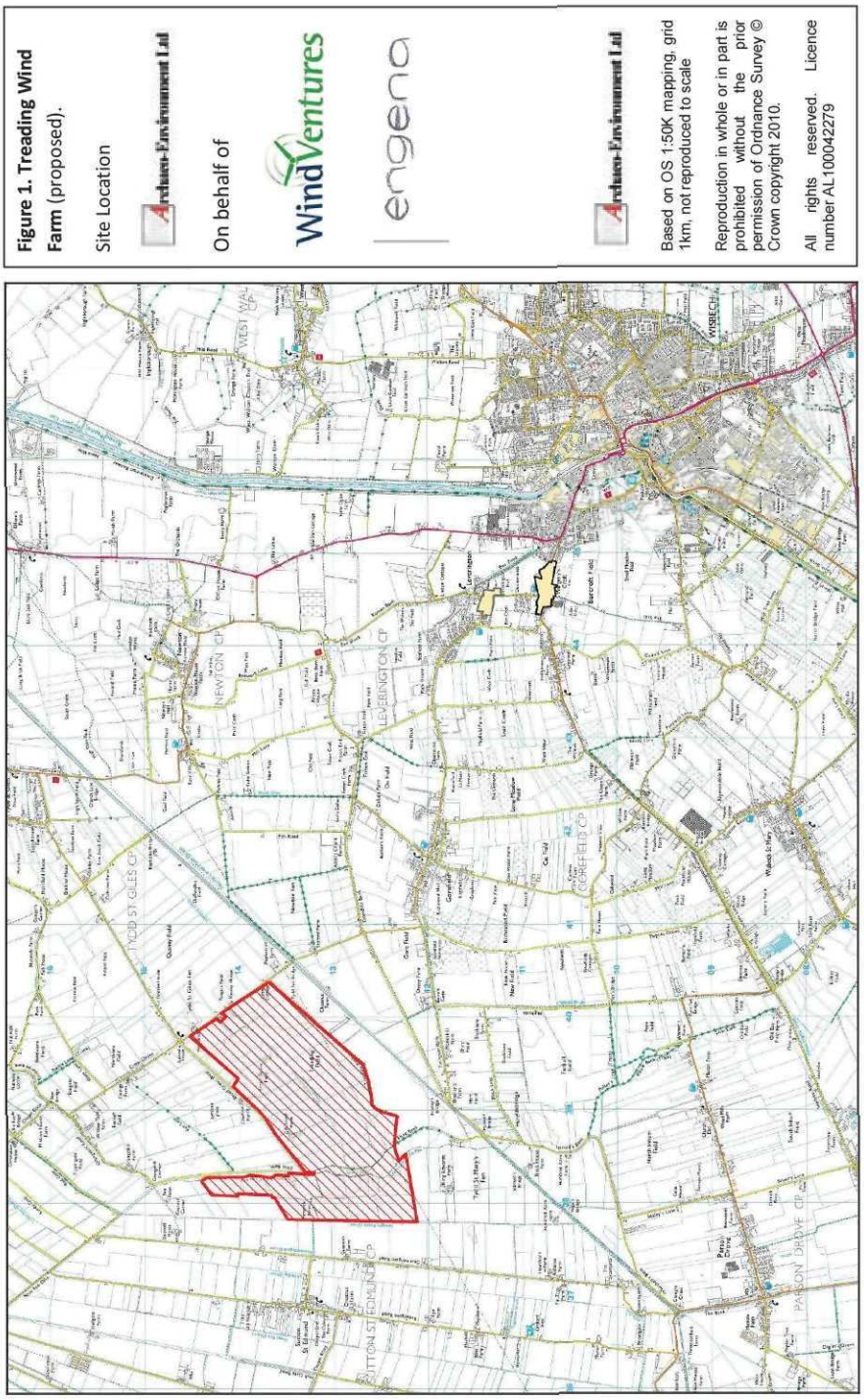
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Figure 1: Proposed treading Wind Farm location.

Figure 2: Proposed Treading Wind Farm showing the following features.

Key




Figure 1. Treading Wind Farm (proposed).
Site Location
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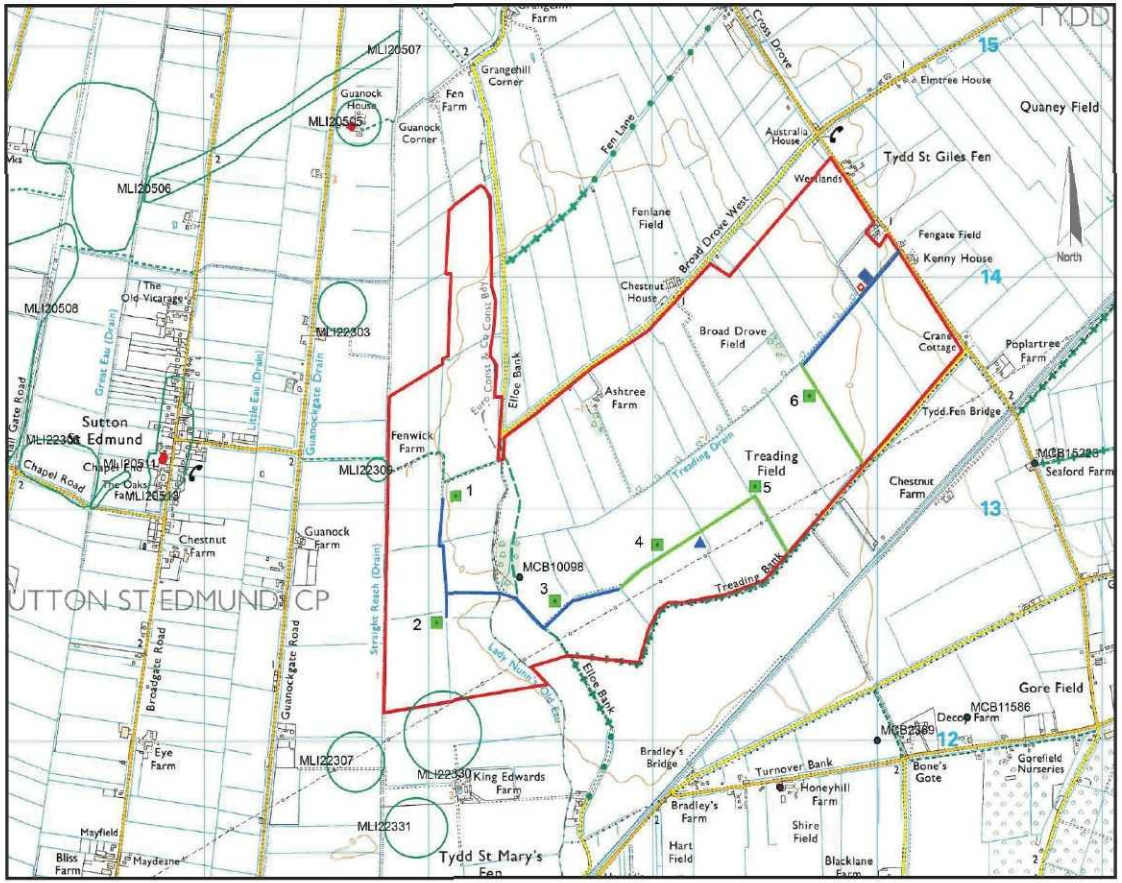


Figure 2. Treading Wind Farm (proposed).

Development and Archaeological Features

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WindVentures

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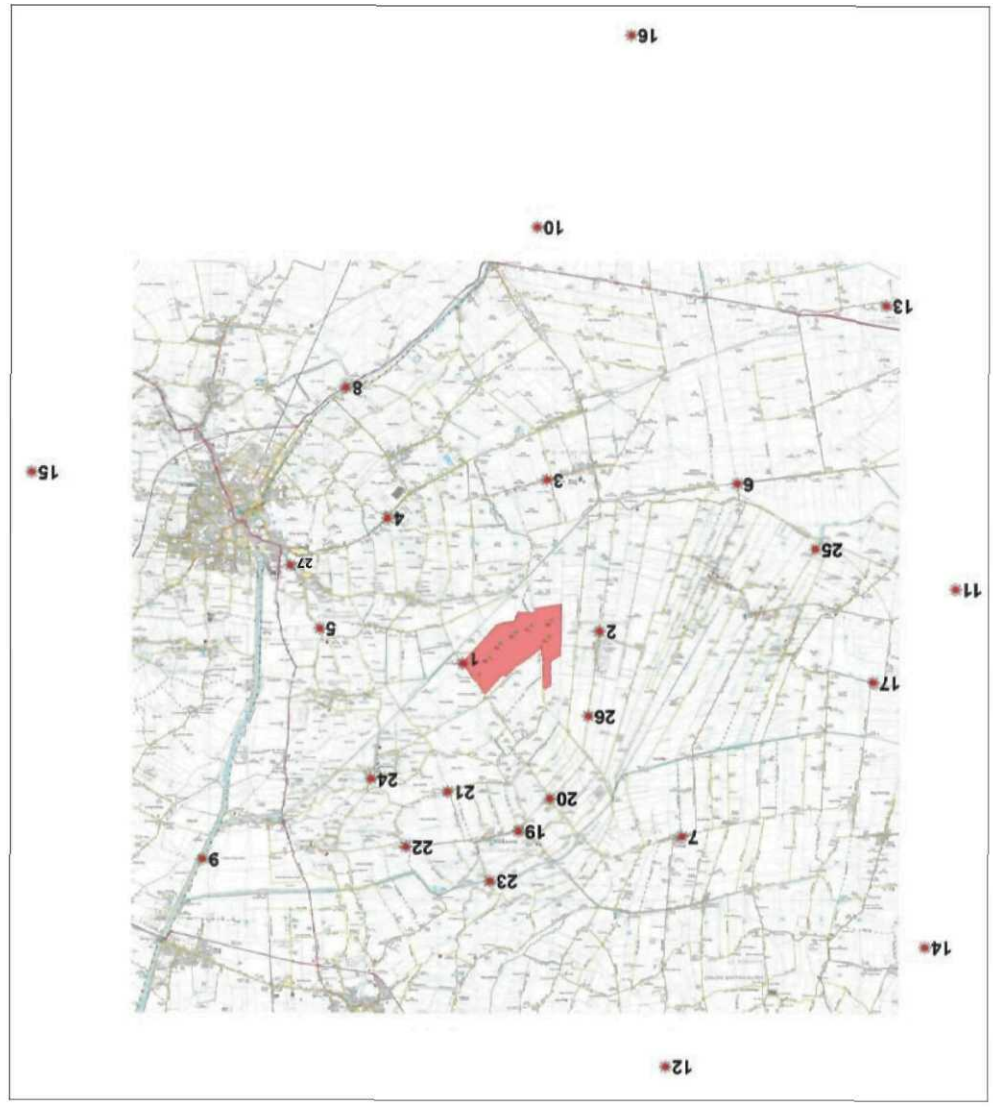


Figure 3. Treading Wind Farm (proposed).

Location of proposed visualisation view points.

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On behalf of

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APPENDIX 12. ORNITHOLOGY

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Appendix 12.1 - Ornithology Appendix

WILD FRONTIER ECOLOGY

Treading Wind Farm Proposal



Ornithology Appendix 13.1

November 2010

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1 Brief

Wild Frontier Ecology Ltd was contracted by Wind Ventures Ltd to carry out ornithological survey and assessment of the proposed Treading Wind Farm site, on the Cambridgeshire/ Lincolnshire county boundary.

The objective of this survey was to provide information concerning the status of avifauna at the proposed wind farm site. This information would then be used to inform assessment of potential impacts of the development to the bird species, and to recommend mitigation measures if required.

2 Methodology

2.1 Overview

The study site was assessed for birds using the following methods:

- Overall evaluation of the study site and surrounding area as a habitat for birds (e.g. foraging areas, potential roosting sites, and probable flyways) from a site walkover, the Phase I habitat survey results, Ordnance Survey maps and aerial imagery.
- Desk study of bird records provided by the Cambridge and Peterborough Biological Record Centre and the Lincolnshire Biodiversity Partnership in a search radius of 2km from the proposed turbines (see Appendix 12.1 for full details of the biological records search). Two records centres were consulted as the proposal site straddles a county boundary. The Cambridge Bird Club and Lincolnshire Bird Club annual bird reports were also used for this study.
- Vantage point (VP) and breeding bird surveys were used. The vantage point locations and survey transects are shown in figure 1.

2.2 Survey Dates

2.2.1 Table 1: Treading Vantage Point Survey Details (Western VP)

Date of Survey	Survey Time		Hours	Cloud Cover		Visibility (G=Good, M=Moderate, P=Poor)		Wind Direction		Wind Force (Beaufort Scale)		Notes
	Start	Finish		Start	Finish	Start	Finish	Start	Finish	Start	Finish	
26/11/2009	8:30	11:30	3	1/8	0/8	G	G	SW	SW	4	5	
26/11/2009	12:00	15:00	3	0/8	3/8	G	G	SW	SW	3	5	
30/11/2009	8:30	11:30	3	5/8	1/8	G	G	NE	NE	2	3	
10/12/2009	8:20	11:20	3	0/8	0/8	G	G	NW	NW	1	2	
16/12/2009	8:10	11:10	3	8/8	5/8	M	M	SW	SW	0	1	
23/12/2009	8:00	11:00	3	0/8	0/8	G	G			0	0	Bright and very cold. Snow cover
12/01/2010	12:20	15:20	3	8/8	8/8	G-M	M	SE	SE	2	3	
19/01/2010	7:30	10:30	3	8/8	8/8	P	P	NE	NE	1	1	Foggy throughout
21/01/2010	7:40	10:40	3	8/8	8/8	M	M	SE	SE	1	1	
04/02/2010	13:30	16:30	3	8/8	8/8	M	M	SE	SE	0	0	Light rain
16/02/2010	10:30	13:30	3	5/8	7/8	G	G	SW	SW	2	2	

22/02/2010	8:00	11:00	3	8/8	8/8	M	G	N	N	2	2	
04/03/2010	8:15	11:15	3	0/8	3/8	G	G		NE	0	2	
18/03/2010	8:05	11:05	3	8/8	8/8	G	G	SW	SW	2	2	Mild
22/03/2010	13:30	16:30	3	7/8	8/8	G	G	SW	SW	4	3	Infrequent light showers
05/04/2010	11:25	13:25	2	8/8	8/8	G	G	SW	SW	4	4	Cold
05/04/2010	13:45	15:45	2	8/8	8/8	G	G	SW	SW	5	4	
05/04/2010	16:05	17:05	1	8/8	7/8	G	G	SW	SW	4	3	Mild
12/04/2010	14:00	16:00	2	1/8	2/8	G	G	NE	NE	4	3	Bright and hazy
14/04/2010	8:05	9:05	1	8/8	8/8	G	G	NE	NE	3	3	Cold and dull
14/04/2010	10:50	12:50	2	5/8	3/8	G	G	E	NE	2	4	Bright and hazy with cold wind
07/05/2010	9:20	10:20	1	4/8	5/8	G	G	NE	NE	4	4	
07/05/2010	11:40	13:40	2	3/8	4/8	G	G	NE	NE	3	4	
19/05/2010	9:30	11:30	2	2/8	4/8	G	G			0	0	Warm, hazy sunshine
21/05/2010	19:00	21:00	2	4/8	2/8	G	G	NE		1	0	
21/05/2010	16:30	18:30	2	5/8	4/8	G	G	NE	NE	2	1	Warm
08/06/2010	7:00	9:00	2	8/8	8/8	G	G	SW	SW	3	3	Steady rain, some heavy bursts
08/06/2010	9:30	11:30	2	8/8	8/8	G	G	SW	SW	3	1	Light rain
09/06/2010	9:30	11:30	2	8/8	8/8	G	G		SW	0	1	
17/06/2010	16:35	18:35	2	0/8	0/8	M	G	NE	NE	3	2	
25/06/2010	9:05	11:05	2	0/8	0/8	G	G	NE	NE	1	2	
30/06/2010	19:10	21:10	2	4/8	5/8	G	G			0	0	
15/07/2010	7:15	9:15	2	8/8	8/8	G	G	SW	SW	4	5	
15/07/2010	9:30	11:30	2	8/8	8/8	G	G	SW	SW	5	6	
19/07/2010	7:15	9:15	2	7/8	6/8	G	G	SW	SW	1	2	
22/07/2010	8:20	10:20	2	2/8	5/8	G	G	SW	SW	1	2	
22/07/2010	10:40	12:40	2	5/8	6/8	G	G	SW		2	0	
16/08/2010	17:45	19:45	2	0/8	2/8	G	G	NW	NW	3	1	
16/08/2010	15:30	17:30	2	8/8	0/8	G	G	NW	NW	3	3	
19/08/2010	9:10	11:10	2	4/8	7/8	G	G	SW	SW	2	4	
19/08/2010	6:55	8:55	2	4/8	5/8	G	G	SW	SW	1	2	
24/08/2010	7:40	9:40	2	0/8	0/8	G	G	SW	SW	4	4	
03/09/2010	9:45	11:45	2	5/8	4/8	G	G	SW	SW	1	1	
08/09/2010	10:45	12:45	2	8/8	8/8	G	G	N	NE	1	2	
15/09/2010	10:00	12:00	2	4/8	8/8	G	G	SW	SW	5	6	
28/09/2010	12:50	14:50	2	8/8	8/8	G	G	E	E	1	1	
28/09/2010	15:05	17:05	2	8/8	8/8	G	G	E	E	1	1	
20/10/2010	12:25	14:25	2	0/8	1/8	G	G	NW	NW	3	4	Cold
22/10/2010	10:20	12:20	2	5/8	1/8	G	G	SW	SW	3	2	
22/10/2010	12:40	14:40	2	1/8	4/8	G	G	W	W	3	4	

25/10/2010	10:15	12:15	2	0/8	0/8	G	G	NW	NW	2	1	
25/10/2010	12:35	14:35	2	0/8	0/8	G	G	NW	NW	1	1	
TOTAL			116									

2.2.2 Table 2: Treading Vantage Point Survey Details (Eastern VP)

Date of Survey	Survey Time		Hours	Cloud Cover		Visibility (G=Good, M=Moderate, P=Poor)		Wind Direction		Wind Force (Beaufort Scale)		Notes
	Start	Finish		Start	Finish	Start	Finish	Start	Finish	Start	Finish	
24/08/2010	9:55	11:55	2	2/8	7/8	G	G	SW	SW	4	5	
24/08/2010	12:20	14:20	2	7/8	8/8	G	G	SW	SW	5	5	Some heavy showers
27/08/2010	8:20	10:20	2	8/8	6/8	G	G	NW	NW	3	2	
27/08/2010	10:35	12:35	2	5/8	4/8	G	G	NW	NW	2	2	
31/08/2010	13:55	15:55	2	2/8	3/8	M	M	NW		1	0	Heat haze
03/09/2010	7:30	9:30	2	8/8	4/8	P	G			0	0	mist for 1st hour then cleared
08/09/2010	8:30	10:30	2	8/8	8/8	M	G-M			0	0	misty / hazey
15/09/2010	7:45	9:45	2	0/8	4/8	G	G	SW	SW	3	4	
27/09/2010	11:40	13:40	2	8/8	8/8	M	G	N	N	3	3	slight haze / mist lifting
27/09/2010	13:50	15:50	2	8/8	8/8	G	G	N	N	3	3	
05/10/2010	7:55	9:55	2	8/8	8/8	M	G	SW	SW	3	2	rain for approx. 1 hour
05/10/2010	10:10	12:10	2	8/8	6/8	G	G	SW	SW	2	2	
12/10/2010	8:15	10:15	2	8/8	8/8	M	M	NE	NE	2	2	
12/10/2010	10:30	12:30	2	8/8	8/8	G	G	NE	NE	2	2	
26/10/2010	8:15	10:15	2	8/8	8/8	G	G	SW	SW	3	3	Rain throughout
11/11/2010	9:30	11:30	2	8/8	8/8	M	M	SW	SW	5	5	driving rain for 1st hour
16/11/2010	13:10	15:10	2	0/8	0/8	G	G			0	0	
18/11/2010	14:20	16:20	2	7/8	8/8	G	P	S	S	2	2	light rain showers
19/11/2010	8:00	10:00	2	8/8	8/8	P	P			0	0	Foggy
19/11/2010	10:10	12:10	2	8/8	8/8	P	P			0	0	Foggy
TOTAL			40									

The breeding bird surveys were conducted over two separate years, as the site was extended to include three eastern turbines after the CBC visits of 2009 had been completed.

2.2.3 Table 3: Breeding Bird Survey Details - Eastern Half

Date	Times	Duration (hr.min)	Weather Conditions
14/04/10	09.10 - 10.45	1.35	No details
07/05/10	06.50 - 08.55	2.05	8/8 cloud, wind NE force 2-4
19/05/10	06.30 - 08.50	2.20	0/8 - 2/8 cloud, calm
09/06/10	06.45 - 09.00	2.15	5/8 - 8/8 cloud, calm
25/06/10	06.45 - 08.40	1.55	0/8 cloud, calm

2.2.4 Table 4: Breeding Bird Survey Details - Western Half

Date	Times	Duration (hr.min)	Weather Conditions
29/04/09	07.00 - 09.00	2	0/8 cloud, light mist burning off, light variable wind
12/05/09	06.10 - 08.00	1.50	1/8 cloud, sunny, wind N force 3-4
28/05/09	06.15 - 08.15	2	8/8 cloud, wind SW force 3
15/06/09	06.40 - 08.30	1.50	8/8 cloud, calm, mild
30/06/09	07.30 - 09.30	2	0/8 cloud, hot and sunny

2.3 Field Survey Protocols - Vantage Point Survey

Using aerial photography and Ordnance Survey maps to assess the terrain of the site a single vantage point was selected to ensure full coverage of the site using the guidance as set out in both Natural England Technical Information Note TIN069 (Natural England, 2010)[1] and Survey Methods for Use in Assessing the Impacts of Onshore Windfarms on Bird Communities (Scottish Natural Heritage 2005)[2]. However the TIN069 guidance was published whilst the surveys were already underway (in January 2010) and these new guidelines recommended a viewing distance of no more than 1 km from the vantage point. Initially it was felt that this new guidance was not strictly applicable to this site, due to the relatively featureless and flat characteristics of the study area; the surveyor was confident that the whole site was observable from the western VP, even though the site extended beyond 1km to the east. However, as the surveys continued into the summer it was noted that a small section around the position of the easternmost proposed turbine was not entirely visible, as a discontinuous line of trees partially obscured views. This issue was less pertinent in the winter, when these trees were bare, but once their foliage thickened the views beyond the trees became partially obscured.

In order to ensure that avian activity within this small section of the site was not going unrecorded a second vantage point was established on the eastern perimeter of the site. The point of this eastern VP was primarily to check that the small section of the site which was not wholly visible from the western VP was not being used by birds which might not have been recorded from the other side of the site. The western VP continued to be used to record birds over the whole site, with the eastern VP used only to ensure that avian activity over this part of the site was similar to that being recorded over the remainder of the study area.

[1] Natural England. 2010. Natural England Technical Information Note TIN069, Assessing the effects of onshore wind farms on birds. Natural England, Peterborough

[2] Scottish Natural Heritage. 2005. Survey Methods for Use in Assessing the Impacts of Onshore Windfarms on Bird Communities. Scottish Natural Heritage, Battleby.

The study area (western VP) was visited on 39 occasions over the period from 26th November 2009 to 25th October 2010 (see Table 1) and on 14 occasions (eastern VP) over the period from 24th August to 19th November 2010 (Table 2). The survey period was continuous through this time. Surveys from the eastern VP are due to continue through to the end of March 2011.

Only the presence/movements of target species (i.e. those considered vulnerable to collision) were fully documented. Vulnerable species were accepted as those which are listed in Langston & Pullan (Langston and Pullan 2004)[3], Assessing significance of impacts from onshore windfarms on birds outwith designated areas (Scottish Natural Heritage 2006)[4], and other species judged to be at risk based on professional opinion and other published reports. The vantage point watches focused mainly on evaluating the use of the study site by waders, raptors and waterfowl.

During the vantage point surveys, data was recorded for each target species sighting. Data recorded for each observation included the following: time of sighting, bird count, direction of flight, estimated height(s) of flight in metres, description of flight behaviour/activity, length of time observed, special notes (e.g. sex of bird observed, mobbing, hunting), and a map reference number. Maps were drawn of all flight patterns observed during each vantage point survey.

2.4 Field Survey Protocols - Breeding Bird Survey

These surveys were an adaptation of the methodology detailed by the British Trust for Ornithology (BTO) in their Common Bird Census (CBC) (Gilbert at al. 1998)[5] and concentrated on recording and mapping Red and Amber list species breeding on the site. Green list species were recorded as present, but territories were not counted.

Five survey visits, conducted between April and June 2009 (western section), and April and June 2010 (eastern section) were seen as an appropriate level of survey to determine which species were nesting on the site, and to give an estimate of their abundance (as opposed to the monitoring purposes of the CBC achieved using eight to ten visits).

Breeding bird surveys were conducted just after dawn along a pre-determined transect route. This route was walked at a slow and steady pace and covered all points within 500 metres of proposed turbine positions. Birds just outside the buffer zone were also recorded on the assumption that part of their territory may overlap with the study site.

Nesting and territorial behaviour (singing, nest building, carrying food, fighting, copulation, nest locations, alarm calling, carrying faecal sacs) were noted by standard codes, as were the age and sex of the birds concerned. Non-nesting behaviour such as over-flying the site was also noted, together with the direction of movement. Birds not considered likely to be nesting on site were still noted where observed.

The site was covered in two sections (eastern and western),due to the addition of the three eastern turbines after the initial 2009 surveys were conducted. The surveys for the eastern section of the site were undertaken in 2010.

Potential barn owl nesting sites (nest boxes, suitable buildings, and large trees) were also searched for within the study site.

[3] Langston R.H.W. and Pullan J.D. 2004. Windfarms and Birds: An analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues. Report written by Birdlife International on behalf of the Bern Convention. Council Europe Report T-PVS/Inf.

[4] Scottish Natural Heritage 2006. Assessing significance of impacts from onshore windfarms on birds outwith designated areas. Scottish Natural Heritage, Battleby

[5] Gilbert G., Gibbons D.W., and Evans J. 1998. Bird Monitoring Methods. RSPB, Sandy.

All breeding bird surveys were conducted by ornithologists with at least 10 years' professional experience.

3 Results

3.1 Vantage Point Survey

The vantage point surveys recorded nineteen target species of bird that are considered to be vulnerable to wind turbine collision over the study site.

Vulnerability to wind turbine collision is based primarily on work by Langton & Pullen (2004), Scottish Natural Heritage (2006) and Wind Turbines and birds in Flanders (Belgium) (Everaert and Kruijken 2007)[6].

A species' conservation status is considered in relation to its inclusion on the EC Birds Directive 1979, the Wildlife and Countryside Act (WCA) 1981 (as amended), the Birds of Conservation Concern (BoCC) Red and Amber Lists of species of conservation concern (Eaton et al 2009)[7], the UK Biodiversity Action Plan (UKBAP) lists of globally threatened/declining species and Local Biodiversity Action Plans (LBAP).

3.1.1 Table 5: Target Species of Conservation Concern Observed During VP Surveys

Species	Conservation status	Occurrence in study area November 2009 - October 2010	Reference(s) for impact vulnerability
Barn Owl	WCA Schedule 1; BoCC Amber list	1 overflight of 1 bird	Langston & Pullan 2004;
Golden Plover	EU Annex 1; BoCC Amber list	20 overflights totalling 1,159 birds, max flock size 500.	Langston & Pullan 2004; Scottish Natural Heritage 2006
Green Sandpiper	WCA Schedule 1; BoCC Amber list	9 overflights totalling 11 birds, occasional pairs seen.	Scottish Natural Heritage 2006
Hen Harrier	EU Annex 1; WCA Schedule 1; BoCC Red listed	2 overflights totalling 2 birds	Scottish Natural Heritage 2006
Kestrel	BoCC Amber list	244 overflights totalling 250 birds, occasional pairs seen.	Everaert & Kruijken 2007
Lapwing	BoCC Red listed; UKBAP; LBAP	43 overflights totalling 3,143 birds, max flock size 370.	Langston & Pullan 2004
Little Egret	BoCC Amber list	6 overflights totalling 6 birds	
Marsh Harrier	EU Annex 1; WCA Schedule 1; BoCC Amber listed	62 overflights totalling 64 birds, occasional pairs seen.	Scottish Natural Heritage 2006
Merlin	EU Annex 1; WCA Schedule 1; BoCC Amber listed	8 overflights totalling 8 birds	Scottish Natural Heritage 2006
Peregrine	EU Annex 1; WCA Schedule 1	9 overflights totalling 9 birds	Everaert & Kruijken 2007; Scottish Natural Heritage 2006
Pink-footed	BoCC Amber listed	1 overflight of 1 bird	Langston &

[6] Everaert J. and Kruijken E. (2007). Wind turbines and birds in Flanders (Belgium) - preliminary summary of the mortality research results. Research Institute for Nature and Forest.

[7] Eaton MA, Brown AF, Noble DG, Musgrove AJ, Hearn R, Aebischer NJ, Gibbons DW, Evans A and Gregory RD. 2009. Birds of Conservation Concern 3: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man. *British Birds* 102, pp296-341

Species	Conservation status	Occurrence in study area November 2009 - October 2010	Reference(s) for impact vulnerability
Goose			Pullan 2004
Redshank	BoCC Amber listed	1 overflight of 1 bird	Langston & Pullan 2004
Snipe	BoCC Amber listed	6 overflights totalling 8 birds, occasional pairs seen.	Langston & Pullan 2004
Shelduck	BoCC Amber listed	7 overflights totalling 14 birds, max flock size 7.	Langston & Pullan 2004

3.1.2 Table 6: Target Species of Low Conservation Concern Observed During VP Surveys

Species	Conservation status	Occurrence in study area December 2008 - October 2010	Reference(s) for impact vulnerability
Buzzard	Basic protected under WCA 1981; BoCC Green listed	65 overflights of 69 birds, occasional pairs seen.	Langston & Pullan 2004
Cormorant	Basic protected under WCA 1981; BoCC Green listed	20 overflights of 25 birds, max flock size 4.	Langston & Pullan 2004
Grey Heron	Basic protected under WCA 1981; BoCC Green listed	27 overflights totalling 27 birds	Langston & Pullan 2004
Mute Swan	Basic protected under WCA 1981; UK BoCC Green listed	4 overflights totalling 11 birds, max flock size 5.	Langston & Pullan 2004
Sparrowhawk	Basic protected under WCA 1981; BoCC Green listed	28 overflights totalling 28 birds	Langston & Pullan 2004

3.1.3 Table 7: Non-target species Observed During VP Surveys

The impact vulnerability for birds in this table is Langston & Pullan 2004, except for gulls, which is Everaert & Kruijken 2007. In conservation unless otherwise stated all birds are UK BoCC Green listed and have basic protection under WCA 1981 and are not UKBAP or LBAP species.

Species	Conservation status	Occurrence in study area December 2008 - October 2010
Black-headed Gull	BoCC Amber listed	Commonly observed foraging on and overflying the site, numbers ranging from singles to flocks of several hundred
Blackbird	BoCC Green listed	Observed in small numbers
Blue Tit	BoCC Green listed	Observed twice in low numbers
Brambling	WCA Schedule 1	5 birds observed once
Carrion Crow	BoCC Green listed	Commonly observed in small numbers
Chaffinch	BoCC Green listed	Occasional records
Common Gull	BoCC Amber listed	Commonly observed in small numbers
Feral Pigeon	Not listed	Infrequently observed in small numbers
Fieldfare	BoCC Red listed (Breeding only)	Observed regularly in small numbers with flocks up to several hundred
Goldfinch	BoCC Green listed	Occasional observations
Great Black-backed Gull	BoCC Amber listed	Occasionally observed overflying the site

Species	Conservation status	Occurrence in study area December 2008 - October 2010
Greenfinch	BoCC Green listed	Occasional observations
Green Woodpecker	BoCC Amber listed	3 sightings
Herring Gull	BoCC Red listed, UKBAP	Regular observations of small numbers overflying the site.
House Martin	BoCC Amber listed	Regular sightings in late summer
House Sparrow	BoCC Red listed	Recorded twice from the vantage point
Jay	BoCC Green listed	Occasional observations
Jackdaw	BoCC Green listed	Regularly observed in small numbers
Kingfisher	EU Annex 1; WCA Schedule 1; BoCC Amber listed	One bird observed once from eastern VP
Lesser Black-backed Gull	BoCC Amber listed	Regular observations of small numbers overflying the site
Linnet	BoCC Red listed, UKBAP	Regularly observed, the largest flock containing 182 birds
Little Grebe	BoCC Amber listed	Observed twice in ditches
Long-tailed Tit	BoCC Green listed	Two small flocks observed
Mallard	BoCC Amber listed	Regularly observed overflying the site in small numbers
Magpie	BoCC Green listed	Occasional observations of small numbers
Meadow Pipit	BoCC Amber listed	Regular sightings of small numbers
Mistle Thrush	BoCC Amber listed	Occasional observations
Pheasant	BoCC Green listed	Commonly observed
Red-legged Partridge	BoCC Green listed	Occasional sightings
Redwing	BoCC Red listed (Breeding only)	Occasional observations of small numbers
Reed Bunting	BoCC Amber listed, UKBAP	Regular observations of small numbers
Reed Warbler	BoCC Green listed	Recorded four times
Rook	BoCC Green listed	Commonly observed
Sand Martin	BoCC Amber listed	Recorded six times overflying the site
Sedge Warbler	BoCC Green listed	Observed four times
Siskin	BoCC Green listed	Observed once from the vantage point
Sky Lark	BoCC Red listed, UKBAP, LBAP	Commonly observed in small numbers
Song Thrush	BoCC Red listed, UKBAP, LBAP	Occasional sightings
Starling	BoCC Red, UKBAP	Regular sightings, the largest gathering totalling 500 birds
Stock Dove	BoCC Amber listed	Commonly observed in small numbers
Stonechat	BoCC Green listed	Observed three times
Swallow	BoCC Amber listed	Regular observations of individuals and small groups
Swift	BoCC Amber listed	Regular observations of up to 86 birds
Wheatear	BoCC Amber listed	Recorded four times

Species	Conservation status	Occurrence in study area December 2008 - October 2010
Whitethroat	BoCC Amber listed	Occasional observations
Woodpigeon	BoCC Green listed	Commonly observed in flocks sometimes containing several thousand birds
Wren	BoCC Green listed	Occasionally recorded
Yellowhammer	BoCC Red listed, UKBAP	Regular observations of small numbers
Yellow Wagtail	BoCC Red listed, UKBAP	Regularly observed

Gull species were noted during surveys as a precautionary measure in case significant numbers were over-flying the site in connection with roosting activities. The relatively small numbers observed show the area to be unimportant as a flyway. This is similar for some other Non-Target species.

3.2 Breeding Birds

When compiled after five survey visits, the Common Bird Census data was analysed to provide an estimate of bird breeding territory distribution and quantity [as described in BTO Common Birds Census Instructions (Marchant 1983)[8] and Bird Census Techniques (Bibby et al. 2000)[9]]. This is achieved by isolating the registrations recorded for a single, selected species in each survey visit, and then plotting all of those registrations together on a single map. The resulting cluster of registrations is then interpreted by an experienced ornithologist to define distinct breeding territories. The same methodology is repeated for each species recorded exhibiting nesting and/or territorial behaviour in any or all of the five survey visits.

The breeding bird survey observed a total of 23 bird species demonstrating probable breeding behaviour within the 500m buffer area. 9 of those species have an elevated BoCC status (either BoCC Red or Amber list). All recorded territories of Red-listed and Amber-listed species are mapped in Figure 2 and Figure 3 respectively.

In Table 7, those species of lower concern have been grouped into categories, following an estimate of numbers. These are 1-10 territories, 11-20 territories and 21-30 territories. Red and Amber- listed species are given to the nearest territory or as appropriate.

3.2.1 Table 8: Species Detected by Breeding Bird Survey in western half of site

Species	Conservation Status	Site status	Nesting habitat
Blackbird	Green list	1 - 10 territories	Woods and hedges
Chaffinch	Green list	1 - 10 territories	Woods and hedges
Dunnock	Amber list	At least 1 territory	Woods and hedges
Goldfinch	Green list	1 - 10 territories	Hedgerows
Great Tit	Green list	1 - 10 territories	Woods and hedges
Greenfinch	Green list	1 - 10 territories	Woods and hedges
Kestrel	Amber list	1 territory	Trees and buildings
Linnet	Red list	At least 1 territory	Hedgerows and scrub
Mallard	Amber list	4 territories	Near water
Pheasant	Green list	1 - 10 territories	Woods and hedges

[8] Marchant J.H. (1983). BTO Common Bird Census Instructions. BTO, Tring.
[9] Bibby C.J., Burgess N.D., Hill D.A., and Mustoe S.H. (2000). Bird Census Techniques (2nd Edition). Academic Press, London.

Species	Conservation Status	Site status	Nesting habitat
Red-legged Partridge	Green list	1 - 10 territories	Hedgerows and field margins
Reed Bunting	Amber list	Around 32 territories	Hedgerows and wet ditches
Reed Warbler	Green list	11 - 20 territories	Reed beds
Robin	Green list	1 - 10 territories	Woods and hedges
Sedge Warbler	Green list	1 - 10 territories	Scrub
Skylark	Red list	Around 24 territories	Open fields
Whitethroat	Amber list	Around 6 territories	Hedgerows and scrub
Woodpigeon	Green list	1- 10 territories	Woods and hedges
Wren	Green list	1 - 10 territories	Woods and hedges
Yellowhammer	Red list	At least 2 territories	Hedgerows
Yellow Wagtail	Red list	Around 2 territories	Open fields

3.2.2 Table 9: Species Detected by Breeding Bird Survey in eastern half of site

Species	Conservation Status	Site status	Nesting habitat
Blackbird	Green list	1 - 10 territories	Woods and hedges
Chaffinch	Green list	1 - 10 territories	Woods and hedges
Grey Heron	Green list	1 nest containing 3 chicks	Plantation
Mallard	Amber list	At least 1 territory	Near water
Meadow Pipit	Amber list	1 territory	Grasslands and field margins
Pheasant	Green list	1 - 10 territories	Woods and hedges
Red-legged Partridge	Green list	1 - 10 territories	Hedgerows and field margins
Reed Bunting	Amber list	Around 20 territories	Hedgerows and wet ditches
Reed Warbler	Green list	11 - 20 territories	Reed beds
Robin	Green list	1 - 10 territories	Woods and hedges
Sedge Warbler	Green list	1 - 10 territories	Scrub
Skylark	Red list	Around 51 territories	Open fields
Woodpigeon	Green list	1- 10 territories	Woods and hedges
Wren	Green list	1 - 10 territories	Woods and hedges
Yellow Wagtail	Red list	Around 6 territories	Open fields

3.2.3 Barn Owl Status

Barn Owls were seen on site, although no nesting habitat was observed.

4 Species Selected for Impact Assessment

Species requiring impact assessment (based on evidence of flight activity or nesting within the 500m buffer area, and elevated conservation status or collision sensitivity) are:

Barn Owl
Buzzard
Cormorant
Dunnock
Grey Heron
Golden Plover
Hen Harrier
Kestrel
Lapwing
Linnet
Little Egret
Mallard

Marsh Harrier	Pink-footed Goose	Skylark
Meadow Pipit	Redshank	Whitethroat
Merlin	Reed Bunting	Yellowhammer
Mute Swan	Shelduck	Yellow Wagtail
Peregrine	Sparrowhawk	

5 Collision Risk Modelling

5.1 Methodology

The collision risk is calculated by using the Band Collision Risk Model (Band et al. 2007[10]; SNH 2000[11]). The model assesses the numbers of birds per annum, of certain species, which will be killed as a result of colliding with the wind turbines of a given site. The estimated mortality for each of the target species for the 25 year life span of the wind farm is also calculated.

In order to reach these figures, hours of vantage point survey are required to gain an idea of the numbers and species of birds regularly over-flying a site.

These will vary from season to season and at different times of day, e.g. large numbers of gulls or wildfowl may over-fly a site at dawn and dusk, commuting to and from roosts, whereas many raptor species will be at their most active from mid-morning to late afternoon.

Detailed data is required regarding the height and dimensions of the turbines, as well as the area and turbine positions of the proposed wind farm. Also the measurements of the individual bird species must be known along with their average speed of flight [(Alerstam et al. 2007)[12], (BirdGuides Ltd. 2006)[13] and (Bruderer & Boldt 2001)[14] were used for this purpose].

Lastly it must be assessed whether a bird is following a predictable or less predictable line of flight. Birds regularly using a site for feeding or roosting purposes will usually be thought to be following a less predictable flight path.

Those birds not directly associated with the area and observed merely passing overhead are deemed to be following a predictable flight path.

Wild Frontier Ecology use the following definitions to calculate the collision risk for the target bird species:

- **Species**: Bird species recorded from the vantage point executing a flight path within the 500m buffer
- **Total Number of Flight Events**: Number of flights recorded within the 500m buffer; flocks and individual birds are both treated as a single flight event
- **Total Number of Birds Involved**: The number of birds witnessed throughout the entire vantage point duration (not necessarily indicative of actual bird numbers -

[10] Band W., Madders M., and Whitfield D.P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms. In: de Lucas M., Janss G., and Ferrer M. (eds.), Birds and Wind Farms Risk Assessment and Mitigation. Quercus.
[11] Scottish Natural Heritage (2000). Guidance - Wind Farms and Birds: Calculating a theoretical risk assuming no avoiding action. SNH, Battleby.
[12] Alerstam T., Rosen M., Backman J., Ericson Per G.P., and Hellgren O. (2007). Flight Speeds among Bird Species: Allometric and Phylogenetic Effects. PLoS BIOLOGY Volume 5: Issue 8: e197
[13] BirdGuides Ltd. (2006). Birds of the Western Palearctic Interactive. DVD.
[14] Bruderer B. and Boldt A. (2001). Flight characteristics of birds: I. Radar measurements of speeds. Ibis 143: 178-204.

repeated flights by the same birds are possible)

- **Total Number of Birds in Risk Window:** The number of birds recorded flying within the rotor swept area.
- **Total Flight Time Seconds**: The aggregate total for each species recorded within the 500m buffer.
- **Time Birds Observed Below the Risk Window:** The total time birds were recorded below the level of the rotor sweep.
- **Time Birds Observed In the Risk Window:** The total time birds were recorded below the level of the rotor sweep
- **Time Birds Observed Above the Risk Window:** The total time birds were recorded above the level of the rotor sweep
- **Flight Path: Predictable** flight path through the wind farm; the species flies through the wind farm in a reasonably defined direction. **Less predictable** flight path through the wind farm; the species occupies a recognised territory overlapping with the 500m buffer area and so flight paths are varied.

5.2 Collision Risk Assessment

Of the target species, only those recorded flying in the risk window of 29.4m to 139.8m altitude (the airspace occupied by a 92m-diameter rotor set on an 80m-high hub, plus buffer to cover error in bird flight height estimation) were modelled for collision risk.

5.2.1 Table 10: Vantage Point Summary (Western VP covering the whole site)

Species	Total Number			Flight path	Risk Window			
	Flight Events	Birds seen in Buffer	Flight Time (s)		Birds in RW	Time Below	Time Above	Time Within
Barn Owl	1	1	70	LP	0	70	0	0
Buzzard	44	44	3,165	LP	14	1,346	0	1,819
Common Snipe	2	2	50	LP	0	50	0	0
Cormorant	18	24	1,460	P	15	32.5	0	935.94
Golden Plover	10	196	47,860	LP	122	3,761	8,750	35,349
Green Sandpiper	2	3	90	LP	0	90	0	0
Grey Heron	22	22	1,375	LP	11	486	0	889
Hen Harrier	2	2	150	LP	0	150	0	0
Kestrel	193	199	24,340	LP	84	12,635.3	430	11,274.7
Lapwing	29	2,081	361,380	LP	1,112	18,029	199,000	144,351
Little Egret	6	6	380	LP	3	200	0	180
Marsh Harrier	23	23	3,015	LP	9	1,599	0	1,416
Merlin	8	8	300	LP	3	130	0	170
Mute Swan	4	11	670	LP	5	270	0	400
Peregrine	5	5	390	LP	3	298.5	0	91.5
Shelduck	7	14	570	LP	3	472.5	0	97.5
Sparrowhawk	20	20	1,090	LP	8	517	0	573

The list of species subject to collision risk modelling after selecting for activity within the risk window is:

Buzzard
Cormorant
Golden Plover
Grey Heron
Kestrel
Lapwing
Little Egret
Marsh Harrier
Merlin
Mute Swan
Peregrine
Shelduck
Sparrowhawk

Species which were not observed flying at heights equivalent to the proposed turbine rotor height are not subject to collision risk modelling.

5.3 Collision Risk Results

5.3.1 Table 11: Collision Risk Summary (Western VP covering the whole site)

Species	Band Collision risk (%)	Adjusted* Collision risk (%)	Annual bird mortality at given avoidance			
			0%	95%	99%	99.9%
Buzzard	8.03	7.63	10.24	0.51	0.102	0.0102
Cormorant	9.5	9.02	17.4	0.87	0.174	0.0174
Golden Plover	6.02	5.71	163.61	8.18	1.636	0.1636
Grey Heron	11.56	10.98	6.07	0.3	0.061	0.0061
Kestrel	7.34	6.97	44.06	2.2	0.441	0.0441
Lapwing	6.72	6.38	608.7	30.44	6.087	0.6087
Little Egret	9.34	8.87	0.9	0.05	0.009	0.0009
Marsh Harrier	8.49	8.07	7.1	0.36	0.071	0.0071
Merlin	6.38	6.06	0.56	0.03	0.006	0.0006
Mute Swan	12.46	11.84	4.26	0.21	0.043	0.0043
Peregrine	7.51	7.14	0.44	0.02	0.004	0.0004
Shelduck	8.03	7.63	0.64	0.03	0.006	0.0006
Sparrowhawk	6.91	6.56	2.36	0.12	0.024	0.0024

*The adjusted collision risk % is calculated based on a projected downtime of the wind farm set at 5%.

5.3.2 Table 12: 25 Year Collision Risk Summary (Western VP covering whole site)

Species	Bird Mortality at % avoidance		
	95%	99%	99.9%
Buzzard	12.8	2.56	0.26
Cormorant	21.75	4.35	0.44
Golden Plover	204.52	40.9	4.09
Grey Heron	7.59	1.52	0.15
Kestrel	55.08	11.02	1.1
Lapwing	760.88	152.18	15.22
Little Egret	1.13	0.23	0.02
Marsh Harrier	8.88	1.78	0.18
Merlin	0.7	0.14	0.01
Mute Swan	5.32	1.06	0.11
Peregrine	0.55	0.11	0.01
Shelduck	0.8	0.16	0.02
Sparrowhawk	2.95	0.59	0.06

5.4 Collision Risk Assessment (Eastern VP)

The data from the eastern VP has been subject to collision risk modelling based on the easternmost two turbine positions. Flight-lines were not recorded for any birds seen over the western four turbine positions during vantage point watches from the eastern vantage point. The point of this secondary collision risk model is to demonstrate that the eastern section of the site (which was not wholly visible from the western VP) was used by a similar assemblage of birds, at a similar frequency and for similar activities, as the rest of the site.

The risk window height band is the same as above (29.4m - 139.8m). The following table summarises all recordings from the eastern VP recorded from 24th August to 19th November 2010.

5.4.1 Table 13: Vantage Point Summary (Eastern VP covering eastern two turbine positions)

Species	Total Number			Flight path	Risk Window			
	Flight Events	Birds seen in Buffer	Flight Time (s)		Birds in RW	Time Below	Time Above	Time Within
Buzzard	21	25	2,590	LP	8	1,415.5	0	1,174.5
Common Snipe	4	6	260	LP	5	23	0	237
Cormorant	2	2	100	P	1	60	0	40
Golden Plover	10	963	74,720	LP	183	61,250	0	13,470
Green Sandpiper	7	8	305	LP	4	135	0	170
Grey Heron	5	5	245	LP	2	110	0	135
Kestrel	51	51	4,840	LP	14	3,272	0	1,568
Lapwing	14	1,062	83,300	LP	379	63,905	0	19,395
Marsh Harrier	39	41	6,755	LP	4	6,360	0	395
Peregrine	4	4	270	LP	3	81.5	0	188.5
Pink-footed Goose	1	1	40	P	1	0	0	40
Redshank	1	1	5	LP	0	5	0	0
Sparrowhawk	8	8	450	LP	2	186	0	264

The list of species subject to collision risk modelling after selecting for activity within the risk window is:

Buzzard
Common Snipe
Cormorant
Golden Plover
Green Sandpiper
Grey Heron
Kestrel
Lapwing
Marsh Harrier
Peregrine
Pink-footed Goose
Sparrowhawk

5.5 Collision Risk Results (Eastern VP)

5.5.1 Table 14: Collision Risk Summary (easternmost two turbines)

Species	Band	Adjusted*	Annual bird mortality at given avoidance

	Collision risk (%)	Collision risk (%)	0%	95%	99%	99.9%
Buzzard	8.03	7.63	15.81	0.79	0.158	0.0158
Common Snipe	5.76	5.48	2.94	0.15	0.029	0.0029
Cormorant	9.5	9.02	3.04	0.15	0.03	0.003
Golden Plover	6.02	5.71	141.32	7.07	1.413	0.1413
Green Sandpiper	6.59	6.26	1.05	0.05	0.01	0.001
Grey Heron	11.56	10.98	2.2	0.11	0.022	0.0022
Kestrel	7.34	6.97	14.65	0.73	0.145	0.0145
Lapwing	6.72	6.38	195.5	9.78	1.955	0.1955
Marsh Harrier	8.49	8.07	4.74	0.24	0.047	0.0047
Peregrine	7.51	7.14	2.16	0.11	0.022	0.0022
Pink-footed Goose	8.11	7.71	0.5	0.03	0.005	0.0005
Sparrowhawk	6.91	6.56	2.6	0.13	0.026	0.0026

*The adjusted collision risk % is calculated based on a projected downtime of the wind farm set at 5%.

5.5.2 Table 15: 25 year Collision Risk Summary (easternmost two turbines)

Species	Bird Mortality at % avoidance		
	95%	99%	99.9%
Buzzard	19.76	3.95	0.4
Common Snipe	3.68	0.74	0.07
Cormorant	3.8	0.76	0.08
Golden Plover	176.66	35.33	3.53
Green Sandpiper	1.31	0.26	0.03
Grey Heron	2.75	0.55	0.06
Kestrel	18.31	3.66	0.37
Lapwing	244.38	48.88	4.89
Marsh Harrier	5.92	1.18	0.12
Peregrine	2.7	0.54	0.05
Pink-footed Goose	0.63	0.13	0.01
Sparrowhawk	3.25	0.65	0.06

5.6 Collision Risk Model Comparison

To determine whether patterns of avian activity over the eastern section of the site are similar to the rest of the site (observable from the western VP), the below table compares the collision risk figures obtained from the western VP data to the eastern VP data.

5.6.1 Table 16: Collision Risk Comparison (Western to Eastern VPs)

Species	Birds calculated to collide with the proposed turbines per year at a 99% rate of avoidance		Difference
	Western vantage point	Eastern vantage point	
Buzzard	0.102	0.158	+0.056
Common Snipe	0	0.029	+0.029
Cormorant	0.174	0.03	-0.144
Golden Plover	1.636	1.413	-0.223
Green Sandpiper	0	0.01	+0.01
Grey Heron	0.061	0.022	-0.039
Kestrel	0.441	0.145	-0.296
Lapwing	6.087	1.955	-4.102

Little Egret	0.009	0	-0.009
Marsh Harrier	0.071	0.047	-0.024
Merlin	0.006	0	-0.006
Mute Swan	0.043	0	-0.043
Peregrine	0.004	0.022	+0.018
Pink-footed Goose	0	0.005	+0.005
Shelduck	0.006	0	-0.006
Sparrowhawk	0.024	0.026	+0.002

Six of the sixteen bird species which have been collision risk modelled were found to occur at frequencies/flight heights which were more vulnerable to turbine collision based on recordings from the eastern VP, than on recordings from the western VP. These are Buzzard, Common Snipe, Green Sandpiper, Peregrine, Pink-footed Goose and Sparrowhawk. The greatest positive difference between the two VP data sets (i.e. where eastern VP data suggests more vulnerable flights over the eastern section of the site than western VP data does) is for Buzzard. For this species it is calculated that 0.056 more birds per year would collide with the turbines, based on eastern VP data, than would collide with the turbines using western VP data (at a 99% rate of avoidance).

Three of the remaining five species (Common Snipe, Green Sandpiper and Pink-footed Goose) which were calculated as more vulnerable using eastern VP data, were found to be so because they were never recorded within the risk window from the western VP. The final two species (Peregrine and Sparrowhawk) were calculated to have collision risks (birds calculated to collide with the turbines per year at a 99% rate of avoidance) of 0.018 and 0.002 birds per year more from the eastern VP than the western VP.

6 Worked Examples

6.1 Definitions used in the modelling:

Risk Window	Cross sectional height at which birds are at risk from the spinning rotors (height between tips of blade), buffered by 5% at bottom and 15% at top to compensate for possible observer error.
Blade Pitch	Pitch of Blade taken at optimum output for average wind speed on site.
Blade Depth	Within this equation can be considered a constant, thus an estimated depth is used.
Wind Farm Area	Combined 500m buffer around all the turbines.
Risk Volume	Risk Window multiplied by Wind Farm Area.
Wind Farm Width	Distance between the two outer most turbines perpendicular to the predominant flight path + 100m to allow for turbine blades.
Risk Area	Risk Window multiplied by Wind Farm Width
Percentage of Turbine Overlap	The percentage of rotors overlapping in the plane of the risk window along the predominant flight path. This is justified, as although collision risk increases the more rotors the birds fly through, few birds will fly through more than one rotor.
Ratio of Wind Farm width to Buffer Width	Surveys are carried out on a buffer surrounding the turbines rather than just over the area of the wind farm in accordance to the guidance by SNH and NE. If a large space is surveyed more observations will be made than if only the wind farm area was surveyed. It is assumed that the flight events seen during surveys are evenly distributed across the buffer along the predictable flight path. To give an accurate representation of birds passing through the wind farm the total number of birds observed is multiplied by the ratio of wind farm width + 100m for turbine blades to width of buffer.
Flight Hours	These are estimated by taking the total hours between sunrise and sunset and adding 25% for twilight for each month the bird is present at the site throughout the year. This gives an estimate of hours which the bird will be flying. 50% is added to daylight hours for birds that have a prolonged flight period e.g. geese. Some species e.g. Barn Owl have been assumed to have a 24 hour a day flight time. Adjustment to daylight hours are made depending on latitude of site.
Estimated Down-time	Estimated percentage time turbines will not be turning.

6.2 Site and turbine details

Site Name	Treading
Grid Square of Wind Farm	TF
Is site upland (U) or lowland (L)	Lowland
Turbine Model Dimension Based On	Generic
Number of Turbines (N)	6
Hub Height	80
Rotor Diameter (D)	92
Number of Blades	3
Blade Max Chord (Bc)	3.2
Blade Pitch (Bp)	10
RPM	16.1
Blade Depth (d)	4.2
Wind Farm Area (A_w)	3,143,000
Estimated Downtime	5%
Risk Window Ceiling (m)	139.8
Risk Window Floor (m)	29.4

6.3 **Predictable**

Cormorant - Worked example		
Model of Turbine Used to Assess Collision Risk	Generic	
Number of Turbines (**N**)	6	
Hub Height	80	**m**
Rotor Diameter (**D**)	92	**m**
Rotor Radius (**R**)	46	**m**
Blade Max Chord (**Bc**)	3.40	**m**
Blade Pitch (**Bp**)	10	**°**
Number of Blades	3	
Rotations Per Minute	16.1	
Rotor Rotation Period (1 rotation) (**Rp**)	3.73	**sec**
Risk Window Ceiling Height (**RWc**)	139.80	**m**
Risk Window Floor Height (**RWf**)	29.40	**m**
Wind Farm Width (X_w) + 100 to allow for turbine blades	1320	**m**
Cross Sectional Area of Risk Window (**W**) = X_w **x (RWc - RWf)**	145728	**m^2**
Rotor Sweep Area of Single Turbine = πR^2	6647.61	**m^2**
Combined Area of Turbine (**A**) = **N x** πR^2	39885.66	**m^2**
Percentage of Turbine Overlap (**o**)	0.00	**%**
Adjusted Combined Area of Turbine to allow for overlap(**Ao**)	39885.66	**m^2**
Proportion of Risk Window Occupied by Rotors **Ao / W**	0.27	**m^2**
Bird Species Data		
Months the Bird Uses the Site	**All Year**	
Speed of Bird Through the Rotor (**v**)	15.20	**m/sec**
Length of Bird (**l**)	0.90	**m**
Wingspan of Bird	1.45	**m**
Vantage Point Hours Completed (**VPh**)	116	**hr**
Time Available for Flight Activity per year	5601.25	**hr/ yr**
Number of Birds Observed in Buffer	24	
Ratio of X-Sectional Area to Buffer	0.663317	
Number of Birds at Observed at Risk Height	22	
Bird in Risk Window (**RWn**)	14.59	
Average Birds per Hour During Survey = **RWn / VPh**	0.13	
Number of Bird Flights through Flight Risk Window (**n**) = **RWn / VPh x Flight Hours**	704.65	
Number of Birds Passing Through Rotors per Year = **n x (Ao/W)**	192.86	
Estimated Down Time per year	5.00	**%**
Chance of Collision (derived from Band 2000)	**9.50**	**%**
Adjusted to include Down Time	9.02	**%**
No Avoidance	17.40	Collisions/ yr
Adjusted for 95% Avoidance	0.87	Collisions/ yr
Adjusted for 99% Avoidance	0.17	Collisions/ yr
Adjusted for 99.9% Avoidance	0.02	Collisions/ yr

6.4 **Less Predictable**

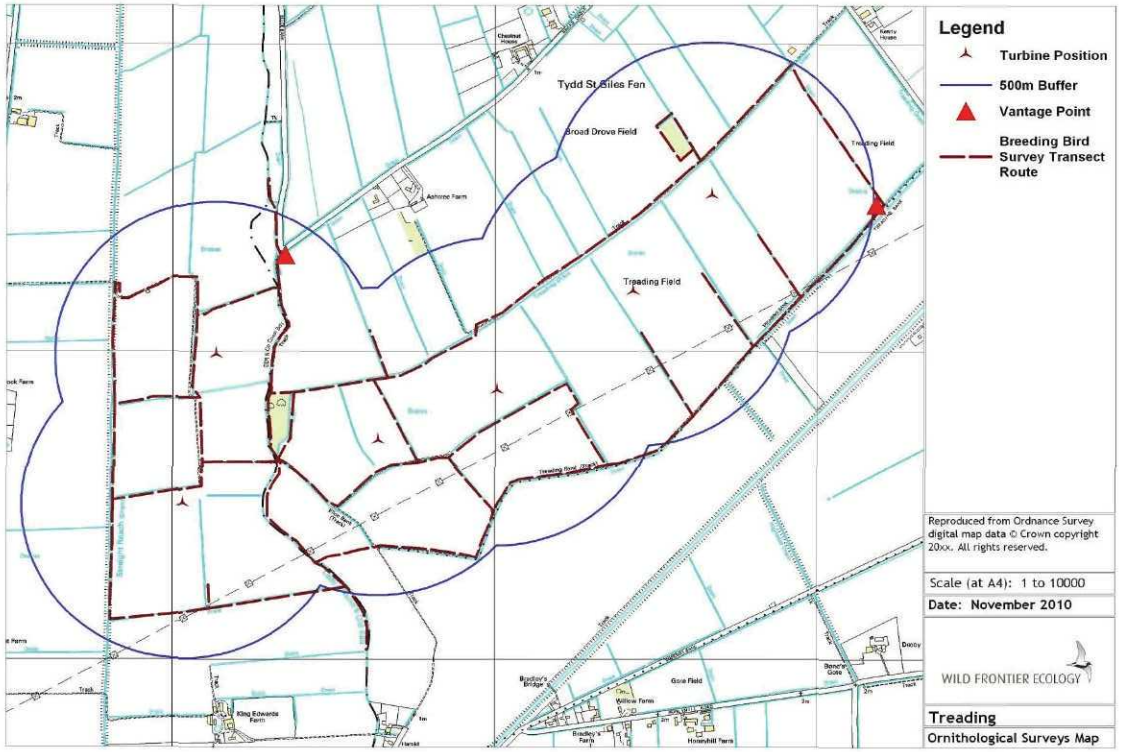
Golden Plover - Worked example

Golden Plover

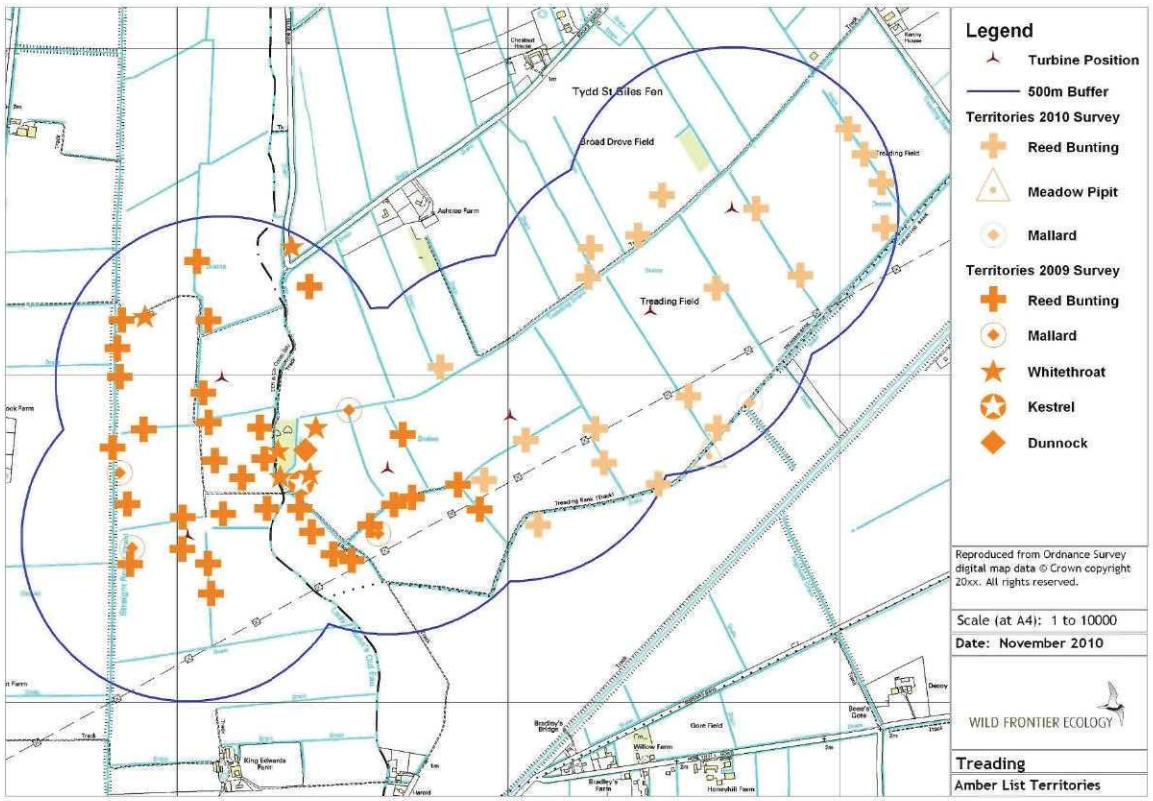
Model of Turbine Used to Assess Collision Risk	Generic	
Number of Turbines (**N**)	6	
Hub Height	80	**m**
Rotor Diameter (**D**)	92	**m**
Rotor Radius (**R**)	46	**m**
Blade Max Chord (**Bc**)	3.40	**m**
Blade Pitch (**Bp**)	10	**°**
Number of Blades	3	
Rotations per Minute	16.1	
Rotor Rotation Period (1 rotation) (**Rp**)	3.73	**sec**
Blade Depth (**d**)	4.2	**m**
Risk Window Ceiling Height (**RWc**)	139.80	**m**
Risk Window Floor Height (**RWf**)	29.40	**m**
Wind Farm Area (A_w)	3143000	m^2
Flight Risk Volume (V_w) = A_w **x (RWc - RWf)**	346987200	m^3
Rotor Sweep Area of Single Turbine = πR^2	6647.61	m^2
Rotor Sweep Volume of Single Turbine = πR^2 **x (d + l)**	29748.05	m^3
Combined Volume Sweep of Turbine (V_r) = **N x** πR^2 **x (d + l)**	178488.33	m^3
Proportion of Flight Risk Volume with Turbines = V_r / V_w	0.0005	
Bird Species Data		
Months the Bird Uses the Site	**Oct to Mar**	
Speed of Bird through the rotor (**v**)	17.90	**m/sec**
Length of Bird (**l**)	0.28	**m**
Wingspan of Bird	0.72	**m**
Vantage Point Hours Completed (**VPh**)	55	**hr**
Vantage Point Seconds Completed (**VPs**)	198000	**sec**
Time available for flight activity per year	2165.00	**hr**
Flight Seconds per year	7794000	**sec**
Number of Birds Observed in Risk Window (**RWn**)	122	
Total Time All Birds Spend in Risk Window (**RWt**)	35349	**sec**
Proportional Time Individual Bird Spends in Risk Window = **(RWt / RWn) / VPs**	0.00	
Average Time Individual Bird Within Risk Window per year (**RWy**)	11405.45	**sec**
Bird Occupancy of Flight Risk Window (**n**) = **RWn x RWy**	1391465.18	**sec**
Birds Occupancy of Rotor Swept Area (**b**)= **n** (V_r/V_w)	715.76	**sec**
Time Taken for Bird to Make Transit Through Rotor (**t**) = **(d + l)/v**	0.25	**sec**
Number of Birds Passing Through Rotors per Year = **b/t**	2863.05	
Estimated Down Time per year	5.00	**%**
Chance of Collision (derived from Band 2000)	**6.02**	**%**
Adjusted to include Down Time	5.71	**%**
No Avoidance	163.61	Collisions/ yr
Adjusted for 95% Avoidance	8.18	Collisions/ yr
Adjusted for 99% Avoidance	1.64	Collisions/ yr
Adjusted for 99.9% Avoidance	0.16	Collisions/ yr

7 Figures

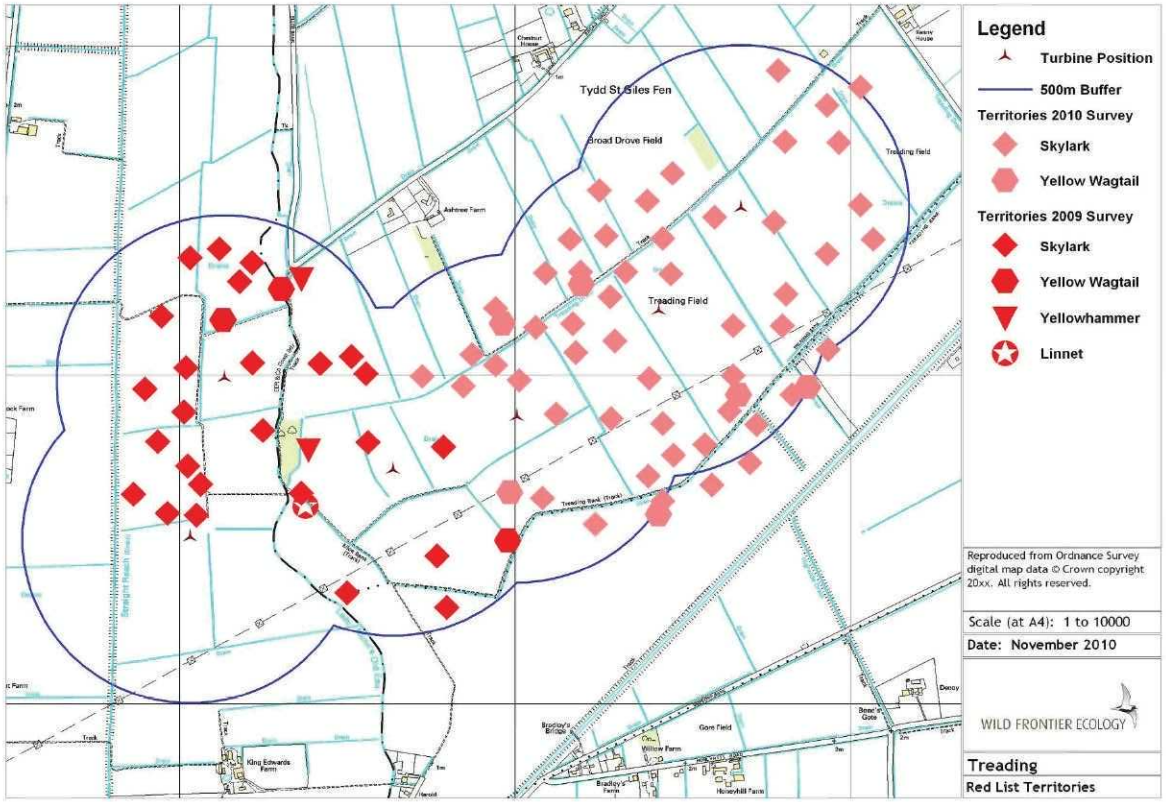
7.1 Figure 1: Vantage Point and Breeding Bird Transect



7.2 Figure 2: BoCC Amber List Breeding Bird Territories



7.3 **Figure 3: BoCC Red List Breeding Bird Territories**



8 Raw Vantage Point Data

8.1 Western Vantage Point

Date DD/MM/YY	Time (24 Hr)	Species BTO code	Species Name	Number of Birds	Flight Direction	Height (m)		Time in Buffer (sec)	Percentage of Time in Each Height Band					
						Min	Max		10m or less	>10 to 30m	>30 to 50m	>50 to 120m	>120 to 200m	>200m
26/11/2009	08:41	H.	Grey Heron	1	W	0	15	40	60	40				
26/11/2009	08:44	K.	Kestrel	1		10	15	10	50	50				
26/11/2009	08:56	K.	Kestrel	1		0	10	110	100					
26/11/2009	08:58	L.	Lapwing	5	SSE	0	20	30	20	80				
26/11/2009	09:07	SH	Sparrowhawk	1	E	2	10	40	100					
26/11/2009	09:40	SH	Sparrowhawk	1	W	1	3	20	100					
26/11/2009	10:02	SH	Sparrowhawk	1	E	5	15	30	30	70				
26/11/2009	10:19	K.	Kestrel	1		0	10	220	100					
26/11/2009	10:25	K.	Kestrel	1		0	10	550	100					
26/11/2009	11:06	K.	Kestrel	1		5	20	160	40	60				
26/11/2009	11:28	K.	Kestrel	1		0	20	170	30	70				
26/11/2009	12:03	K.	Kestrel	1		5	20	30	20	80				
26/11/2009	12:08	H.	Grey Heron	1	E	0	2	30	100					
26/11/2009	12:20	K.	Kestrel	1		5	20	90	50	50				
26/11/2009	12:23	K.	Kestrel	1	SE	10	20	100	40	60				
26/11/2009	12:30	K.	Kestrel	1		0	10	200	100					
26/11/2009	12:39	K.	Kestrel	1		0	15	160	80	20				
26/11/2009	12:48	K.	Kestrel	1		15	25	130		100				
26/11/2009	13:18	H.	Grey Heron	1	NE	0	20	50	30	70				
26/11/2009	13:46	K.	Kestrel	1		10	10	20	100					
26/11/2009	14:05	K.	Kestrel	1		5	20	30	20	80				
26/11/2009	14:15	K.	Kestrel	1		10	30	40	10	90				
30/11/2009	08:48	CA	Cormorant	1	ENE	35	40	30		100				
30/11/2009	09:00	K.	Kestrel	1	SW	5	10	20	100					
30/11/2009	09:35	K.	Kestrel	1		0	10	240	100					

30/11/2009	09:42	BZ	Buzzard	1		0	0	0	100					
30/11/2009	10:11	K.	Kestrel	1		0	15	90	60	40				
30/11/2009	10:16	L.	Lapwing	19	NE	15	30	40		100				
30/11/2009	10:21	K.	Kestrel	1		5	30	70	10	90				
30/11/2009	10:38	K.	Kestrel	2		2	40	260	20	60	20			
30/11/2009	10:46	BZ	Buzzard	1	N	5	20	30	20	80				
30/11/2009	11:07	K.	Kestrel	1		30	40	110		30	70			
30/11/2009	11:10	K.	Kestrel	1		40	60	70			80	20		
30/11/2009	11:15	K.	Kestrel	1		5	10	80	100					
10/12/2009	08:39	K.	Kestrel	1		0	10	120	100					
10/12/2009	08:56	ML	Merlin	1	E	15	50	40		50	50			
10/12/2009	08:59	K.	Kestrel	1		0	10	80	100					
10/12/2009	09:03	K.	Kestrel	1		0	10	10	100					
10/12/2009	09:17	SH	Sparrowhawk	1		1	15	60	70	30				
10/12/2009	09:26	L.	Lapwing	39	NE	40	50	80			100			
10/12/2009	09:38	K.	Kestrel	1		10	25	150	20	80				
10/12/2009	09:39	SH	Sparrowhawk	1		20	40	20		70	30			
10/12/2009	09:48	K.	Kestrel	1		15	20	30		100				
10/12/2009	09:48	SH	Sparrowhawk	1		15	20	30		100				
10/12/2009	09:58	K.	Kestrel	1		10	20	30	60	40				
10/12/2009	10:04	K.	Kestrel	1		0	15	80	30	70				
10/12/2009	10:17	BZ	Buzzard	1		10	10	20	100					
10/12/2009	10:19	K.	Kestrel	1		15	20	50		100				
10/12/2009	10:30	K.	Kestrel	1		5	30	230	20	80				
10/12/2009	10:45	K.	Kestrel	1		10	40	200	30	70				
10/12/2009	10:57	K.	Kestrel	1		0	20	70	70	30				
10/12/2009	11:01	L.	Lapwing	170	SE	60	70	60				100		
10/12/2009	11:03	K.	Kestrel	1		10	30	180	40	60				
10/12/2009	11:13	K.	Kestrel	1		5	30	270	50	50				
16/12/2009	09:02	ML	Merlin	1	W	1	1	30	100					
16/12/2009	09:36	GP	Golden Plover	16	S	20	20	60		100				
16/12/2009	09:38	BZ	Buzzard	1	SE	1	2	30	100					

16/12/2009	10:10	GP	Golden Plover	23	S	20	20	60	100					
16/12/2009	10:11	BZ	Buzzard	1	E	1	5	60	100					
16/12/2009	10:33	MS	Mute Swan	2	N	3	6	60	100					
23/12/2009	09:04	H.	Grey Heron	1	W	1	2	30	100					
23/12/2009	09:17	L.	Lapwing	5	SW	5	15	30	40	60				
23/12/2009	09:43	GE	Green Sandpiper	1	E	5	20	50	30	70				
23/12/2009	09:47	K.	Kestrel	1		5	30	250	10	90				
23/12/2009	10:00	MS	Mute Swan	5	SW	15	30	80		100				
23/12/2009	10:14	PE	Peregrine	1	N	10	40	50	5	55	40			
23/12/2009	10:22	GE	Green Sandpiper	2		0	20	20	20	80				
23/12/2009	10:23	SN	Common Snipe	1	NE	0	15	30	50	50				
23/12/2009	10:35	H.	Grey Heron	1	W	5	10	40	100					
23/12/2009	10:51	K.	Kestrel	1		10	20	150	40	60				
12/01/2010	12:42	K.	Kestrel	1		15	50	120		50	50			
12/01/2010	12:44	SN	Common Snipe	1	N	10	10	20	100					
12/01/2010	12:48	K.	Kestrel	1	W	15	50	240		60	40			
12/01/2010	13:06	BZ	Buzzard	1	N	2	10	70	100					
12/01/2010	13:10	K.	Kestrel	1		5	30	180	50	50				
12/01/2010	13:13	PE	Peregrine	1	N	40	40	20			100			
12/01/2010	13:28	K.	Kestrel	1		30	60	50		20	70	10		
12/01/2010	13:36	K.	Kestrel	1	N	10	15	20	50	50				
12/01/2010	14:06	K.	Kestrel	1		10	40	340	20	50	30			
12/01/2010	14:09	BZ	Buzzard	1	S	1	5	60	100					
12/01/2010	14:31	K.	Kestrel	1		0	30	120	30	70				
21/01/2010	08:11	H.	Grey Heron	1	S	0	10	45	100					
21/01/2010	08:31	BZ	Buzzard	1	W	5	8	60	100					
21/01/2010	08:51	ET	Little Egret	1	S	0	5	80	100					
21/01/2010	09:03	ET	Little Egret	1	N	0	5	40	100					
21/01/2010	09:30	MS	Mute Swan	2	N	3	5	60	100					
04/02/2010	13:41	L.	Lapwing	3	W	30	40	100		30	70			

04/02/2010	13:48	CA	Cormorant	2	S	100	100	50				100		
04/02/2010	13:52	BZ	Buzzard	1	S	1	1	20	100					
04/02/2010	14:08	K.	Kestrel	1		5	20	30	50	50				
04/02/2010	14:42	BZ	Buzzard	1	E	0	10	80	100					
04/02/2010	14:50	BZ	Buzzard	1		0	5	20	100					
04/02/2010	15:52	K.	Kestrel	1		2	15	120	80	20				
04/02/2010	15:58	SH	Sparrowhawk	1	NE	3	5	20	100					
16/02/2010	10:36	CA	Cormorant	2	S	40	50	50			100			
16/02/2010	10:53	MR	Marsh Harrier	1	N	0	80	160	5	10	10	75		
16/02/2010	10:58	MR	Marsh Harrier	1		0	2	10	100					
16/02/2010	11:15	K.	Kestrel	1		5	25	350	10	90				
16/02/2010	11:28	SH	Sparrowhawk	1	NE	50	60	90			50	50		
16/02/2010	11:39	HH	Hen Harrier	1		1	2	100	100					
16/02/2010	11:43	HH	Hen Harrier	1		1	3	50	100					
16/02/2010	11:52	K.	Kestrel	1		5	20	90	10	90				
16/02/2010	11:57	CA	Cormorant	1	SW	100	100	30				100		
16/02/2010	12:02	K.	Kestrel	1	SW	0	2	10	100					
16/02/2010	12:10	K.	Kestrel	1	NE	1	3	15	100					
16/02/2010	12:17	K.	Kestrel	1		10	60	180	5	25	60	10		
16/02/2010	12:38	BZ	Buzzard	1	S	10	20	80	30	70				
16/02/2010	13:02	K.	Kestrel	1		10	15	60	60	40				
16/02/2010	13:21	K.	Kestrel	1	E	0	5	15	100					
22/02/2010	09:06	CA	Cormorant	1	SW	80	100	60				100		
22/02/2010	09:16	L.	Lapwing	60	S	100	100	30				100		
22/02/2010	09:32	L.	Lapwing	4	NE	0	15	40	20	80				
22/02/2010	09:49	K.	Kestrel	1	W	2	10	100	100					
22/02/2010	09:52	K.	Kestrel	1	NE	10	80	40	50	10	10	30		
22/02/2010	09:54	K.	Kestrel	1	NE	2	3	20	100					
22/02/2010	09:58	MR	Marsh Harrier	1	NE	1	5	40	100					
22/02/2010	10:02	CA	Cormorant	1	NE	30	60	40		20	80			
22/02/2010	10:31	ET	Little Egret	1	S	40	50	70			100			
04/03/2010	08:31	CA	Cormorant	1	SW	70	80	40				100		

04/03/2010	08:48	CA	Cormorant	1	SE	80	80	30				100		
04/03/2010	09:04	CA	Cormorant	1	N	50	50	40			100			
04/03/2010	09:08	L.	Lapwing	150	N	20	20	30		100				
04/03/2010	10:03	BZ	Buzzard	1		0	50	260	10	20	70			
04/03/2010	10:20	K.	Kestrel	1		0	15	50	30	70				
04/03/2010	10:25	K.	Kestrel	1		20	20	20		100				
04/03/2010	10:28	K.	Kestrel	1		0	25	90	10	90				
04/03/2010	10:30	K.	Kestrel	1		0	15	90	50	50				
04/03/2010	11:02	ML	Merlin	1	NE	2	3	10	100					
04/03/2010	11:09	K.	Kestrel	1		80	100	190		100				
18/03/2010	08:14	K.	Kestrel	1	E	10	40	90	10	30	60			
18/03/2010	08:25	K.	Kestrel	1	W	15	50	40		60	40			
18/03/2010	08:47	K.	Kestrel	1	SW	1	2	15	100					
18/03/2010	09:24	SU	Shelduck	1		20	50	60		50	50			
18/03/2010	09:28	K.	Kestrel	2		1	60	330	10	50	30	10		
18/03/2010	09:32	SU	Shelduck	2	NE	1	5	60	100					
18/03/2010	09:33	K.	Kestrel	2	SW	20	50	90		30	70			
18/03/2010	09:36	K.	Kestrel	1		1	30	180	20	80				
18/03/2010	09:40	H.	Grey Heron	1	S	60	60	50				100		
18/03/2010	10:14	K.	Kestrel	1		1	10	40	100					
18/03/2010	10:16	BZ	Buzzard	1		1	2	20	100					
18/03/2010	10:38	K.	Kestrel	1		0	15	280	60	40				
18/03/2010	10:45	SU	Shelduck	1	S	1	10	20	100					
22/03/2010	13:38	K.	Kestrel	1		5	15	120	80	20				
22/03/2010	13:46	BZ	Buzzard	1	E	0	2	15	100					
22/03/2010	14:10	BZ	Buzzard	1	NE	30	60	100		20	60	20		
22/03/2010	14:29	K.	Kestrel	1		0	10	110	100					
22/03/2010	14:34	K.	Kestrel	1		1	20	40	50	50				
22/03/2010	14:56	BZ	Buzzard	1	NE	30	50	60			100			
22/03/2010	15:39	K.	Kestrel	1		0	15	60	50	50				
22/03/2010	16:03	K.	Kestrel	1	S	1	10	110	100					
22/03/2010	16:10	K.	Kestrel	1		1	5	20	100					

05/04/2010	12:08	K.	Kestrel	1	S	0	10	115	100					
05/04/2010	12:37	K.	Kestrel	1		5	10	40	100					
05/04/2010	12:49	H.	Grey Heron	1	NE	20	30	85		100				
05/04/2010	12:55	BZ	Buzzard	1	WSW	5	30	125	30	70				
05/04/2010	13:18	BZ	Buzzard	1	ENE	5	10	90	100					
05/04/2010	14:09	K.	Kestrel	1	N	5	10	20	100					
05/04/2010	14:15	SU	Shelduck	1	SW	5	30	105	90	10				
05/04/2010	14:18	BZ	Buzzard	1	N	5	10	65	100					
05/04/2010	14:32	K.	Kestrel	1	SW	5	10	145	100					
05/04/2010	14:46	SH	Sparrowhawk	1	N	5	5	85	100					
05/04/2010	15:17	K.	Kestrel	1	SW	5	10	50	100					
05/04/2010	15:25	L.	Lapwing	4	NW	20	30	20		100				
05/04/2010	15:31	SU	Shelduck	7	SW	5	5	25	100					
05/04/2010	16:58	BZ	Buzzard	1	W	5	5	20	100					
12/04/2010	15:15	SU	Shelduck	1	WSW	5	10	60	100					
12/04/2010	15:19	BZ	Buzzard	1	NE	50	60	40				100		
12/04/2010	15:26	K.	Kestrel	1	WNW	5	20	80	50	50				
12/04/2010	15:48	H.	Grey Heron	1	SW	20	50	110		50	50			
14/04/2010	08:49	H.	Grey Heron	1	SW	5	5	25	100					
14/04/2010	10:52	SU	Shelduck	1	E	0	30	30	10	90				
14/04/2010	11:25	GP	Golden Plover	44		0	200	635	5	15	10	50	20	
14/04/2010	12:05	MR	Marsh Harrier	1		5	150	440	30	30	20	10	10	
14/04/2010	12:06	SH	Sparrowhawk	1	NE	50	80	25				100		
14/04/2010	12:09	GP	Golden Plover	1	E	5	30	60	40	60				
14/04/2010	12:20	MR	Marsh Harrier	1		120	150	60					100	
07/05/2010	09:27	H.	Grey Heron	1	WNW	30	100	150		10	40	50		
07/05/2010	09:56	BZ	Buzzard	1	E	2	20	40	30	70				
07/05/2010	11:58	SH	Sparrowhawk	1	NE	1	5	20	100					
07/05/2010	12:41	BZ	Buzzard	1	W	5	15	30	40	60				
07/05/2010	13:02	K.	Kestrel	1		5	20	60	10	90				
19/05/2010	10:10	BZ	Buzzard	1	N	1	5	20	100					
19/05/2010	10:18	K.	Kestrel	1		60	120	410				100		

19/05/2010	10:59	K.	Kestrel	1		50	120	230			10	90		
19/05/2010	11:21	CA	Cormorant	1		60	70	50				100		
19/05/2010	11:22	BZ	Buzzard	1		50	70	60			20	80		
21/05/2010	16:37	K.	Kestrel	1	SE	20	20	30		100				
21/05/2010	16:49	SH	Sparrowhawk	1	S	10	30	60	20	80				
21/05/2010	17:31	BZ	Buzzard	1		2	10	30	100					
21/05/2010	18:10	SH	Sparrowhawk	1		40	80	70			30	70		
21/05/2010	18:12	MA	Mallard	1	SW	20	20	20		100				
21/05/2010	19:05	H.	Grey Heron	1	SW	30	30	30		100				
21/05/2010	19:11	MA	Mallard	2	SW	10	15	30	50	50				
21/05/2010	19:13	K.	Kestrel	1	E	5	10	20	100					
21/05/2010	19:19	H.	Grey Heron	1	N	10	20	50	30	70				
21/05/2010	20:00	K.	Kestrel	1		30	40	40			100			
21/05/2010	20:21	H.	Grey Heron	1	N	10	30	40	20	80				
08/06/2010	07:26	K.	Kestrel	1	E	3	4	20	100					
08/06/2010	07:58	CA	Cormorant	1	S	5	40	40	10	70	20			
08/06/2010	09:44	H.	Grey Heron	1	NE	20	30	110		100				
08/06/2010	09:52	K.	Kestrel	1	E	5	10	30	100					
08/06/2010	10:41	MR	Marsh Harrier	1	N	2	2	40	100					
08/06/2010	11:05	ET	Little Egret	1	S	30	30	50		100				
08/06/2010	11:06	BO	Barn Owl	1		0	3	70	100					
09/06/2010	09:30	K.	Kestrel	1		15	30	60		100				
09/06/2010	09:46	K.	Kestrel	1		5	30	90	20	80				
09/06/2010	09:48	K.	Kestrel	1	N	20	20	20		100				
09/06/2010	09:54	K.	Kestrel	1	N	20	30	60		100				
09/06/2010	10:09	K.	Kestrel	1	S	20	40	50		70	30			
09/06/2010	10:25	K.	Kestrel	1		15	60	180		30	40	30		
09/06/2010	10:58	H.	Grey Heron	1	S	10	40	90	20	40	40			
09/06/2010	11:07	K.	Kestrel	1		40	60	70			50	50		
17/06/2010	16:58	BZ	Buzzard	1		1	10	30	100					
17/06/2010	17:27	L.	Lapwing	1	N	15	30	30		100				
17/06/2010	17:37	CA	Cormorant	1	E	30	30	40		100				

17/06/2010	18:05	CA	Cormorant	1	SW	20	30	40		100				
17/06/2010	18:18	K.	Kestrel	1		30	50	130		20	80			
25/06/2010	09:54	ET	Little Egret	1	N	50	50	60			100			
25/06/2010	10:08	H.	Grey Heron	1	E	40	40	40			100			
25/06/2010	10:21	K.	Kestrel	2		40	80	150			30	70		
25/06/2010	10:45	MR	Marsh Harrier	1		5	30	60	5	95				
25/06/2010	10:58	K.	Kestrel	1		10	80	230	2	28	20	50		
30/06/2010	19:37	K.	Kestrel	1	SW	30	40	20		40	60			
30/06/2010	19:41	K.	Kestrel	1		25	45	170		30	70			
30/06/2010	20:22	BZ	Buzzard	1	SW	15	30	80		50	50			
30/06/2010	20:41	K.	Kestrel	1	W	10	30	30	20	80				
15/07/2010	07:17	K.	Kestrel	1		10	10	20	100					
15/07/2010	07:19	K.	Kestrel	1		10	15	90	40	60				
15/07/2010	07:59	MS	Mute Swan	2	E	2	5	15	100					
15/07/2010	08:55	K.	Kestrel	1		2	20	210	20	80				
19/07/2010	07:29	CA	Cormorant	1	N	50	60	70			50	50		
19/07/2010	08:26	MR	Marsh Harrier	1		2	15	230	80	20				
19/07/2010	08:40	K.	Kestrel	1		5	40	80	20	50	30			
19/07/2010	08:59	MR	Marsh Harrier	1		1	10	80	100					
19/07/2010	09:08	H.	Grey Heron	1	SW	10	15	40	60	40				
19/07/2010	09:10	CA	Cormorant	1	SE	5	40	50	10	70	20			
19/07/2010	09:11	K.	Kestrel	1		2	30	130	50	50				
22/07/2010	08:22	L.	Lapwing	1	S	0	40	90	30	50	20			
22/07/2010	08:48	K.	Kestrel	1	SW	30	30	20		100				
22/07/2010	09:39	BZ	Buzzard	1		10	50	50	5	35	60			
22/07/2010	09:50	K.	Kestrel	1		5	30	80	20	80				
22/07/2010	09:52	BZ	Buzzard	1		40	100	220			30	70		
22/07/2010	10:02	BZ	Buzzard	1		20	120	330		10	30	60		
22/07/2010	10:04	K.	Kestrel	1		60	120	110				100		
22/07/2010	10:40	K.	Kestrel	1		5	100	140	2	18	20	60		
22/07/2010	10:51	K.	Kestrel	2		30	40	30			100			
22/07/2010	10:54	BZ	Buzzard	1		30	80	120		20	20	60		

22/07/2010	11:02	K.	Kestrel	1		40	50	70			100			
22/07/2010	11:31	K.	Kestrel	1	SE	10	20	30	20	80				
22/07/2010	11:39	K.	Kestrel	1		0	50	170	2	18	80			
16/08/2010	15:38	K.	Kestrel	1		10	30	240	10	90				
16/08/2010	15:41	MR	Marsh Harrier	1		2	10	60	100					
16/08/2010	16:10	K.	Kestrel	1		0	5	20	100					
16/08/2010	16:20	K.	Kestrel	1		10	40	260	20	50	30			
16/08/2010	16:29	K.	Kestrel	1		10	60	420	10	30	30	30		
16/08/2010	16:45	K.	Kestrel	1		15	20	30		100				
16/08/2010	16:51	K.	Kestrel	1		5	40	190	30	40	30			
16/08/2010	17:08	SH	Sparrowhawk	1		1	10	30	100					
16/08/2010	17:11	SH	Sparrowhawk	1		5	40	150	20	50	30			
16/08/2010	17:12	K.	Kestrel	1		5	30	40	10	90				
16/08/2010	17:23	K.	Kestrel	1		0	30	140	30	70				
16/08/2010	17:28	L.	Lapwing	1	SW	10	30	40	40	60				
16/08/2010	17:48	K.	Kestrel	1	W	0	15	40	20	80				
16/08/2010	17:51	K.	Kestrel	1		0	20	140	20	80				
16/08/2010	18:01	K.	Kestrel	1		0	10	60	100					
16/08/2010	18:03	K.	Kestrel	1		2	10	70	100					
16/08/2010	18:05	K.	Kestrel	1	E	40	40	10			100			
16/08/2010	18:23	L.	Lapwing	15	N	10	25	60	30	70				
16/08/2010	18:33	L.	Lapwing	9	N	5	10	60	100					
16/08/2010	19:19	K.	Kestrel	1	E	15	15	120		100				
16/08/2010	19:38	GP	Golden Plover	3	SW	15	30	110		100				
19/08/2010	07:33	BZ	Buzzard	1	N	2	3	20	100					
19/08/2010	07:44	L.	Lapwing	62	NE	20	20	50		100				
19/08/2010	08:13	ML	Merlin	1	NE	40	50	40			100			
19/08/2010	08:14	L.	Lapwing	130	S	30	40	90		50	50			
19/08/2010	08:24	K.	Kestrel	1	E	0	5	40	100					
19/08/2010	08:26	K.	Kestrel	1		5	40	240	10	40	50			
19/08/2010	08:36	BZ	Buzzard	1	SW	1	4	80	100					
19/08/2010	09:36	K.	Kestrel	1		0	20	90	40	60				

19/08/2010	10:01	MR	Marsh Harrier	1		30	100	330		10	30	60		
19/08/2010	10:03	ML	Merlin	1	W	1	5	20	100					
19/08/2010	10:04	MR	Marsh Harrier	1		1	5	80	100					
19/08/2010	10:14	K.	Kestrel	1		5	30	140	5	95				
19/08/2010	10:27	K.	Kestrel	1		0	25	340	50	50				
19/08/2010	10:33	K.	Kestrel	1	SW	5	10	30	100					
19/08/2010	10:41	L.	Lapwing	160	N	30	50	100		20	40	40		
19/08/2010	10:52	L.	Lapwing	140	N	60	80	60				100		
24/08/2010	07:46	H.	Grey Heron	1	W	5	15	20	50	50				
24/08/2010	08:10	GP	Golden Plover	4	SW	15	30	80		100				
24/08/2010	08:36	K.	Kestrel	1	N	5	30	150	20	80				
24/08/2010	09:10	MR	Marsh Harrier	1		2	30	130	50	50				
24/08/2010	09:11	MR	Marsh Harrier	1		2	20	70	40	60				
24/08/2010	09:20	BZ	Buzzard	1	SW	0	2	20	100					
24/08/2010	09:24	K.	Kestrel	1		2	10	40	100					
24/08/2010	09:26	MR	Marsh Harrier	1		1	5	320	100					
03/09/2010	09:51	SH	Sparrowhawk	1		20	30	120		100				
03/09/2010	09:52	K.	Kestrel	1		15	35	90		70	30			
03/09/2010	09:58	MR	Marsh Harrier	1		10	30	220	10	90				
03/09/2010	10:28	K.	Kestrel	1	N	2	5	20	100					
03/09/2010	10:34	K.	Kestrel	1	NW	10	30	50	20	80				
03/09/2010	11:29	K.	Kestrel	1		20	30	240		100				
08/09/2010	10:47	MR	Marsh Harrier	1	S	2	5	60	100					
08/09/2010	11:02	K.	Kestrel	1	S	5	10	20	100					
08/09/2010	11:17	BZ	Buzzard	1	E	5	10	30	100					
08/09/2010	11:35	K.	Kestrel	1		10	20	60	30	70				
08/09/2010	11:36	MR	Marsh Harrier	1		0	5	15	100					
08/09/2010	11:37	K.	Kestrel	1		10	30	120	40	60				
08/09/2010	11:43	K.	Kestrel	1		2	15	120	50	50				
08/09/2010	11:43	SH	Sparrowhawk	1	E	1	5	50	100					
08/09/2010	11:54	MR	Marsh Harrier	1		60	80	120				100		
08/09/2010	12:08	K.	Kestrel	1		20	40	190		50	50			

08/09/2010	12:12	K.	Kestrel	1		1	30	210	10	90				
08/09/2010	12:14	K.	Kestrel	1		0	20	60	30	70				
08/09/2010	12:29	K.	Kestrel	1		0	30	50	1	99				
08/09/2010	12:35	K.	Kestrel	1		30	40	440			100			
08/09/2010	12:42	ML	Merlin	1		20	50	90		50	50			
15/09/2010	10:02	K.	Kestrel	1		0	5	20	100					
15/09/2010	10:04	K.	Kestrel	1		0	25	200	30	70				
15/09/2010	10:15	K.	Kestrel	1		0	35	320	5	55	40			
15/09/2010	10:34	K.	Kestrel	1		1	40	220	20	60	20			
15/09/2010	11:06	MR	Marsh Harrier	1	E	10	50	140	10	40	50			
15/09/2010	11:22	K.	Kestrel	1		0	30	140	50	50				
15/09/2010	11:30	MR	Marsh Harrier	1	N	10	20	30	50	50				
15/09/2010	11:39	BZ	Buzzard	1	SW	1	3	100	100					
28/09/2010	13:06	L.	Lapwing	150	W	30	60	300		20	50	30		
28/09/2010	13:10	K.	Kestrel	1		50	80	120			30	70		
28/09/2010	13:32	L.	Lapwing	56		0	50	370	5	65	30			
28/09/2010	13:34	K.	Kestrel	1	W	2	4	20	100					
28/09/2010	13:39	MR	Marsh Harrier	1		1	10	120	100					
28/09/2010	13:55	K.	Kestrel	1	E	30	50	80		30	70			
28/09/2010	14:11	K.	Kestrel	1	W	30	40	30		50	50			
28/09/2010	14:14	CA	Cormorant	2	S	10	15	20	40	60				
28/09/2010	14:27	MR	Marsh Harrier	1	S	1	10	200	100					
28/09/2010	15:15	PE	Peregrine	1	S	10	40	30	20	60	20			
28/09/2010	15:38	K.	Kestrel	2		10	15	60	20	80				
28/09/2010	15:39	GP	Golden Plover	2	W	40	40	40			100			
28/09/2010	15:41	K.	Kestrel	1	E	20	50	210		50	50			
28/09/2010	16:03	K.	Kestrel	1	NE	5	5	20	100					
28/09/2010	16:06	BZ	Buzzard	1		80	100	200				100		
28/09/2010	16:08	L.	Lapwing	3	N	100	100	10				100		
28/09/2010	16:31	BZ	Buzzard	1		0	10	60	100					
28/09/2010	16:44	K.	Kestrel	1	S	0	15	60	80	20				
28/09/2010	16:47	K.	Kestrel	1		2	15	40	50	50				

20/10/2010	12:45	CA	Cormorant	1	NE	80	120	220				100		
20/10/2010	12:54	K.	Kestrel	1	SSW	5	10	650	100					
20/10/2010	12:59	K.	Kestrel	1		10	30	85		100				
20/10/2010	13:06	K.	Kestrel	1		0	5	85	100					
20/10/2010	13:30	K.	Kestrel	1		30	120	230			10	90		
20/10/2010	13:36	K.	Kestrel	1	SSW	5	10	150	100					
20/10/2010	13:45	K.	Kestrel	1	S	5	10	120	100					
20/10/2010	13:50	K.	Kestrel	1		5	10	50	100					
20/10/2010	13:55	H.	Grey Heron	1	NNE	0	10	90	100					
20/10/2010	14:00	BZ	Buzzard	1	WSW	0	5	20	100					
20/10/2010	14:02	BZ	Buzzard	1	NNW	0	5	60	100					
20/10/2010	14:21	K.	Kestrel	1	S	0	10	210	100					
22/10/2010	10:27	ML	Merlin	1	N	<5	10	20	100					
22/10/2010	10:32	L.	Lapwing	370		<5	30	320	20	80				
22/10/2010	10:34	SH	Sparrowhawk	1	E	<5	10	40	100					
22/10/2010	10:46	L.	Lapwing	105	WNW	0	30	190	20	80				
22/10/2010	10:54	K.	Kestrel	1	S	<5	5	140	100					
22/10/2010	11:02	K.	Kestrel	1		0	5	250	100					
22/10/2010	11:23	CA	Cormorant	4	SSW	30	50	110			100			
22/10/2010	11:24	K.	Kestrel	1	S	10	30	150		100				
22/10/2010	11:33	K.	Kestrel	1		0	10	300	100					
22/10/2010	11:57	K.	Kestrel	1		0	5	150	100					
22/10/2010	12:01	ET	Little Egret	1	SW	5	10	80	100					
22/10/2010	12:08	SH	Sparrowhawk	1		<5	5	50	100					
22/10/2010	12:43	L.	Lapwing	70	ENE	20	80	160		10	60	30		
22/10/2010	12:49	SH	Sparrowhawk	1	NE	50	60	80				100		
22/10/2010	13:00	K.	Kestrel	1	S	5	10	20	100					
22/10/2010	13:02	K.	Kestrel	1	SW	10	20	60		100				
22/10/2010	13:28	BZ	Buzzard	1	NE	50	80	120				100		
22/10/2010	13:38	K.	Kestrel	1	ESE	20	30	30		100				
22/10/2010	13:53	L.	Lapwing	17	S	0	10	80	100					
22/10/2010	14:03	L.	Lapwing	110	N	<5	40	160	20	40	40			

22/10/2010	14:13	GP	Golden Plover	33		20	100	180		10	30	60		
22/10/2010	14:24	L.	Lapwing	42	S	0	20	50	50	50				
22/10/2010	14:25	GP	Golden Plover	35	S	30	50	60			100			
22/10/2010	14:33	GP	Golden Plover	35		<5	50	250	10	60	30			
22/10/2010	14:33	L.	Lapwing	180		<5	30	350	20	80				
22/10/2010	14:35	ML	Merlin	1	ESE	<5	20	50	50	50				
25/10/2010	10:57	K.	Kestrel	1		<5	5	50	100					
25/10/2010	11:11	H.	Grey Heron	1	NE	40	50	90			100			
25/10/2010	11:17	K.	Kestrel	1	S	<5	15	120	50	50				
25/10/2010	11:17	PE	Peregrine	1		<5	20	180	50	50				
25/10/2010	11:25	K.	Kestrel	1	W	0	20	100	10	90				
25/10/2010	11:34	PE	Peregrine	1		0	20	110	50	50				
25/10/2010	11:46	K.	Kestrel	1	N	<5	5	270	100					
25/10/2010	11:52	H.	Grey Heron	1	SE	20	30	120		100				
25/10/2010	12:02	K.	Kestrel	1		5	5	70	100					
25/10/2010	12:37	K.	Kestrel	1	NE	<5	5	130	100					
25/10/2010	12:46	K.	Kestrel	1		10	80	220		20	50	30		
25/10/2010	13:29	BZ	Buzzard	1	N	30	80	120			50	50		
25/10/2010	13:42	K.	Kestrel	1	SW	10	20	45		100				
25/10/2010	13:47	K.	Kestrel	1	S	50	80	150				100		
25/10/2010	14:00	K.	Kestrel	1		5	10	320	100					
25/10/2010	14:10	K.	Kestrel	1		<5	50	430	10	50	40			
25/10/2010	14:14	K.	Kestrel	1	NNW	5	10	120	100					

APPENDIX 13. NON-AVIAN ECOLOGY

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Appendix 13.1 - Desk Study

WILD
FRONTIER
ECOLOGY

Treading Wind Farm Proposal



Appendix 13.1 Desk Study

October 2010

Report produced by	**Client details**
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2 Aims

The desk study aimed to locate the closest statutory and non-statutory nature conservation sites to the proposed wind farm site, and to locate records of protected and valued species.

A search was conducted for all SPAs (Special Protection Areas) within 20km of the proposed wind farm. SPAs are statutory nature conservation sites designated for their high value to birds. An expansive search was undertaken for these sites specifically because of the perceived ornithological impacts of wind farms. Certain species such as geese and swans frequently travel further than 10km from feeding or roosting grounds (sites which would typically be designated SPAs), so a wider area was examined for these sites than was searched for other statutory designated sites.

A search was undertaken for all other statutory nature conservation sites (Special Areas of Conservation (SACs), Ramsar sites (Wetlands of International Importance), National Nature Reserves (NNRs), and Sites of Special Scientific Interest (SSSIs)) within 10km of the proposed wind farm site. A 10km search was also undertaken to identify all areas of Ancient Woodland within this distance of the site.

A search was also conducted for all non-statutory nature conservation sites (Local Wildlife Sites (LWSs), County Wildlife Sites (CWSs) and any other local designations such as Protected Road Side Verges) within 2km of the proposed wind farm.

All qualifying features of these sites were examined so that the potential for any impacts arising from the development could be assessed.

3 Methodology

The desk study accumulated designated site data from on-line resources and via records requests from the Cambridgeshire and Peterborough Biological Record Centre (CPBRC) and the Lincolnshire Biodiversity Partnership (LBP). These two agencies were contacted as the site straddles the boundary between these two counties.

- Natural England's and the Joint Nature Conservation Committee's websites were used to identify designated sites and their qualifying features.
- CPBRC and LBP searched within 2km of the study site for non-statutory designated sites and for species records.

4 Results

Statutory Nature Conservation Sites

- There are two Special Protection Areas within 20km of the proposed wind farm site (**Figure 1**):
  - Nene Washes SPA is approximately 9.7km to the south of the site.
  - The Wash SPA is 16km to the northeast of the site at its most proximate point.
- There is one Special Area of Conservation within 10km of the proposed wind farm (**Figure 2**):
  - Nene Washes SAC is 9.8km to the south of the site
- The is one Ramsar site (Wetland of International Importance) within 10km of the proposed wind farm (**Figure 3**):
  - Nene Washes Ramsar is located approximately 9.7km south of the site.
- There are no National Nature Reserves within 10km of the site; the closest NNR is The Wash, 15.5km to the northeast.
- There is one nationally designated nature conservation site (a Site of Special Scientific Interest (SSSI)) within 10km of the proposed wind farm (**Figure 4**):
  - Nene Washes (Whittlesey) SSSI is located 9.7km south of the proposed wind farm.

Natura 2000 Data Forms and Natural England citations are attached at the end of this appendix.

4.1.1 Special Protection Areas

Nene Washes SPA

At its most proximate point this SPA is approximately 9.7km south of the nearest proposed turbine.

Nene Washes is an extensive area of seasonally flooding wet grassland lying along the River Nene. The seasonal inundation and agricultural practices on and around the site make it an important site for feeding wildfowl and breeding waders. The site also acts as a refuge for birds displaced from colder continental sites and from the nearby Ouse Washes when this is deeply flooded.

The site qualifies as an SPA for supporting populations of European importance of the following species listed on Annex 1 of Directive 79/409/EEC:

During the breeding season: Ruff and Spotted Crake
Over winter: Bewick's Swan and Ruff

The site also qualifies as an SPA by supporting populations of European importance of the following migratory species:

During the breeding season: Black-tailed Godwit
Over winter: Pintail and Shoveler

The site also has an Assemblage Qualification by regularly supporting at least 20,000 waterfowl:

Over winter the area regularly supports 25,437 individual waterfowl (based on a 5 year peak mean 1991/92–1995/96), including: Black-tailed Godwit, Lapwing, Pochard, Teal, Gadwall, Wigeon, Shoveler, Pintail, Ruff and Bewick's Swan.

The Wash SPA

At its most proximate point this extensive site is approximately 16km to the northeast of the nearest proposed turbine.

This SPA is the largest estuarine system in the UK, fed by four rivers. The variety of habitats found here make it an important site for waterfowl, offering extensive opportunities for feeding, roosting and breeding.

The site qualifies as an SPA for supporting populations of European importance of the following species listed on Annex 1 of Directive 79/409/EEC:

During the breeding season: Common Tern, Little Tern and Marsh Harrier

Over winter: Avocet, Bar-tailed Godwit, Golden Plover and Whooper Swan

The site also qualifies as an SPA by supporting populations of European importance of the following migratory species:

On passage: Ringed Plover and Sanderling

Over winter: Black-tailed Godwit, Curlew, Dark-bellied Brent Goose, Dunlin, Grey Plover, Knot, Oystercatcher, Pink-footed Goose, Pintail, Redshank, Shelduck and Turnstone

The site also has an Assemblage Qualification by regularly supporting at least 20,000 waterfowl: [The Wash has the largest waterfowl assemblage in the UK]

Over winter the area regularly supports 400,273 individual waterfowl (based on a 5 year peak mean 1991/92-1995/96), including: Black-tailed Godwit, Avocet, Golden Plover, Bar-tailed Godwit, Pink-footed Goose, Dark-bellied Brent Goose, Shelduck, Pintail, Oystercatcher, Grey Plover, Whooper Swan, Dunlin, Sanderling, Curlew, Redshank, Turnstone, Little Grebe, Cormorant, White-fronted Goose, Wigeon, Mallard, Ringed Plover, Lapwing, Knot and Whimbrel.

4.1.2 Special Areas of Conservation

Nene Washes SAC

This site covers some of the same area as Nene Washes SPA. At its most proximate point it is approximately 9.8km to the south of the nearest proposed turbine.

This site (also known as Moreton's Leam, a large drainage ditch running along the north-east side of the Nene Washes) is designated as an SAC for the presence of the largest population in the UK of one Annex 2 species:

Spined Loach

4.1.3 Ramsar Sites (Wetlands of International Importance)

Nene Washes Ramsar

This site occupies the same area as Nene Washes SPA, so is also 9.7km to the south of the nearest proposed turbine.

It is designated as a Ramsar site as it supports an important assemblage of nationally rare breeding birds and a wide range of raptors occurs here throughout the year. The site also supports several nationally scarce plants, and two vulnerable and two rare British Red Data Book invertebrate species.
Bird species protected under this designation are as follows:

Species with peak counts in the winter: Tundra (Bewick's) Swan

Species for future consideration:

Species with peak counts in spring/autumn: Black-tailed Godwit
Species with peak counts in winter: Pintail

Other noteworthy fauna includes the following:

Species with peak counts in winter, occurring at levels of national importance: Whooper Swan, Wigeon, Teal, Shoveler, Pochard, Golden Plover and Ruff
Invertebrates: *Valvata macrostoma, Agabus undulatus,* The Scarce Chaser Dragonfly *Libellula fulva* and *Anasimyia interpuncta*.

4.1.4 Sites of Special Scientific Interest

Nene Washes SSSI

This site is located in the same place as Nene Washes SPA and Ramsar, 9.7km south of the nearest proposed turbine.

It is also designated as a SSSI for many of the same reasons as the above three designations. Nene Washes represents one of the country's few remaining areas of washland habitat which is essential to the survival nationally and internationally of populations of wildfowl and waders. The site is additionally notable for the diversity of plant and associated animal life within its network of dykes. The seasonal uptake of floodwaters and traditional cattle grazing have given rise to a mosaic of rough grassland and wet pasture, which provide a variety of sward structure and herbs of importance respectively for bird nesting habitat and feeding. Furthermore, when deep flood water prevents feeding at the nearby Ouse Washes the Nene Washes acts as a refuge for displaced birds. As well as the bird species listed above, Snipe and Redshank regularly breed here. Many of the ditches on the site hold a rich flora

Non-Statutory Nature Conservation Sites

There are no County Wildlife Sites within 2km of the proposed wind farm site.

Ancient woodland

Ancient Woodland is defined by Natural England as:
"Land that has had continuous woodland cover since at least 1600AD, and may be:

Ancient Semi-Natural Woodland – ancient woodland sites that have retained the native tree and shrub cover that has not been planted,

although it may have been managed by coppicing or felling and allowed to regenerate naturally.
Ancient Replanted Woodland – ancient woodland sites where the original native tree cover has been felled and replaced by planting, usually with conifers and usually this century."

There are no areas of Ancient Woodland within 10km of the proposed wind farm site.

Species records

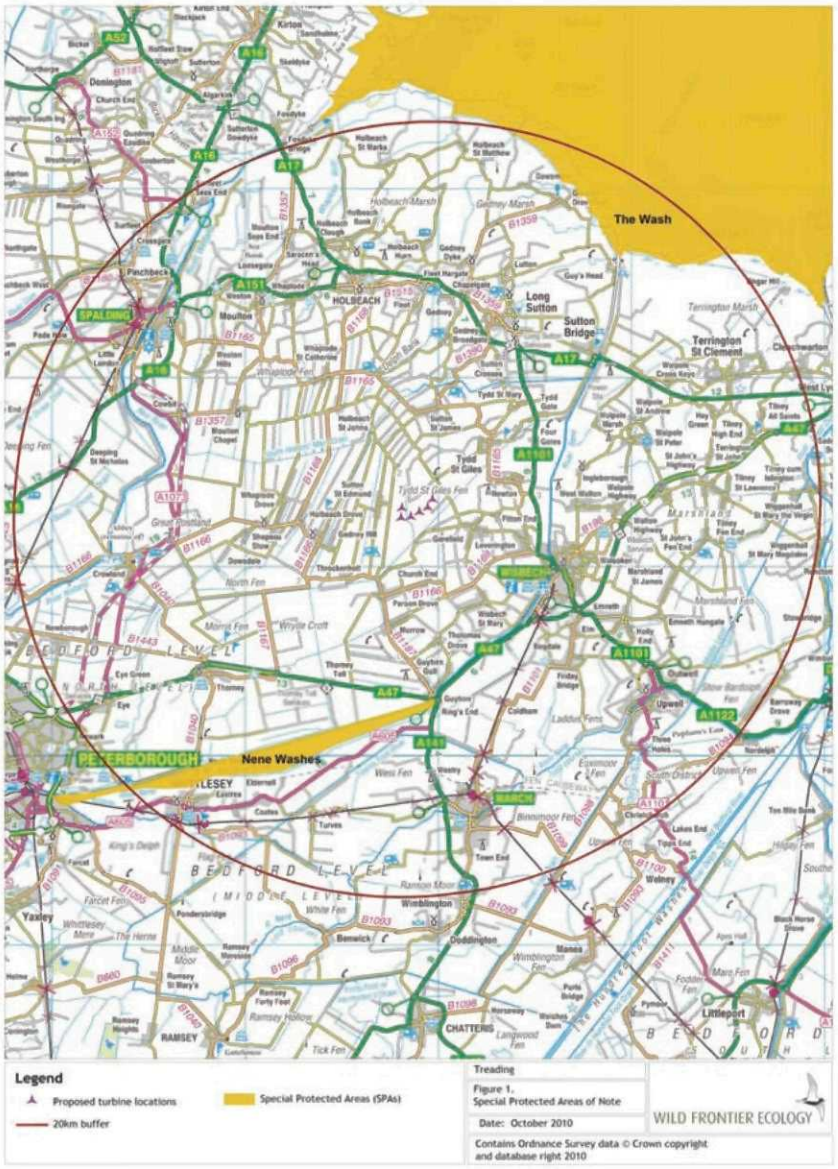
The data search within 2km of the development produced 15 faunal records of 7 different species (**Table 1**). The accuracy of the records locations varies from 100m² to 1km². All records are from CPBRC, LBP did not hold any records for the area within 2km of the site.

Table 1 *– Faunal Species records within 2km of the Wind Farm Site*

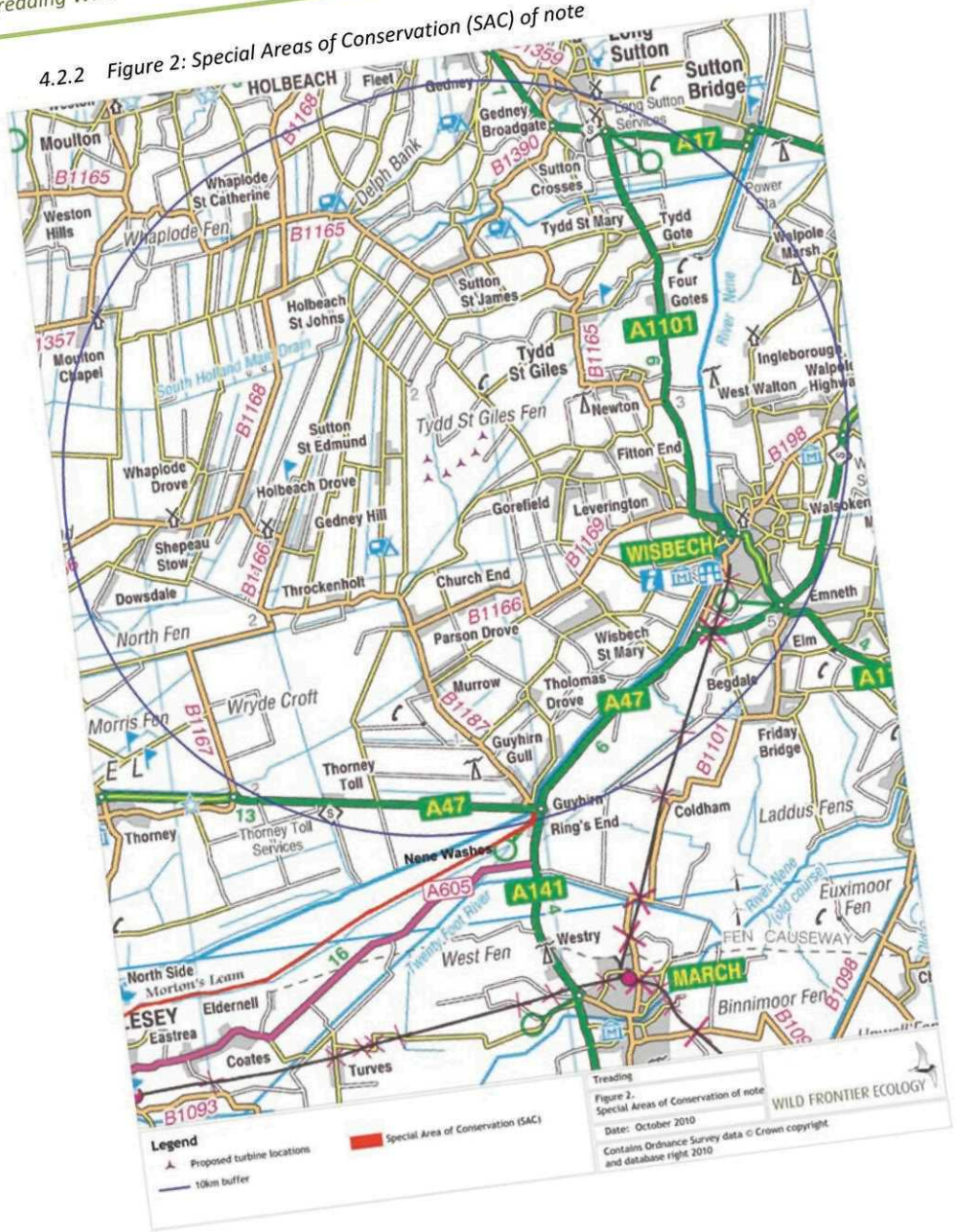
Common Name	Latin Name	Location	Grid Ref	Date	Designations
Water Vole	Arvicola terrestris	North Level Main Drain	TF392119	31/01/1997	WCA Sch5, UKBAP, C&P LBAP
Water Vole	Arvicola terrestris	North Level Main Drain, Gorefield	TF386114	22/03/2002	
Water Vole	Arvicola terrestris	Haroldsbridge	TF391119	1992	
Barn Owl	Tyto alba	Gorefield	TF4012	18/01/2008	WCA Schedule 1
Barn Owl	Tyto alba	Gorefield	TF4012	20/02/2008	
Barn Owl	Tyto alba	Gorefield	TF4012	30/04/2008	
Barn Owl	Tyto alba	Gorefield	TF4012	31/05/2008	
Common Kingfisher	Alcedo atthis	Gorefield	TF4012	28/10/2008	WCA Schedule 1
Eurasian Hobby	Falco subbuteo	Gorefield	TF4012	15/05/2007	WCA Schedule 1
Eurasian Marsh Harrier	Circus aeruginosus	Gorefield	TF4012	29/08/2007	WCA Schedule 1
Eurasian Marsh Harrier	Circus aeruginosus	Gorefield	TF4012	17/09/2007	
Eurasian Marsh Harrier	Circus aeruginosus	Gorefield	TF4012	12/09/2008	
Grey Partridge	Perdix perdix	Gorefield	TF4012	02/03/2007	UKBAP, NERCS41, C&P LBAP
Grey Partridge	Perdix perdix	Gorefield	TF4012	05/09/2007	
Wall Butterfly	Lasiommata megera	Consult Butterfly Conservation	TF31W	06/08/1993	UKBAP, NERCS41

4.2 Maps of all Designated Sites and Species Records

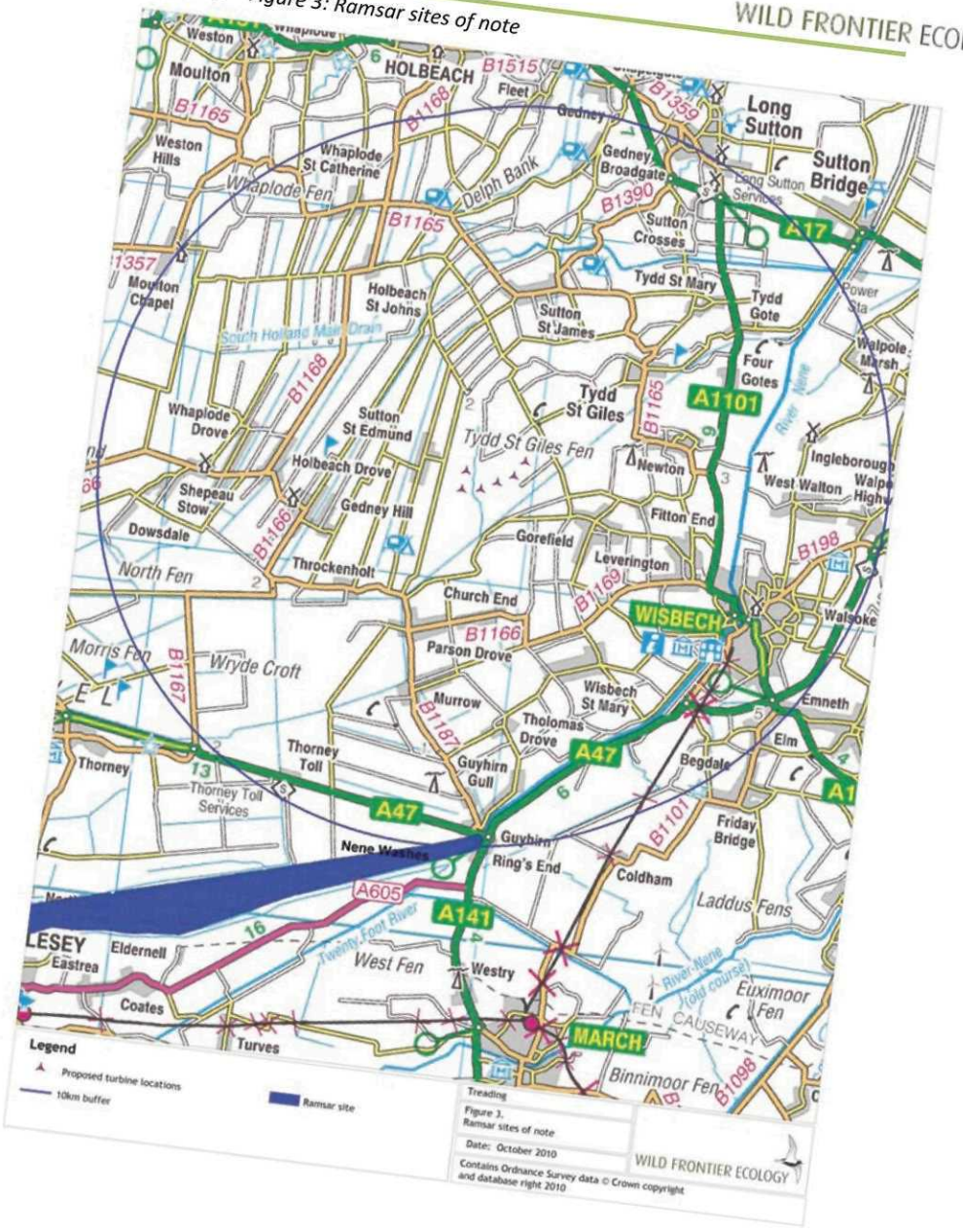
4.2.1 Figure 1: Special Protected Areas (SPA) of note



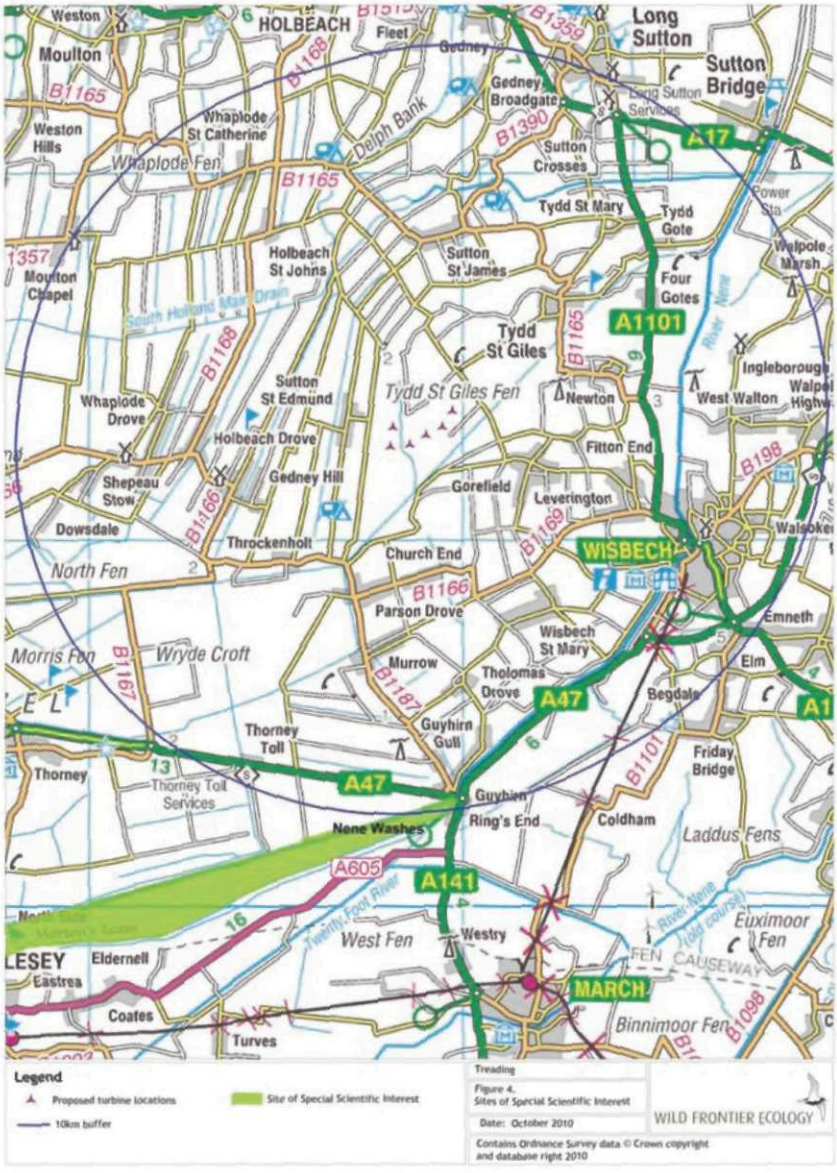
4.2.2 *Figure 2: Special Areas of Conservation (SAC) of note*



4.2.3 Figure 3: Ramsar sites of note



4.2.4 Figure 4: Sites of Special Scientific Interest (SSSIs) within 10km



4.3 Supplementary Information

4.3.1 SPA Citations

UK SPA data form

NATURA 2000

STANDARD DATA FORM

FOR SPECIAL PROTECTION AREAS (SPA)
FOR SITES ELIGIBLE FOR IDENTIFICATION AS SITES OF COMMUNITY IMPORTANCE (SCI)
AND
FOR SPECIAL AREAS OF CONSERVATION (SAC)

1. Site identification:

1.1 Type F **1.2 Site code** UK9008031

1.3 Compilation date 199303 **1.4 Update** 199902

1.5 Relationship with other Natura 2000 sites

U	K	0	0	3	0	2	2	2

1.6 Respondent(s) International Designations, JNCC, Peterborough

1.7 Site name Nene Washes

1.8 Site indication and designation classification dates

date site proposed as eligible as SCI	
date confirmed as SCI	
date site classified as SPA	199303
date site designated as SAC	

2. Site location:

2.1 Site centre location

longitude	latitude
00 04 33 W	52 34 41 N

2.2 Site area (ha) 1517.49 **2.3 Site length (km)**

2.5 Administrative region

NUTS code	Region name	% cover
UK401	Cambridgeshire	100.00%

2.6 Biogeographic region

Alpine	Atlantic	Boreal	Continental	Macaronesia	Mediterranean
	X				

3. Ecological information:

3.1 Annex I habitats

Habitat types present on the site and the site assessment for them:

Annex I habitat	% cover	Representativity	Relative surface	Conservation status	Global assessment

Nene Washes
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UK SPA data form

3.2 Annex I birds and regularly occurring migratory birds not listed on Annex I

		Population				Site assessment			
		Resident	Migratory						
Code	Species name		Breed	Winter	Stage	Population	Conservation	Isolation	Global
A054	*Anas acuta*			1435 I		B		C	
A056	*Anas clypeata*		36 P			B		C	
A056	*Anas clypeata*			318 I		B		C	
A052	*Anas crecca*			2179 I		C		C	
A050	*Anas penelope*			8292 I		B		C	
A055	*Anas querquedula*		5 P			A		C	
A051	*Anas strepera*			206 I		B		C	
A051	*Anas strepera*		25 P			B		C	
A037	*Cygnus columbianus bewickii*			1718 I		A		C	
A156a	*Limosa limosa limosa*		16 P			A		B	

4. Site description:

4.1 General site character

Habitat classes	% cover
Marine areas. Sea inlets	
Tidal rivers. Estuaries. Mud flats. Sand flats. Lagoons (including saltwork basins)	2.0
Salt marshes. Salt pastures. Salt steppes	
Coastal sand dunes. Sand beaches. Machair	
Shingle. Sea cliffs. Islets	
Inland water bodies (standing water, running water)	67.0
Bogs. Marshes. Water fringed vegetation. Fens	
Heath. Scrub. Maquis and garrigue. Phygrana	
Dry grassland. Steppes	
Humid grassland. Mesophile grassland	10.0
Alpine and sub-alpine grassland	
Improved grassland	
Other arable land	20.0
Broad-leaved deciduous woodland	1.0
Coniferous woodland	
Evergreen woodland	
Mixed woodland	
Non-forest areas cultivated with woody plants (including orchards, groves, vineyards, dehesas)	
Inland rocks. Screes. Sands. Permanent snow and ice	
Other land (including towns, villages, roads, waste places, mines, industrial sites)	
Total habitat cover	**100%**

4.1 Other site characteristics

Soil & geology:

Acidic, Alluvium, Basic, Clay, Neutral, Peat

Geomorphology & landscape:

Floodplain, Lowland

4.2 Quality and importance

ARTICLE 4.1 QUALIFICATION (79/409/EEC)

Over winter the area regularly supports:

UK SPA data form

Cygnus columbianus bewickii (Western Siberia/North-eastern & North-western Europe)	23.9% of the GB population 5 year peak mean 1991/92-1995/96

ARTICLE 4.2 QUALIFICATION (79/409/EEC)

During the breeding season the area regularly supports:

Anas clypeata (North-western/Central Europe)	3.6% of the population in Great Britain Count, as at 1990
Anas querquedula (Western Siberia/Europe/Western Africa)	33.3% of the population in Great Britain 5 year mean, 1988-1992
Anas strepera (North-western Europe)	3.2% of the population in Great Britain Count, as at 1990
Limosa limosa limosa (Western Europe/W Africa)	55.2% of the population in Great Britain Count, as at 1992

Over winter the area regularly supports:

Anas acuta (North-western Europe)	5.2% of the population in Great Britain 5 year peak mean 1991/92-1995/96
Anas clypeata (North-western/Central Europe)	3.2% of the population in Great Britain 5 year peak mean 1991/92-1995/96
Anas crecca (North-western Europe)	1.6% of the population in Great Britain 5 year peak mean 1991/92-1995/96
Anas penelope (Western Siberia/North-western/North-eastern Europe)	3% of the population in Great Britain 5 year peak mean 1991/92-1995/96
Anas strepera (North-western Europe)	2.5% of the population in Great Britain 5 year peak mean 1991/92-1995/96

4.3 Vulnerability

The continued international importance of this site is dependant on the maintenance of a winter flooding regime and a high but controlled summer water table. The establishment of a water level management regime is being addressed through the Nene Washes Management Strategy Group. A Management Plan was agreed in 1992 and a Water Level Management Plan is currently being drafted. English Nature also has management agreements with a number of landowners. Wildfowling occurs on all sections of the Washes but is not considered to cause significant disturbance at current levels. Any proposals for increased wildfowling will be regulated through the Habitat Regulations.

5. Site protection status and relation with CORINE biotopes:

5.1 Designation types at national and regional level

Code	% cover
UK04 (SSSI/ASSI)	100.0

UK SPA data form

NATURA 2000

STANDARD DATA FORM

FOR SPECIAL PROTECTION AREAS (SPA)
FOR SITES ELIGIBLE FOR IDENTIFICATION AS SITES OF COMMUNITY IMPORTANCE (SCI)
AND
FOR SPECIAL AREAS OF CONSERVATION (SAC)

1. Site identification:

1.1 Type J **1.2 Site code** UK9008021

1.3 Compilation date 198803 **1.4 Update** 199902

1.5 Relationship with other Natura 2000 sites

U	K	0	0	1	7	0	7	5

1.6 Respondent(s) International Designations, JNCC, Peterborough

1.7 Site name **The Wash**

1.8 Site indication and designation classification dates

date site proposed as eligible as SCI	
date confirmed as SCI	
date site classified as SPA	198803
date site designated as SAC	

2. Site location:

2.1 Site centre location

longitude	**latitude**
00 17 12 E	52 56 16 N

2.2 Site area (ha) 62211.66 **2.3 Site length (km)**

2.5 Administrative region

NUTS code	Region name	% cover
UK33	Lincolnshire	28.00%
0	Marine	60.00%
UK402	Norfolk	12.00%

2.6 Biogeographic region

Alpine	Atlantic	Boreal	Continental	Macaronesia	Mediterranean
	X				

The Wash
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UK SPA data form

3. Ecological information:

3.1 Annex I habitats

Habitat types present on the site and the site assessment for them:

Annex I habitat	% cover	Representativity	Relative surface	Conservation status	Global assessment

3.2 Annex I birds and regularly occurring migratory birds not listed on Annex I

		Population				Site assessment			
		Resident	Migratory						
Code	Species name		Breed	Winter	Stage	Population	Conservation	Isolation	Global
A054	*Anas acuta*			923 I		B		C	
A050	*Anas penelope*			3241 I		C		C	
A051	*Anas strepera*			71 I		C		C	
A040	*Anser brachyrhynchus*			33265 I		A		B	
A169	*Arenaria interpres*			717 I		C		C	
A046a	*Branta bernicla bernicla*			22248 I		A		C	
A067	*Bucephala clangula*			114 I		C		C	
A144	*Calidris alba*			355 I		C		C	
A149	*Calidris alpina alpina*			35620 I		B		C	
A143	*Calidris canutus*			186892 I		A		C	
A037	*Cygnus columbianus bewickii*			68 I		C		C	
A130	*Haematopus ostralegus*			25651 I		B		C	
A157	*Limosa lapponica*			11250 I		A		C	
A156	*Limosa limosa islandica*			859 I		B		C	
A065	*Melanitta nigra*			68 I		C		C	
A160	*Numenius arquata*			3835 I		B		C	
A141	*Pluvialis squatarola*			9708 I		A		C	
A195	*Sterna albifrons*		>33 P			C		C	
A193	*Sterna hirundo*		152 P			C		C	
A048	*Tadorna tadorna*			15981 I		A		C	
A162	*Tringa totanus*			2953 I		B		C	

4. Site description:

4.1 General site character

Habitat classes	% cover
Marine areas. Sea inlets	55.0
Tidal rivers. Estuaries. Mud flats. Sand flats. Lagoons (including saltwork basins)	39.0
Salt marshes. Salt pastures. Salt steppes	6.0
Coastal sand dunes. Sand beaches. Machair	
Shingle. Sea cliffs. Islets	
Inland water bodies (standing water, running water)	
Bogs. Marshes. Water fringed vegetation. Fens	
Heath. Scrub. Maquis and garrigue. Phygrana	
Dry grassland. Steppes	
Humid grassland. Mesophile grassland	
Alpine and sub-alpine grassland	
Improved grassland	
Other arable land	
Broad-leaved deciduous woodland	
Coniferous woodland	
Evergreen woodland	
Mixed woodland	
Non-forest areas cultivated with woody plants (including orchards, groves, vineyards, dehesas)	

The Wash
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UK SPA data form

Habitat classes	% cover
Inland rocks. Screes. Sands. Permanent snow and ice	
Other land (including towns, villages, roads, waste places, mines, industrial sites)	
Total habitat cover	**100%**

4.1 Other site characteristics

Soil & geology:

Clay, Mud, Neutral, Sand, Sedimentary, Shingle

Geomorphology & landscape:

Coastal, Enclosed coast (including embayment), Estuary, Intertidal sediments (including sandflat/mudflat), Lowland, Subtidal sediments (including sandbank/mudbank)

4.2 Quality and importance

ARTICLE 4.1 QUALIFICATION (79/409/EEC)

During the breeding season the area regularly supports:

Sterna albifrons (Eastern Atlantic - breeding)	at least 1.4% of the GB breeding population 5 year mean, 1992-1996
Sterna hirundo (Northern/Eastern Europe - breeding)	1.2% of the GB breeding population Count, as at 1993

Over winter the area regularly supports:

Cygnus columbianus bewickii (Western Siberia/North-eastern & North-western Europe)	0.9% of the GB population 5 year peak mean 1991/92-1995/96
Limosa lapponica (Western Palearctic - wintering)	21.4% of the GB population 5 year peak mean 1991/92-1995/96

ARTICLE 4.2 QUALIFICATION (79/409/EEC)

Over winter the area regularly supports:

Anas acuta (North-western Europe)	1.5% of the population 5 year peak mean 1991/92-1995/96
Anas penelope (Western Siberia/North-western/North-eastern Europe)	1.2% of the population in Great Britain 5 year peak mean 1991/92-1995/96
Anas strepera (North-western Europe)	0.9% of the population in Great Britain 5 year peak mean 1991/92-1995/96
Anser brachyrhynchus (Eastern Greenland/Iceland/UK)	14.8% of the population 5 year peak mean 1991/92-1995/96
Arenaria interpres (Western Palearctic - wintering)	1.1% of the population 5 year peak mean 1991/92-1995/96
Branta bernicla bernicla (Western Siberia/Western Europe)	7.4% of the population 5 year peak mean 1991/92-1995/96

UK SPA data form

Bucephala clangula (North-western/Central Europe)	0.7% of the population in Great Britain 5 year peak mean 1991/92-1995/96
Calidris alba (Eastern Atlantic/Western & Southern Africa - wintering)	0.3% of the population 5 year peak mean 1991/92-1995/96
Calidris alpina alpina (Northern Siberia/Europe/Western Africa)	2.6% of the population 5 year peak mean 1991/92-1995/96
Calidris canutus (North-eastern Canada/Greenland/Iceland/North-western Europe)	54.2% of the population 5 year peak mean 1991/92-1995/96
Haematopus ostralegus (Europe & Northern/Western Africa)	2.9% of the population 5 year peak mean 1991/92-1995/96
Limosa limosa islandica (Iceland - breeding)	11.6% of the population in Great Britain 5 year peak mean 1991/92-1995/96
Melanitta nigra (Western Siberia/Western & Northern Europe/North-western Africa)	0.2% of the population in Great Britain 5 year peak mean 1991/92-1995/96
Numenius arquata (Europe - breeding)	1.1% of the population 5 year peak mean 1991/92-1995/96
Pluvialis squatarola (Eastern Atlantic - wintering)	5.8% of the population 5 year peak mean 1991/92-1995/96
Tadorna tadorna (North-western Europe)	5.3% of the population 5 year peak mean 1991/92-1995/96
Tringa totanus (Eastern Atlantic - wintering)	1.7% of the population 5 year peak mean 1991/92-1995/96

ARTICLE 4.2 QUALIFICATION (79/409/EEC): AN INTERNATIONALLY IMPORTANT ASSEMBLAGE OF BIRDS

Over winter the area regularly supports:

400367 waterfowl (5 year peak mean 01/04/1998)

Including:

Cygnus columbianus bewickii , Anser brachyrhynchus , Branta bernicla bernicla , Tadorna tadorna , Anas penelope , Anas strepera , Anas acuta , Melanitta nigra , Bucephala clangula , Haematopus ostralegus , Pluvialis squatarola , Calidris canutus , Calidris alba , Calidris alpina alpina , Limosa limosa islandica , Limosa lapponica , Numenius arquata , Tringa totanus , Arenaria interpres .

UK SPA data form

4.3 Vulnerability

The biological richness of the Wash is largely dependant on the physical processes that dominate the natural systems and consequently the ecological vulnerability is closely linked to the physical environment. The intertidal zone is vulnerable to coastal squeeze as a result of land-claim, coastal defence works, sea-level rise, and storm surges. Intertidal habitats are potentially affected by changes in sediment budget caused by dredging and coastal protection, construction of river training walls and flood defence works. The site is also potentially vulnerable to gas exploration. Activities affecting sediment budget and anthropogenic causes of coastal squeeze will be addressed through the management scheme being developed jointly for the SAC/SPA on this site.
The estuary is fed by four large rivers which drain a substantial area of Eastern England. The volume and quality of water entering the Wash is dependent on the use made of these rivers for water abstraction and agricultural, and domestic effluents. Discharge consents and abstraction licenses will be reviewed under the provisions of the Habitats Regulations.

There are two Air Weapons Ranges within the site; activities on these ranges are covered by a Memorandum of Understanding between the Ministry of Defence and Department of the Environment, a Declaration of Intent between the Ministry of Defence and English Nature and by Site Management Statements with English Nature. There is a Nature Conservation Management Plan and Management Committee for one of the ranges.

These issues have been addressed in the Wash Estuary Management Plan and by Local Environment Agency Plans and will be extended through the Marine Scheme of Management which is now in progress.

5. Site protection status and relation with CORINE biotopes:

5.1 Designation types at national and regional level

Code	% cover
UK01 (NNR)	13.5
UK04 (SSSI/ASSI)	100.0

4.3.2 SAC Citations

UK SAC data form

NATURA 2000

STANDARD DATA FORM

FOR SPECIAL PROTECTION AREAS (SPA)
FOR SITES ELIGIBLE FOR IDENTIFICATION AS SITES OF COMMUNITY IMPORTANCE (SCI)
AND
FOR SPECIAL AREAS OF CONSERVATION (SAC)

1. Site identification:

1.1 Type G **1.2 Site code** UK0030222

1.3 Compilation date 200101 **1.4 Update**

1.5 Relationship with other Natura 2000 sites

U	K	9	0	0	8	0	3	1

1.6 Respondent(s) International Designations, JNCC, Peterborough

1.7 Site name Nene Washes

1.8 Site indication and designation classification dates

date site proposed as eligible as SCI	200101
date confirmed as SCI	
date site classified as SPA	
date site designated as SAC	

2. Site location:

2.1 Site centre location

longitude	latitude
00 04 42 W	52 34 22 N

2.2 Site area (ha) 88.19 **2.3 Site length (km)**

2.5 Administrative region

NUTS code	Region name	% cover
UK401	Cambridgeshire	100.0%

2.6 Biogeographic region

Alpine	Atlantic	Boreal	Continental	Macaronesia	Mediterranean
	√				

3. Ecological information:

3.1 Annex I habitats

Habitat types present on the site and the site assessment for them:

Annex I habitat	% cover	Representativity	Relative surface	Conservation status	Global assessment

Nene Washes
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UK SAC data form

3.2 Annex II species

		Population			Site assessment			
	Resident	Migratory						
Species name		Breed	Winter	Stage	Population	Conservation	Isolation	Global
Cobitis taenia	Present	-	-	-	C	C	C	A

4. Site description

4.1 General site character

Habitat classes	% cover
Marine areas. Sea inlets	
Tidal rivers. Estuaries. Mud flats. Sand flats. Lagoons (including saltwork basins)	
Salt marshes. Salt pastures. Salt steppes	
Coastal sand dunes. Sand beaches. Machair	
Shingle. Sea cliffs. Islets	
Inland water bodies (standing water, running water)	65.0
Bogs. Marshes. Water fringed vegetation. Fens	10.0
Heath. Scrub. Maquis and garrigue. Phygrana	
Dry grassland. Steppes	
Humid grassland. Mesophile grassland	
Alpine and sub-alpine grassland	
Improved grassland	25.0
Other arable land	
Broad-leaved deciduous woodland	
Coniferous woodland	
Mixed woodland	
Non-forest areas cultivated with woody plants (including orchards, groves, vineyards, dehesas)	
Inland rocks. Screes. Sands. Permanent snow and ice	
Other land (including towns, villages, roads, waste places, mines, industrial sites)	
Total habitat cover	**100%**

4.1 Other site characteristics

Soil & geology:

Alluvium, Clay, Neutral, Peat

Geomorphology & landscape:

Floodplain, Lowland

4.2 Quality and importance

Cobitis taenia

- for which this is one of only four known outstanding localities in the United Kingdom.

UK SAC data form

4.3 Vulnerability

Moreton's Leam is a 14th century dyke which forms the southern boundary of the Nene Washes SSSI. It is fed by water from the River Nene via a sluice at Stanground in Peterborough. During winter the entire washes and Moreton's Leam may take flood-water from the Nene.

Issues of concern relate to water quality, turbidity and sediment. The WLMP addresses the need to maintain sufficient flow through the system and has been agreed upon by a wide range of parties with an interest in the Leam. Water is abstracted by gravity only and is primarily for use as 'wet fences' on the Nene Washes SSSI and for Bassenhally Pit SSSI. A fishing-lake at Whittlesey also abstracts water. Abstraction from the Nene by Anglia Water Services for Rutland Water is believed to be under review at present, but no formal applications have been received although further abstraction has been the subject of assessment. Water quality is of concern. During the summer, flows in the Nene are occasionally maintained only through treated sewage effluent, with raised levels of phosphate in particular. Flag Fen Sewage Treatment Works at Peterborough will be covered by the Urban Waste Water Directive, but effluents from other smaller works should also be kept under strict review. A case could be submitted to OFWAT and the Water Industries AMP 4 Programme to strip phosphates from all relevant sewage works in the system. Large-scale mineral extraction, such as present proposals at Bradley Fen, could affect the site by underground seepage, increased turbidity from washings etc. Angling is widely practised in the Leam and could affect local populations.

5. Site protection status and relation with CORINE biotopes:

5.1 Designation types at national and regional level

Code	% cover
UK04 (SSSI/ASSI)	99.8

4.3.3 Ramsar Citations

Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX. 22 of the 9th Conference of the Contracting Parties (2005).

Notes for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
2. Further information and guidance in support of Ramsar site designations are provided in the *Strategic Framework for the future development of the List of Wetlands of International Importance* (Ramsar Wise Use Handbook 7, 2nd edition, as amended by COP9 Resolution IX.1 Annex B). A 3rd edition of the Handbook, incorporating these amendments, is in preparation and will be available in 2006.
3. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers should provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of all maps.

1. Name and address of the compiler of this form:

FOR OFFICE USE ONLY.
DD MM YY

Designation date | Site Reference Number

Joint Nature Conservation Committee
Monkstone House
City Road
Peterborough
Cambridgeshire PE1 1JY
UK
Telephone/Fax: +44 (0)1733 – 562 626 / +44 (0)1733 – 555 948
Email: RIS@JNCC.gov.uk

2. Date this sheet was completed/updated:
Designated: 05 March 1993

3. Country:
UK (England)

4. Name of the Ramsar site:
Nene Washes

5. Designation of new Ramsar site or update of existing site:

This RIS is for: Updated information on an existing Ramsar site

6. For RIS updates only, changes to the site since its designation or earlier update:
a) Site boundary and area:

** Important note: If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:

7. Map of site included:

Refer to Annex III of the *Explanatory Notes and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

a) A map of the site, with clearly delineated boundaries, is included as:

i) **hard copy** (required for inclusion of site in the Ramsar List): *yes* ✓ -or- *no* □;
ii) **an electronic format** (e.g. a JPEG or ArcView image) Yes
iii) **a GIS file providing geo-referenced site boundary vectors and attribute tables** *yes* ✓ -or- *no* □;

b) Describe briefly the type of boundary delineation applied:

e.g. the boundary is the same as an existing protected area (nature reserve, national park etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

The site boundary is the same as, or falls within, an existing protected area.

For precise boundary details, please refer to paper map provided at designation

8. Geographical coordinates (latitude/longitude):
52 34 41 N 00 04 33 W

9. General location:

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

Nearest town/city: Peterborough

The site extends for 21 km east from Peterborough, in eastern England.

Administrative region: Cambridgeshire; City of Peterborough

10. Elevation (average and/or max. & min.) (metres): **11. Area** (hectares): 1517.49

Min. 1
Max. 6
Mean 2

12. General overview of the site:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

This site is an extensive area of seasonally-flooding wet grassland (washland) of importance for national and international populations of breeding and wintering waders and wildfowl. During severe winter weather elsewhere, the site can attract waterfowl from other areas due to its relatively mild climate (compared with continental Europe) and abundant food resources available. The site is also notable for the diversity of plant and associated animal life within its network of dykes.

13. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

2, 6

14. Justification for the application of each Criterion listed in 13 above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Ramsar criterion 2

The site supports an important assemblage of nationally rare breeding birds. In addition, a wide range of raptors occur through the year. The site also supports several nationally scarce plants, and two vulnerable and two rare British Red Data Book invertebrate species have been recorded.

Ramsar criterion 6 – species/populations occurring at levels of international importance.

Qualifying Species/populations (as identified at designation):

Species with peak counts in winter:

Tundra swan , *Cygnus columbianus bewickii*, NW Europe	694 individuals, representing an average of 2.3% of the population (5 year peak mean 1998/9-2002/3)

Species/populations identified subsequent to designation for possible future consideration under criterion 6.

Species with peak counts in spring/autumn:

Black-tailed godwit , *Limosa limosa islandica*, Iceland/W Europe	482 individuals, representing an average of 1.3% of the population (5 year peak mean 1998/9-2002/3 - spring peak)

Species with peak counts in winter:

Northern pintail , *Anas acuta*, NW Europe	1848 individuals, representing an average of 3% of the population (5 year peak mean 1998/9-2002/3)

Contemporary data and information on waterbird trends at this site and their regional (sub-national) and national contexts can be found in the Wetland Bird Survey report, which is updated annually. See www.bto.org/survey/webs/webs-alerts-index.htm.

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15. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region:
Atlantic

b) biogeographic regionalisation scheme (include reference citation):
Council Directive 92/43/EEC

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16. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Soil & geology	acidic, basic, neutral, clay, alluvium, peat
Geomorphology and landscape	lowland, floodplain
Nutrient status	eutrophic
pH	circumneutral
Salinity	fresh
Soil	mainly organic
Water permanence	usually seasonal / intermittent

Summary of main climatic features	Annual averages (Cambridge, 1971–2000) (www.metoffice.com/climate/uk/averages/19712000/sites/cambridge.html) Max. daily temperature: 14.1° C Min. daily temperature: 6.1° C Days of air frost: 41.9 Rainfall: 553.5 mm Hrs. of sunshine: 1501.2

General description of the Physical Features:

The Nene Washes are an extensive area of seasonally-flooding wet grassland ('washland') lying along the River Nene.

17. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

The Nene Washes are an extensive area of seasonally-flooding wet grassland ('washland') lying along the River Nene.

18. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

Flood water storage / desynchronisation of flood peaks

19. Wetland types:

Human-made wetland, Inland wetland

Code	Name	% Area
4	Seasonally flooded agricultural land	100

20. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

A mixture of largely arable land and agriculturally-improved, floristically-poor grassland. The latter being dominated by species such as *Elymus repens*, *Poa trivialis* and *Deschampsia cespitosa*. Areas of more structurally-diverse grassland exist containing a range of grasses, sedges and rushes. Species of frequent occurrence include *Eleocharis palustris*, *Glyceria fluitans*, *Glyceria maxima*, *Phalaris arundinacea*, *Alopecurus geniculatus* and *Juncus effusus*. A couple of small semi-natural grassland areas are also present. The washlands are used for the seasonal uptake of floodwaters and traditionally, cattle grazing in summer months. The mosaic of rough grassland and wet pasture provide a variety of habitats for breeding and feeding birds. Many of the ditches hold a rich flora and several nationally scarce plants including fringed water-lily *Nymphoides peltata*, hair-like pondweed *Potamogeton trichoides* and marsh dock *Rumex palustris*.

Ecosystem services

21. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Nationally important species occurring on the site.

Higher Plants.
Nymphoides peltata, Potamogeton trichoides, Rumex palustris, Potamogeton friesii, Alisma lanceolatum, Hordeum marinum.

22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Birds

Species currently occurring at levels of national importance:

Species with peak counts in winter:

Whooper swan , *Cygnus cygnus*, Iceland/UK/Ireland	80 individuals, representing an average of 1.3% of the GB population (5 year peak mean 1998/9-2002/3)
Eurasian wigeon , *Anas penelope*, NW Europe	9651 individuals, representing an average of 2.3% of the GB population (5 year peak mean 1998/9-2002/3)
Eurasian teal , *Anas crecca*, NW Europe	2015 individuals, representing an average of 1% of the GB population (5 year peak mean 1998/9-2002/3)
Northern shoveler , *Anas clypeata*, NW & C Europe	343 individuals, representing an average of 2.3% of the GB population (5 year peak mean 1998/9-2002/3)
Common pochard , *Aythya ferina*, NE & NW Europe	1795 individuals, representing an average of 3% of the GB population (5 year peak mean 1998/9-2002/3)
European golden plover , *Pluvialis apricaria apricaria*, P. a. altifrons Iceland & Faroes/E Atlantic	2949 individuals, representing an average of 1.1% of the GB population (5 year peak mean 1998/9-2002/3)
Ruff , *Philomachus pugnax*, Europe/W Africa	98 individuals, representing an average of 14% of the GB population (5 year peak mean 1998/9-2002/3)

Species Information

Nationally important species occurring on the site.

Invertebrates.
Valvata macrostoma, Agabus undulatus, Libellula fulva, Anasimyia interpuncta.

23. Social and cultural values:

Describe if the site has any general social and/or cultural values e.g. fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

Aesthetic
Livestock grazing
Non-consumptive recreation
Sport hunting

b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning? No

If Yes, describe this importance under one or more of the following categories:

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i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:

ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:

iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:

iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

24. Land tenure/ownership:

Ownership category	On-site	Off-site
Non-governmental organisation (NGO)	+	
Private	+	+
Private	+	+

25. Current land (including water) use:

Activity	On-site	Off-site
Nature conservation	+	
Recreation	+	
Permanent arable agriculture	+	+
Permanent pastoral agriculture	+	+
Hay meadows	+	
Flood control	+	
Transport route		+

26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

Explanation of reporting category:

1. *Those factors that are still operating, but it is unclear if they are under control, as there is a lag in showing the management or regulatory regime to be successful.*
2. *Those factors that are not currently being managed, or where the regulatory regime appears to have been ineffective so far.*

NA = Not Applicable because no factors have been reported.

Adverse Factor Category	Reporting Category	Description of the problem (Newly reported Factors only)	On-Site	Off-Site	Major Impact?
No factors reported	NA				

For category 2 factors only.

What measures have been taken / are planned / regulatory processes invoked, to mitigate the effect of these factors?
Is the site subject to adverse ecological change? NO

27. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

Conservation measure	On-site	Off-site
Site/ Area of Special Scientific Interest (SSSI/ASSI)	+	
Special Protection Area (SPA)	+	
Land owned by a non-governmental organisation for nature conservation	+	
Management agreement	+	
Site management statement/plan implemented	+	
Special Area of Conservation (SAC)	+	

b) Describe any other current management practices:

The management of Ramsar sites in the UK is determined by either a formal management plan or through other management planning processes, and is overseen by the relevant statutory conservation agency. Details of the precise management practises are given in these documents.

28. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

No information available

29. Current scientific research and facilities:

e.g. details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

Fauna.

Numbers of migratory and wintering wildfowl and waders are monitored annually as part of the national Wetland Birds Survey (WeBS) organised by the British Trust for Ornithology, Wildfowl & Wetlands Trust, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee.

Annual breeding bird survey.

30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:

e.g. visitor centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

Occasional guided walks are provided by RSPB warden.

31. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Wildfowling and sport hunting annually from September to February.

32. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept. of Agriculture/Dept. of Environment, etc.

Head, Natura 2000 and Ramsar Team, Department for Environment, Food and Rural Affairs, European Wildlife Division, Zone 1/07, Temple Quay House, 2 The Square, Temple Quay, Bristol, BS1 6EB

33. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Site Designations Manager, English Nature, Sites and Surveillance Team, Northminster House, Northminster Road, Peterborough, PE1 1UA, UK

34. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see **15** above), list full reference citation for the scheme.

Site-relevant references

Cranswick, PA, Waters, RJ, Musgrove, AJ & Pollitt, MS (1997) *The Wetland Bird Survey 1995–96: wildfowl and wader counts*. British Trust for Ornithology, Wildfowl and Wetlands Trust, Royal Society for the Protection of Birds & Joint Nature Conservation Committee, Slimbridge

Environment Agency (1996) *Nene Washes water level management plan, Draft*. Environment Agency

Folkard, N, Ausden, M & Kitchen, C (1998) *Conservation management of the Nene Washes RSPB Reserve*. Royal Society for the Protection of Birds, Sandy

McLeod, CR, Yeo, M, Brown, AE, Burn, AJ, Hopkins, JJ & Way, SF (eds.) (2004) *The Habitats Directive: selection of Special Areas of Conservation in the UK*. 2nd edn. Joint Nature Conservation Committee, Peterborough. www.jncc.gov.uk/SACselection

Musgrove, AJ, Pollitt, MS, Hall, C, Hearn, RD, Holloway, SJ, Marshall, PE, Robinson, JA & Cranswick, PA (2001) *The Wetland Bird Survey 1999–2000: wildfowl and wader counts*. British Trust for Ornithology, Wildfowl and Wetlands Trust, Royal Society for the Protection of Birds & Joint Nature Conservation Committee, Slimbridge. www.wwt.org.uk/publications/default.asp?PubID=14

Shirt, DB (ed.) (1987) *British Red Data Books: 2. Insects*. Nature Conservancy Council, Peterborough

Stewart, A, Pearman, DA & Preston, CD (eds.) (1994) *Scarce plants in Britain*. Joint Nature Conservation Committee, Peterborough

Stroud, DA, Chambers, D, Cook, S, Buxton, N, Fraser, B, Clement, P, Lewis, P, McLean, I, Baker, H & Whitehead, S (eds.) (2001) *The UK SPA network: its scope and content*. Joint Nature Conservation Committee, Peterborough (3 vols.) www.jncc.gov.uk/UKSPA/default.htm

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Telephone: **+41 22 999 0170** • Fax: **+41 22 999 0169** • email: **ramsar@ramsar.org**

4.3.4 SSSI Citations

COUNTY: CAMBRIDGESHIRE **SITE NAME:** NENE WASHES

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981

Local Planning Authorities: Peterborough City Council
Fenland District Council

National Grid Reference: TL 200977 to TF 395029

Ordnance Survey Sheet 1:50,000: 142 **1:10,000:** TL 29 NW, TL 29 NE, TL 39 NW, TF 30 SW, TF 30 SE

Date Notified (Under 1949 Act): 1959 **Date of Last Revision:** 1981

Date Notified (Under 1981 Act): 1983 **Date of Last Revision:**

Area: 1310 ha 3237 ac

Other information: Part of this site was formerly scheduled under the name 'Whittlesey Washes'. Part of the area is a Nature Reserve of the Royal Society for the Protection of Birds. 'A Nature Conservation Review' site (recent addition to the original NCR listing of 1977).

Description and Reasons for Notification

This site represents one of the country's few remaining areas of washland habitat which is essential to the survival nationally and internationally of populations of wildfowl and waders. The site is additionally notable for the diversity of plant and associated animal life within its network of dykes.

The washlands are used for the seasonal uptake of floodwaters and, traditionally, for cattle grazing in the summer months. The mosaic of rough grassland and wet pasture provide a variety of sward structure and herbs of importance respectively for bird nesting habitat and feeding. Additional winter feeding is provided by remains of arable cropping on small areas. These washlands play an additional role in relation to the nearby Ouse Washes in that they accommodate wildfowl populations displaced from the Ouse Washes when deep floodwaters prevent their feeding.

The site is favoured by large numbers of wintering wildfowl and particularly the dabbling ducks wigeon *Anas penelope*, teal *Anas crecca*, pintail *A. acuta* and Bewick's swan *Cygnus bewickii*. Wetland birds such as snipe *Gallinago gallinago* and redshank *Tringa totanus* regularly breed and during passage periods there is often a large movement of waders and raptors through the area.

Many of the ditches hold a rich flora which includes such uncommon species as frogbit *Hydrocharis morsus-ranae*, water violet *Hottonia palustris* and flowering rush *Butomus umbellatus*.

Appendix 13.2 - Phase 1 Habitat

WILD
FRONTIER
ECOLOGY

Treading Wind Farm Proposal



Appendix 13.2 Phase 1 Habitat

July 2010

Report produced by	Client details
Susannah Dickinson BSc	Engena Ltd.
Checked by: Robert Yaxley BSc CEnv MIEEM	
Unit 2 Cold Blow Farm Great Snoring Fakenham Norfolk NR21 0HF	The Old Stables, Bosmere Hall Creeting St Mary Suffolk IP6 8LL
Tel: 01328 864633 susie@wildfrontier-ecology.co.uk	Contact: Eve Browning Tel: 01449 723 205

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Aims

The Phase 1 survey provides an overview of the habitats present at the Treading wind farm proposal site, including those suitable for protected species. The survey informs further survey work that may be required, such as protected species surveys.

Methodology

The Phase 1 Habitat Survey followed the standard Joint Nature Conservation Committee guidelines (2010):

The study area was visited by two trained surveyors and the habitat types were specified according to the Phase 1 classification. Further information was gathered in the form of descriptive target notes, which give a brief account of particular areas and features of interest. Once mapped, the results are presented in this report, supported by plant species lists and photographs.

Survey Details

Date of Survey: 24th June 2010

Survey Area: extends to 500 metres around the proposed turbine locations (Figure 1).

Surveyors: William Riddett BA and Susannah Dickinson BSc.

Results

Table 1: Botanical Species List: Plants found on Treading Wind Farm Proposal Site

Species Common Name	Latin Name	Red data list species
Sycamore	*Acer pseudoplatanus*	Not Native
Horse Chestnut	*Aesculus hippocastanum*	Not Native
Creeping Bent-grass	*Agrostis stolonifera*	LC
Meadow Foxtail	*Alopecurus pratensis*	LC
Cow Parsley	*Anthriscus sylvestris*	LC
False Oat-grass	*Arrhenatherum elatius*	LC
Mugwort	*Artemisia vulgaris*	LC
Common Wild Oat	*Avena fatua*	LC
Soft Brome	*Bromus hordeaceus*	LC
Barren Brome	*Bromus sterilis*	LC
White Bryony	*Bryonia alba*	LC
Hedge Bindweed	*Calystegia sepium*	LC
Shepherds Purse	*Capsella bursa-pastoris*	LC
European Hornbeam	*Carpinus betulus*	LC
Sweet Chestnut	*Castanea sativa*	LC
Common Mouse-ear	*Cerastium fontanum*	LC
Fat Hen	*Chenopodium album*	LC
Creeping Thistle	*Cirsium arvense*	LC
Spear Thistle	*Cirsium vulgare*	LC
Field Bindweed	*Convolvulus arvensis*	LC
Swine-cress	*Coronopus squamatus*	LC
Hazel	*Corylus avellana*	LC
Hawthorn	*Crataegus monogyna*	LC
Rough Hawk's-beard	*Crepis biennis*	LC
Leyland Cypress	*Cupressocyparis leylandii*	Not Native
Cocksfoot	*Dactylis glomerata*	LC
Couch Grass	*Elytrigia repens*	LC
Great Willowherb	*Epilobium hirsutum*	LC
Sun Spurge	*Euphorbia helioscopia*	LC
Beech	*Fagus sylvatica*	LC
Red Fescue	*Festuca rubra*	LC
Ash	*Fraxinus excelsior*	LC
Common Hemp-nettle	*Galeopsis tetrahit*	LC
Cleavers	*Galium aparine*	LC
Cut-leaved crane's-bill	*Geranium dissectum*	LC
Herb Robert	*Geranium robertianum*	LC
Hogweed	*Heracleum sphondylium*	LC
Wall Barley	*Hordeum murinum*	LC
White Deadnettle	*Lamium album*	LC
Red Deadnettle	*Lamium purpureum*	LC
Oxeye Daisy	*Leucanthemum vulgare*	LC
Rye Grass	*Lolium perenne*	LC
Crab Apple	*Malus sylvestris*	LC
Common Mallow	*Malva sylvestris*	LC
Pineapple Mayweed	*Matricaria discoidea*	Non Native
Black Medick	*Medicago lupulina*	LC
Poppy	*Papaver rhoeas*	LC

Species Common Name	Latin Name	Red data list species
Redshank	*Persicaria maculosa*	LC
Timothy	*Phleum pratense*	LC
Common Reed	*Phragmites australis*	LC
Bristly Ox-tongue	*Picris echioides*	LC
Scots Pine	*Pinus sylvestris*	LC
Pine	*Pinus sp.*	
Greater Plantain	*Plantago major*	LC
Annual Meadow-grass	*Poa annua*	LC
Hybrid Black Polar	*Populus x canadensis*	
Creeping Cinquefoil	*Potentilla reptans*	LC
Wild Cherry	*Prunus avium*	LC
Cherry Laurel	*Prunus laurocerasus*	Not native
Blackthorn	*Prunus spinosa*	LC
Firethorn	*Pyracantha sp.*	Not Native
Oak	*Quercus robur*	LC
Creeping Buttercup	*Ranunculus repens*	LC
Wild Radish	*Raphanus raphanistrum*	LC
Bramble	*Rubus fruticosa agg.*	LC
Common Sorrel	*Rumex acetosa*	LC
Curled Dock	*Rumex crispus*	LC
Broad-leaved Dock	*Rumex obtusifolius*	LC
White Willow	*Salix alba*	LC
Goat Willow	*Salix caprea*	LC
Grey Willow	*Salix cinerea*	LC
Crack Willow	*Salix fragilis*	LC
Osier	*Salix viminalis*	LC
Elder	*Sambucus nigra*	LC
Common Ragwort	*Senecio jacobaea*	LC
Groundsel	*Senecio vulgaris*	LC
White Campion	*Silene latifolia*	LC
Charlock	*Sinapis arvensis*	LC
Hedge Mustard	*Sisymbrium officinale*	LC
Prickly Sow Thistle	*Sonchus asper*	LC
Rowan	*Sorbus aucuparia*	LC
Common Chickweed	*Stellaria media*	LC
Dandelion	*Taraxacum officinale*	LC
Small-leaved lime	*Tilia cordata*	LC
Large-leaved Lime	*Tilia platyphyllos*	LC
Goatsbeard	*Tragopogon pratensis*	LC
Stinging Nettle	*Urtica dioica*	LC
Common Field Speedwell	*Veronica persica*	Non Native
Wayfaring Tree	*Viburnum lantana*	LC
Wild Pansy	*Viola arvensis*	LC

General Description of Site

The study site consists of lowland habitats and includes the following Phase 1 categories (see Figure 1 for map)

- Arable land
- Broadleaved plantation woodland
- Buildings
- Dry (seasonally inundated) ditches
- Improved grassland
- Species poor, intact hedgerow
- Tall herb and ruderal
- Wet (permanent) ditches

This site is located between the villages of Sutton St Edmund and Gorefield in the Cambridgeshire Fens. It is part of The Fens national character area, and it is very much typical of that area. The site is an intensively managed arable landscape with drains and ditches. The site lies at and slightly below sea level.

The majority of the arable fields are bordered on all sides by ditches and drains. All of these ditches are seasonal, holding water at some time during the year. The larger drains have a steady flow of water throughout the year. Many of these ditches are covered with emergent vegetation, surrounded by tall ruderal vegetation in the generally narrow field margins adjacent to the ditches.

All ditches were assessed for potential to support Great Crested Newt, but potential habitat was exceedingly limited with the majority of ditches drying early in the year, or containing water with a steady current. No further surveys for Great Crested Newt were conducted on the basis of lack of suitable breeding habitat.

Only four of the field boundaries are hedged, and only one of these contains over four woody species, classifying it as a species-rich hedgerow. Access tracks for farm vehicles traverse the site. Other than these tracks the field margins are generally narrow or non-existent, and contain a common assemblage of arable margin plants.

Aside from the arable fields which dominate the site there are two small areas of plantation broadleaf woodland, used as game cover. A line of electricity pylons bisects the site from east to west. The bases of these pylons and not farmed, resulting in small areas of established tall herb, ruderal vegetation under each one.

Table 2. Target Notes of Ecological Features on site

Target Note	Description	Photograph Reference
TN1	Single standard Hawthorn (*Crataegus monogyna*) ~5m high.	Plate 1
TN2	Grassy field with recently planted fruit trees. Dominant Rye grass (*Lolium perenne*) and Timothy (*Phleum pratense*). Frequent False Oat-grass (*Arrhenatherum elatius*).	Plate 2
TN3	Open grass with overgrown clump of straw bales. Abundant Stinging Nettle (*Urtica dioica*).	Plate 3
TN4	Small standard Crab Apple (*Malus sylvestris*) ~4m	Plate 4
TN5	Concrete pad surrounded by grass and ruderal. Abundant Stinging Nettle (*Urtica dioica*) and Creeping Cinquefoil (*Potentilla reptans*).	-
TN6	Large White Willow (*Salix alba*) ~12m, next to large wet ditch. Hawthorn (*Crataegus monogyna*) just to the west, 5m along track.	Plate 5
TN7	Wide strip either side of ditch with cover crop and encroaching Common Reed (*Phragmites australis*).	-
TN8	Four further small Crab Apple (*Malus sylvestris*) spaced along ditch (as TN04).	-
TN9	Standard trees lining ditch. Sycamore (*Acer Pseudoplatanus*), Horse Chestnut (*Aesculus hippocastanum*), Hornbeam (*Carpinus betulus*), Sweet Chestnut (*Castanea sativa*), Hybrid Black Poplar (*Populus x Canadensis*), Wild Cherry (*Prunus avium*), Oak (*Quercus rober*), Rowan (*Sorbus aucuparia*), Small-leaved Lime (*Tilia cordata*) and Large-leaved Lime (*Tilia platyphyllos*).	Plate 6
TN10	Plantation woodland, predominantly broadleaved. Sycamore (*Acer Pseudoplatanus*), Hawthorn (*Crataegus monogyna*), Beech (*Fagus sylvatica*), Scots Pine (*Pinus sylvestris*), Cherry Laurel (*Prunus laurocerasus*), Blackthorn (*Prunus spinosa*), Oak(*Quercus rober*) and Elder (*Sambucus nigra*).	-
TN11	Plantation woodland, Sycamore (*Acer pseudoplatanus*), Leyland Cypress (*Cupressocyparis leylandii*), Hawthorn (*Crataegus monogyna*), Ash (*Fraxinus excelsior*), Spruce (*Picea sp.*), Wild Cherry (*Prunus avium*), Cherry Laurel (*Prunus laurocerasus*), Firethorn (*Pyracantha sp.*), Oak (Quercus robur), White Willow (*Salix alba*), Crack Willow (*Salix fragilis*), Elder (*Sambucus nigra*) and Wayfaring Tree (*Viburnum lantana*).	-
TN12	Agricultural Barn.	Plate 7

Target Note Photographs

Plate 1. TN01



Plate 2. TN02



Plate 3. TN03



Plate 4. TN04



Plate 5. TN06



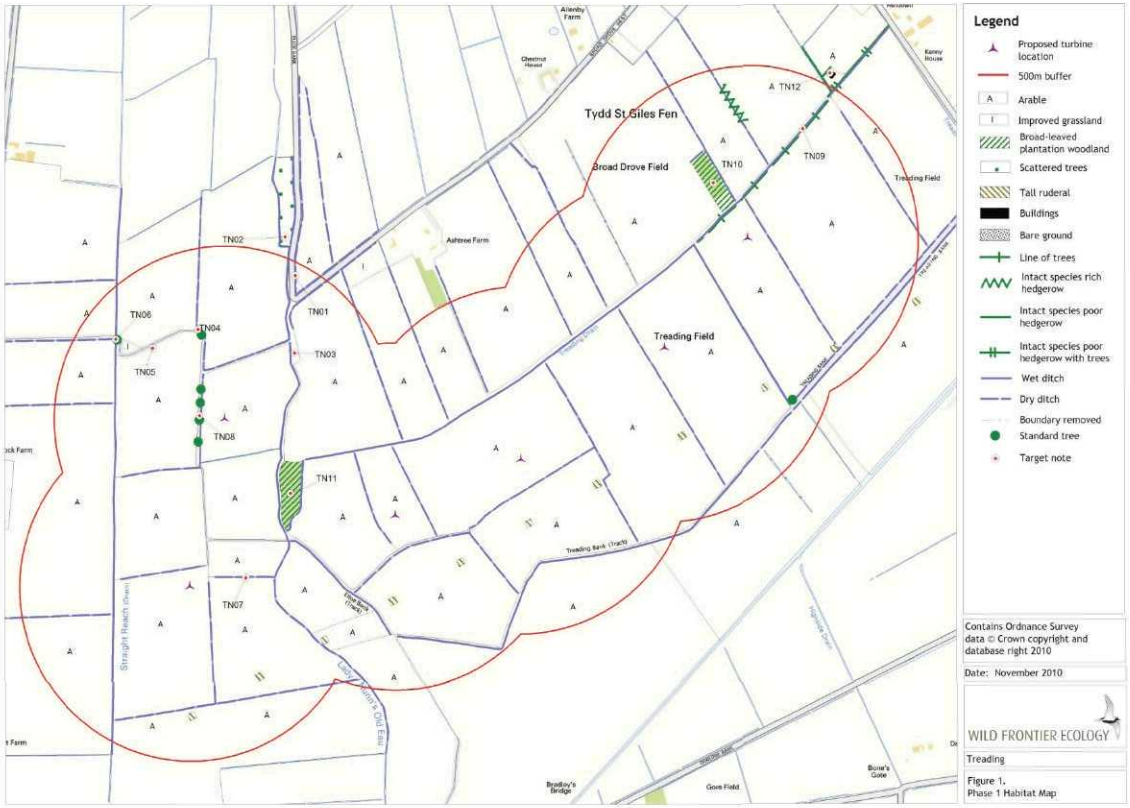
Plate 6. TN09



Plate 7. TN12



Figure 1 – Phase 1 map showing habitat types and target notes



Appendix 13.3 - Bat Surveys

WILD
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Treading Wind Farm Proposal



Appendix 13.3: Bat Surveys

November 2010

Report produced by	Client details
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Brief

Wild Frontier Ecology Ltd was contracted by Engena Ltd. to carry out a bat survey of the proposed Treading Wind Farm site.

The objective of this study was to characterise bat activity occurring on the proposed wind farm site and to assess the significance of the observed bat activity relative to the development proposal.

Methodology

Overview

The study site was assessed for bats using the following methods:

- Overall evaluation of the study site and surrounding area as a habitat for bats (e.g. foraging areas, potential roosting sites, potential hibernacula, and probable flyways) from a site walkover, the Phase I habitat survey results, and aerial imagery.
- Desk study of bat records provided by the Lincolnshire Biodiversity Partnership (LBP) and the Cambridgeshire and Peterborough Biological Records Centre (CPBRC) (see Appendix X.1 for full details of the biological records search).
- Manual (walked) transects and automated static surveys employing bat detectors. The distribution of survey transects and static positions are provided in Figures 1 and 2.

Survey dates

Manual transect surveys: 25th May 2010; 24th June 2010; 27th July 2010; 24th August 2010; 16th August 2010; 30th September 2010; 26th October 2010.

Automated static surveys: 1st-4th June 2010; 16th-19th August 2010 and 30th September-5th October 2010.

Field survey protocol

The study site was sampled using manual transects and automated static monitoring stations. Batbox Duet (coupled with Creative Zen V MP3 recording devices) and Anabat SD1 frequency division bat detectors were used in combination to identify bat activity.

Bat activity declines markedly after the first two hours following sunset (Horn et al. 2008)[1], so this was the principal survey period for manual transect surveys.

Each bat echolocation registered on a bat detector was recorded for:

- Time of occurrence;
- Estimated map location;
- The habitat in the area;
- Estimated number of bats present;
- Estimation of the bat activity exhibited based on the number passes, the distance away, and any special call features (e.g. social calls, feeding buzzes).

[1] Horn, J.W., Arnett, E.B., and Kunz, T.H. 2008. Behavioral Responses of Bats to Operating Wind Turbines. Journal of Wildlife Management 72(1): 123-132.

Air temperature was measured at the beginning and end of each survey. Wind speed was measured at intervals either by handheld anemometer or by estimating to a Beaufort Wind Scale value.

Audio recording analysis

All sound recordings were reviewed 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 Anabat SD1 recordings were analysed using AnalookW software.

Audio analysis of frequency division and time expansion data was achieved by comparing sound characteristics and sonogram shapes and measurements (peak call frequency, call frequency range, and mode pulse interval) to reference measurements and/or recordings provided by Russ (1999)[2], Parsons and Jones (2000)[3], the Bat Conservation Trust (2008)[4], and Dr. Sandy Sowler (2010)[5].

Results

Desk study data

No bat records were returned by the records search commissioned to LBP and CPBRC.

[2] Russ, J. 1999. The Bats of Britain and Ireland. Alana Books, UK.
[3] Parsons, S. and Jones, G. 2000. Acoustic Identification of Twelve Species of Echolocating Bat by Discriminate Function Analysis and Artificial Neural Networks. The Journal of Experimental Biology 203: 2641-2656.
[4] Bat Conservation Trust. 2008. Bat Sound Library. Online at: http://www.bats.org.uk/pages/bat_sound_library_introduction.html?handle=bat_sound_library_introduction.html
[5] Sowler, S. 21 April, 2010. Difficult Sonograms and Social Calls - Advanced Anabat Analysis. Alana Ecology Workshop. Bury St. Edmunds, Suffolk.

Manual transect survey data
See Figure 1 for map of transect locations.

25th May 2010

Recorders Name(s): K. Moyes	*Start time: 2054 (sunset 2105)*			*Finish time: 2259*		
Record number	Time	Species	Number	Activity	No. passes	Notes
1	2203	Common Pipistrelle	2	Foraging (feeding buzz)	Multiple	Flying along wet ditch @ ~4 m
2	2225-2231	Common Pipistrelle	3	Patrolling	Multiple	Flying along ditch
3	2248	Common Pipistrelle	1	Foraging (feeding buzz)	Multiple	Flying along ditch

Recorders Name(s): W. Riddett	*Start time: 2043 (sunset 2105)*			*Finish time: 2303*		
Record number	Time	Species	Number	Activity	No. passes	Notes
1	2206	Common Pipistrelle	1	Foraging (feeding buzz)	Multiple	
2	2218	Common Pipistrelle	1	Distant pass	1	
3	2231	Common Pipistrelle	2+	Foraging (feeding buzz)	Multiple	Feeding over water
4	2251	Common Pipistrelle	2+	Patrolling	Multiple	

24th June 2010

Recorders Name(s): S. Dickinson	*Start time: 2120 (sunset 2128)*			*Finish time: 2330*		
Record number	Time	Species	Number	Activity	No. passes	Notes
1	2224	Common Pipistrelle	2	Patrolling	3	Along ditch

Recorders Name(s): S. Dickinson		Start time: 2120 (sunset 2128)		Finish time: 2330		
Record number	Time	Species	Number	Activity	No. passes	Notes
2	2244	Common Pipistrelle	1	Patrolling	Multiple	Along ditch
3	2254	Common Pipistrelle	1	Patrolling	3	Along dry ditch
4	2304	Common Pipistrelle	2	Commuting	1	Along dry ditch
5	2314	poss Nathusius' Pipistrelle	1	Patrolling	2	Next to plantation
6	2319	Common Pipistrelle	3	Foraging (feeding buzz)	2	Next to woodland and ditch
7	2324	Common Pipistrelle	1	Foraging (feeding buzz)	2	Next to wet ditch

Recorders Name(s): W. Riddett		Start time: 2118 (sunset 2128)		Finish time: 2331		
Record number	Time	Species	Number	Activity	No. passes	Notes
1	2231	Common Pipistrelle	1	Commuting	1	
2	2236	Common Pipistrelle	1	Commuting	1	
3	2238	Common Pipistrelle	1	Patrolling	Multiple	
4	2244	Common Pipistrelle	2+	Foraging (feeding buzz)	Multiple	
5	2311	Common Pipistrelle	1	Commuting	1	
6	2321	Common Pipistrelle	1	Patrolling	2	
7	2326	Common Pipistrelle	1	Commuting	1	

27th July 2010

Recorders Name(s): K. Moyes		Start time: 2048 (sunset 2101)		Finish time: 2303		
Record number	Time	Species	Number	Activity	No. passes	Notes

Recorders Name(s): K. Moyes	Start time: 2048 (sunset 2101)			Finish time: 2303		
Record number	Time	Species	Number	Activity	No. passes	Notes
1	2207	Common Pipistrelle	2	Foraging (feeding buzz)	3 each	Next to ditch
2	2215	Common Pipistrelle	2	Foraging (feeding buzz)	2	
3	2220	Common Pipistrelle	1	Patrolling	2	Hedgerow
4	2228	Common Pipistrelle	1	Patrolling	Multiple	Hedgerow
5	2232	Common Pipistrelle	2	Foraging (feeding buzz)	3	Hedgerow, near plantation
6	2243	Common Pipistrelle	1	Patrolling	2	Line of trees
7	2253	Common Pipistrelle	1	Commuting	1	Ditches
8	2300	Common Pipistrelle	1	Commuting	1	Ditches

16th August 2010

Recorders Name(s): J. Harris	Start time: 2000 (sunset 2024)			Finish time: 2200		
Record number	Time	Species	Number	Activity	No. passes	Notes
1	2125	Common Pipistrelle	1	Patrolling	2	Ditch
2	2127	Common Pipistrelle	1	Patrolling	Multiple	Ditch
3	2132	Common Pipistrelle; Soprano Pipistrelle	2+; 2+	Foraging (feeding buzz)	Multiple	Wet ditch
4	2148	Common Pipistrelle	1	Commuting	1	Ditch
5	2151	Common Pipistrelle	1	Commuting	1	Dry ditch
6	2154	Common Pipistrelle	1	Commuting	1	Dry ditch
7	2158	Common Pipistrelle	2	Foraging (feeding buzz)	Multiple	Dry ditch

Recorders Name(s):	Start time: 2000 (sunset 2024)	Finish time: 2200

G. Riley						
Record number	Time	Species	Number	Activity	No. passes	Notes
1	2114	Common Pipistrelle	1	Commuting	1	Ditch
2	2118	Common Pipistrelle	2	Patrolling	3	Ditch
3	2122	Common Pipistrelle	1	Patrolling	Multiple	Ditch
4	2126	Common Pipistrelle	1	Foraging (feeding buzz)	Multiple	Plantation
5	2131	Common Pipistrelle	1	Patrolling	Multiple	Plantation
6	2138	Common Pipistrelle	1	Commuting	1	Ditch and plantation
7	2142	Common Pipistrelle	1	Foraging (feeding buzz)	Multiple	Ditch
8	2153	Common Pipistrelle	1	Foraging (feeding buzz)	1	Ditch
9	2156	Common Pipistrelle	1	Patrolling	2	Ditch

30th September 2010

Recorders Name(s): W. Riddett	*Start time: 1841 (sunset 1840)*			*Finish time: 2042*		
Record number	Time	Species	Number	Activity	No. passes	Notes
1	1929	Common Pipistrelle	1	Patrolling	Multiple	
2	1939	Common Pipistrelle	1	Commuting	1	
3	1949	Common Pipistrelle	1	Patrolling	2	

Recorders Name(s): S. Dickinson		Start time: 1845 (sunset 1840)		Finish time: 2045		
Record number	Time	Species	Number	Activity	No. passes	Notes
1	1922	Common Pipistrelle	1	Commuting	1	
2	1936	Common Pipistrelle; possible Nathusius' Pipistrelle	2+; 1	Foraging (feeding buzz)	Multiple	Ditch
3	1942	Common Pipistrelle	1	Foraging (feeding buzz)	Multiple	Ditch
4	1947	Common Pipistrelle	1	Foraging (feeding buzz)	Multiple	Ditch
5	2033	Common Pipistrelle	1	Patrolling (distant)	Multiple	Ditch

26th October 2010

Recorders Name(s): S. Dickinson		Start time: 1740 (sunset 1742)		Finish time: 1925		
Record number	Time	Species	Number	Activity	No. passes	Notes
1	1917	Common Pipistrelle	1	Foraging (feeding buzz)	Multiple	Plantation and ditch

Recorders Name(s): K. Moyes		Start time: 1742 (sunset 1742)		Finish time: 1927		
Record number	Time	Species	Number	Activity	No. passes	Notes
1	1839	Common Pipistrelle	1	Patrolling	Multiple	Wet drain

Automated static monitoring station data

See Figure 2 for map of monitoring station locations.

Dates	Anabat	species	total number of passes	first recorded	last recorded
1st-4th June 2010	A	45 pip	117	22:04	00:30
	B	45 pip	11	22:21	23:52
	C	45 pip	8	22:29	00:22
	D	45 pip	356	22:07	03:02
		55 pip	1	22:42	22:42
16th-19th August 2010	A	45 pip	44	21:32	04:29
	B	45 pip	161	21:16	04:45
	C	45 pip	15	21:20	23:33
	D	45 pip	280	21:08	05:04
		50 pip	1	22:26	22:26
		55 pip	2	23:12	23:24
		Myotis sp.	3	22:45	00:27
		BLE	5	00:12	03:59
30th September - 5th October 2010	A	45 pip	1	19:53	19:53
	B	45 pip	1	22:40	22:40
	C	45 pip	22	19:08	00:54
	D	45 pip	4	19:13	22:53

Interpretation of results

See Figure 3 for a map of bat registration locations. Multiple passes presumably indicate some level of foraging, while single passes imply the bat is commuting to another location.

Species

Common Pipistrelle (*Pipistrellus pipistrellus*)

The Common Pipistrelle is by far the most abundant and widely distributed bat species within the surveyed area. The species was found throughout the site, but mostly along the wet ditches and along the edges of the plantations (Figures 3 and 4). Multiple individuals (approximately four) were observed foraging along the ditches at the same time. One Pipistrelle was recorded echolocating at 50kHz during the Anabat monitoring. This probably represents either a Common or Soprano Pipistrelle echolocating outside of its normal range

Soprano Pipistrelle (*Pipistrellus pygmaeus*)

Soprano Pipistrelles are uncommon on the site. They were recorded once during the transect surveys, foraging with Common Pipistrelles along a wet ditch in the east of the site and a single Soprano Pipistrelle pass was recorded during the June Anabat survey (Figures 3 and 4).

Nathusius' Pipistrelle (*Pipistrellus nathusii*)

This species was recorded twice during the course of the manual surveys, in June and September, foraging along the wet ditch to the west of the site and by the western

plantation. September is the peak month for Nathusius' Pipistrelle records in the UK, which coincides with the period of migration by the species in continental Europe - hence Continental Nathusius' Pipistrelles are believed to be migrating into the UK in autumn and exiting again in spring (Russ 2008). The record in June could not be considered conclusively diagnostic as the passes were at 41 kHz and therefore could have been produced by a Nathusius' Pipistrelle or else an atypical Common Pipistrelle. The September record is more likely to be a Nathusius' Pipistrelle as the frequency was between 39kHz and 41 kHz.

Myotis species

Myotis bats were recorded three times during one Anabat survey towards the east of the site. *Myotis* sonograms can be very difficult or impossible to identify to species due to the substantial interspecific call similarities. Due to the few echolocations recorded, it is not possible to identify these records to species-level.

Brown Long-eared Bat (*Plecotus auritus*)

Due to its very subtle echolocations, this relatively common bat species can be easily missed by audio detection techniques. However, it was recorded five times during one Anabat survey towards the east of the site.

Activity patterns

The distribution of Common Pipistrelle activity was, as would be expected, strongly associated with wet ditches and plantations. Bats were more commonly observed commuting along the dry ditches, rather than foraging. The highest species diversity was towards the east of the site, near to a broad-leaved plantation woodland, where *Myotis* spp., Soprano Pipistrelle and Brown Long-Eared bats were recorded along with Common Pipistrelle. Bats were commonly observed flying up and down the linear features while foraging, and less commonly observed flying over the open fields.

Roosting

The earliest recorded pass of Common Pipistrelle was approximately half an hour after sunset during the autumn Anabat survey. However, during the rest of the year, and crucially during the breeding season, Common Pipistrelle were more frequently first observed approximately 50 minutes to an hour after sunset. Pipistrelles usually emerge from roosts approximately 20 to 25 minutes after sunset[6], it is therefore likely that the bats observed did not roost on the site. There are few roosting opportunities on site, and considering the evidence that Pipistrelles favour establishing maternity roosts in buildings (Altringham 2003)[7], the study site is considered unlikely to hold anything other than at best scattered individual (i.e. non-maternity) bat roosts in the few mature trees present. Bats that were encountered on site are likely to roost in farm buildings outside of the 500m buffer. The assessment of a lack of roosting opportunity is supported by the generally low level of bat activity on site.

Conclusions

The site's bat activity is dominated by a population of Common Pipistrelles, and Soprano Pipistrelle, Nathusius' Pipistrelle, Myotis spp. and Brown Long-Eared Bats were rarely encountered. Bat activity shows a strong association with the wet ditches and two small broad-leaved plantations. Bats were also observed to use the dry ditches for commuting along.

[6] Richardson P. (2000) *Bats*, British Natural History Series, Whittet Books, Suffolk.
[7] Altringham J. (2003) British Bats. HarperCollins Publishers, UK

No significant bat roosts are likely to be present within the study area due to the observed lack of roosting opportunity, the delay witnessed between sunset and the first bat observation of each survey, and the generally low level of bat activity on the site.

Figure 1: Manual survey transects

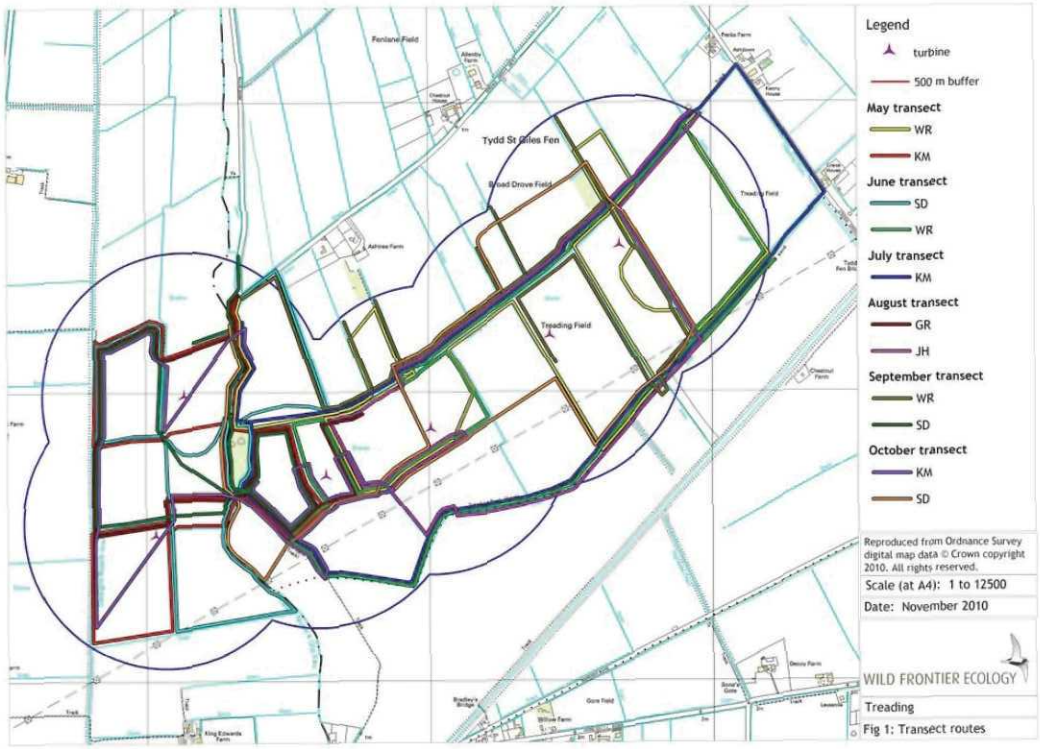


Figure 2: Automated (Anabat) survey stations

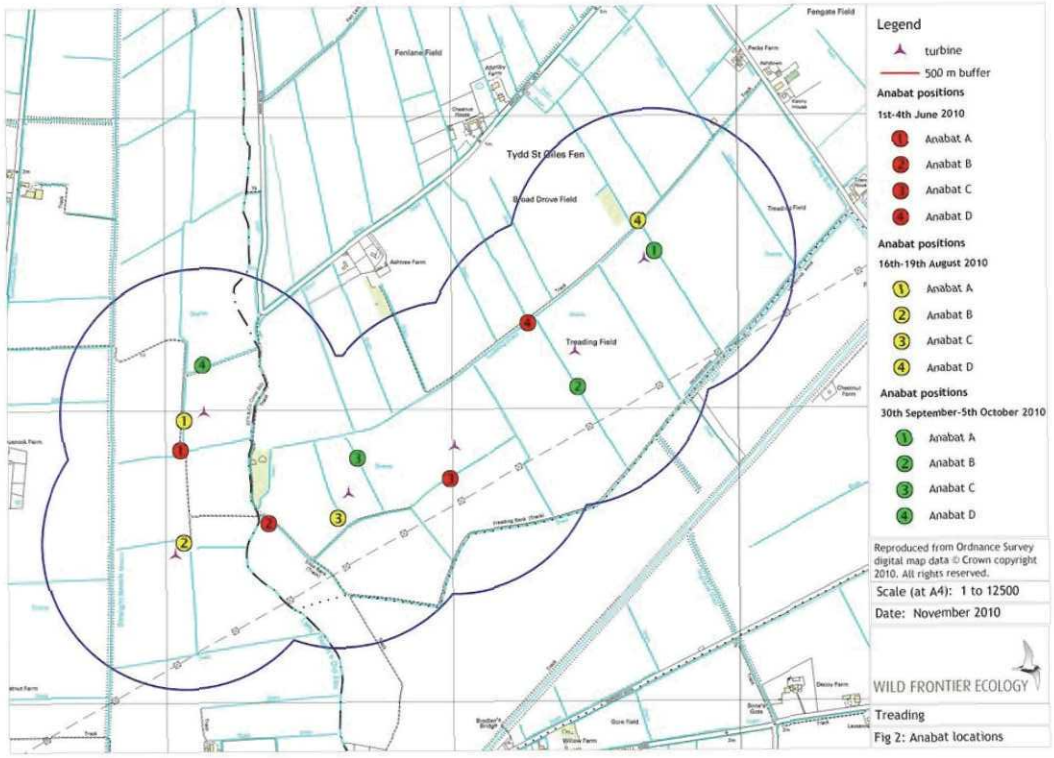


Figure 3: Bat activity registered by manual transects

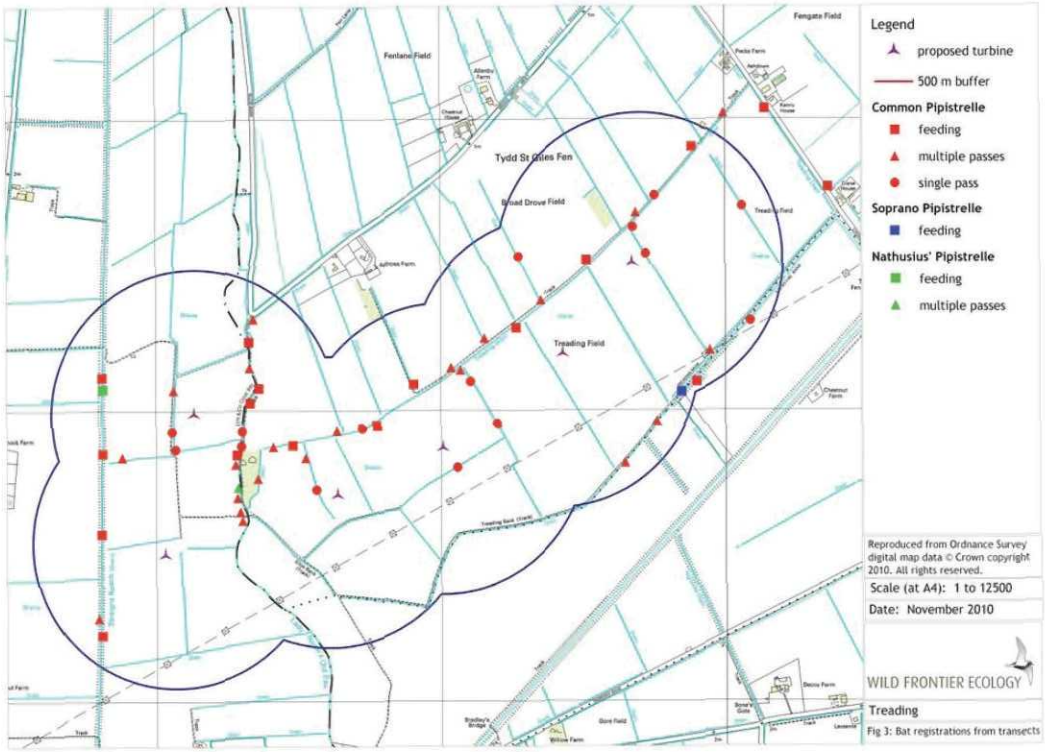
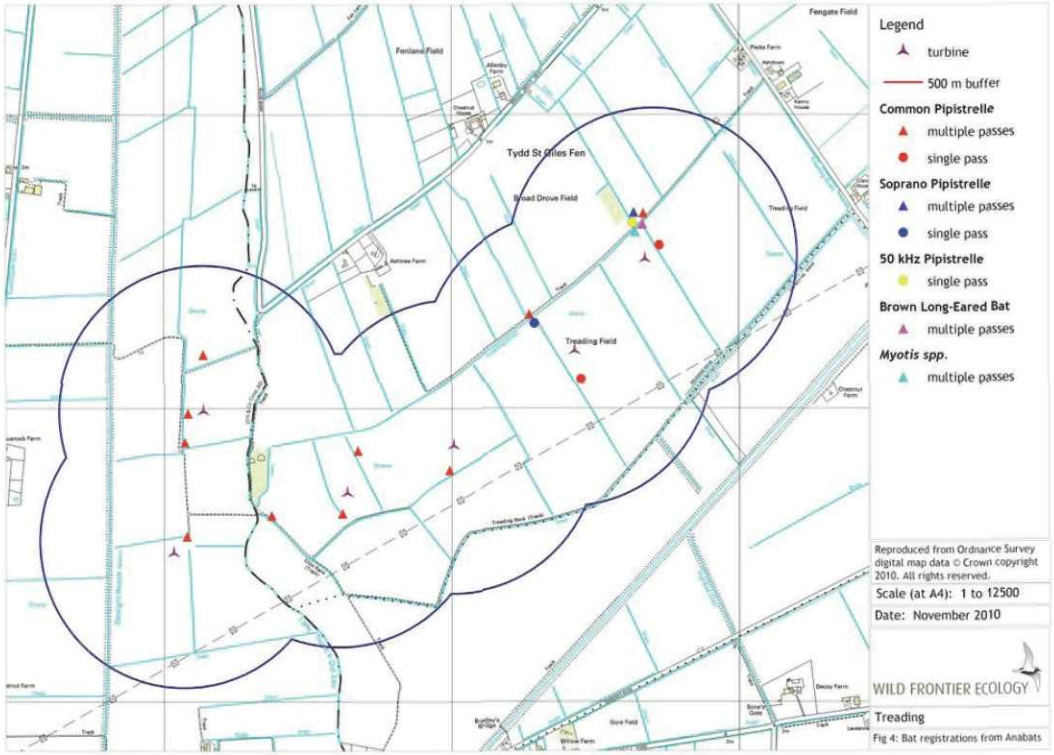


Figure 4: Bat activity registered by Anabat stations

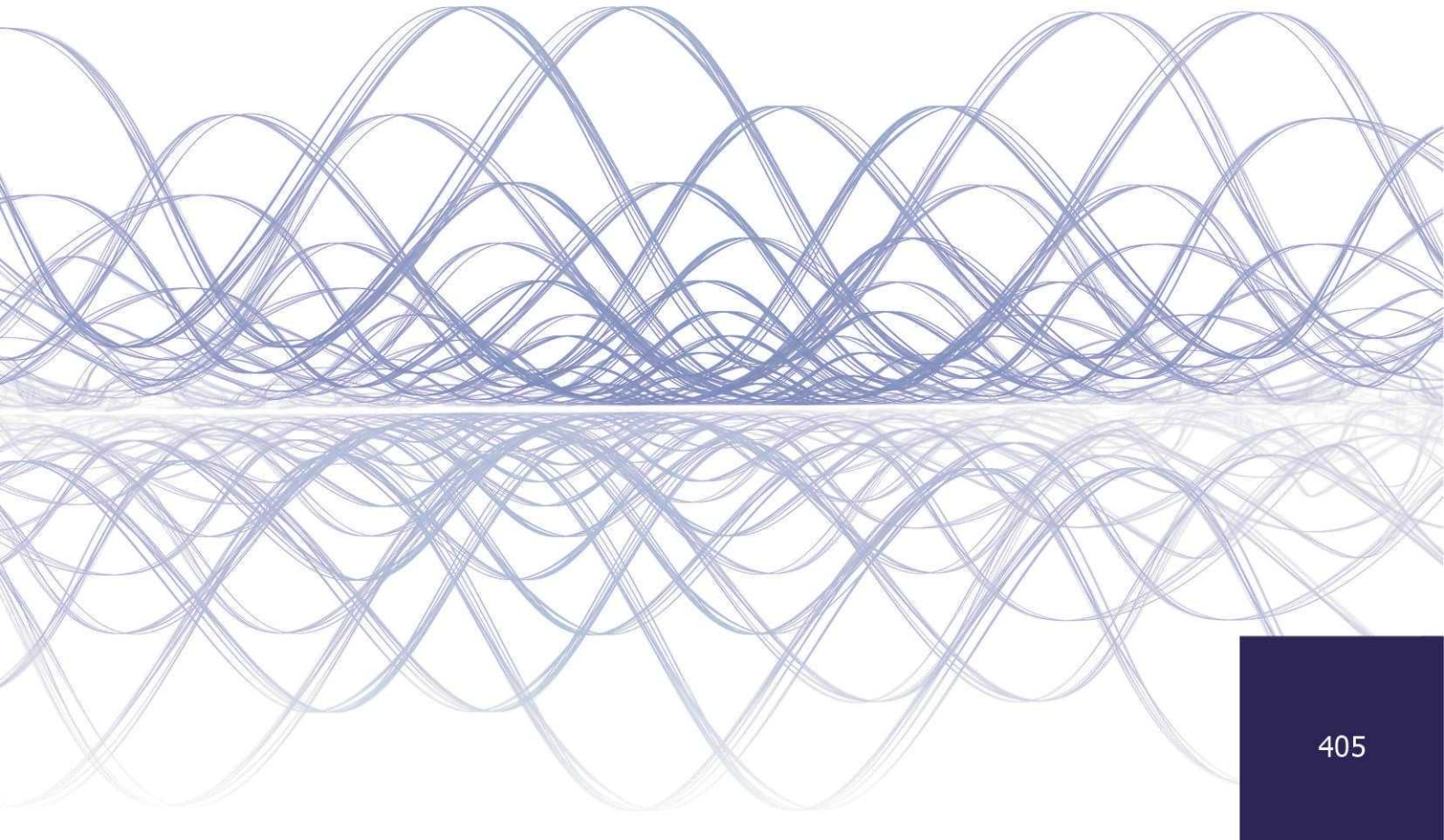


APPENDIX 14. NOISE

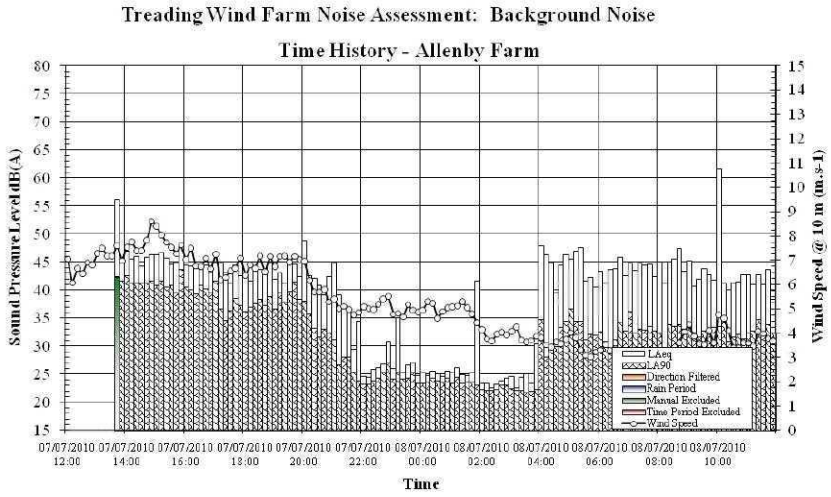
Contents

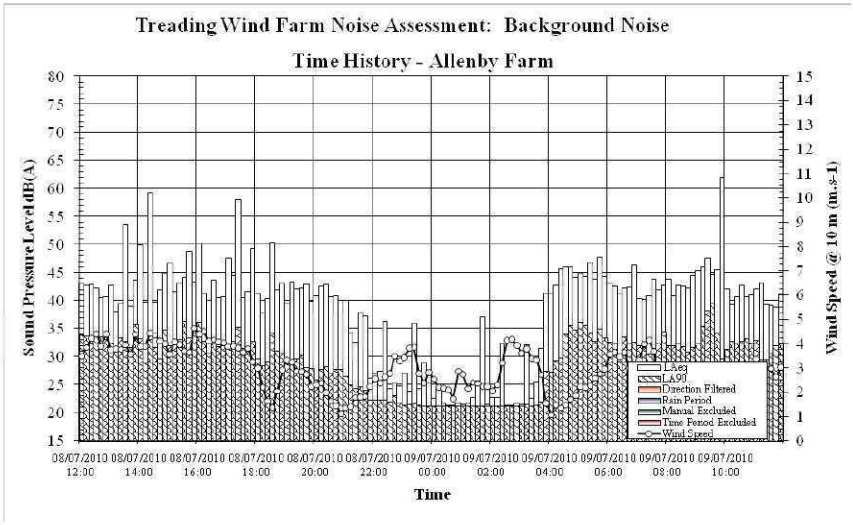
406 Appendix 14.1 - Noise and Wind Histograms

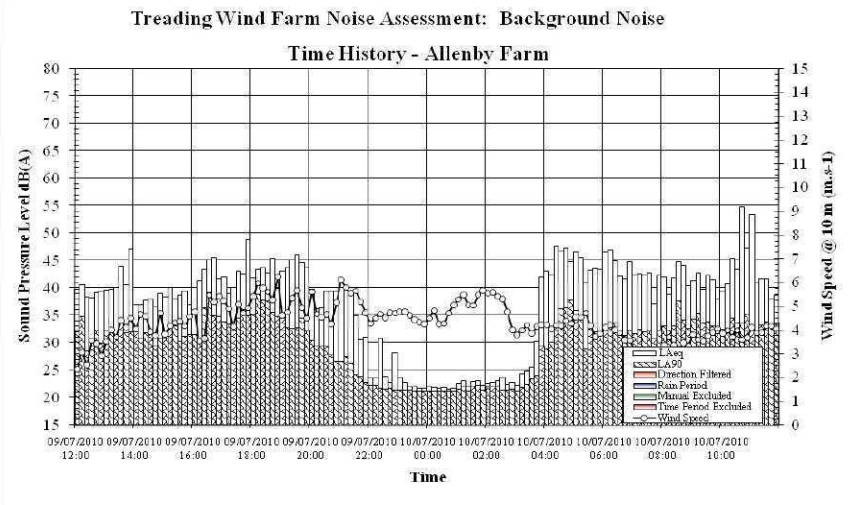
444 Appendix 14.2 - Turbine Noise Data

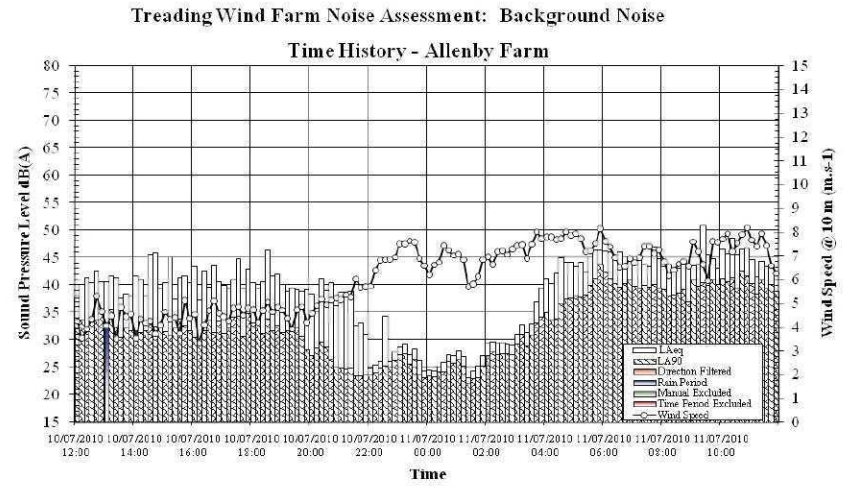


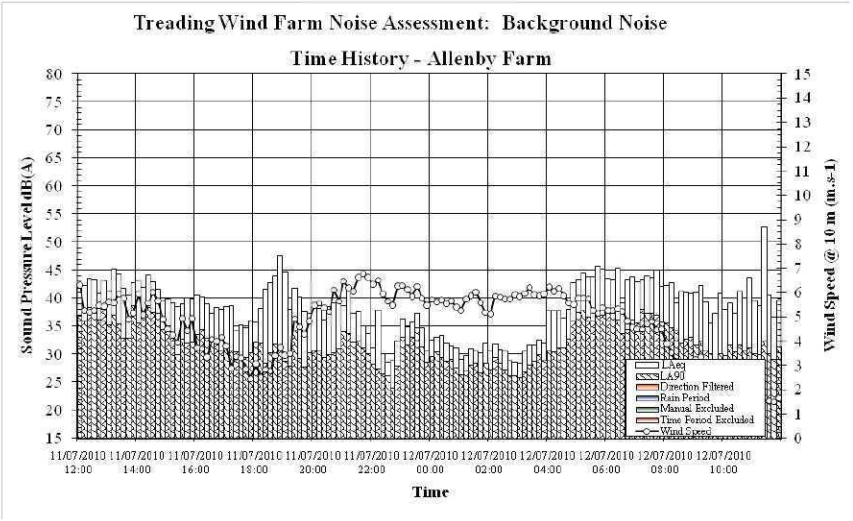
Appendix 14.1 - Noise and Wind Histograms

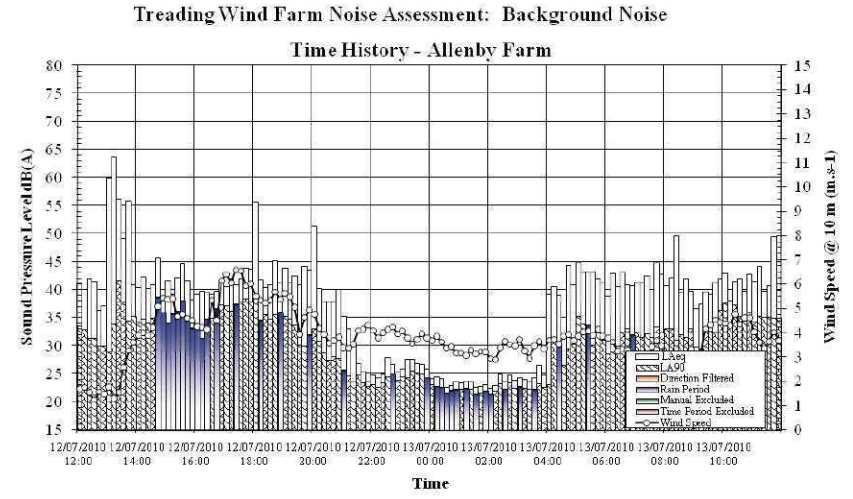





Treading Wind Farm Noise Assessment: Background Noise
Time History - Allenby Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

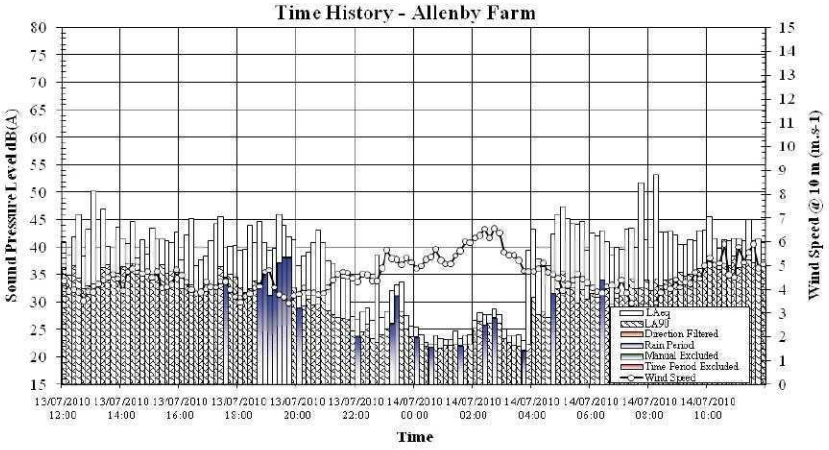

Treading Wind Farm Noise Assessment: Background Noise
Time History - Allenby Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Allenby Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Allenby Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

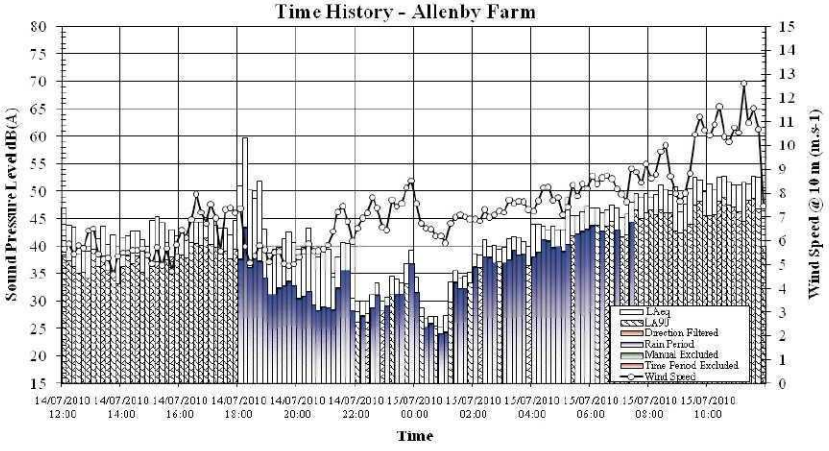
Treading Wind Farm Noise Assessment: Background Noise

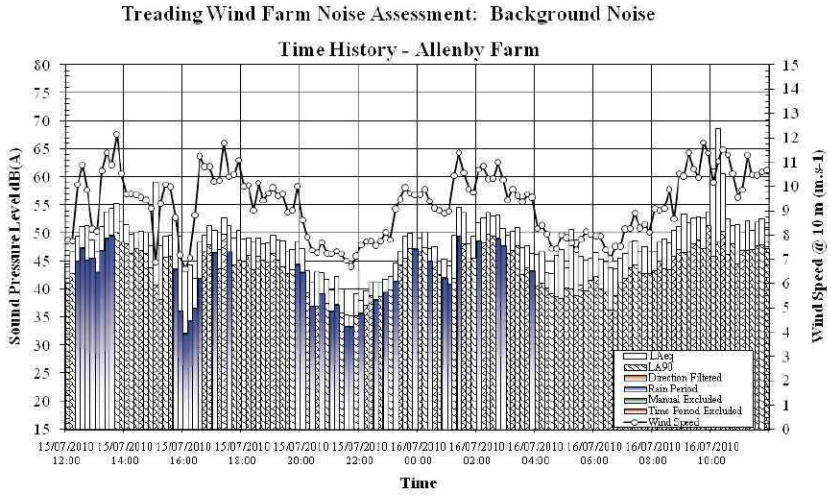
Time History - Allenby Farm

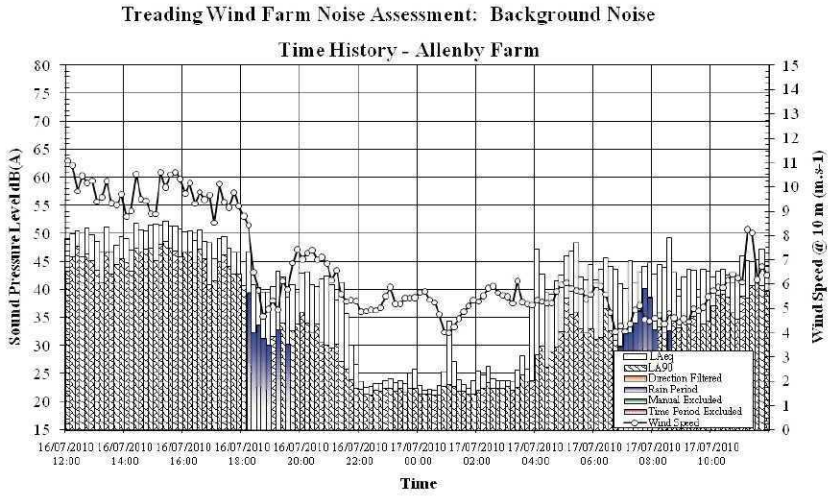


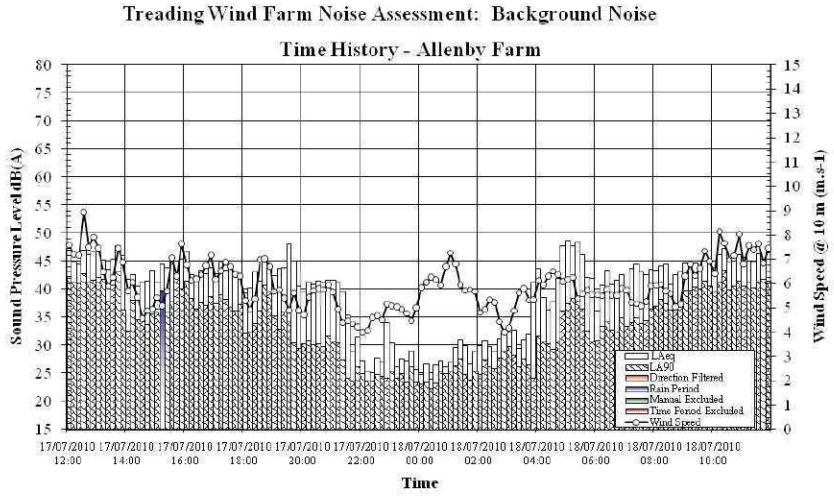
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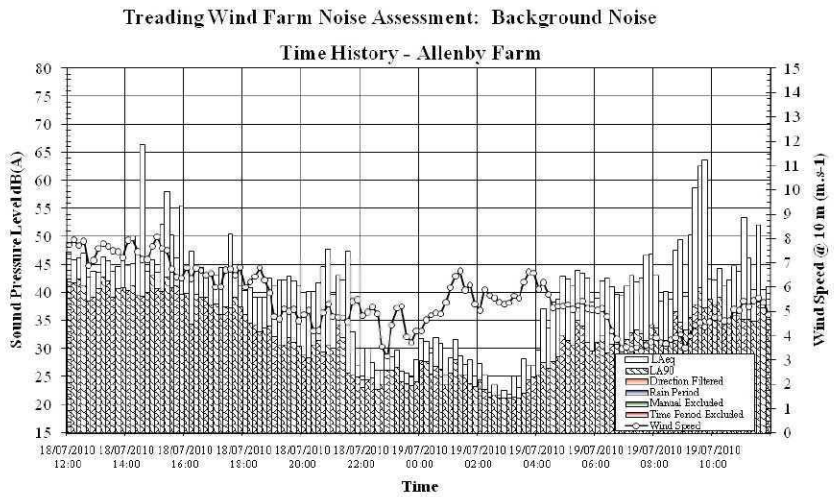
Time History - Allenby Farm

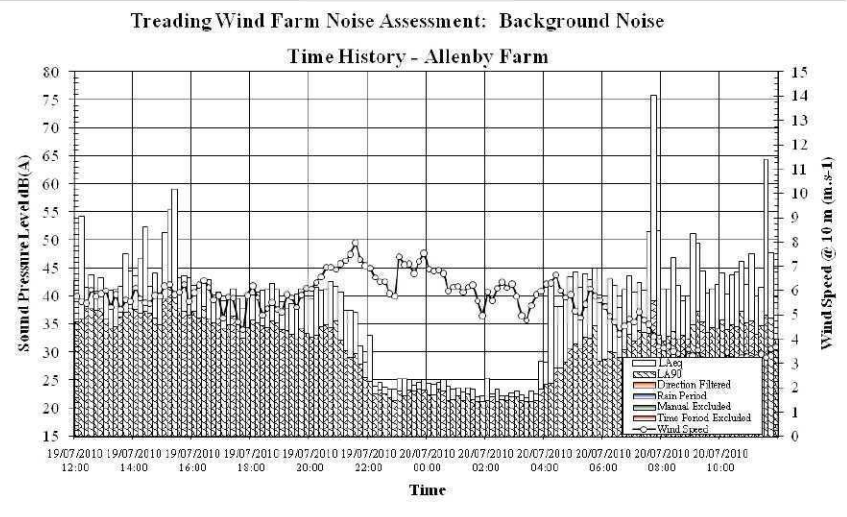


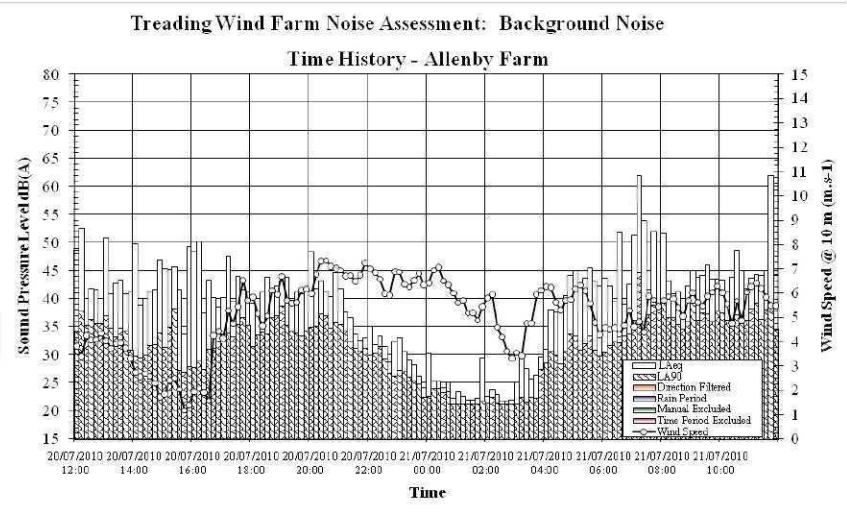

Treading Wind Farm Noise Assessment: Background Noise
Time History - Allenby Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Allenby Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Allenby Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
17/07/2010 12:00
17/07/2010 14:00
17/07/2010 16:00
17/07/2010 18:00
17/07/2010 20:00
17/07/2010 22:00
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18/07/2010 10:00
Time

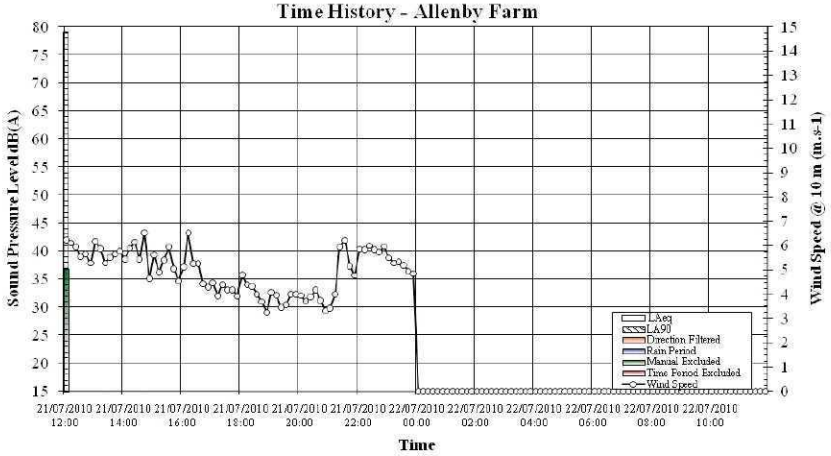

Treading Wind Farm Noise Assessment: Background Noise
Time History - Allenby Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
18/07/2010 12:00
18/07/2010 14:00
18/07/2010 16:00
18/07/2010 18:00
18/07/2010 20:00
18/07/2010 22:00
19/07/2010 00:00
19/07/2010 02:00
19/07/2010 04:00
19/07/2010 06:00
19/07/2010 08:00
19/07/2010 10:00
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Allenby Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Allenby Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

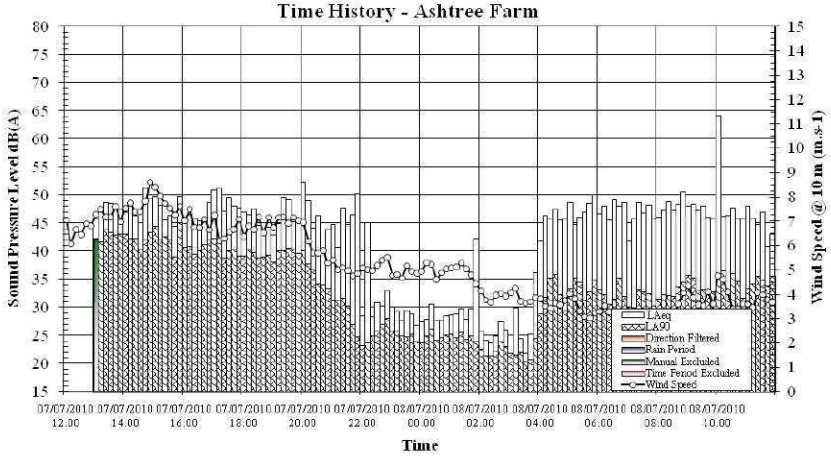
Treading Wind Farm Noise Assessment: Background Noise

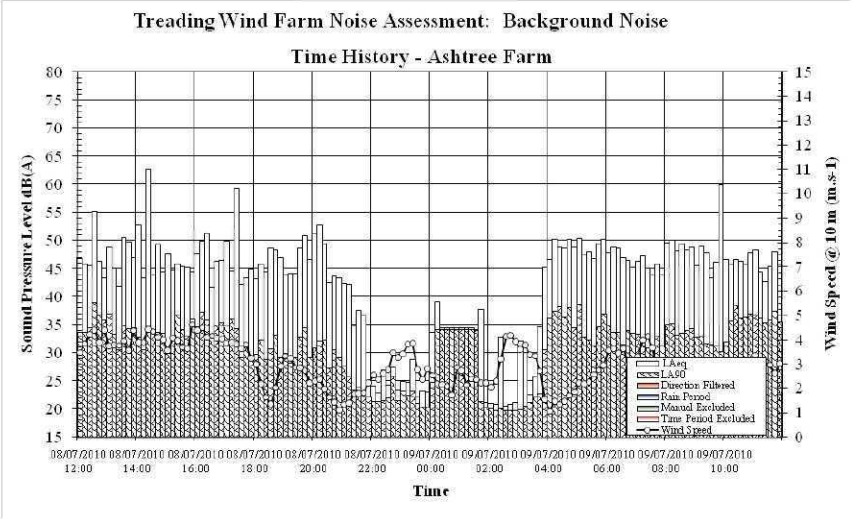
Time History - Allenby Farm

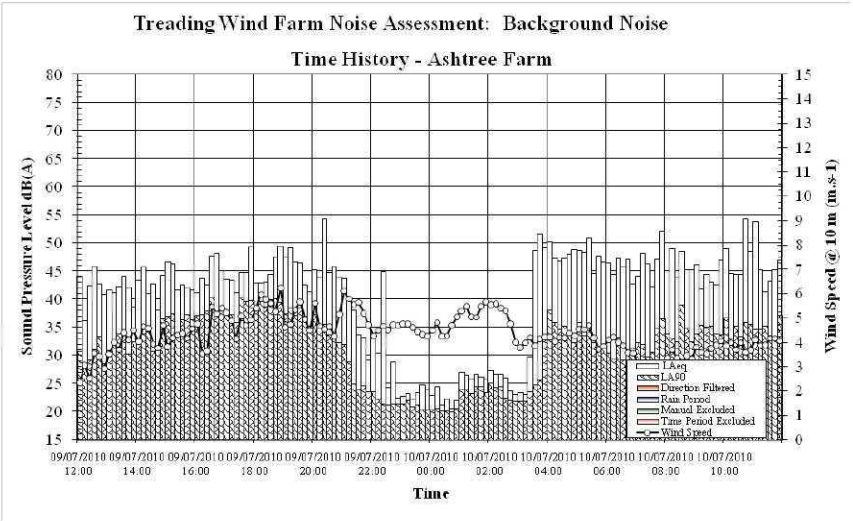


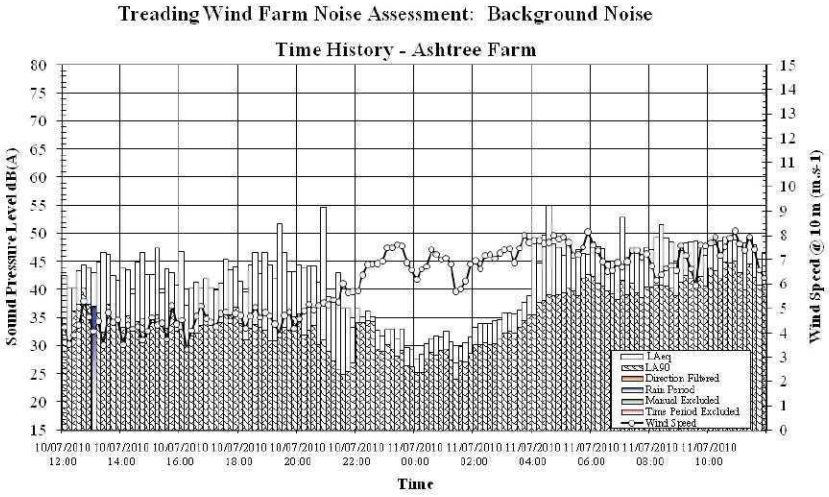
Treading Wind Farm Noise Assessment: Background Noise

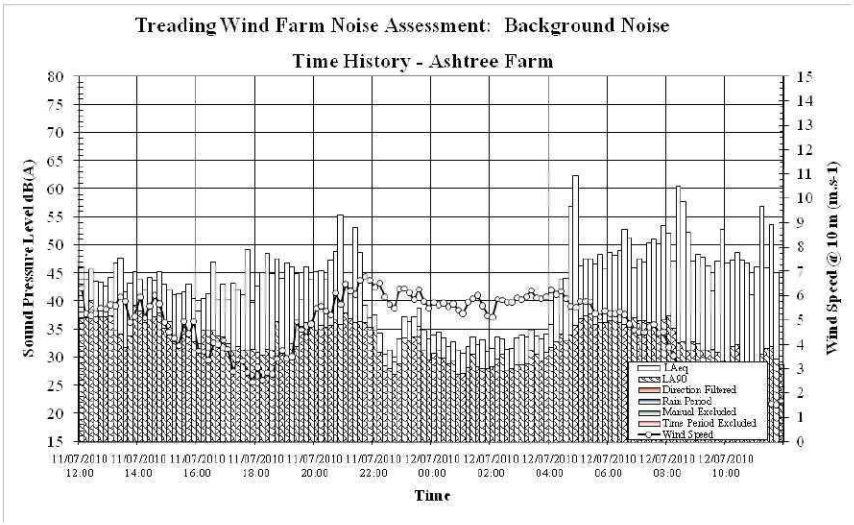
Time History - Ashtree Farm

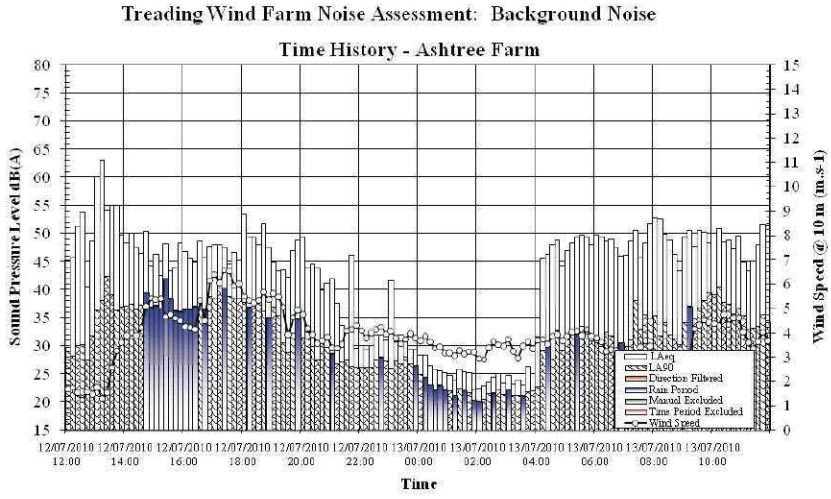


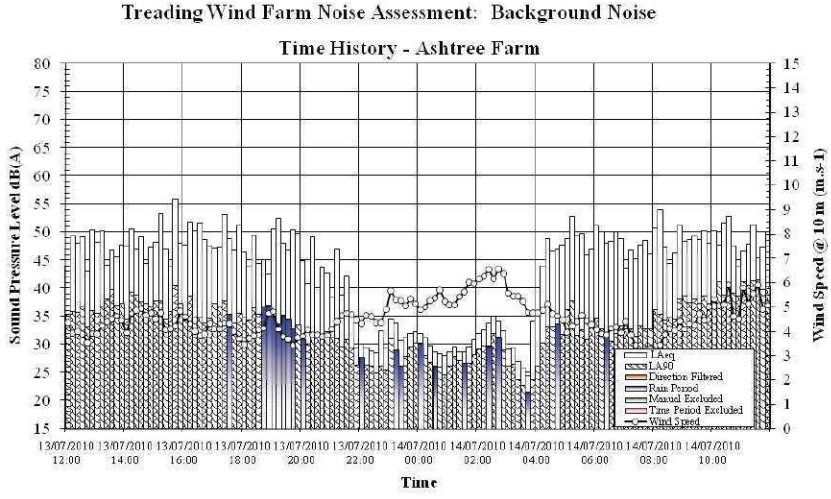

Treading Wind Farm Noise Assessment: Background Noise
Time History - Ashtree Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Ashtree Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Ashtree Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

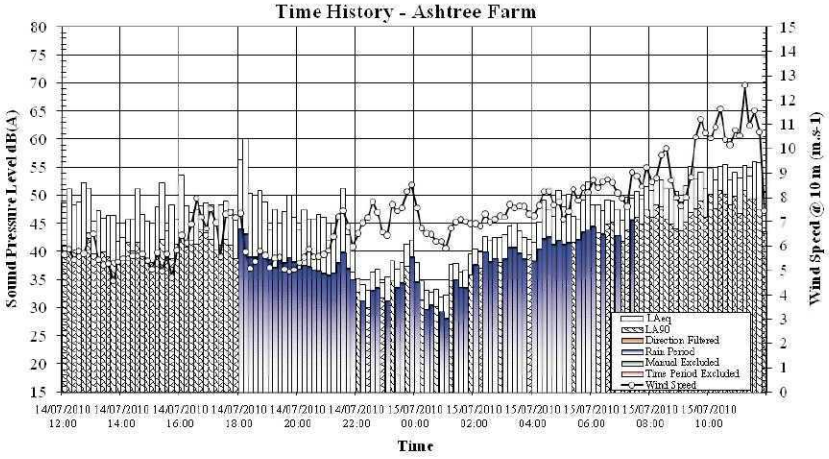

Treading Wind Farm Noise Assessment: Background Noise
Time History - Ashtree Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Ashtree Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Ashtree Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

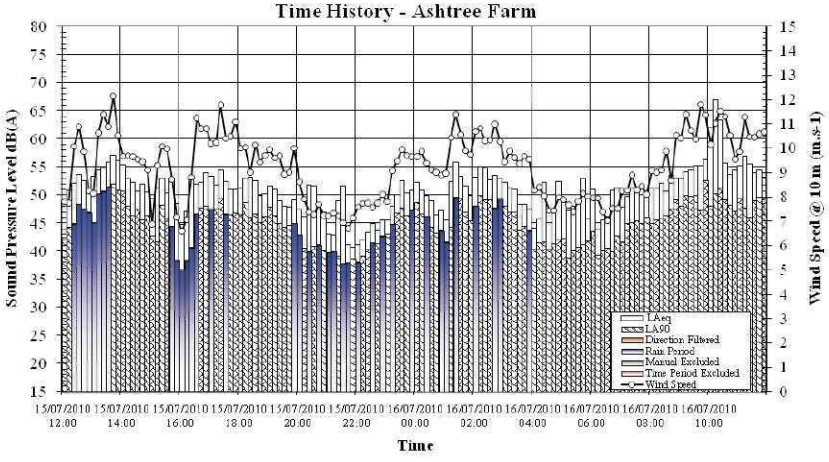
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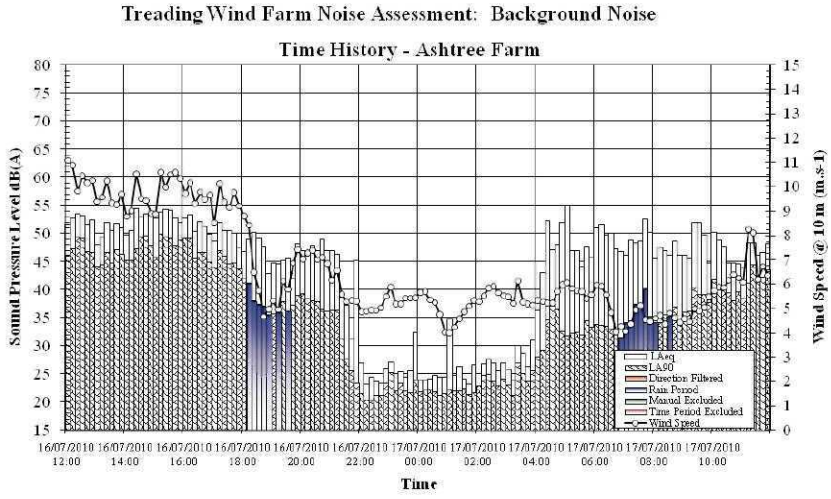
Time History - Ashtree Farm

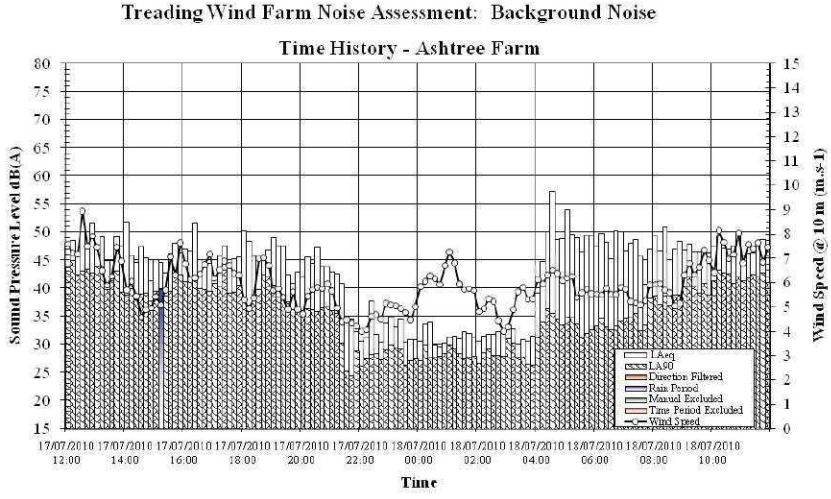


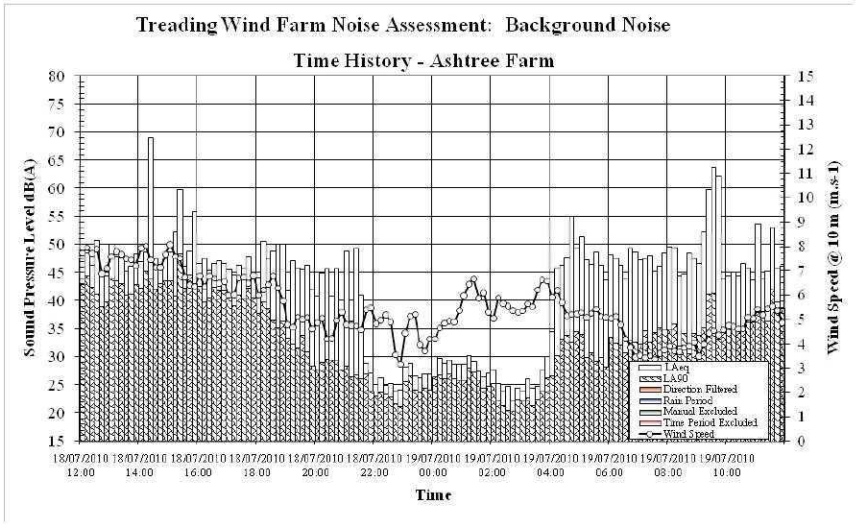
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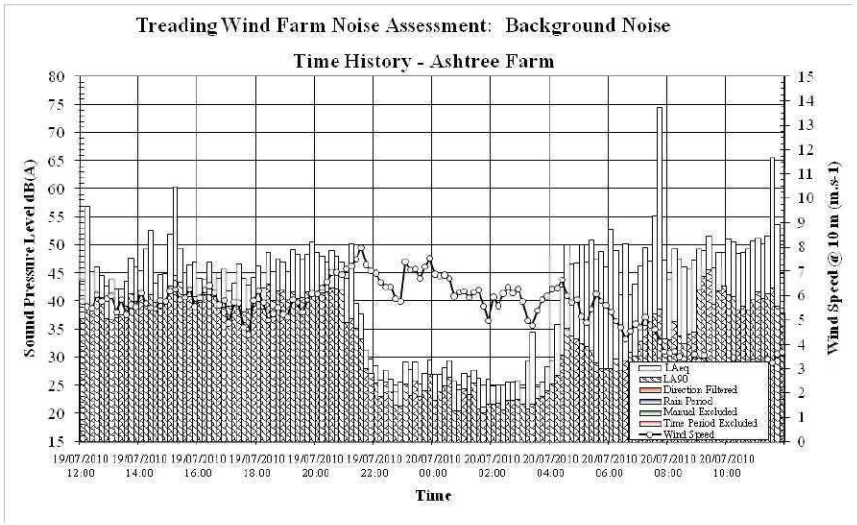
Time History - Ashtree Farm

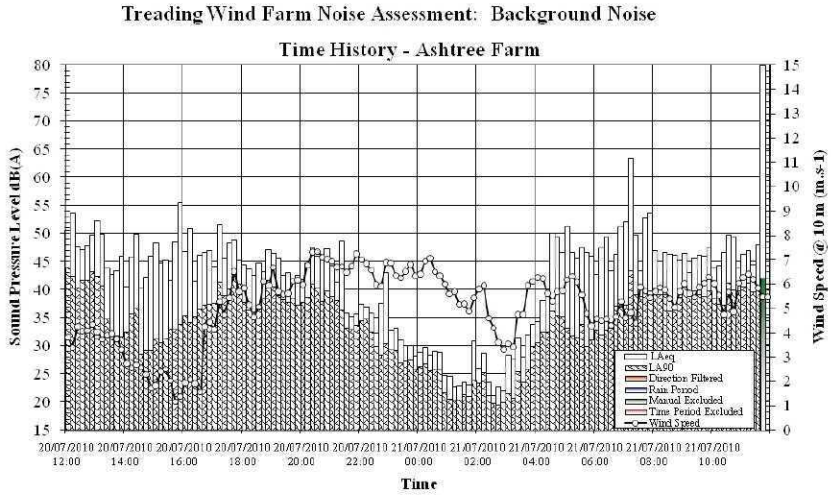


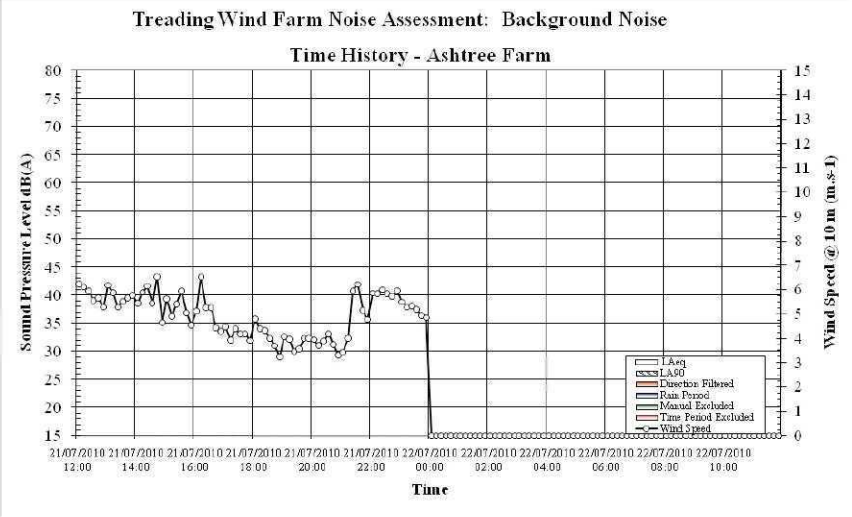

Treading Wind Farm Noise Assessment: Background Noise
Time History - Ashtree Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

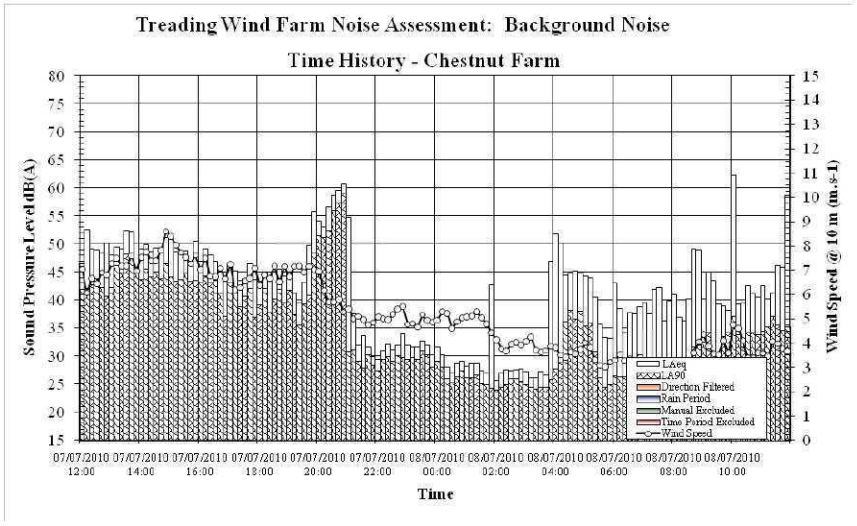

Treading Wind Farm Noise Assessment: Background Noise
Time History - Ashtree Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
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Time Period Excluded
Wind Speed
Time

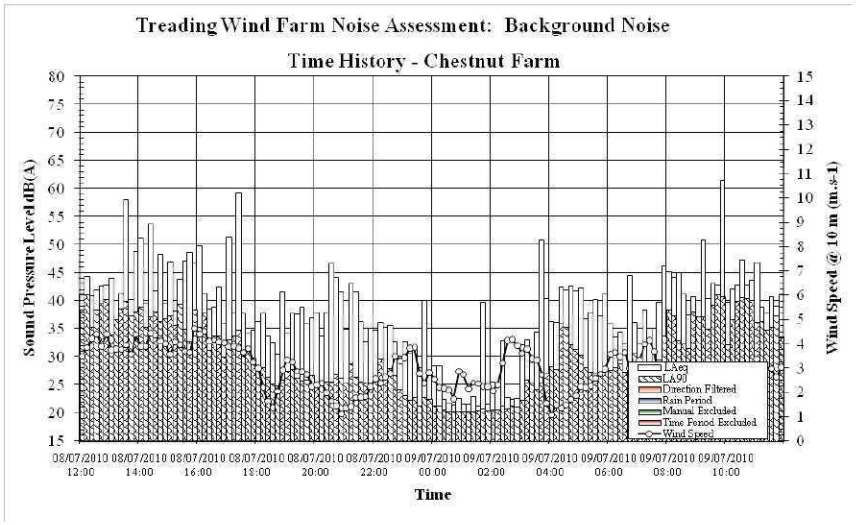

Treading Wind Farm Noise Assessment: Background Noise
Time History - Ashtree Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
18/07/2010 12:00
18/07/2010 14:00
18/07/2010 16:00
18/07/2010 18:00
18/07/2010 20:00
18/07/2010 22:00
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19/07/2010 10:00
Time

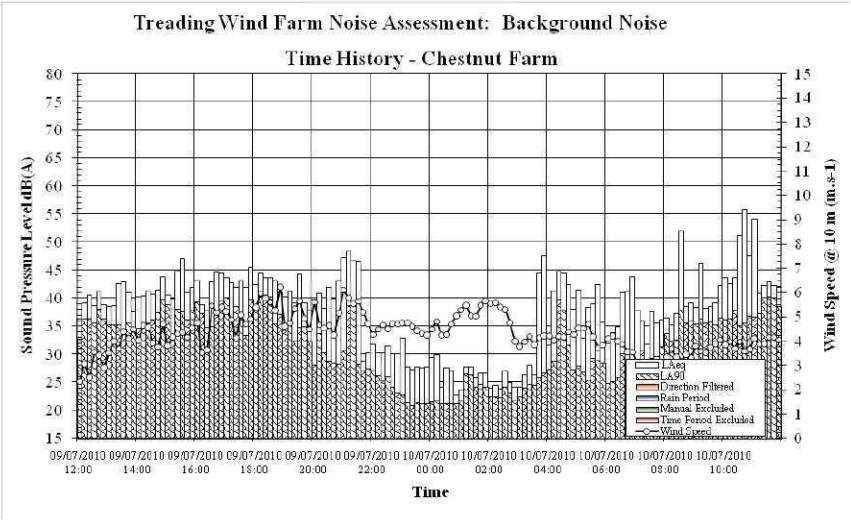

Treading Wind Farm Noise Assessment: Background Noise
Time History - Ashtree Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
19/07/2010 12:00
19/07/2010 14:00
19/07/2010 16:00
19/07/2010 18:00
19/07/2010 20:00
19/07/2010 22:00
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20/07/2010 10:00
Time

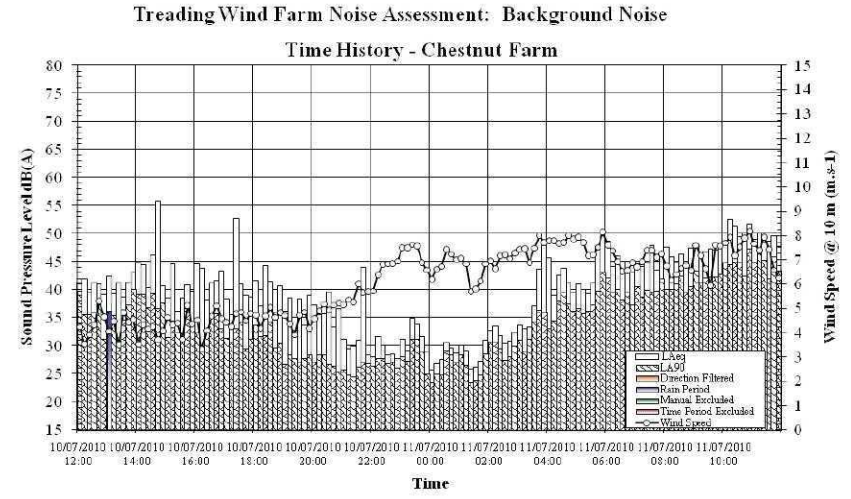

Treading Wind Farm Noise Assessment: Background Noise
Time History - Ashtree Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

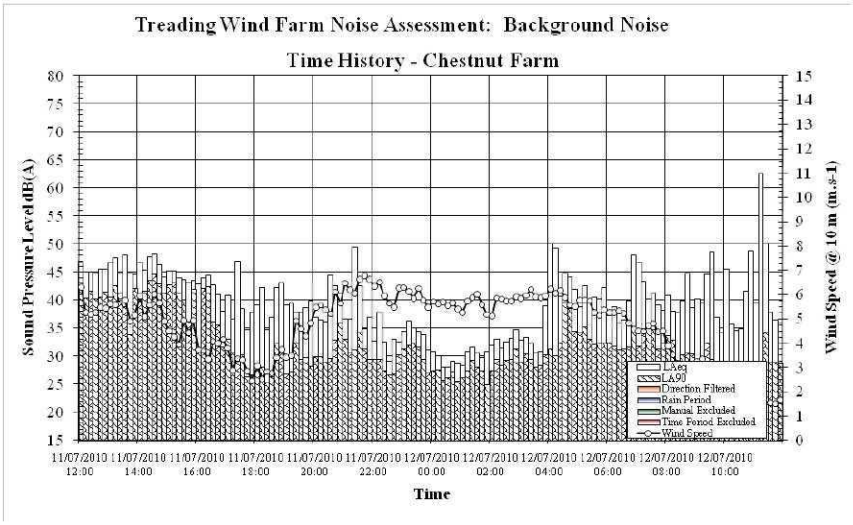

Treading Wind Farm Noise Assessment: Background Noise
Time History - Ashtree Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

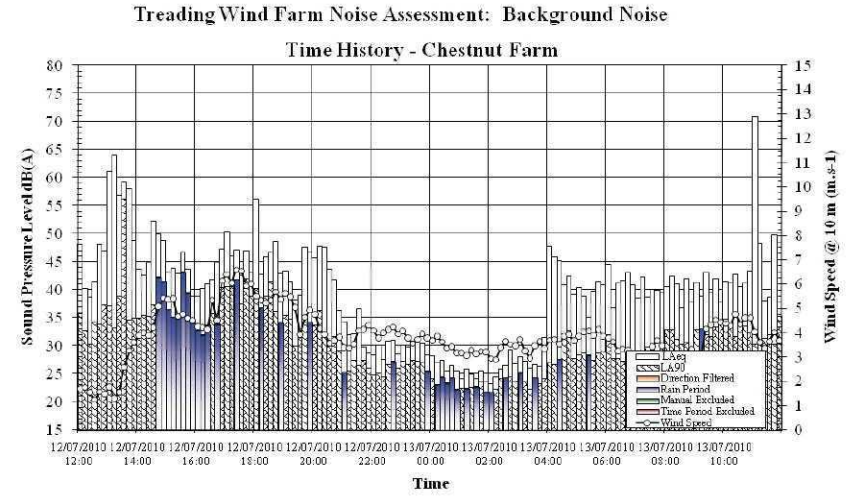

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

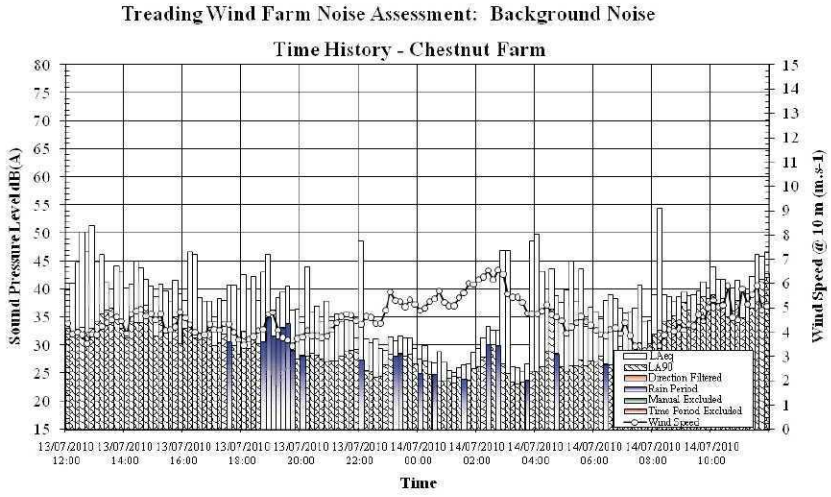

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

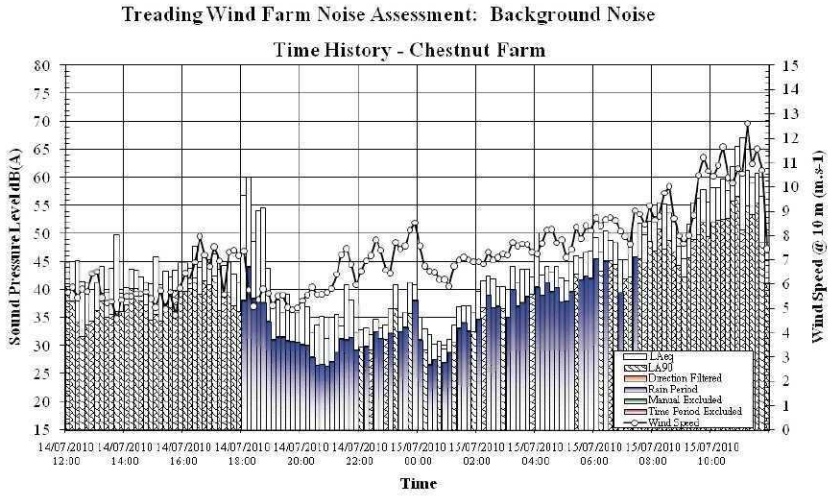

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
09/07/2010 12:00
09/07/2010 14:00
09/07/2010 16:00
09/07/2010 18:00
09/07/2010 20:00
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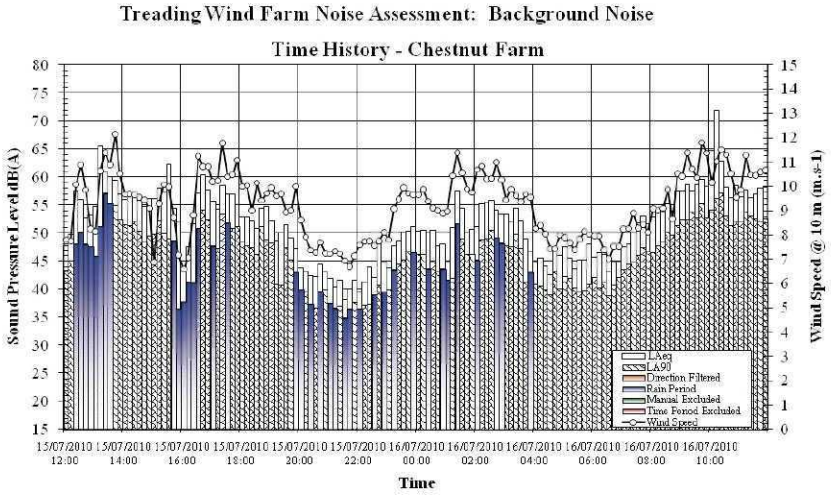

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
10/07/2010 12:00
10/07/2010 14:00
10/07/2010 16:00
10/07/2010 18:00
10/07/2010 20:00
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11/07/2010 10:00
Time

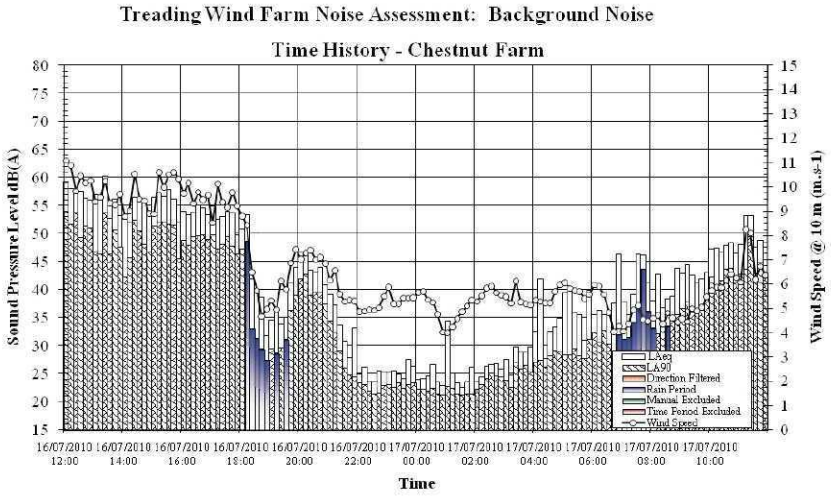

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
11/07/2010 12:00
11/07/2010 14:00
11/07/2010 16:00
11/07/2010 18:00
11/07/2010 20:00
11/07/2010 22:00
12/07/2010 00:00
12/07/2010 02:00
12/07/2010 04:00
12/07/2010 06:00
12/07/2010 08:00
12/07/2010 10:00
Time

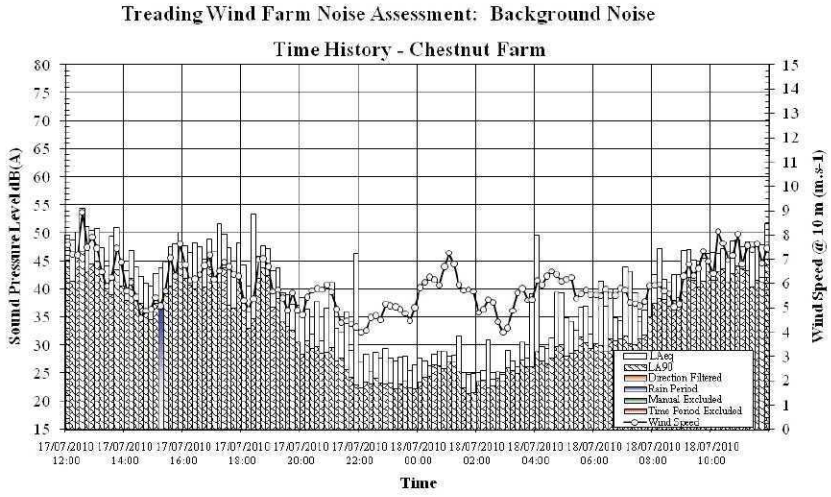

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
12/07/2010 12:00
12/07/2010 14:00
12/07/2010 16:00
12/07/2010 18:00
12/07/2010 20:00
12/07/2010 22:00
13/07/2010 00:00
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13/07/2010 10:00
Time

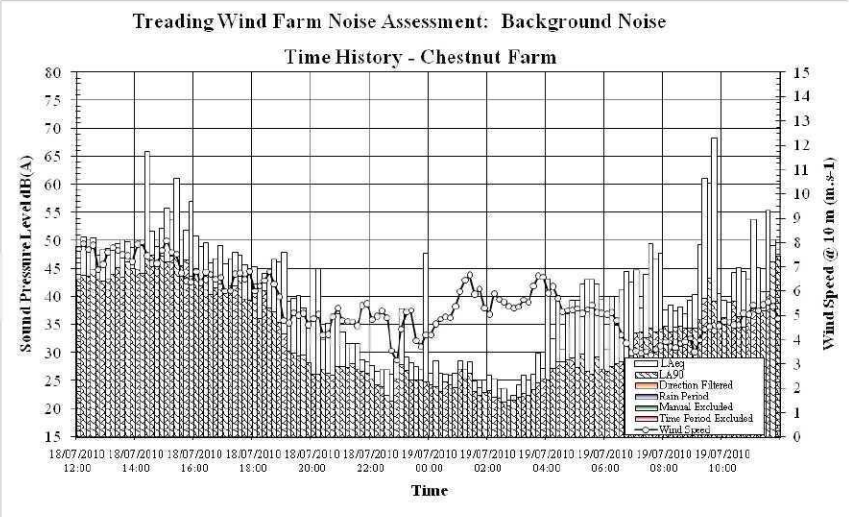

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

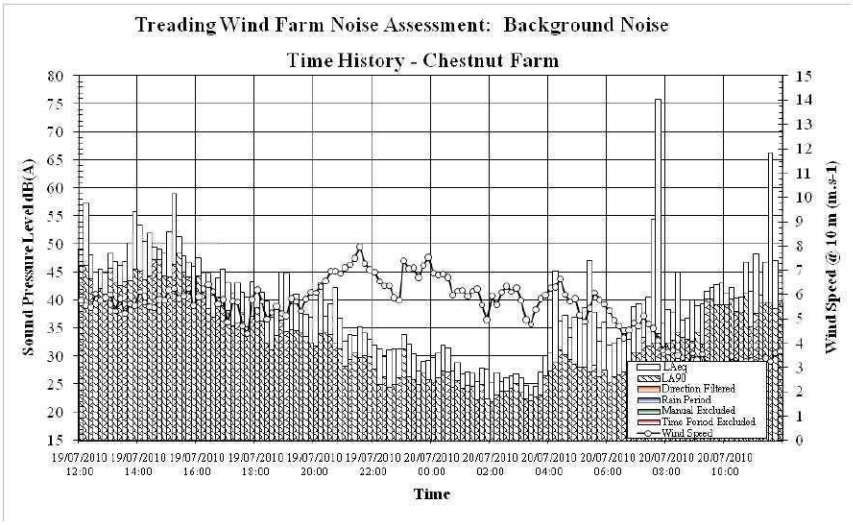

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

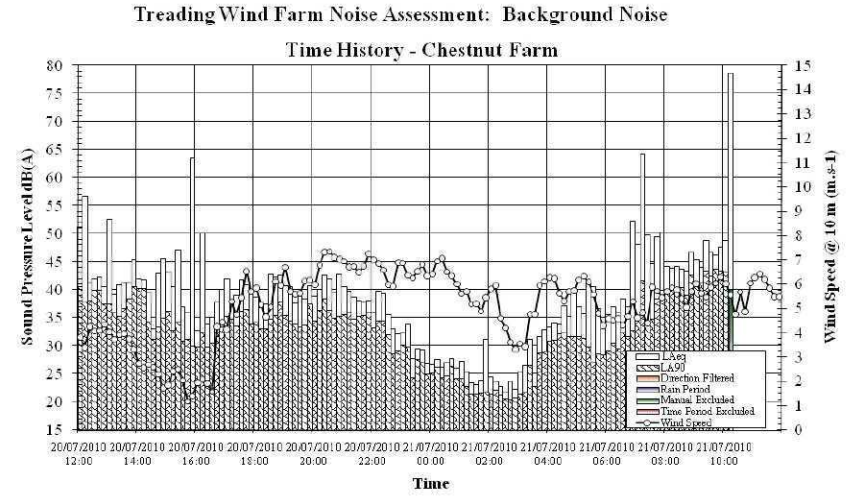

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
15/07/2010 12:00
15/07/2010 14:00
15/07/2010 16:00
15/07/2010 18:00
15/07/2010 20:00
15/07/2010 22:00
16/07/2010 00:00
16/07/2010 02:00
16/07/2010 04:00
16/07/2010 06:00
16/07/2010 08:00
16/07/2010 10:00
Time

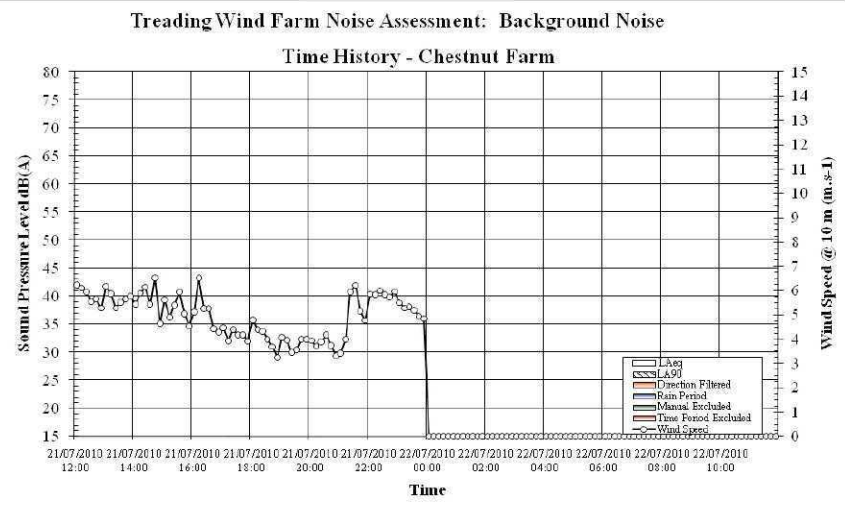

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
16/07/2010 12:00
16/07/2010 14:00
16/07/2010 16:00
16/07/2010 18:00
16/07/2010 20:00
16/07/2010 22:00
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17/07/2010 10:00
Time

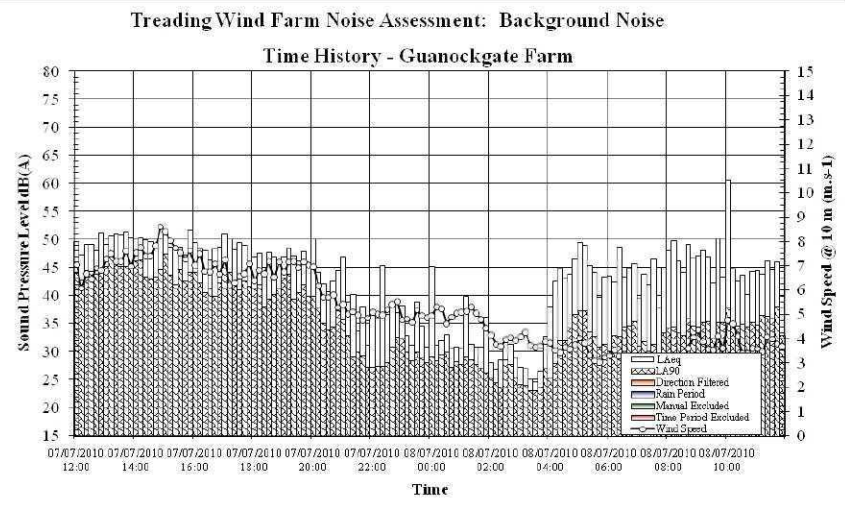

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

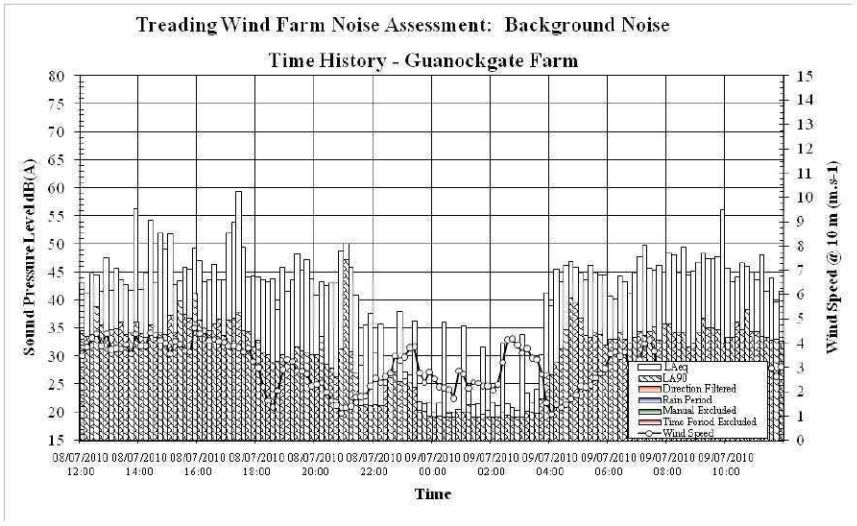

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

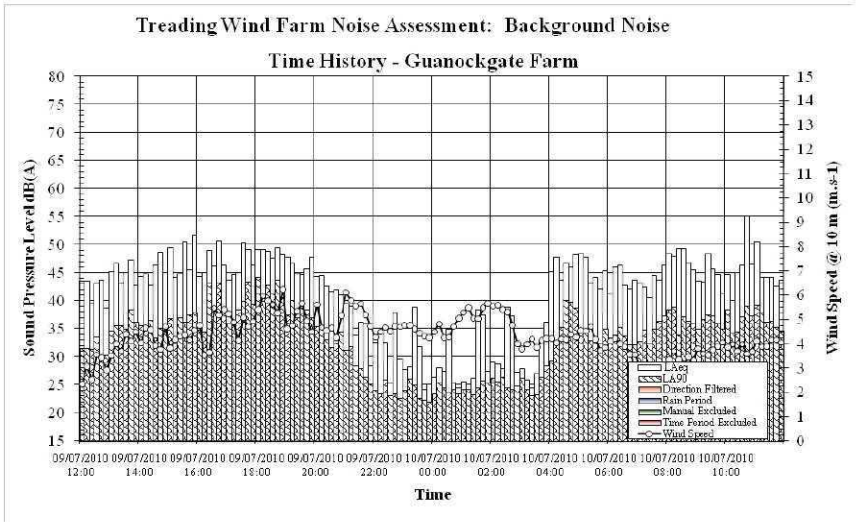

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
19/07/2010 12:00
19/07/2010 14:00
19/07/2010 16:00
19/07/2010 18:00
19/07/2010 20:00
19/07/2010 22:00
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20/07/2010 10:00
Time

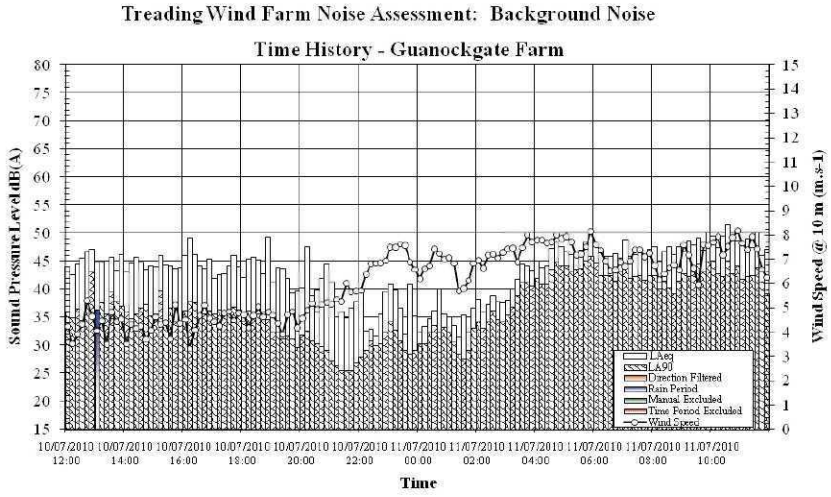

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
20/07/2010 12:00
20/07/2010 14:00
20/07/2010 16:00
20/07/2010 18:00
20/07/2010 20:00
20/07/2010 22:00
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21/07/2010 08:00
21/07/2010 10:00
Time

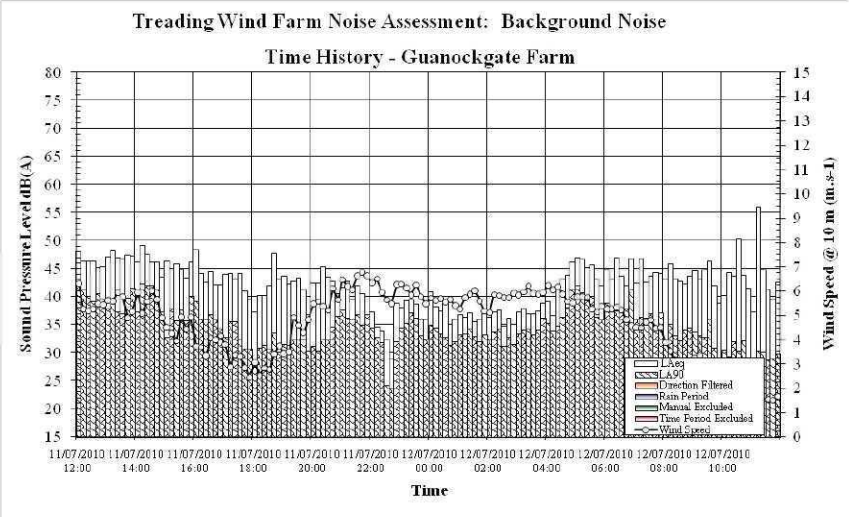

Treading Wind Farm Noise Assessment: Background Noise
Time History - Chestnut Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
21/07/2010 12:00
21/07/2010 14:00
21/07/2010 16:00
21/07/2010 18:00
21/07/2010 20:00
21/07/2010 22:00
22/07/2010 00:00
22/07/2010 02:00
22/07/2010 04:00
22/07/2010 06:00
22/07/2010 08:00
22/07/2010 10:00
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Guanockgate Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
07/07/2010 12:00
07/07/2010 14:00
07/07/2010 16:00
07/07/2010 18:00
07/07/2010 20:00
07/07/2010 22:00
08/07/2010 00:00
08/07/2010 02:00
08/07/2010 04:00
08/07/2010 06:00
08/07/2010 08:00
08/07/2010 10:00
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Guanockgate Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
08/07/2010 12:00
08/07/2010 14:00
08/07/2010 16:00
08/07/2010 18:00
08/07/2010 20:00
08/07/2010 22:00
09/07/2010 00:00
09/07/2010 02:00
09/07/2010 04:00
09/07/2010 06:00
09/07/2010 08:00
09/07/2010 10:00
Time

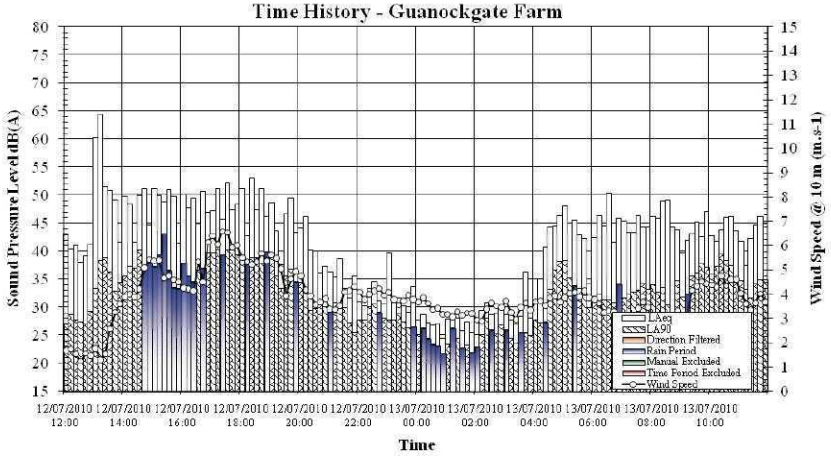

Treading Wind Farm Noise Assessment: Background Noise
Time History - Guanockgate Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
09/07/2010 12:00
09/07/2010 14:00
09/07/2010 16:00
09/07/2010 18:00
09/07/2010 20:00
09/07/2010 22:00
10/07/2010 00:00
10/07/2010 02:00
10/07/2010 04:00
10/07/2010 06:00
10/07/2010 08:00
10/07/2010 10:00
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Guanockgate Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Guanockgate Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

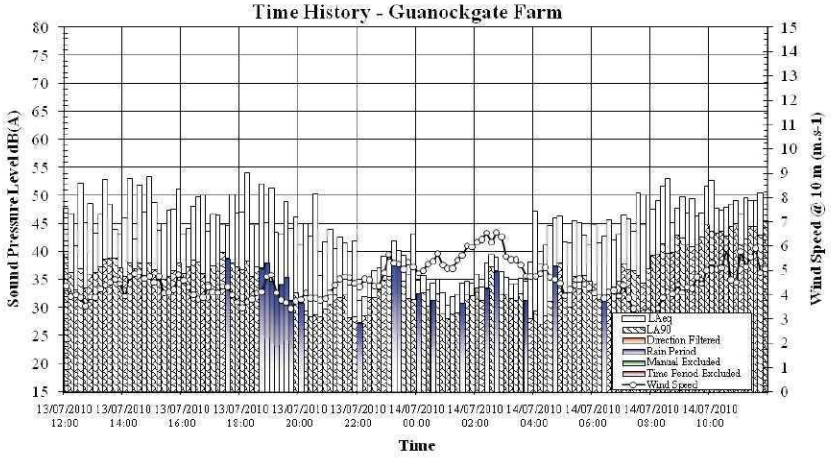
Treading Wind Farm Noise Assessment: Background Noise

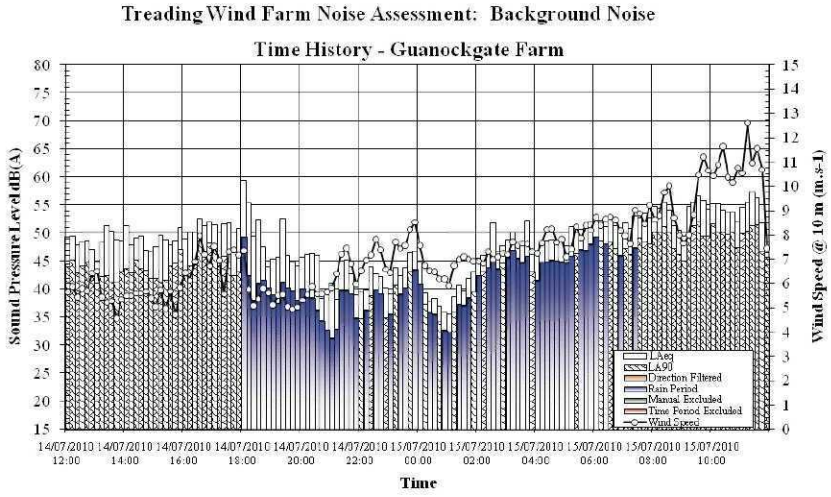
Time History - Guanockgate Farm

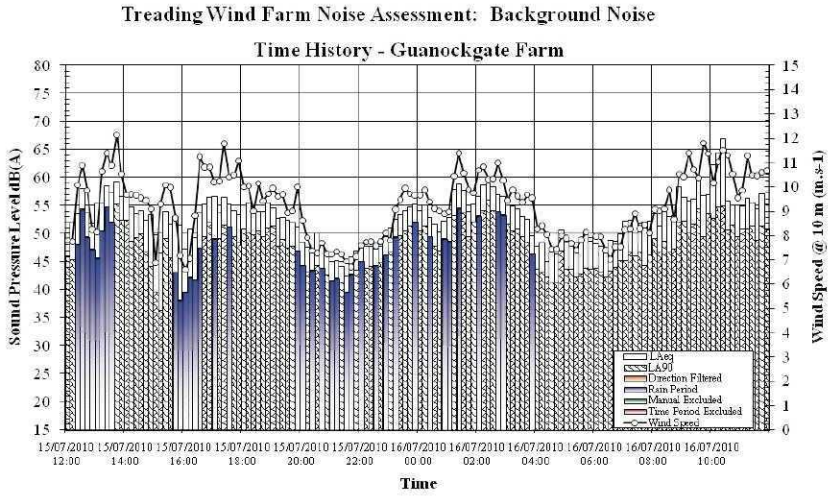


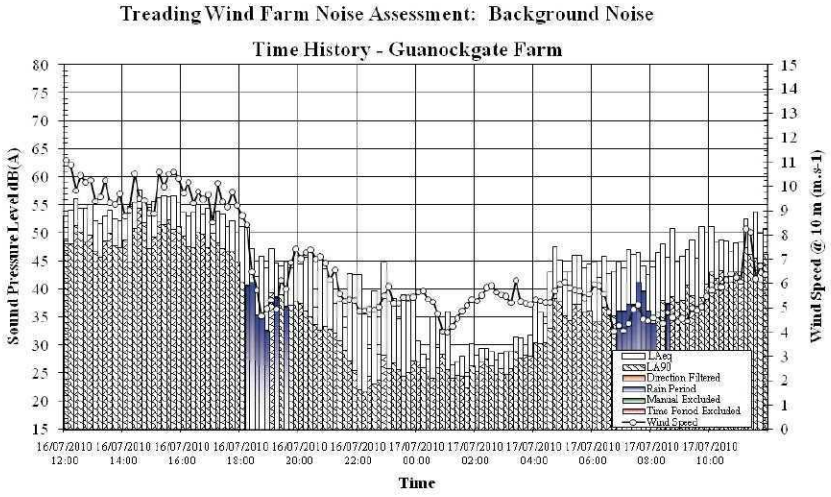
Treading Wind Farm Noise Assessment: Background Noise

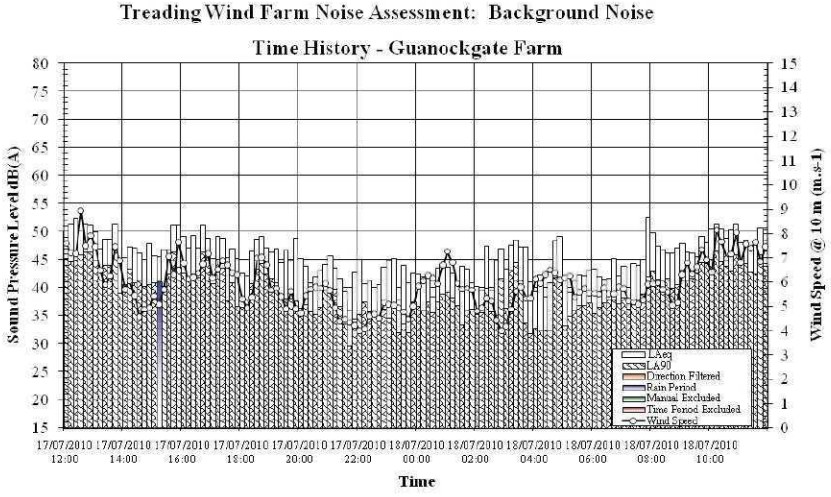
Time History - Guanockgate Farm

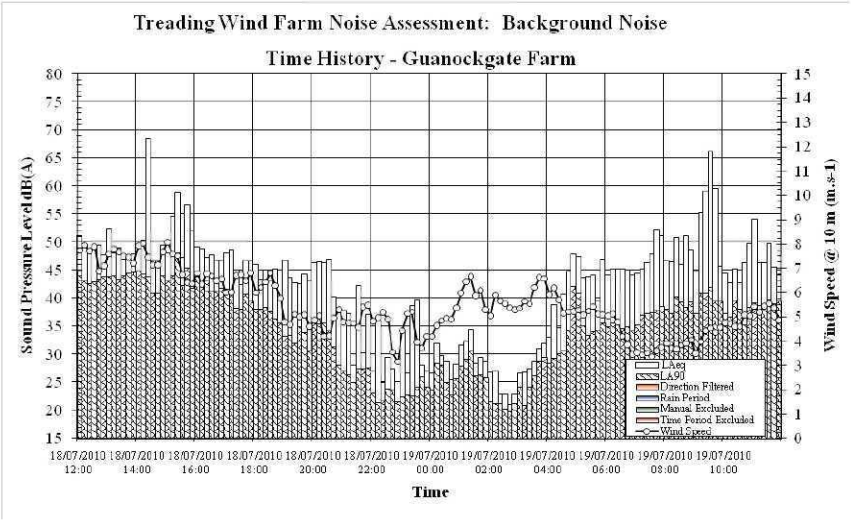


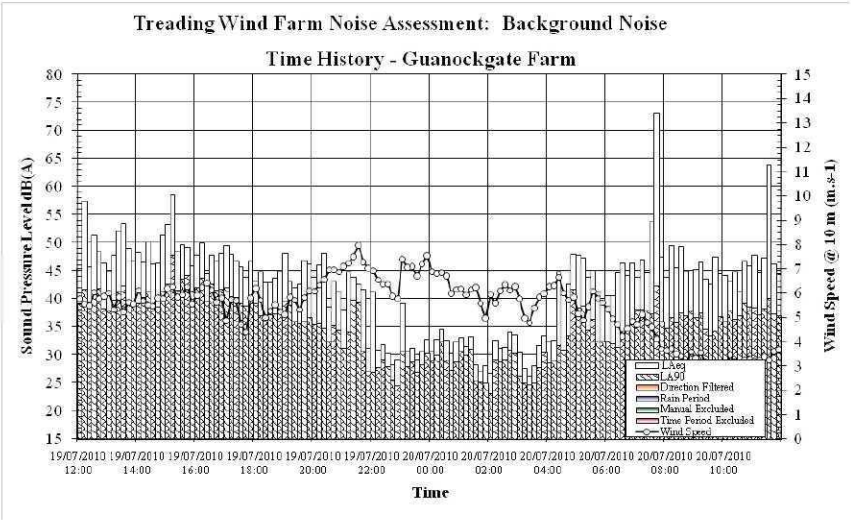

Treading Wind Farm Noise Assessment: Background Noise
Time History - Guanockgate Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

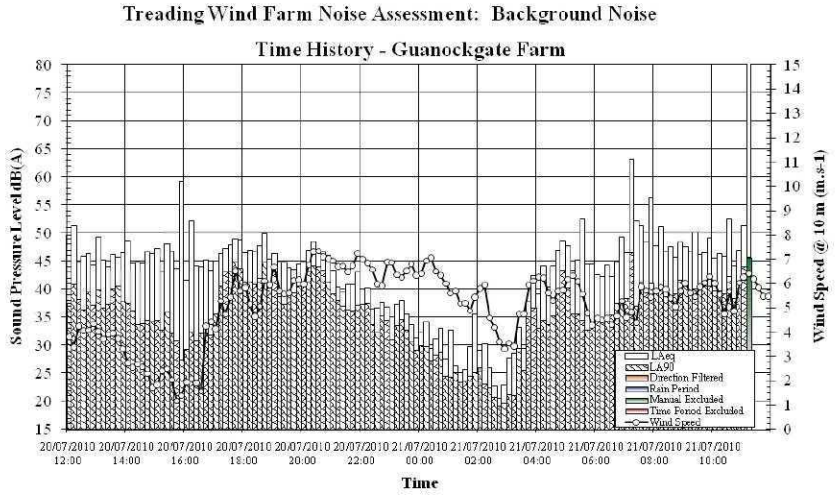

Treading Wind Farm Noise Assessment: Background Noise
Time History - Guanockgate Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

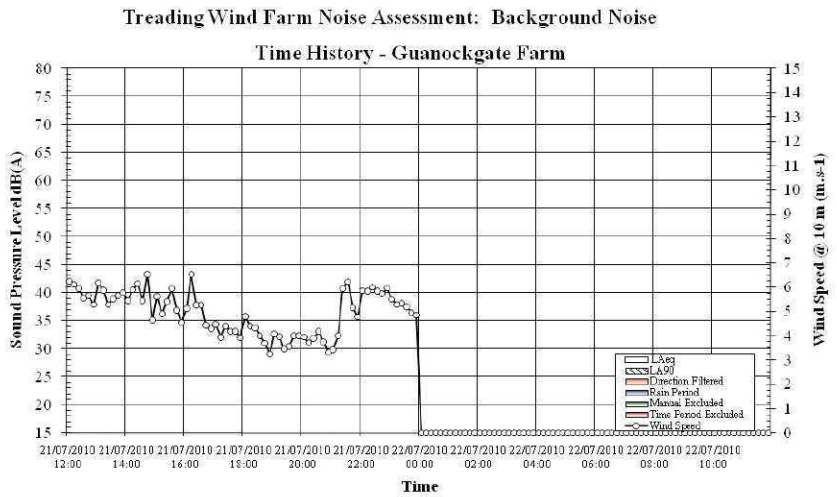

Treading Wind Farm Noise Assessment: Background Noise
Time History - Guanockgate Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
16/07/2010 12:00
16/07/2010 14:00
16/07/2010 16:00
16/07/2010 18:00
16/07/2010 20:00
16/07/2010 22:00
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17/07/2010 10:00
Time

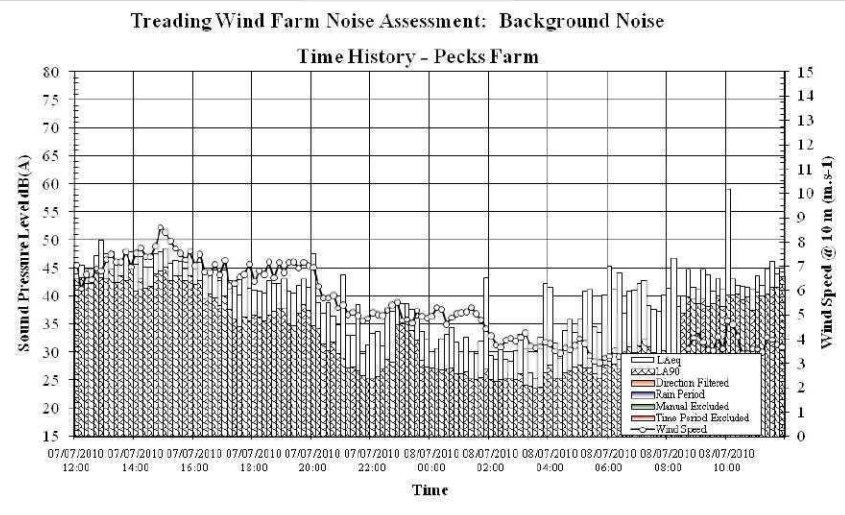

Treading Wind Farm Noise Assessment: Background Noise
Time History - Guanockgate Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
17/07/2010 12:00
17/07/2010 14:00
17/07/2010 16:00
17/07/2010 18:00
17/07/2010 20:00
17/07/2010 22:00
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18/07/2010 10:00
Time

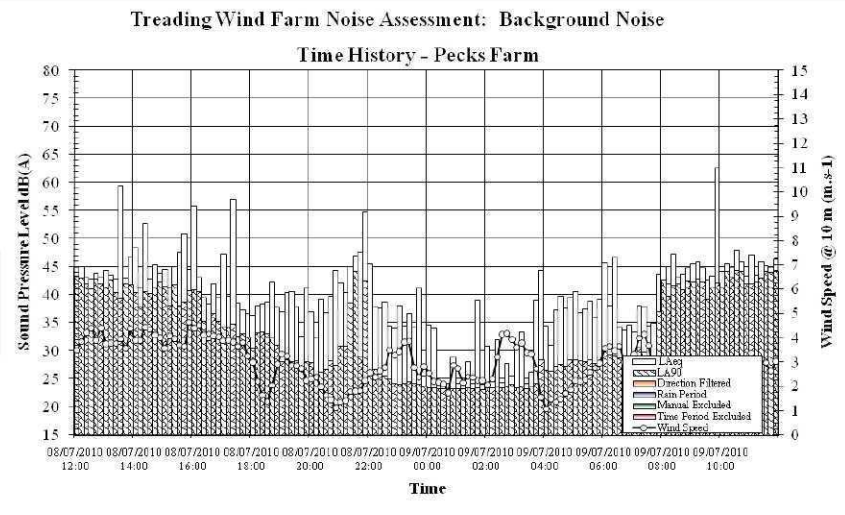

Treading Wind Farm Noise Assessment: Background Noise
Time History - Guanockgate Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
18/07/2010 12:00
18/07/2010 14:00
18/07/2010 16:00
18/07/2010 18:00
18/07/2010 20:00
18/07/2010 22:00
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19/07/2010 10:00
Time

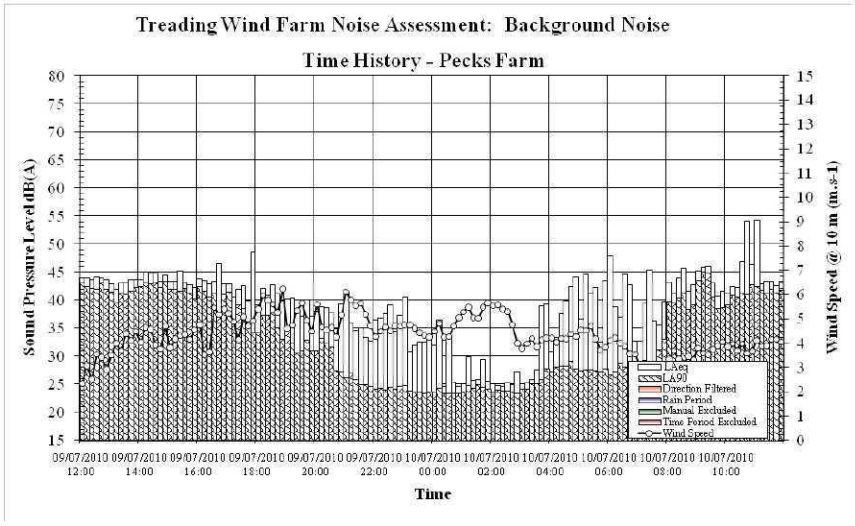

Treading Wind Farm Noise Assessment: Background Noise
Time History - Guanockgate Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
19/07/2010 12:00
19/07/2010 14:00
19/07/2010 16:00
19/07/2010 18:00
19/07/2010 20:00
19/07/2010 22:00
20/07/2010 00:00
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20/07/2010 10:00
Time

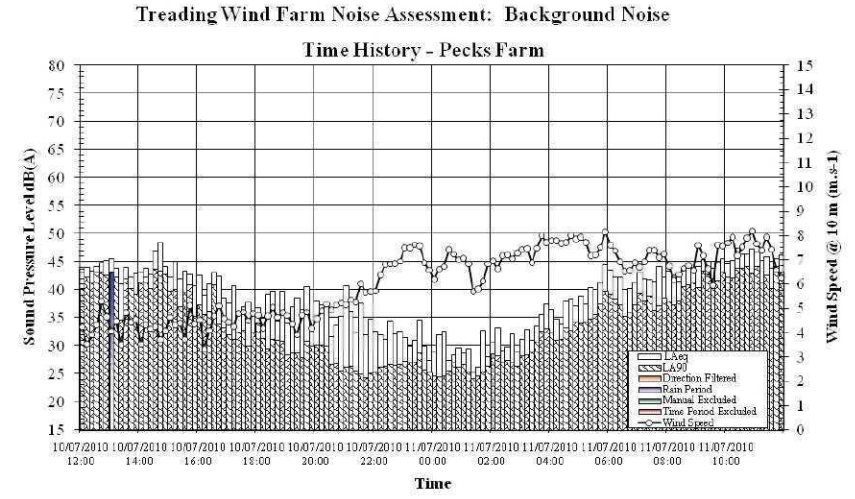

Treading Wind Farm Noise Assessment: Background Noise
Time History - Guanockgate Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
20/07/2010 12:00
20/07/2010 14:00
20/07/2010 16:00
20/07/2010 18:00
20/07/2010 20:00
20/07/2010 22:00
21/07/2010 00:00
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21/07/2010 08:00
21/07/2010 10:00
Time

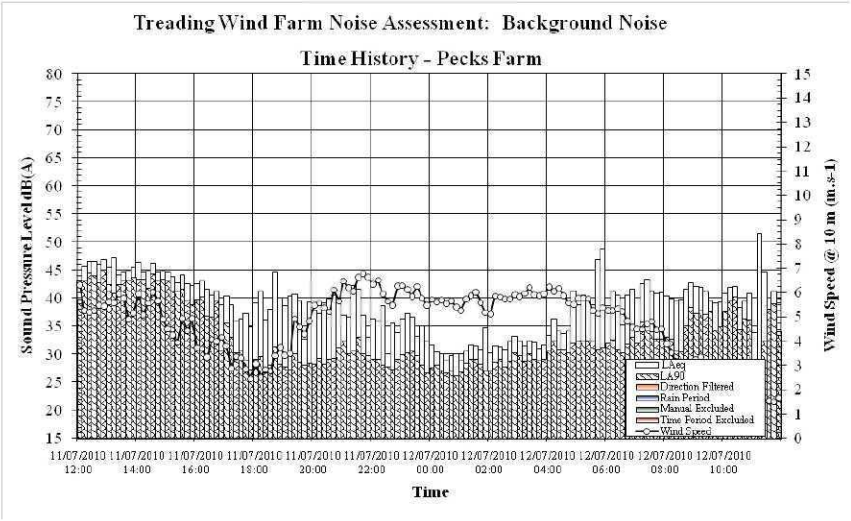

Treading Wind Farm Noise Assessment: Background Noise
Time History - Guanockgate Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
21/07/2010 12:00
21/07/2010 14:00
21/07/2010 16:00
21/07/2010 18:00
21/07/2010 20:00
21/07/2010 22:00
22/07/2010 00:00
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22/07/2010 10:00
Time

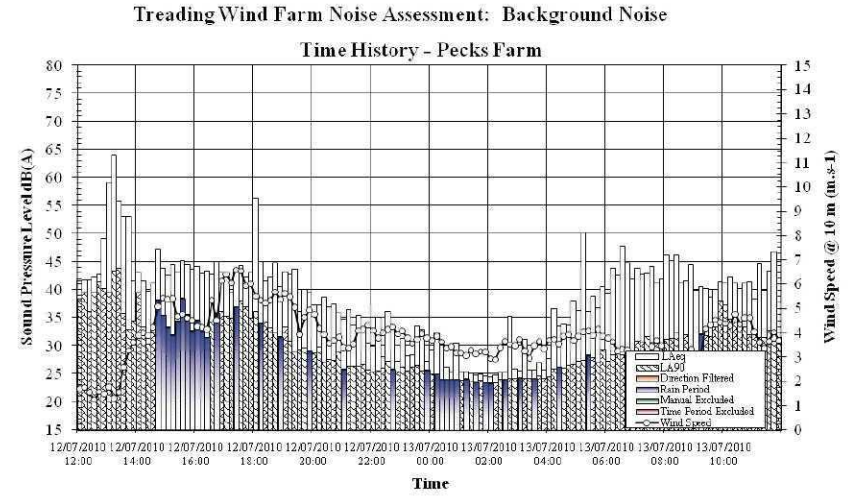

Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
07/07/2010 12:00
07/07/2010 14:00
07/07/2010 16:00
07/07/2010 18:00
07/07/2010 20:00
07/07/2010 22:00
08/07/2010 00:00
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08/07/2010 10:00
Time

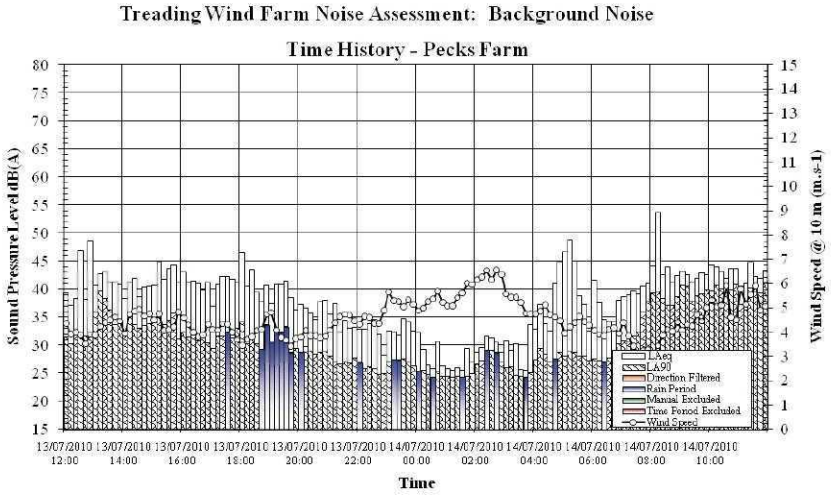

Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
08/07/2010 12:00
08/07/2010 14:00
08/07/2010 16:00
08/07/2010 18:00
08/07/2010 20:00
08/07/2010 22:00
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09/07/2010 06:00
09/07/2010 08:00
09/07/2010 10:00
Time

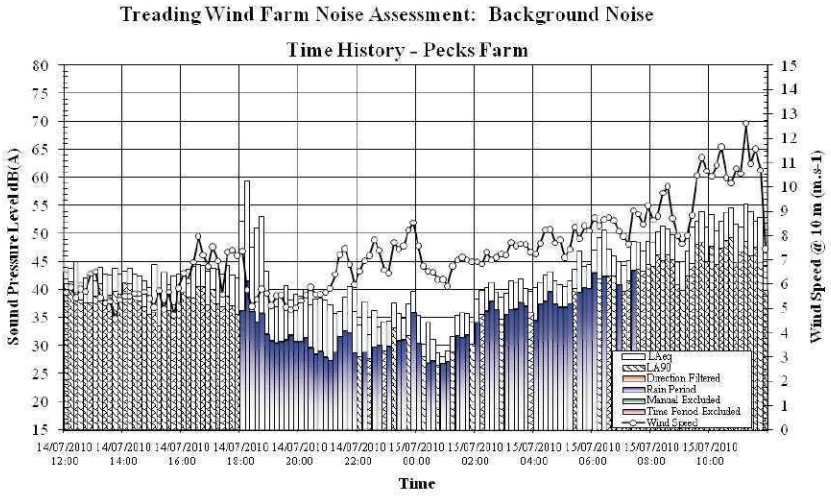

Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
09/07/2010 12:00
09/07/2010 14:00
09/07/2010 16:00
09/07/2010 18:00
09/07/2010 20:00
09/07/2010 22:00
10/07/2010 00:00
10/07/2010 02:00
10/07/2010 04:00
10/07/2010 06:00
10/07/2010 08:00
10/07/2010 10:00
Time

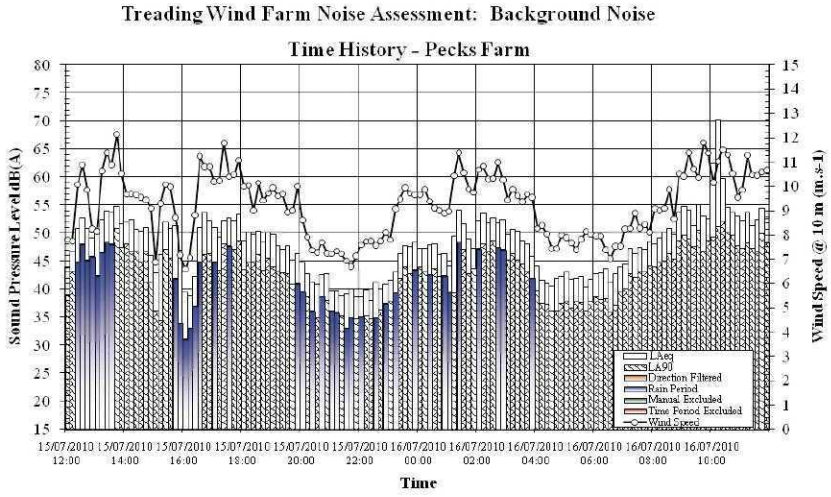

Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
10/07/2010 12:00
10/07/2010 14:00
10/07/2010 16:00
10/07/2010 18:00
10/07/2010 20:00
10/07/2010 22:00
11/07/2010 00:00
11/07/2010 02:00
11/07/2010 04:00
11/07/2010 06:00
11/07/2010 08:00
11/07/2010 10:00
Time

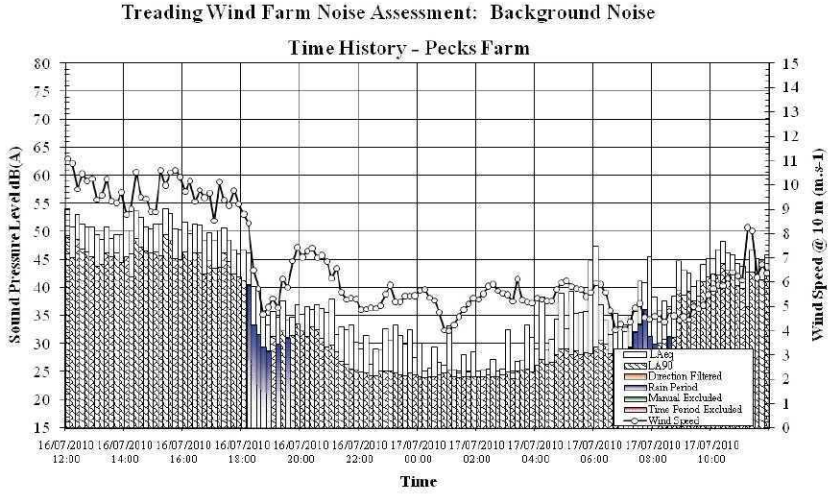

Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

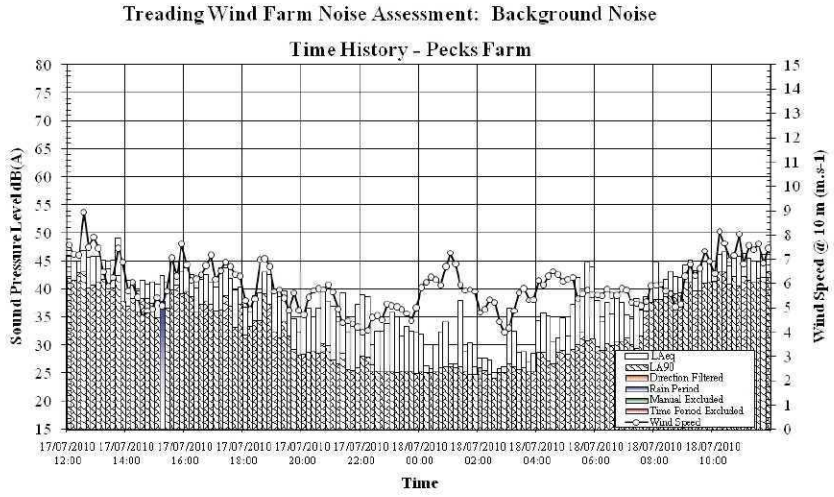

Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

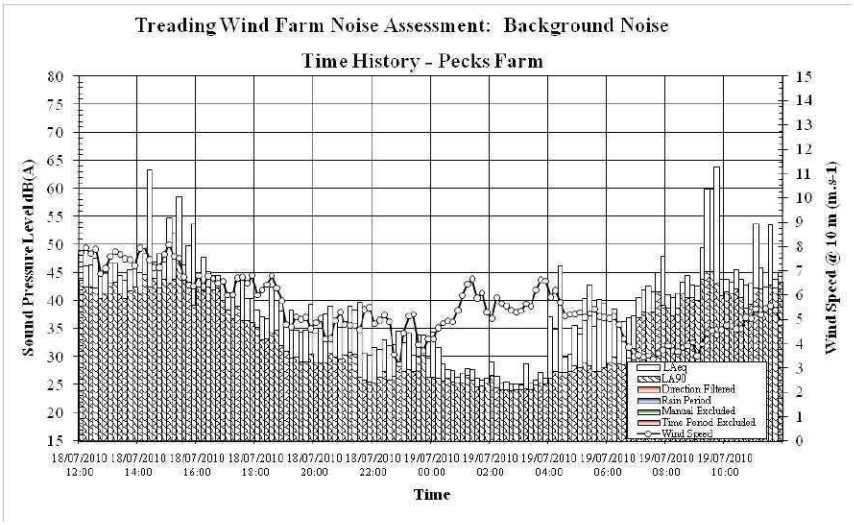

Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
13/07/2010 12:00
13/07/2010 14:00
13/07/2010 16:00
13/07/2010 18:00
13/07/2010 20:00
13/07/2010 22:00
14/07/2010 00:00
14/07/2010 02:00
14/07/2010 04:00
14/07/2010 06:00
14/07/2010 08:00
14/07/2010 10:00
Time

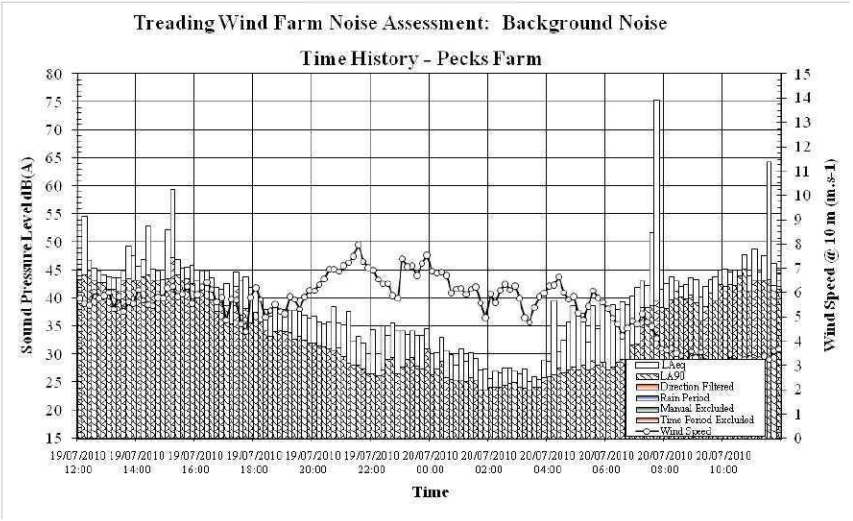

Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
14/07/2010 12:00
14/07/2010 14:00
14/07/2010 16:00
14/07/2010 18:00
14/07/2010 20:00
14/07/2010 22:00
15/07/2010 00:00
15/07/2010 02:00
15/07/2010 04:00
15/07/2010 06:00
15/07/2010 08:00
15/07/2010 10:00
Time

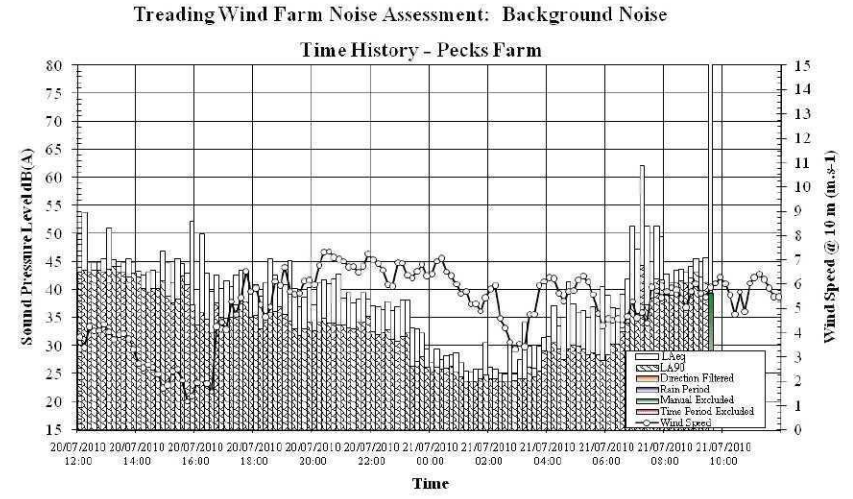

Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time

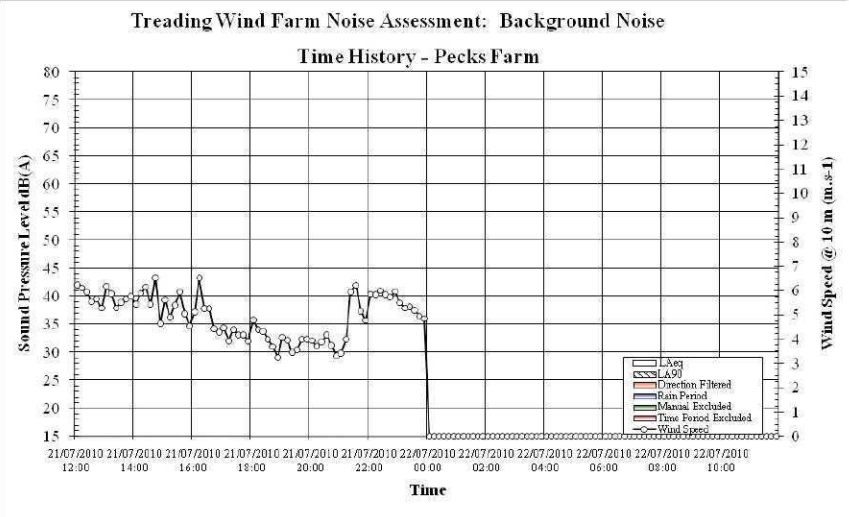

Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
17/07/2010 12:00
17/07/2010 14:00
17/07/2010 16:00
17/07/2010 18:00
17/07/2010 20:00
17/07/2010 22:00
18/07/2010 00:00
18/07/2010 02:00
18/07/2010 04:00
18/07/2010 06:00
18/07/2010 08:00
18/07/2010 10:00
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
18/07/2010 12:00
18/07/2010 14:00
18/07/2010 16:00
18/07/2010 18:00
18/07/2010 20:00
18/07/2010 22:00
19/07/2010 00:00
19/07/2010 02:00
19/07/2010 04:00
19/07/2010 06:00
19/07/2010 08:00
19/07/2010 10:00
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed
Time


Treading Wind Farm Noise Assessment: Background Noise
Time History - Pecks Farm
Sound Pressure Level dB(A)
Wind Speed @ 10 m (m.s-1)
Time
LAeq
LA90
Direction Filtered
Rain Period
Manual Excluded
Time Period Excluded
Wind Speed

Appendix 14.2 - Turbine Noise Data

3 Calculated Sound Power Level MM92 2050 kW for sound propagation (for information only)

3.1 Sound Power Level according to IEC for different Hub Heights

HH	v_{10}[5] [m/s]	5.0	6.0	7.0	8.0	9.0	10.0
68.5m	L_{WA}[6] [dB(A)]	101.2	103.1	104.2	104.2	104.2	104.2
78.5m	L_{WA}[6] [dB(A)]	101.4	103.3	104.2	104.2	104.2	104.2
80m	L_{WA}[6] [dB(A)]	101.4	103.3	104.2	104.2	104.2	104.2
100m	L_{WA}[6] [dB(A)]	101.7	103.4	104.2	104.2	104.2	104.2

All sound power levels above are based on wind speeds of v_{10} at 10 m height. The data of the noise level are based on the requirements of the IEC 61400-11 : 2002 + A1 : 2006
The calculation of the wind speed in 10m height is based on a roughness length of 0.05m, equivalent to a vertical wind shear coefficient of 0.14.

3.2 Sound Power Level according to FGW Guideline at 95% of rated power

The sound power level measured according to the "Technische Richtlinie für Windenergieanlagen Teil 1: Rev. 18 der FGW" at 95% of the rated power is independent of the hub height:

$$L_{WA,95\%} = 104.2 \text{ dB(A)}$$

[5] Wind speed at 10m height

[6] Sound power level at hub height

Report No. SE06010B2A1

Excerpt from the acoustic test report SE06010B2

Summary of results from the acoustic noise measurement at the wind turbine type REpower MM92 according to

IEC 61400-11:2002: Wind turbine generator systems – Part 11: Acoustic noise measurement techniques.

General information		Technical data (manufacturers specifications)	
Manufacturer:	REpower Systems AG Rödemis Hallig D-25813 Husum	Rated power (generator):	2000 kW
		Rotor diameter:	92,5 m
		Hub height above ground:	80 m
Serial No.:	90001	Tower design:	Steel tube
Location:	RW: 3505388 HW: 5983725	Power control	Pitch
Supplementary data about the rotor (manufacturers specifications		**Supplementary data about gearbox and generator (manufacturers specifications)**	
Rotor blade manufacturer:	LM or similar	Gearbox manufacturer:	Eickhoff or similar
Blade type:	LM 45.3_P	Gearbox type:	CPNHZ-224
Blade pitch setting:	---°	Generator manufacturer:	VEM or similar
Number of blades	3	Generator type:	DASAA5025-4UA
Rotor speed range:	7,8 – 15,0 rpm	Generator speed range:	1000 – 1800 rpm

Test report for the power curve: REpower document No. D-2.9-VM.LK.01-A Rev B-GB

	Reference point		Noise emission-parameter		Comments
	Standardized wind speed at 10 m height	Electrical active power			
Sound power level L_{WAP}	6 ms^{-1} 7 ms^{-1} 8 ms^{-1} 9 ms^{-1} 10 ms^{-1}	1088 kW 1640 kW 1980 kW 2025 kW ---	101,6 dB 102,9 dB 103,0 dB 102,1 dB ---		95 % rated power at 7,6 m/s > 95 % rated power ---
Tonality for the vicinity of the wind turbine ΔL_{ax}	6 ms^{-1} 7 ms^{-1} 8 ms^{-1} 9 ms^{-1} 10 ms^{-1}	1088 kW 1640 kW 1980 kW 2025 kW ---	0 dB 0 dB 0 dB 0 dB ---	6 ms^{-1} 7 ms^{-1} 8 ms^{-1} 9 ms^{-1} 10 ms^{-1}	95 % rated power at 7,6 m/s > 95 % rated power ---
Impulsivity for the vicinity of the wind turbine	6 ms^{-1} 7 ms^{-1} 8 ms^{-1} 9 ms^{-1} 10 ms^{-1}	1088 kW 1640 kW 1980 kW 2025 kW ---	0 dB 0 dB 0 dB 0 dB ---		95 % rated power at 7,6 m/s > 95 % rated power ---

Third octave sound power level at v_{10} = 7,6 ms^{-1} in dB

Frequency	50	63	80	100	125	160	200	250	315	400	500	630
$L_{WA,P}$	74,44	78,59	82,1	84,5	86,49	88,8	89,83	92,86	94,05	93,33	94,18	93,76
Frequency	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
$L_{WA,P}$	93,15	91,59	89,74	88,14	85,61	83,43	81,54	78,98	76,84	77,37	76,84	74,76

Octave sound power level at v_{10} = 7,6 ms^{-1} in dB

Frequency	63	125	250	500	1000	2000	4000	8000
$L_{WA,P}$	83,15	91,41	97,03	98,7	96,73	91,01	84,3	81,09

These specifications do not substitute the above mentioned full test report (particularly for noise immission prognosis).

Comments:

Measured by: WINDTEST Grevenbroich GmbH
Frimmersdorfer Str.73
D-41517 Grevenbroich

Date: 25.05.2007

REpower Dokumenten-Nummer: D-2.9-VM.SM.07-D Rev.: A-GB
Freigabe: Datum: 25.05.2007

Dipl.-Met. Klaus Hanswillemenke Dipl.-Ing. Thomas Fischer

APPENDIX 15. UTILITIES AND TELECOMMUNICATIONS

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471 National Grid

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Appendix 15.1 - Microwave Telecoms Link Operator Correspondence

OFCOM

Monday, 4 January 2010 09:43

Subject: SUTTON ST EDMUND, SITE CENTRE NGR TF 39089 13029, RADIUS 1500 METRES
Date: Tuesday, 22 December 2009 13:53
From: Gerard Blaevoet <Gerard.Blaevoet@ofcom.org.uk>
To: Eve Browning eve.b@engena.co.uk
Conversation: SUTTON ST EDMUND, SITE CENTRE NGR TF 39089 13029, RADIUS 1500 METRES

SCOPING REPORT REPLY – LINKS FOUND

-

FIXED LINK REPORT FOR WINDFARM CO-ORDINATION AREA:
SUTTON ST EDMUND, SITE CENTRE NGR TF 39089 13029, RADIUS 1500 METRES

Dear Eve,

Ofcom have found that within the assessed fixed link frequency bands (see table below), the following fixed link end(s) within or fixed link path(s) that cross your requested coordination area, as given above. This assessment is based on the Ofcom fixed links database status as at 13/12/2009, which may vary before the windfarm project implementation. Please be aware that the data in the table below is "as recorded" by Ofcom on its database, based on the grid reference coordinates and other details provided to Ofcom by Fixed Link operators at the time of their licence application. These details are not verified by Ofcom for accuracy or currency and Ofcom makes no guarantees for the currency or accuracy of information or that they are error free. As such, Ofcom cannot accept liability for any inaccuracies or omissions in the data provided, or its currency however so arising. These data are provided without any representation or endorsement made and without warranty of any kind, whether express or implied, including but not limited to the implied warranties of satisfactory quality, fitness for a particular purpose, non-infringement, compatibility, security and accuracy.

Links	*Company*	*Contact*	*Telephone*	*Email*
0509020/1	Vodafone Limited	Simon Bartrip	7771775750	windfarms@vodafone.com
0789825/1	Bt	Mike Redwin	0	radionetworkprotection@bt.com

The fixed link operator(s) identified in the table above should be contacted directly if further information is required.

This response to your co-ordination request is only in respect of microwave fixed links managed and assigned by Ofcom within the bands and frequency ranges specified in the table below. For scanning telemetry systems operating in the 457-458 MHz paired with 463-464 MHz band, a copy of your co-ordination request has been sent to:

Atkins Ltd. windfarms@atkinsglobal.com

Joint Radio Company (JRC). Peter Swan 020 7953 7142 windfarms@jrc.co.uk

For self coordinated links operating in the 64-66GHz, 71-76GHz and 81-86GHz bands a list of current links can be found at: http://www.ofcom.org.uk/radiocomms/ifi/licensing/classes/fixed/

Regarding assessment with respect to TV reception, the BBC has an online tool available on their website: http://windfarms.kw.bbc.co.uk/. Ofcom do not forward enquiries to the BBC.

Please note other organisations may require coordination with regard to your request; more information regarding windfarm planning is available on the British Wind Energy Association website www.bwea.com .

-

Table of assessed fixed links bands and frequency ranges

Band (GHz)	Frequency Range (MHz)
1.4/1.5	1350 – 1375 1450 – 1452 1492 – 1530
1.6	1672 – 1690
1.7	1764 - 1900
2	1900 - 2690
4	3600 - 4200
6	5925 - 7110
7.5	7425 - 7900
11	10700 - 11700
13	12750 - 13250
14	14250 - 14620
15	14650 - 15350
18	17300 - 19700
22	22000 - 23600
25	24500 - 26500
28	27500 - 29500
38	37000 - 39500
50	49200 - 50200
55	55780 - 57000

Regards

Page 1 of 2

:: Gerry Blaevoet
Windfarm Administration & International Co-ordination
Corporate Customer Team
Desk 02:70
Tel: 020 7981 3160 Fax: 020 7981 3060
gerard.blaevoet@ofcom.org.uk

::
Riverside House
2a Southwark Bridge Road
London
SE1 9HA
www.ofcom.org.uk
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****
For more information visit www.ofcom.org.uk

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Any views expressed in this message are those of the individual sender and do not represent the views or opinions of Ofcom unless expressly stated otherwise.
****

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For more information please visit http://www.messagelabs.com/email

BT

Monday, 4 January 2010 12:08

Subject: RE: Sutton St. Edmund wind farm BT link (BT Ref: WID3841)
Date: Monday, 4 January 2010 11:32
From: radionetworkprotection@bt.com
To: Eve Browning <eve.b@engena.co.uk>

Eve,

Please find attached no objection letter.

For Info end point co-ordinates for Link 0789825/1 are: TF4242013860 to TF3300003500.

Peter McSorley
BT Operate

Tel: 020 7626 6878
Email: peter.mcsorley@bt.com
Web: www.bt.com <http://www.bt.com>
This email contains BT information, which may be privileged or confidential.
It's meant only for the individual(s) or entity named above. If you're not the intended recipient, note that disclosing, copying, distributing or using this information is prohibited. If you've received this email in error, please let me know immediately on the email address above. Thank you.
We monitor our email system, and may record your emails.
British Telecommunications plc
Registered office: 81 Newgate Street London EC1A 7AJ
Registered in England no: 1800000

From: Eve Browning [mailto:eve.b@engena.co.uk]
Sent: 04 January 2010 10:25
To: radionetworkprotection G
Subject: Sutton St. Edmund wind farm BT link (BT Ref: WID3841)

Dear Sir/Madam,

We have had an Ofcom response on a potential six-turbine wind farm at Sutton St. Edmund, Lincolnshire, which suggests that you hold a link in the area: 0789825/1

The turbines will likely be 80m hub and 90m rotor (125m to tip) and their co-ordinates are;

1. 538067, 312547
2. 538100, 313062
3. 538607, 312793
4. 538987, 312894
5. 539379, 313233
6. 539726, 313494

Page 1 of 2

Can you let me know if the turbines will be a problem to you anc
provide the co-ordinates of the link so that we can map and try t

Many thanks,
Eve

--

Eve Browning
Assistant Project Manager

Engena Limited
The Old Stable Block
Bosmere Hall
CREETING ST MARY
IP6 8LL

t: 01449 723 205
f: 01449 723 205
m: 07872 542 065
w: http://www.engena.co.uk

Engena Limited Registered in England and Wales, Number: 5382184, registered address T
Hall, CREETING ST MARY, IP6 8LL

Eve Browning
Engena Limited

4 January 2010
Your reference:

Our ref. WID3841

Dear Sir/Madam,

RE: PROPOSED Sutton St Edmond Wind Farm, Turbines:

1. 538067, 312547
2. 538100, 313062
3. 538607, 312793
4. 538987, 312894
5. 539379, 313233
6. 539726, 313494

Thank you for your letter dated 4 January 2010.

We have studied this wind farm proposal with respect to EMC and related problems to BT point-to-point microwave radio links.

The conclusion is that, the Wind farm Project indicated should not cause interference to BT' s current and presently planned radio networks.

Yours sincerely

Peter McSorley
BT Network Radio Protection

PP 306B, Monument TE, 11-13 Gt Tower St, London, EC3R 5AQ

Vodafone

Monday, 1 March 2010 13:37

Subject: RE: Ref Proposed Wind Turbines @ Sutton St Edmund
Date: Monday, 1 March 2010 13:01
From: Bakkioui, Farid, VF UK, Partner <farid.bakkioui@vodafone.co.uk>
To: Eve Browning <eve.b@engena.co.uk>

Hi Eve

Sorry about the delay I was off last week. I can confirm that any turbine at 70m or greater is just acceptable based on exact ngr locations. Please let me know if the positions change.

Regards

Farid

-----Original Message-----
From: Eve Browning [mailto:eve.b@engena.co.uk]
Sent: 24 February 2010 15:11
To: Bakkioui, Farid, VF UK, Partner
Subject: Re: Ref Proposed Wind Turbines @ Sutton St Edmund

Hi Farid,

Thanks for the phone call earlier to clarify Vodafone's position on how far away a turbine can be from a link. Please find attached the a proposed layout for the site. It turns out that if the turbine towers can be 70m or more away from the link, then our original layout meets this criterion. I have included a 70m buffer zone around the Vodafone link, and our turbine towers fall outside of this. Could you confirm that Vodafone have no objection to this layout?

Thanks,
Eve
--
Eve Browning
Project Manager
>
> Engena Limited
> The Old Stable Block
> Bosmere Hall
> CREETING ST MARY
> IP6 8LL
>
> t: 01449 723 205
> f: 01449 723 205
> m: 07872 542 065
> w: http://www.engena.co.uk
>
> Engena Limited Registered in England and Wales, Number: 5382184,
> registered address The Old Stables, Bosmere Hall, CREETING ST MARY,
> IP6 8LL
>

> From: "Bakkioui, Farid, VF UK, Partner"
> <farid.bakkioui@vodafone.co.uk>
> Date: Wed, 24 Feb 2010 12:38:50 +0100

> To: Eve Browning <eve.b@engena.co.uk>
> Subject: RE: Ref Proposed Wind Turbines @ Sutton St Edmund
>
> Hi Liz
>
> The minimum distance is 100m from link to turbine, but we can accept
> 90 as a bear minimum as long as the site NGRs are exact. I have
> checked the grids and they are ok.
>
> Regards
>
> Farid
>
> -----Original Message-----
> From: Eve Browning [mailto:eve.b@engena.co.uk]
> Sent: 24 February 2010 10:42
> To: Bakkioui, Farid, VF UK, Partner
> Subject: Re: Ref Proposed Wind Turbines @ Sutton St Edmund
>
> Hi Farid,
>
> I was wondering how you were getting on with regards to the site at
> Sutton St. Edmund? I think you might have said you were going to try
> and verify the link ends a bit more accurately.
>
> Also, I was wondering what Vodafone's current position is on the
> distance that our turbines can be from the link? As I mentioned in my
> email of last Thursday, our proposed turbine positions are situated
> well outside of the 2nd Fresnel zone, which is the guidance that Ofcom

> give for a trouble-free situation. We are hoping to resolve this issue

> as soon as possible and arrive at a situation where Vodafone is happy
> to give a no objection letter, as we believe that turbines outside the

> 2nd Fresnel zone should not affect your links adversely.
>
> Best wishes,
> Eve
> --
> Eve Browning
> Project Manager
>>
>> Engena Limited
>> The Old Stable Block
>> Bosmere Hall
>> CREETING ST MARY
>> IP6 8LL
>>
>> t: 01449 723 205
>> f: 01449 723 205
>> m: 07872 542 065
>> w: http://www.engena.co.uk
>>
>> Engena Limited Registered in England and Wales, Number: 5382184,
>> registered address The Old Stables, Bosmere Hall, CREETING ST MARY,
>> IP6 8LL
>>
>
>

>
>
>> From: "Bakkioui, Farid, VF UK, Partner"
>> <farid.bakkioui@vodafone.co.uk>
>> Date: Wed, 17 Feb 2010 14:02:42 +0100
>> To: Eve Browning <eve.b@engena.co.uk>
>> Subject: RE: Ref Proposed Wind Turbines @ Sutton St Edmund
>>
>> Hi Eve
>>
>> Link VFE06226 is transmitting on 18Ghz.
>>
>> Regards
>>
>> Farid
>>
>> -----Original Message-----
>> From: Eve Browning [mailto:eve.b@engena.co.uk]
>> Sent: 17 February 2010 12:05
>> To: Bakkioui, Farid, VF UK, Partner
>> Subject: Re: Ref Proposed Wind Turbines @ Sutton St Edmund
>>
>> Hi Farid,
>>
>> Thanks very much for the link end co-ordinates. Would it be possible
>> to also have the frequency of the link so we can run it through a
>> Fresnel zone calculator?
>>
>> Thanks for your help,
>> Eve
>> --
>>   Eve Browning
>>   Assistant Project Manager
>>>
>>> Engena Limited
>>> The Old Stable Block
>>> Bosmere Hall
>>> CREETING ST MARY
>>> IP6 8LL
>>>
>>> t: 01449 723 205
>>> f: 01449 723 205
>>> m: 07872 542 065
>>> w: http://www.engena.co.uk
>>>
>>> Engena Limited Registered in England and Wales, Number: 5382184,
>>> registered address The Old Stables, Bosmere Hall, CREETING ST MARY,
>>> IP6 8LL
>>>
>>
>>
>>
>>
>>> From: "Bakkioui, Farid, VF UK, Partner"
>>> <farid.bakkioui@vodafone.co.uk>
>>> Date: Mon, 15 Feb 2010 18:42:55 +0100
>>> To: Eve Browning <eve.b@engena.co.uk>
>>> Subject: RE: Ref Proposed Wind Turbines @ Sutton St Edmund
>>>
>>>

>>> Please Ignore My last email. The correct Grids are as follows:
>>>
>>> Site ID 256A:
>>>
>>> Easting: 542430 Northing: 313890
>>>
>>> Site ID 11090A:
>>>
>>> Easting: 522800 Northing: 310600
>>>
>>> Regards
>>>
>>> Farid
>>>
>>>
>>>
>>> -----Original Message-----
>>> From: Eve Browning [mailto:eve.b@engena.co.uk]
>>> Sent: 15 February 2010 16:59
>>> To: Bakkioui, Farid, VF UK, Partner
>>> Subject: Re: Ref Proposed Wind Turbines @ Sutton St Edmund
>>>
>>> Hi Farid,
>>>
>>> Would it be possible to get the link end co-ordinates so we can map
>>> it
>>
>>> on our software?
>>>
>>> Thanks very much,
>>> Eve
>>> --
>>>   Eve Browning
>>>   Assistant Project Manager
>>>>
>>>> Engena Limited
>>>> The Old Stable Block
>>>> Bosmere Hall
>>>> CREETING ST MARY
>>>> IP6 8LL
>>>>
>>>> t: 01449 723 205
>>>> f: 01449 723 205
>>>> m: 07872 542 065
>>>> w: http://www.engena.co.uk
>>>>
>>>> Engena Limited Registered in England and Wales, Number: 5382184,
>>>> registered address The Old Stables, Bosmere Hall, CREETING ST MARY,
>>>> IP6 8LL
>>>>
>>>
>>>
>>>
>>>
>>>> From: "Bakkioui, Farid, VF UK, Partner"
>>>> <farid.bakkioui@vodafone.co.uk>
>>>> Date: Mon, 15 Feb 2010 17:50:57 +0100
>>>> To: Eve Browning <eve.b@engena.co.uk>
>>>> Cc: "Bartrip, Simon, VF UK" <Simon.Bartrip@vodafone.com>
>>>> Subject: Ref Proposed Wind Turbines @ Sutton St Edmund

>>>>
>>>> Hi Eve
>>>>
>>>> Please find attached the desk top survey for the proposed wind
>>>> turbines at Sutton St Edmund. It can be seen that the nearest VF
>>>> link
>>
>>>> is 100m away from proposed locations. Please note that this is the
>>>> minimum separation between Turbine blade tip and microwave link.
>>>>
>>>> ID request Date Requested By Turbine X Y ATP Impact
>>>>
>>>> 3115 861 21/01/2010 eve.b@engena.co.uk Sutton St
>>>> EdmundT1 538124 313073 No impact
>>>> 3116 861 22/01/2010 eve.b@engena.co.uk Sutton St
>>>> EdmundT2 538067 312547 No impact
>>>> 3117 861 23/01/2010 eve.b@engena.co.uk Sutton St
>>>> EdmundT3 538581 312609 No impact
>>>> 3118 861 24/01/2010 eve.b@engena.co.uk Sutton St
>>>> EdmundT4 539015 312850 No impact
>>>> 3119 861 25/01/2010 eve.b@engena.co.uk Sutton St
>>>> EdmundT5 539444 313090 No impact
>>>> 3120 861 26/01/2010 eve.b@engena.co.uk Sutton St
>>>> EdmundT6 539706 313527 No impact
>>>>
>>>>
>>>> Regards
>>>>
>>>> Farid
>>>
>>>
>>>
>>
>>
>>
>
>
>

Cable & Wireless

Tuesday, 2 February 2010 09:10

Subject: RE: Sutton St. Edmund wind farm Cable and Wireless links
Date: Monday, 1 February 2010 14:17
From: >Access Evaluation <AccessEvaluation@cw.com>
To: Eve Browning <eve.b@engena.co.uk>

Eve, C&W do not have any operations in this area. There are no objections to this proposal.

Andy Prince
Senior Planner
Radio Planning NS&E, Bracknell
Cable&Wireless Worldwide
Direct Dial: +44 (0)1344 70 4661
Comnet: 60 - 4661
Mobile: +44 (0)7917 599907
email: andrew.prince@cw.com
www.cw.com <http://www.cw.com>

-----Original Message-----
From: Eve Browning [mailto:eve.b@engena.co.uk]
Sent: 25 January 2010 12:04
To: Prince, Andrew
Subject: Sutton St. Edmund wind farm Cable and Wireless links

Dear Andrew,

We are working on a proposed site of six turbines, (125m to tip, 90m rotor diameter and 80m hub height) near Sutton St. Edmund, Lincolnshire. The turbines would be located at:

1. 538124 313073
2. 538067 312547
3. 538581 312609
4. 539015 312850
5. 539444 313090
6. 539706 313527

Please could you let us know of any telecoms links within a 1km radius that may be affected by these turbines?

With many thanks,

Eve
--

Eve Browning
Assistant Project Manager

Engena Limited
The Old Stable Block
Bosmere Hall
CREETING ST MARY
IP6 8LL

t: 01449 723 205
f: 01449 723 205
m: 07872 542 065
w: http://www.engena.co.uk

Engena Limited Registered in England and Wales, Number: 5382184, registered address
The Old Stables, Bosmere Hall, CREETING ST MARY, IP6 8LL

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Cable and Wireless plc
Registered in England and Wales.Company Number 238525
Registered office: 3rd Floor, 26 Red Lion Square, London WC1R 4HQ

Atkins Ltd.

Subject: WF6744 - Sutton St Edmund, Lincs - NGR TF 39089 13029
Date: Monday, 1 March 2010 16:00
From: windfarms@atkinsglobal.com
To: Eve Browning <eve.b@engena.co.uk>

Dear Eve,

I am responding to an email of 19th February 2010, regarding the above named proposed development.

Atkins does not have any objections regarding our clients in this area, however Anglian Water Services operate radio links in the region therefore we forwarded your original email to them on 22nd December 2009. If they have not got back to you I suggest you try our contact Melanie Knight, mKnight@anglianwater.co.uk to find out if they have any problems with your proposal.

Windfarm Support
ATKINS
The official engineering design services provider
for the London 2012 Olympic and Paralympic Games
200 Broomielaw, Glasgow, G1 4RU | Web: www.atkinsglobal.com/communications

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The ultimate parent company of the Atkins Group is WS Atkins plc. Registered in England No. 1885586. Registered Office Woodcote Grove, Ashley Road, Epsom, Surrey KT18 5BW. A list of wholly owned Atkins Group companies registered in the United Kingdom and locations around the world can be found at http://www.atkinsglobal.com/terms_and_conditions/index.aspx.

Consider the environment. Please don't print this e-mail unless you really need to.

Anglian Water Services

Thursday, 25 March 2010 10:03

Subject: FW: WF6727 - Sutton St Edmund
Date: Tuesday, 23 March 2010 17:17
From: Glover, Ross <ross.glover@ogenergy.com>
To: Eve Browning <eve.b@engena.co.uk>, John Fairlie <john.f@engena.co.uk>
Cc: richard lord <4lords@tiscali.co.uk>

No objection from Anglian Water...

From: Knight Melanie [mailto:mKnight@anglianwater.co.uk]
Sent: 23 March 2010 17:17
To: Glover, Ross
Cc: info@fenland.gov.uk
Subject: WF6727 - Sutton St Edmund

Dear Ross,

Wind farm Application WF6727 at Sutton St Edmund

With reference to your application for the above wind farm we can confirm that for the stated location there should be no affect on the Anglian Water Services (AWS) business microwave or UHF radio links. Therefore we do not object to the application with regard to AWS radio communications.

This analysis and confirmation does not cover any other part of the AWS infrastructure and the planning process for these must be followed.

If you have any queries, please contact Mel Knight on 01223 542743.

Yours faithfully,

Mel Knight
IS Telemetry Co-ordinator
Milton House
Tel: 01223 542743

--*----*----*----*----*----*----*----*----*----*----*----*----*----*----*----*----*---

The information contained in this message is likely to be confidential and may be

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Anglian Water Services Limited

Registered Office: Anglian House, Ambury Road, Huntingdon, Cambridgeshire, PE29 3NZ

Registered in England No 2366656

Please consider the environment before printing this email.

BBC Wind Farms Tool

Monday, 18 January 2010 14:25

Subject: [The BBC Windfarms Tool] Your query results. (Sutton)
Date: Monday, 18 January 2010 12:55
From: Engena Ltd <engena@hotmail.co.uk>
To: Eve Browning <eve.b@engena.co.uk>

> Date: Mon, 18 Jan 2010 12:52:37 +0000
> Subject: [The BBC Windfarms Tool] Your query results.
> To: engena@hotmail.co.uk
> From: Windfarm.Tool@bbc.co.uk
>
> If you were to place turbines in the following locations:
>
> TF381130
> TF380125
> TF385128
> TF390128
> TF394130
> TF397135
>
> You would be likely to affect 0 homes for whom there is no
> alternative off-air service.
>
> In addition, you may affect up to 2530 homes for whom there may
> be an alternative off-air service.
>
> The transmitters likely to be affected are:
>
> WALTHAM CH5
> WALTHAM
> BELMONT CH5
> BELMONT
> SANDY HEATH
>
> This information is provided for the guidance of Wind Farm developers.
> The results of this query are a rough estimate of populations that may
> suffer interference from wind farms built at the locations specified.
> The information is not intended to be a substitute for an on-site survey
> where the potential for disruption to television services may more
> accurately be assessed.
>
> The BBC does not accept liability for the consequence of any use of
> the information provided by this web site. All television reception
> difficulties caused by the erection of wind turbines are the
> responsibility of the wind farm developer.

>
> This email was automatically generated in response to a query at the
> BBC Windfarms Tool website. Please do not reply to this address.
>
> If you wish to contact the BBC, please visit:
> http://www.bbc.co.uk/feedback/
>
> --
> The BBC accepts no responsibility for this email. This email is generated
> by a request on the BBC webserver. If you were not expecting this email,
> please contact webweaver@bbc.co.uk including all headers from the email.

Not got a Hotmail account? Sign-up now - Free <http://clk.atdmt.com/UKM/go/197222280/direct/01/>

Appendix 15.2 - Utilities Correspondence

Anglian Water

GEODESYS
LAND & PROPERTY INFORMATION

Engena Ltd
The Old Stables Rosmere Hall
Creeting St Mary
Ipswich
Suffolk
IP6 8LL

Our ref: A799240

Your ref:

Dear Sirs,

FARMLAND NEAR, SUTTON STREET, EDMUND, LINCOLNSHIRE,

Thank you for your enquiry in connection with the above site.

Please find enclosed copy of records and/or drawings of assets belonging to Anglian Water Services Limited (Anglian Water) in the vicinity of the above site. Anglian Water has provided this information in good faith on the understanding that it is the best information available at this time. However, Anglian Water can accept no liability in respect of the information provided and your attention is drawn to the disclaimer on the information provided.

Please be advised that our records show there are no public sewers in the vicinity of the works.

Water Service connections are not shown but may normally be traced from stop tap boxes. The possibility of damage or disturbance to connections must be avoided at all times.

Large species of trees should not be planted within five metres of Anglian Water apparatus/assets to reduce the possibility of damage from roots.

To avoid incurring costs arising from damage or disturbance to Anglian Water apparatus/assets we recommend the use of manual rather than mechanical excavation to ascertain their depth. Please contact us on 08457 145 145 if you are excavating to more than 450mm or if your activity may cause ground movement or vibration.

If you should wish to discuss connections, supplies, build overs or pre-development and capacity information please contact Developer Services on 0845 6066087.

Yours faithfully

Caroline Jefferies
Mapping Services Advisor

4001962

Anglian Water Services Limited trading as GEODESYS
Registered Office: Anglian House, Ambury Road, Huntingdon, Cambridgeshire, PE29 3NZ
Company Registration Number: 2366656

Spencer House, Spitfire Close, Ermine Business Park
Huntingdon, Cambridgeshire, PE29 6XY
Tel: +44 (0) 1480 323891
Fax: +44 (0) 1480 323892
www.geodesys.com

JRC

Monday, 4 January 2010 09:44

Subject: Sutton St. Edmund, Lincs -- Engena Limited
Date: Wednesday, 23 December 2009 15:18
From: Windfarms Team <windfarms@jrc.co.uk>
To: Eve Browning <eve.b@engena.co.uk>
Cc: Gerard Blaevoet <Gerard.Blaevoet@ofcom.org.uk>, <martin.lawton@central-networks.co.uk>, <john.taylor@central-networks.co.uk>, "Burton, Graham" <graham.burton@uk.ngrid.com>, <michael.grime@cw.com>

Dear Eve Browning,

Sutton St. Edmund, Lincs -- Engena Limited

Site Centre NGR: 539089,313029 Development Radius 1.5km

JRC analyses proposals for wind farms on behalf of the UK Fuel & Power Industry.This is to assess their potential to interfere with radio systems operated by utility companies in support of their regulatory operational requirements.

In the case of this proposed wind energy development, JRC does not foresee any potential problems based on known interference scenarios and the data you have provided. However,if any details of the wind farm change, particularly the disposition or scale of any turbine(s), it will be necessary to re-evaluate the proposal.

In making this judgement, JRC has used its best endeavours with the available data, although we recognise that there may be effects which are as yet unknown or inadequately predicted. JRC cannot therefore be held liable if subsequently problems arise that we have not predicted.

It should be noted that this clearance pertains only to the date of its issue. As the use of the spectrum is dynamic, the use of the band is changing on an ongoing basis and consequently, you are advised to seek re-coordination prior to submitting a planning application, as this will negate the possibility of an objection being raised at that time as a consequence of any links assigned between your enquiry and the finalisation of your project.

JRC offers a range of radio planning and analysis services. If you require any assistance, please contact us by phone or email.

Regards

Keith Brogden

Wind Farm Team

The Joint Radio Company Limited
Dean Bradley House,
52 Horseferry Road,
LONDON SW1P 2AF
United Kingdom

DDI: +44 20 7706 5197
TEL: +44 20 7706 5199
Skype: keithb_jrc

<keith.brogden@jrc.co.uk>

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This e-mail is strictly confidential and is intended for the use of the addressee only. The contents shall not be disclosed to any third party without permission of the JRC.

JRC Ltd. is a Joint Venture between the Energy Networks Association (on behalf of the UK Energy Industries) and National Grid.
Registered in England & Wales: 2990041
<http://www.jrc.co.uk/about>

Linesearch



Search Results

Thank you for your enquiry: LS-100122-VD-647-BUX

Subject always to our standard terms and conditions, this enquiry result is valid for 28 days only from the date of enquiry and is based on the confirmed information you entered. If the location of the work changes then a further enquiry must be made. Should the work not be undertaken within 28 days of the enquiry then a further enquiry must be made.

ENQUIRER DETAILS
Name: Mr Rankin
Company: Engena Limited
Email: jonny.r@engena.co.uk

ENQUIRY DETAILS
Your reference: Sutton St. Edmund
Your location: 539015 312850
Confirmed location: OS grid reference (538850 312500)
Estimated start date: 01-12-2010
Type of work: Planning Applications - Wind Farm
Distance covered: 1000 metres

IN THE ZONE OF INTEREST

Operator: **National Grid Gas (National Transmission System)**

Further information will be required to confirm the exact location and nature of the proposed works.

The following list outlines what we need from you:

- Location plan
- Detailed plan (minimum scale 1:2500)
- Cross sectional drawings (if available)
- Work Specification

Please either email the requested additional information and Linesearch reference to plantprotection@uk.ngrid.com or print this page and post to the following address(es):

National Grid Gas (National Transmission System)
Plant Protection
Block 1: Floor 2
Brick Kiln Street
Hinckley
Leicestershire
LE10 0NA

In an emergency contact: Gas 0800 111 999 Electricity 0800 40 40 90

NOT IN THE ZONE OF INTEREST

BOC Limited (A Member of the Linde Group)	**INEOS Manufacturing (Scotland and TSEP)**
BP Exploration Purbeck Southampton Pipeline	**Mainline Pipelines Limited**
BPA	**Manchester Jetline Limited**
Centrica Energy	**Marchwood Power Ltd (Gas Pipeline)**
ConocoPhillips (UK) Ltd	**NPower CHP Pipelines**
ConocoPhillips Ltd Humber Refinery	**Premier Transmission Ltd (SNIP)**
Coryton Energy Co Ltd (Gas Pipeline)	**Sabic UK Petrochemicals**
E-on UK Plc (Gas Pipelines Only)	**Scottish Power Generation Ltd**
Esso Petroleum Company Limited	**Shell UK Ltd**
FibreSpeed Limited	**Total**
Geo Networks Limited	**Wingas Storage UK Ltd**
Government Pipelines & Storage System	

Thank you for your enquiry, you must now contact the affected operator(s) listed above 'IN THE ZONE OF INTEREST'

Please note that the Linesearch.org system only contains information on National Grid - (National Gas and Electricity Transmission Networks) This does not include National Grid's or others local high pressure (above 7 bar) gas pipelines and lower pressure gas pipelines. Details of who to contact for National Grid's distribution assets, including their local high pressure pipelines, can be found via http://www.nationalgrid.com/uk/LandandDevelopment/DDC/GasElectricNW

For other energy network operators' contact details see http://2008.energynetworks.org/

Please quote the Linesearch enquiry reference number in *all* correspondence

---

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National Grid

Friday, 30 April 2010 11:52

Subject: Sutton St. Edmund Wind Farm
Date: Wednesday, 21 April 2010 13:23
From: Stockley, Robert <robert.stockley@uk.ngrid.com>
To: Eve Browning <eve.b@engena.co.uk>
Cc: "Needham, Jamie" <jamie.needham@uk.ngrid.com>

Hi Eve,

Guidance for siting Wind Farms as discussed earlier.

Any other queries please give me a call.

<<Wind Turbines - 1.5x Mast Height.pdf>> <<Wind Farm Guidance.pdf>> <<SitingWindTurbines.pdf>>

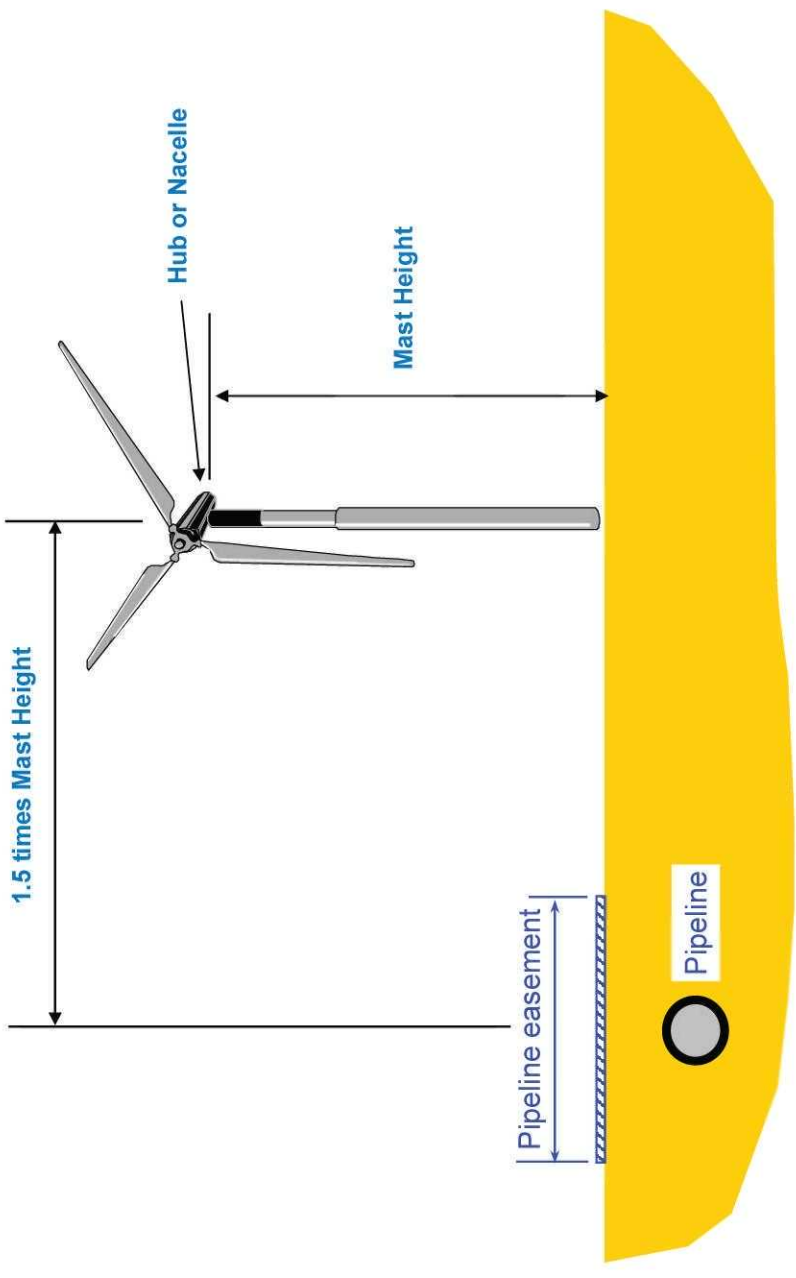
Regards
Rob
Robert Stockley | Gas Asset Management Engineer (Pipelines) | Gas Network Investment | National Grid
T 01926 655589 | **F** 01926 656263 | **M** 07866 488892 | **E** robert.stockley@uk.ngrid.com <blocked::mailto:robert.stockley@uk.ngrid.com> | www.nationalgrid.com <blocked::http://www.nationalgrid.com/>
National Grid House, Warwick Technology Park, Gallows Hill, Warwick, CV34 6DA
or
Daines Sub Station (Pipelines), Isherwood Road, Carrington, Manchester M31 4BH

*For **a Quick Search for** UKT Plant Enquiries:*
http://www.Linesearch.org <http://www.linesearch.org/>
or contact:
plantprotection@uk.ngrid.com
National Grid Plant Protection
National Grid, Block 1, Floor 2
Brick Kiln Street
Hinckley LE10 0NA

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You may report the matter by calling us on 0800 085 4806.

Wind Turbines



Wind Turbines – Required Distance From National Grid Pipelines

nationalgrid
The power of action.

UKOPA

United Kingdom Onshore Pipeline Operators' Association

REQUIREMENTS FOR THE SITING OF WIND TURBINES CLOSE TO PIPELINES CONTAINING HAZARDOUS FLUIDS

Pipeline Operators are receiving increasing numbers of applications from developers to site wind turbines in the vicinity of pipelines containing hazardous fluids. In response to this, a detailed technical study has been undertaken to identify the potential risks to these pipelines from wind turbines.

The study was based on data collected for wind farms in the UK and used a methodology that has been developed in the Netherlands. The study assessed all the potential failure modes that could be a potential threat to the integrity of a pipeline, including blade failure; fall of the nacelle or rotor and toppling of the mast.



Based on the study, the appropriate exclusion zone (distance from base of the wind turbine mast to the edge of the pipeline) has been identified as 1.5 times the turbine mast height.

Further work is ongoing to investigate whether there are any additional pipeline protection measures that could be taken to reduce this exclusion zone. Until this work is completed, the 1.5 times the mast height exclusion zone should be observed.

Internet Address: www.ukopa.co.uk Email Address: info@ukopa.co.uk

UKOPA is formed as a Company Limited by Guarantee, funded as a non-profit making organisation by membership fees paid by the pipeline operator members. Registered in England and Wales (Company No. 4052297). Registered Office: Pipeline Maintenance Centre, Ripley Road, Ambergate, Derbyshire DE56 2FZ. The names of the directors may be obtained from that address.

Wind Farm Guidance in Proximity to National Grid HP Gas Pipelines

You should be aware, from our desktop map drawings, that National Grid does have Transmission High Pressure gas pipelines in the vicinity of the proposed development.

If you are not in possession of the appropriate drawings, then you should contact our Hinckley office immediately, and they will provide the necessary drawings and information.

plantprotection@uk.ngrid.com

National Grid Plant Protection

National Grid

Block 1, Floor 2

Brick Kiln Street

Hinckley

LE10 0NA

The pipelines are generally subject to a legal easement, which is a width of 24.4m (i.e. 12.2m either side of the pipeline) and it prohibits certain activities in proximity to the pipelines i.e. permanent or temporary buildings or structures, modifications to ground levels, crossing with heavy plant etc. (See T/SP/SSW/22 for a full list of restrictions) Before any work can take place within the easement, National Grid must be contacted formally to agree a safe method of working, and written permission will be required before any activities proceed.

For wind farm developments, outside the easement of 24.4m, the industry standard for the separation distance between a National Grid High Pressure gas pipeline and a wind farm turbine is 1.5 times the mast hub height. The safety advice can be found on the UK Onshore Pipeline Operators Associations website (www.ukopa.co.uk).

The final location of the wind turbines should be agreed with a National Grid representative, and provided that the appropriate guidance and separation distances are adhered to, National Grid would not unreasonably object to the development. However, the access road(s), potential cable route(s) that may have to cross the pipeline, and any lay-down areas need to be considered and assessed. They are generally not a problem as long as the following is adhered to:

1) Access Road - An impact protection concrete slab compliant with National Grid Specification T/SP/CE/12 (SD3) will have to be constructed under the supervision of a National Grid representative. Hand dug trial holes, to establish the actual depth and position of the pipeline, should be excavated under National Grid supervision to ensure the slab is positioned correctly.

2) Cable Crossing - Any cable crossing of a pipeline, again has to be supervised by a National Grid representative. The cable must be a minimum of 600mm from the crown or underside of the pipeline and cross the easement and pipeline perpendicularly. The separation distance should be greater, where possible, and again must be agreed by National Grid.

National Grid require that an Indemnity Clause is agreed and completed, for any cable crossing point, which should be negotiated with our Land & Development Department.

To assist you during the construction of the wind farm, and/or for any future developments, the attached document (T/SSW/22) will help you when carrying out activities in close proximity to National Grid high pressure gas pipelines.

Please let me know whether National Grid can provide you with technical or other information that may be of assistance.

Rob Stockley - Technical Engineer (Pipelines)
Tel: 01926 655589
Mob: 07866 488892

H:\Work\Word\Guidance\Wind Farm Guidance.doc

Eon Central Networks

Monday, 26 July 2010 16:05

Subject: FW: Potential wind farm at Sutton St Edmund
Date: Monday, 26 July 2010 15:52
From: John Fairlie <john.f@engena.co.uk>
To: Eve Browning <eve.b@engena.co.uk>

-----Original Message-----
From: Birchall, Karen [mailto:Karen.Birchall@central-networks.co.uk]
Sent: 08 December 2009 12:31
To: '4lords@tiscali.co.uk'
Subject: FW: Potential wind farm at Sutton St Edmund

Please find response to your wind farm enquiries.
Kind regards

From: Balcombe, Christopher
Sent: Monday, December 07, 2009 9:23 PM
To: Birchall, Karen
Cc: Pearce, Dave Dr.; Blokhuizen, Rene
Subject: FW: Potential wind farm at Sutton St Edmund

Karen,

Many thanks for your E-Mail, and my apologies for the delay in getting back to you. I have been in touch with E.ON Climate & Renewables UK, and received the following advice from Rene Blokhuizen, Onshore Wind Farm Development Origination Manager:

"As far as I'm aware there is no statutory requirement for minimum separation distance of wind turbines from power lines. NGET has however recently issued guidance on this (which has practically the same weight as a statutory requirement) which states tip height plus 10%, below is the relevant extract:

'Following National Grid's Policy Statement (Transmission) PS(T)087 - Issue 1 on Overhead Line Separation From Wind Turbines, published in Sept last year, they now issued a new version with improvements on several points. It establishes that there is no impact on transmission lines by turbines that are sited more than 3 rotor diameters away from the line. In addition it does not prohibit closer sitting (provided that separation is greater than topple distance) but instead encourages early communication with NGET. The definition of topple distance has changed from tip height plus 20m to tip height plus 10%. In most cases the new definition is likely to result in a lower figure. The latest document also clarifies that this policy applies only to 275kV and 400kV transmission lines.'"

I hope that the above is of interest and use – although I'm not sure what the rating of the line is. If the line rating is not 275 or 400kV, I would suggest that we ask for the more onerous requirement, albeit that tip height + 20 m is equal to 146 m, whilst tip height + 10 % is equal to 139 m. In any case, it may also be prudent to add an extra margin, and thereby look to maximise the separation distance between turbines and power lines as far

as possible, i.e. minimise the extent to which current planned separation distances are eroded. In any case, I suggest that the wind farm developers also contact National Grid for their comments, and confirm the extent to which they would like to move their planned turbines closer to the transmission line.

If you have any follow-up comments or questions, please do not hesitate to get in touch. I would be pleased to provide any additional assistance required.

Kind regards / Mit freundlichen Grüßen

Chris.

Chris Balcombe
Team Leader, Renewables
Sustainable Energy Department
T: +44 (0) 2476 192335
M: +44 (0) 7525 704242
F: +44 (0) 115 936 2600
chris.balcombe@eon-engineering.com <mailto:chris.balcombe@eon-engineering.com>

E.ON Engineering Limited
Technology Centre, Ratcliffe on Soar
Nottingham, NG11 0EE
www.eon-engineering.com <http://www.eon-engineering.com/EONENGINEERING_eng.jsp>

From: Birchall, Karen
Sent: Wednesday, November 18, 2009 8:08 AM
To: Pearce, Dave Dr.
Subject: FW: Potential wind farm at Sutton St Edmund

Good morning,

Please see enquiry received regarding a proposed windfarm.
Is this something your team are able to help with, or can you advise who might be able to talk to Mr Lord?
Many thanks
Karen

Karen Birchall

Projects Team Leader
Asset Information Management
Operations & Asset Management

e·on | Central Networks

Internal: (06) 186354
External: 02476 186354

Karen.Birchall@central-networks.co.uk

Click here <http://portal.corp.pg.eon.net/sites/CustomerandNetworkOps/assetinformation/default.aspx> to visit the AIM Website

From: richard lord [mailto:4lords@tiscali.co.uk]
Sent: Tuesday, November 17, 2009 4:23 PM
To: CNUK AIM Bureau Services
Subject: Potential wind farm at Sutton St Edmund

Hi,

This mail follows a brief telcon with Helen where she advised that I email you for information on whether there is a potential problem with our proposed wind farm development.

I am pleased to attach a draft site layout for this windfarm. It is located east of Sutton St Edmund with map ref in the region of TF38520 12600 and is at about 15 miles NE of Peterborough. We are considering 2MW class turbines with a maximum tip height of 126 m.

From the sketch, you will see that the terrain is typical flat fenlands and that the turbines are generally located downwind of your line. Wind speeds are expected to be modest.

We are looking at 4 turbines located parallel to your gridline and about 250m away. Ideally we would like to move the central turbines closer to the line to give greater clearance from the dwelling to the north and a more even spacing. Would you advise if this would be possible without causing you excessive problems.

Thanking you in advance for your assistance,

Richard Lord for Wind Ventures Ltd.
Tel 01895 234210 or 07803 605413.

31 Sweetcroft Lane
Hillingdon
MIDDX UB10 9LE

APPENDIX 16. AVIATION

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Appendix 16.1 - CAA, Defence Estates and Fenland Airfield Correspondence

16.1.1 Initial Application Pro-forma

AS

(BWEA email #1692)WIND FARM DEVELOPERS APPLICATION PROFORMA:

Civil Aviation & Ministry of Defence Safeguarding

NOTICE TO WIND FARM DEVELOPERS
Please submit a completed application form for all new or revised onshore and offshore wind farm plans. This form has been compiled in consultation with the British Wind Energy Association. Its purpose is to standardise the information provided and to expedite the assessment of your proposed wind farm development. Assessment is made against air safety and defence interests, through evaluation of the possible effects on air traffic systems, defence systems and low flying needs.

NOTICE TO PLANNING AUTHORITIES
This form has been compiled with the assistance of the Civil Aviation Authority (CAA), the Ministry of Defence (MOD), the National Air Traffic Service (NATS) and the British Wind Energy Association (BWEA), to assist in the processing and assessment of wind farm applications. It is important that copies of this form are forwarded within the planning consultation process. This will help these organisations trace their records of any earlier consultations, as well as provide them with the relevant information for their assessments.

WHAT TO DO WITH THIS FORM
Please provide as much detail as possible by **filling in the shaded areas.** If the specific turbine and/or exact positions have yet to be established then fill in the likely turbine size (hub height, rotor diameter) and boundary points as a minimum. On completion send copies to both the following addresses.

Safeguarding
Defence Estates
Blakemore Drive
Sutton Coldfield
B75 7RL

Directorate of Airspace Policy
K6 Gate 3
CAA House
45-49 Kingsway
London, WC2B 6TE

It is important that a copy of this form is retained for inclusion with subsequent planning applications at the same site. If no application has been made prior to a planning application, please include a completed form in your planning application.

Wind Farm Name	
Sutton St Edmund Wind Farm, Cambs	
Also known as:	

Developers reference	SE01
Application identification No.	RL05

Related/previous applications (at or near this site): Provide reference names or numbers	Not known

CAA/NATS/MOD Wind Farm Application form

Developer Information	
Company name:	Wind Ventures Limited
Address:	Brook Henderson House 37-43 Blagrave St Reading RG1 1PZ
Contact:	Richard Lord
Telephone:	O1895 234 210
Facsimile:	01895 234210
e-mail:	4lords @tiscali.co.uk

Relevant Wind Turbine Details			
Wind turbine manufacturer:	**Vestas**		
Wind turbine model:	**V90**		
Wind farm generation capacity (MW)	**6 MW**	**Number of turbines**	3
Blade manufacturer	Vestas		
Number of blades	3		
Rotor diameter	90	Meters	
Rotation speed (or range)	14	Rpm	
Blade material including lightning conductors	GRP, possibly with glass, carbon fibre and wooden core with epoxy resins		
Wind turbine hub height	80	Metres	
Tower design (* delete as required)	* Tubular		
Tower base diameter/dimensions	5	Metres	
Tower top diameter/dimensions	3	Metres	

CAA/NATS/MOD Wind Farm Application form

Comments
The layout is roughly 3 turbines in a triangle.

Turbine Locations

Please provide as much information as you can. The position and height above sea level of every machine if available, the site boundary if not. The height above sea level is the above ordinance datum (AOD) used to specify all heights on OS maps. Please note grid references **and** latitude/longitude and must be included. For co-ordinate conversion: **www.gps.gov.uk**

An Ordinance Survey (OS) map, or maritime chart, should be submitted with this pro-forma, showing locations of proposed turbine/turbines or scheme boundaries. Please number the turbines or boundary points on the map, to correlate with the information provided below.

Copy this page as necessary to account for all turbines or boundary points

Wind farm Name & Address:	**Sutton St Edmund Wind Farm** Sutton St Edmund Cambs

Turbine no.	1		**Height** AOD (m) of tower base		0	
Grid Reference			100 km square letter(s) identifier		TF	
Easting (10 m)	3 8	2 1			1 3	0 0
	Degrees		Minutes		Seconds	
Latitude	5	2	4	1	5	2
Longitude	0	0	0	2	2	2

Turbine no.	2		**Height** AOD (m) of tower base		0	
Grid Reference			100 km square letter(s) identifier		TF	
Easting (10 m)	3 8	1 3	Northing (10 m)		1 2	6 0
	Degrees		Minutes		Seconds	
Latitude	5	2	4	1	3	9
Longitude	0	0	0	2	1	8

Turbine no.	3		**Height** AOD (m) of tower base		0	
Grid Reference			100 km square letter(s) identifier		TF	
Easting (10 m)	3 8	5 2	Northing (10 m)		1 2	6 5
	Degrees		Minutes		Seconds	
Latitude	5	2	4	1	4	2
Longitude	0	0	0	2	3	1

16.1.2 - Defence Estates 05/09/2008

AS

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DEFENCE ESTATES
Delivering Estate Solutions to Defence Needs

DE Operations North
Safeguarding Wind Energy
Kingston Road, Sutton Coldfield, B75 7RL

Chris Evans: 0121 311 2025
Claire Duddy: 0121 311 3714
Facsimile: 0121 311 2218
Mobile: 07901 751770
E-mail: chris.evans@de.mod.uk
E-mail: claire.duddy@de.mod.uk
Internet Site: www.defence-estates.mod.uk

8 - SEP 2008

Mr Richard Lord
Wind Ventures Limited
Brook Henderson House
37-43 Blagrave St
Reading
RG1 1PZ

Your Reference:

Our Reference:
DE/C/SUT/43/10/1/6776

Date:
5 September 2008

Dear Mr Lord

DE Ref Number: 6776

Site Name: Sutton St Edmund Wind Farm

I am writing to tell you that the MOD has no concerns with the proposal as set out in your pro-forma dated 29th July 2008.

The application is for 3 turbines at 125 metres to blade tip. This has been assessed using the grid references below as submitted in your pro-forma.

Turbine	100km Square Letter	Easting	Northing
1	TF	38210	13000
2	TF	38130	12600
3	TF	38520	12650

The MOD subject matter expert has identified a need for the turbines to be fitted with aviation lighting in the interests of air safety. All turbines should be fitted with a 200 candela omni-directional red light at the highest practicable point.

If the application is altered in any way we must be consulted again as even the slightest change could unacceptably affect us.

If you apply for planning permission you must ensure that the relevant planning authority consults this office to ensure that no concerns have arisen since the date of this letter.

If planning permission is granted you must tell us;

- the date construction starts and ends;
- the maximum height of construction equipment;
- the latitude and longitude of every turbine.

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This information is vital as it will be plotted on flying charts to make sure that military aircraft avoid this area.

Yours sincerely

Chris Evans
Assistant Safeguarding Officer – Wind Energy
Defence Estates

SAFEGUARDING SOLUTIONS TO DEFENCE NEEDS

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16.1.3 - CAA 15/08/2008

E13 A5

Civil Aviation Authority

Directorate of Airspace Policy

Mr Richard Lord
Wind Ventures Ltd
Brook Henderson House
37-43 Blagrave Street
Reading
RG1 1PZ

15/08/2008

Our Ref: DAP/Wind/Sutton St Edmund
Your Ref: SE01

Dear Mr Lord

Wind Farm Proposal – Sutton St Edmund

Thank you for notification of the title proposal. This Directorate has the following observation(s):

This development might affect the following aeronautical site(s), the licensee/operator of which should be consulted:

Fenland Airfield
Fenland Aero Club (Licensing) Ltd
Fenland Airfield
Holbeach St Johns
Spalding
Lincs
PE12 8RQ

It is in your interests to contact the persons or organisations identified above, as recommended in the Wind Energy and Aviation Interim Guidelines. By so doing you should ensure that there are no unexpected aviation objections when you reach the stage of applying for planning permission. You are also advised that the appropriate Local Planning Authority should be able to provide information relating to safeguarding requirements of local aerodromes.

There may be issues related to en route navigational facilities. Accordingly details of your proposal have been copied to National Air Traffic Services for any comment. If you do not hear from NATS or wish to contact them, they can be contacted at:

National Air Traffic Services Ltd
Navigation Spectrum & Surveillance
Corporate and Technical Centre
4000 Parkway, Whiteley
Fareham
Hampshire, PO15 7FL

In respect of any aviation need to increase the conspicuity of the turbines, developers should be aware that there may be a need to install aviation obstruction lighting to some or all of the associated wind turbines should this development be progressed (the UK Air Navigation Order 2007, Article 134 refers). This comment is made specifically if there were

Civil Aviation Authority
CAA House K6G6 45-59 Kingsway London WC2B 6TE www.caa.co.uk
Telephone 020 7453 6557 Fax 020 7453 6565 E-mail delpha.pope@caa.co.uk

concerns expressed by other elements of the aviation industry; ie the operators. For example, if the Ministry of Defence or a local aerodrome had suggested such a need, we the Civil Aviation Authority (sponsor of policy for aviation obstruction lighting) would wish, in generic terms, to support such a claim. We would do so if it could reasonably be argued that the structure(s), by virtue of their location and nature, could be considered a significant navigational hazard. That said, if the claim was clearly outside credible limits (ie the proposed turbine(s) was/were many miles away from an any aerodrome or it/they were of a height that was unlikely to effect even military low flying) the Authority would play an 'honest-broker' role.

Moreover all parties should be aware that an anticipated amendment to international aviation regulatory documentation will require that the rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines that are deemed to be an aviation obstruction should be painted white, unless otherwise indicated by an aeronautical study. It follows that the CAA advice on the colour of wind turbines would align with these international criteria.

The number of pre-planning enquiries associated with windfarm developments has been significant. It is possible that the proliferation of wind turbines in any particular area might potentially result in difficulties for aviation that a single development would not have generated. It is, therefore, not necessarily the case that, because a generic area was not objected to by the aviation industry, future, similarly located potential developments would *receive the same positive response.*

Developers are advised that there is a civil aviation requirement in the UK for all structures over 300 feet high to be charted on civil aviation maps (I understand that the ministry of defence utilises a lower threshold height). Should this proposed wind turbine development progress and the 300 feet height be breached, to achieve this civil aviation charting requirement, developers will need to provide details of the development to:

Defence Geographic Centre
AIS Information Centre
Jervis Building
Elmwood Avenue
Feltham
Middlesex
TW13 7AH
Telephone: 020 8818 2708 (This number is for Defence Geographic, not the undersigned.)

If you would prefer to receive this information Emailed to you as a PDF please advise me by Email at windfarms@caa.co.uk. Please ensure that your Email contains clear contact details and the Email address that you would like this information sent to.

Yours sincerely

J. Mottershead

J Mottershead

Continued 2 of 2 pages)

16.1.4 Secondary Application Pro-forma

(BWEA email #1692)**WIND FARM DEVELOPERS APPLICATION PROFORMA:**

Civil Aviation & Ministry of Defence Safeguarding

NOTICE TO WIND FARM DEVELOPERS
Please submit a completed application form for all new or revised onshore and offshore wind farm plans. This form has been compiled in consultation with the British Wind Energy Association. Its purpose is to standardise the information provided and to expedite the assessment of your proposed wind farm development. Assessment is made against air safety and defence interests, through evaluation of the possible effects on air traffic systems, defence systems and low flying needs.

NOTICE TO PLANNING AUTHORITIES
This form has been compiled with the assistance of the Civil Aviation Authority (CAA), the Ministry of Defence (MOD), the National Air Traffic Service (NATS) and the British Wind Energy Association (BWEA), to assist in the processing and assessment of wind farm applications. It is important that copies of this form are forwarded within the planning consultation process. This will help these organisations trace their records of any earlier consultations, as well as provide them with the relevant information for their assessments.

WHAT TO DO WITH THIS FORM
Please provide as much detail as possible by **filling in the shaded areas.** If the specific turbine and/or exact positions have yet to be established then fill in the likely turbine size (hub height, rotor diameter) and boundary points as a minimum. On completion send copies to both the following addresses.

Safeguarding
Defence Estates
Blakemore Drive
Sutton Coldfield
B75 7RL

Directorate of Airspace Policy
K6 Gate 3
CAA House
45-49 Kingsway
London, WC2B 6TE

It is important that a copy of this form is retained for inclusion with subsequent planning applications at the same site. If no application has been made prior to a planning application, please include a completed form in your planning application.

Wind Farm Name	
Sutton St Edmund Wind Farm, Cambs	
Also known as:	

Developers reference	SE01
Application identification No.	

Related/previous applications (at or near this site): Provide reference names or numbers	DE Ref No: 6776

CAA/NATS/MOD Wind Farm Application form

Developer Information	
Company name:	Wind Ventures Limited
Address:	Brook Henderson House 37-43 Blagrave St Reading RG1 1PZ
Contact:	Ross Glover
Telephone:	0118 900 8088
Facsimile:	0118 900 8099
e-mail:	ross.glover@windventures.co.uk

Relevant Wind Turbine Details			
Wind turbine manufacturer:	**REPower**		
Wind turbine model:	**3.XM**		
Wind farm generation capacity (MW)	**13.2 MW**	**Number of turbines**	4
Blade manufacturer	REPower		
Number of blades	3		
Rotor diameter	104	Meters	
Rotation speed (or range)	14	Rpm	
Blade material including lightning conductors	GRP, possibly with glass, carbon fibre and wooden core with epoxy resins		
Wind turbine hub height	80	Metres	
Tower design (* delete as required)	* Tubular		
Tower base diameter/dimensions	6	Metres	
Tower top diameter/dimensions	3	Metres	

CAA/NATS/MOD Wind Farm Application form

Comments
The layout is roughly 4 turbines in a dogleg.

Turbine Locations

Please provide as much information as you can. The position and height above sea level of every machine if available, the site boundary if not. The height above sea level is the above ordinance datum (AOD) used to specify all heights on OS maps. Please note grid references **and** latitude/longitude and must be included. For co-ordinate conversion: www.gps.gov.uk

An Ordinance Survey (OS) map, or maritime chart, should be submitted with this pro-forma, showing locations of proposed turbine/turbines or scheme boundaries. Please number the turbines or boundary points on the map, to correlate with the information provided below.

Copy this page as necessary to account for all turbines or boundary points

Wind farm Name & Address:	**Sutton St Edmund Wind Farm** Sutton St Edmund Cambs

Turbine no.	1		**Height** AOD (m) of tower base			-1				
Grid Reference					100 km square letter(s) identifier			TF		
Easting (10 m)	**3**	**8**	**2**	**0**		**1**	**3**	**0**	**0**	
	Degrees				Minutes			Seconds		
Latitude										
Longitude										
Turbine no.	2		**Height** AOD (m) of tower base			-1				
Grid Reference					100 km square letter(s) identifier			TF		
Easting (10 m)	**3**	**8**	**1**	**0**	Northing (10 m)	**1**	**2**	**5**	**2**	
	Degrees				Minutes			Seconds		
Latitude										
Longitude										
Turbine no.	3		**Height** AOD (m) of tower base			-1				
Grid Reference					100 km square letter(s) identifier			TF		
Easting (10 m)	**3**	**8**	**6**	**5**	Northing (10 m)	**1**	**2**	**6**	**0**	
	Degrees				Minutes			Seconds		
Latitude										
Longitude										

CAA/NATS/MOD Wind Farm Application form

Turbine no.	4		**Height** AOD (m) of tower base		-1				
Grid Reference				100 km square letter(s) identifier			TF		
Easting (10 m)	**3**	**9**	**0**	**7**	Northing (10 m)	**1**	**2**	**8**	**0**
	Degrees				Minutes		Seconds		
Latitude									
Longitude									

Issue 1
May 2001

Page 4 of 3

16.1.5 - Defence Estates 17/08/2009

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MINISTRY OF DEFENCE

Mr Ross Glover
Wind Ventures Limited
Brook Henderson House
37-43 Blagrave St
Reading
RG1 1PZ

Claire Duddy
Assistant Safeguarding Officer/Safeguarding Assistant

Safeguarding - Wind Energy
Defence Estates
Kingston Road
Sutton Coldfield
West Midlands
B75 7RL

Claire Duddy: 0121 311 3714
Facsimile: 0121 311 2218
E-mail: claire.duddy@de.MOD.uk
Internet Site: www.defence-estates.MOD.uk

Your Reference:
Our Reference: *DE/C/SUT/43/10/1/6776*

17 August 2009

Dear Mr Glover

DE Reference Number: 6776

Site Name: Sutton St Edmund Wind Farm

I am writing to confirm that we have the following concerns with your proposal. This has been assessed on the grid references below (as submitted in the Scoping Request from South Holland District Council) for 4 turbines at 132 metres to blade tip height.

Turbine	100km Square letter	Easting	Northing
1	TF	38200	13000
2	TF	38100	12520
3	TF	38650	12600
4	TF	39070	12800

We will look at suggested mitigations that you may wish to propose. However, the Ministry of Defence (MOD) will object if you apply for planning permission without addressing these concerns to our satisfaction.

Air Traffic Control (ATC) radar

The turbines will be 47 km from; in line of sight to; and will cause unacceptable interference to the ATC radar at RAF Cottesmore. Following trials carried out in 2005, it has been concluded that wind turbines can affect the probability of detection of aircraft flying over or in the vicinity of wind turbines. Due to this, the RAF would be unable to provide a full Air Traffic Radar service in the area of the proposed wind farm.

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Precision Approach Radar (PAR)

The turbines will be 36.5 km from; in line of sight to; and will cause unacceptable interference to the Precision Approach Radar (PAR) at RAF Wittering. In late 2008, the PAR at RAF Lossiemouth was repositioned to observe targets of opportunity over the Rothes wind farm. This has shown that wind turbines affect the detection of aircraft by the PAR. Due to this, the RAF would be unable to provide a full air traffic service in the area of the proposed wind farm.

Currently, the MOD is not aware of any acceptable technical mitigation for the interference that will be caused to the PAR by your wind farm proposal. The MOD is currently working towards a full trial to better understand the effects of wind turbines on the PAR. It is the aspiration of the MOD to have this work complete by the end of 2009. The unclassified results of these trials will be provided to the wind energy industry.

If the developer is able to overcome the issues stated above, we will request the turbines be fitted with aviation lighting.

Defence Estates Safeguarding wishes to be consulted and notified of the progression of planning applications and submissions relating to this proposal to verify that it will not adversely affect defence interests.

I hope this adequately explains our position on this matter. If you require further information or would like to discuss this matter further please do not hesitate to contact me.

Yours sincerely

C. Duddy.

Claire Duddy
Assistant Safeguarding Officer – Wind Energy
Defence Estates

SAFEGUARDING SOLUTIONS TO DEFENCE NEEDS

DEFENCE ESTATES
Delivering Estate Solutions to Defence Needs

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16.1.6 - CAA 03/06/2009

Glover, Ross

From: Pope DelphaL [DelphaL.Pope@caa.co.uk]
Sent: 03 June 2009 15:57
To: Glover, Ross
Subject: Sutton St Edmund WindFarm

Our Ref: DAP/Wind/Sutton St Edmund\864
Your Ref: SE01

Dear Mr Glover

Wind Farm Proposal – Sutton St Edmund

Thank you for notification of the title proposal. This Directorate has the following observation(s):

This development might affect the following aeronautical site(s), the licensee/operator of which should be consulted:

Fenland Airfield
Secretary
Fenland Aero Club
Fenland Airfield
Spalding
Lincs
PE12 8RQ
Phone Number: 01406 540330
Email: fenlandairfield@btconnect.com

It is in your interests to contact the persons or organisations identified above, as recommended in the Wind Energy and Aviation Interim Guidelines. By so doing you should ensure that there are no unexpected aviation objections when you reach the stage of applying for planning permission. You are also advised that the appropriate Local Planning Authority should be able to provide information relating to safeguarding requirements of local aerodromes.

There may be issues related to en route navigational facilities. Accordingly details of your proposal have been copied to National Air Traffic Services for any comment. If you do not hear from NATS or wish to contact them, they can be contacted at:

National Air Traffic Services Ltd
Navigation Spectrum & Surveillance
Corporate and Technical Centre
4000 Parkway, Whiteley
Fareham
Hampshire, PO15 7FL
For completeness it would also be sensible to establish the related viewpoint of local emergency services air support units. This is because of the unique nature of their operations in respect of operating altitudes and potentially unusual landing sites.

In respect of any aviation need to increase the conspicuity of the turbines, developers should be aware that there may be a need to install aviation obstruction lighting to some or all of the associated wind turbines should this development be progressed. This comment is made specifically if there were concerns expressed by other elements of the aviation industry; ie the operators. For example, if the Ministry of Defence or a local aerodrome had suggested such a need, we the Civil Aviation Authority (sponsor of policy for aviation obstruction lighting) would wish, in generic terms, to support such a claim. We would do so if it could reasonably be argued that the structure(s), by virtue of their location and nature, could be considered a significant navigational hazard. That said, if the claim was clearly outside credible limits (ie the proposed turbine(s) was/were many miles away from an any aerodrome or it/they were of a height that was unlikely to effect even military low flying) the Authority would play an 'honest-broker' role.

All parties should be aware that international aviation regulatory documentation requires that the rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines that are deemed to be an aviation obstruction should be painted white, unless otherwise indicated by an aeronautical study. It follows that the CAA advice on the colour of wind turbines would align with these international criteria.

The number of pre-planning enquiries associated with windfarm developments has been significant. It is possible that the proliferation of wind turbines in any particular area might potentially result in difficulties for aviation that a single development would not have generated. It is, therefore, not necessarily the case that, because a generic area was not objected to by the aviation industry, future, similarly located potential developments would receive the same positive response.

Developers are advised that there is a civil aviation requirement in the UK for all structures over 300 feet high to be charted on civil aviation maps (I understand that the ministry of defence utilises a lower threshold height). Should this proposed wind turbine development progress and the 300 feet height be breached, to achieve this civil aviation charting requirement, developers will need to provide details of the development to:

Defence Geographic Centre
AIS Information Centre
Jervis Building
Elmwood Avenue
Feltham
Middlesex
TW13 7AH
Telephone: 020 8818 2708 (This number is for Defence Geographic, not the undersigned.)

An amendable version of the proforma is available electronically at
http://www.bwea.com/docs/developers_proforma.doc and can be E-mailed to windfarms@caa.co.uk when submitting preplanning information.

Please be aware that due to the rationalisation of CAA Email addresses the windfarms Email address is now windfarms@caa.co.uk, the previous address windfarms@dap.caa.co.uk will no longer work.

Regards

Delpha

Mrs Delpha Pope
S&SM Administration Officer
Civil Aviation Authority
Surveillance and Spectrum Management, K6G6, CAA House, 45-59 Kingsway, London, WC2B 6TE
Tel 020 7453 6557 Fax 020 7543 6556 Email DelphaL.Pope@caa.co.uk

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any other party.
Thank you.

Please note that all e-mail messages sent to the Civil Aviation Authority are subject to monitoring / interception for lawful business

16.1.7 - Defence Estates 17/08/2009

Claire Duddy
Assistant Safeguarding Officer

Safeguarding - Wind Energy
Defence Estates
Kingston Road
Sutton Coldfield
West Midlands
B75 7RL

Cyranne Taylor: 0121 311 2195
Claire Duddy: 0121 311 3714
Facsimile: 0121 311 2218
E-mail: cyranne.taylor@de.MOD.uk
E-mail: claire.duddy@de.MOD.uk
Internet Site: www.defence-estates.MOD.uk

Mr David Robert
South Holland District Council
Council Offices
Priory Road
Spalding
Lincs
PE11 2XE

Your Reference: 1870.9
Our Reference: DE/C/SUT/43/10/1/6776

17 August 2009

Dear Mr Roberts

SCOPING REPORT – PROPOSED WIND FARM, SUTTON ST EDMUND, LINCS

Thank you for consulting the Ministry of Defence (MOD) on the scoping request with respect to the above proposal.

The scheme outlined involves the construction of 4 free standing wind turbines with associated infra-structure. The turbines are expected to be 132 metres to blade tip above ground level.

The principal safeguarding concern of the MOD with respect to the development of wind turbines relates to their potential to create a physical obstruction to air traffic movements and cause interference to Air Traffic Control and Air Defence radar installations.

We were consulted by the developer at the pre-planning stage on 3 turbines at 125m to blade tip height, and this identified no concerns. However, the scoping request is for 4 turbines at 132 metres, and we have subsequently identified the following concerns:

Air Traffic Control (ATC) radar

The turbines will be 47 km from; in line of sight to; and will cause unacceptable interference to the ATC radar at RAF Cottesmore. Following trials carried out in 2005, it has been concluded that wind turbines can affect the probability of detection of aircraft flying over or in the vicinity of wind turbines. Due to this, the RAF would be unable to provide a full Air Traffic Radar service in the area of the proposed wind farm.

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Precision Approach Radar (PAR)

The turbines will be 36.5 km from; in line of sight to; and will cause unacceptable interference to the Precision Approach Radar (PAR) at RAF Wittering. In late 2008, the PAR at RAF Lossiemouth was repositioned to observe targets of opportunity over the Rothes wind farm. This has shown that wind turbines affect the detection of aircraft by the PAR. Due to this, the RAF would be unable to provide a full air traffic service in the area of the proposed wind farm.

Currently, the MOD is not aware of any acceptable technical mitigation for the interference that will be caused to the PAR by your wind farm proposal. The MOD is currently working towards a full trial to better understand the effects of wind turbines on the PAR. It is the aspiration of the MOD to have this work complete by the end of 2009. The unclassified results of these trials will be provided to the wind energy industry.

If the developer is able to overcome the issues stated above, we will request the turbines be fitted with aviation lighting.

Government guidance on renewable energy developments as set out in Paragraph 25 of Planning Policy Statement 22 stipulates that:

" ...It is the responsibility of developers to address any potential impacts, taking account of Civil Aviation Authority, Ministry of Defence and Department for Transport guidance in relation to radar and aviation, and the legislative requirements on separation distances, before planning applications are submitted. Local Planning Authorities should satisfy themselves that such issues have been addressed before considering planning applications".

Accordingly the applicant should take account of MOD aviation and radar operations in completing the EIA particularly in identifying a suitable site for development and the dimensions of the turbines that are to be installed.

Defence Estates Safeguarding wishes to be consulted and notified of the progression of planning applications and submissions relating to this proposal to verify that it will not adversely affect defence interests.

I hope this adequately explains our position on this matter. If you require further information or would like to discuss this matter further please do not hesitate to contact me.

Yours sincerely

C. Duddy.

Claire Duddy
Assistant Safeguarding Officer – Wind Energy
Defence Estates

SAFEGUARDING SOLUTIONS TO DEFENCE NEEDS

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Delivering Estate Solutions to Defence Needs

16.1.8 - CAA 15/07/2009

Directorate of Airspace Policy

Civil Aviation Authority

Mr David Roberts
South Holland District Council
Council Offices
Priory Road
Spalding
Lincolnshire
PE11 2XE

15 July 2009

Ref ERM/DAP/Wind/SuttonStEdmund
Your Ref 1870.19 dated 13 July 2009

Dear Mr Roberts

Proposed Wind Turbine Development at Sutton St Edmund, Lincolnshire – Scoping Comment

Thank you for your recent correspondence relating to a proposed wind turbine development at Sutton St Edmund, Lincolnshire. You sought related Civil Aviation Authority (CAA) comment related to the associated Scoping Report (SR); I trust the following is useful.

As alluded to with the documentation provided, like any wind turbine development, the proposed subject development has the potential to impact upon aviation-related operations; the Department for Trade and Industry (DTI – now the Department for Energy and Climate Change)-sponsored document 'Wind Energy and Aviation Interests' and Civil Air Publication 764 refer[1]. The related need to establish the scale of the potential impact of the Sutton St Edmund development (or indeed any other wind turbine related proposal) is evident.

Further to the comment above and in line related comment in the SR concerning future consultation with aviation stakeholders, the best means by which to initiate the aviation related consultation process is via the completion and submission of an associated aviation pre-planning proforma in line with the process described within the aforementioned DTI guidance document. To date I can find no record of the submission of a pre-planning proforma in respect of a development under the title of '*Sutton St Edmund*'.

Notwithstanding the above, having reviewed the SR and, in particular, the site in question and can advise that the development might have a potential impact upon operations associated with Fenland Aerodrome and recommend that the developer open lines of communication with the aerodrome operator / licensee to establish the scale of any such

[1] These documents are available at http://www.bwea.com/pdf/Wind-Energy-and-aviation-interim-guidelines.pdf and http://www.caa.co.uk/docs/33/Cap764.pdf respectively. Please note that after a full review CAP 764 was re-issued on 12 February 2009.

Civil Aviation Authority
CAA House 45-59 Kingsway London WC2B 6TE www.caa.co.uk
Telephone 0207 453 6545 Fax 0207 453 6565 marks.smalles@caa.co.uk

FS 36365 INVESTOR IN PEOPLE

impact. All parties should be aware that aerodrome safeguarding responsibility rests with the aerodrome operator / licensee. Any related Environmental Impact Assessment (EIA), or equivalent, would be expected to acknowledge and quantify any potential impact upon the aerodrome-related operations and, where applicable, detail appropriate mitigation.

Similarly, the relative perspectives of both the Ministry of Defence (MoD) should be established by the developer and any related concerns addressed.

Additionally, if more generically, all parties should be aware that:

- *There might be a need to install aviation obstruction lighting to some or all of the* associated wind turbines should development proposals be progressed.

  This comment is made specifically if there were concerns expressed by other elements of the aviation industry, ie the operators. For example, if the MoD or a local aerodrome had suggested such a need, we the CAA (sponsor of policy for aviation obstruction lighting) would wish, in generic terms, to support such a claim. We would do so if it could reasonably be argued that the structure(s), by virtue of their location and nature, could be considered a significant navigational hazard. That said, if the claim was clearly outside credible limits (ie the proposed turbine(s) was/were many miles away from an any aerodrome or it/they were of a height that was unlikely to effect even military low flying) the Authority would play an 'honest-broker' role. Whilst responsibility for establishing further lighting related comment rests with the developer, I should highlight that, in isolation, the CAA would not make any related case or recommendation for aviation lighting.

- An anticipated amendment to international aviation regulatory documentation will require that the rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines that are deemed to be an aviation obstruction should be painted white, unless otherwise indicated by an aeronautical study. It follows that the CAA advice on the colour of wind turbines would align with these international criteria. As with the potential need for lighting, in isolation, the CAA would make no special case for marking.

- There is a civil aviation requirement in the UK for all structures over 300 feet high to be charted on aviation maps. Should this development progress and the 300 feet height be breached, to achieve this charting requirement, developers will need to provide details of the development to the CAA and Defence Geographic Centre.

- The number of pre-planning enquiries associated with windfarm developments has been significant. It is possible that the proliferation of wind turbines in any particular area might potentially result in difficulties for aviation that a single development would not have generated. It is, therefore, not necessarily the case that, because a generic area was not objected to by the aviation industry, future, similarly located potential developments would receive the same positive response. There is a CAA perceived requirement for a co-ordinated regional wind turbine development plan, aimed at meeting renewable energy priorities, whilst addressing aviation concerns and minimising such proliferation issues.

- Due to the unique nature of associated operations in respect of operating altitudes and potentially unusual landing sites, it would also be sensible to establish the related viewpoint of local emergency services air support units.

Any associated EIA should mention and, where applicable, address the issues highlighted above.

Ref 8AP/31/05/01 Continued (2 of 3 pages)

Whilst none of the above negates the need, where applicable, for planning authorities to consult in accordance with ODPM / DfT Circular 1/2003, I trust that this information and guidance is of assistance. Please do not hesitate to contact me if you require further input or clarification of any point.

Yours sincerely

Mark Smailes
Off Route Airspace 5

16.1.9 - Fenland Airfield Letter

A5

WindVentures

Fenland Aero Club
Fenland Airfield
Holbeach St Johns
Spalding
Lincs
PE12 8RQ

18th November 2008

Dear Sir/Madam

Sutton St Edmund - wind farm investigation

We are in the early phase of investigating whether this site could be suitable location from which to generate renewable electricity. Discussions with the Civil Aviation Authority indicate that you operate locally and we therefore would like to seek your confirmation that a wind farm on the proposed site would not interfere with your activities. If this is the case we would also like to confirm that you would not object on these grounds to a planning application for the wind farm.

The proposed wind farm would be at a distance of about 8km from your site.

The map reference for the nearest turbine to your site is TF 38520 12650. We are considering the installation of 3 to 4 turbines which could have a rotor hub height of 80m and rotor tip height of 125m.

I appreciate that this may be a subject with which you are not familiar and so would welcome the opportunity to answer any questions you may have. I would appreciate your response and feedback on this potential development.

Yours faithfully,

Ross Glover

Wind Ventures Limited
Brook Henderson House
37-43 Blagrave Street
Reading RG1 1PZ

Wind Ventures Limited. Registered office as above. Company Registration No: 06427282

Appendix 16.2 - Initial Mitigation Proposal Response

MINISTRY OF DEFENCE

David Jones
Senior Safeguarding Officer – Engagements
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Alan Hartley
BAE Systems,
Eastwood House,
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Chelmsford,
Essex CM1 1QW

Ref. 6776

27 Sept 2010

Dear Alan,

Re: Sutton St Edmunds Mitigation Proposal

Thank you for your proposal to use the RAF Marham Primary Surveillance Radar (PSR) as an infill to mitigate the unacceptable interference that the proposed Sutton St Edmunds wind turbine development would have on the PSR at RAFs Cottesmore.

While we note your base of cover analysis for the RAF Marham PSR, the Ministry of Defence's (MoD) Air Defence & Air Traffic Services (ADATS) Delivery Team have found that it will provide a base of coverage of 544ft agl at best, and 1023ft agl at worst for the infill patch area. The MoD has taken this technical information into account along with a whole host of operational considerations.

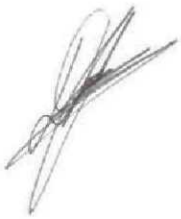
In this instance the MoD is unable to accept your mitigation proposal. The base of cover provided for the proposed infill patch *may* be acceptable if the lateral dimensions were much smaller. However, the large lateral dimension so close to Fenland, and in airspace regularly used for low-flying, makes the proposed infill unacceptable. Too much radar coverage would be lost at low-level, leading to a reduction in surveillance capability and controller situational awareness.

Whilst the use of the RAF Marham PSR is deemed to be unacceptable in this case, there may still be a way ahead for mitigation of this site. Numerous technology companies are developing short-range radars which can be sited within the wind turbine development to provide the necessary radar infill without the loss of radar coverage. These radars do not suffer from the effects of the turbines and are likely to provide the coverage required in this area. Given the flat nature of the terrain and that most existing radars would have visibility of the turbines; it seems reasonable to suggest that a wind turbine development sited radar system may be required if radar infill mitigation is your preferred option.

DE
DEFENCE ESTATES

Should you wish to discuss this matter any further, please do no hesitate to contact me at any time.

Kind regards,



David Jones

Appendix 16.3 - Secondary Mitigation Proposal

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Mitigating Treading Wind Farm: The Holographic Radar Solution

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Date: 29th October 2010

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Document Details

Document Title	Mitigating Treading Wind Farm: The Holographic Radar Solution
Issue	Issue 1
Date	29th October 2010
Author	Jon Arden
Approved by	Annaliza Willis
Cambridge Consultants	
Distribution	Ross Glover, Wind Ventures

Amendment Record

Issue	Amendment	Date
1	Mitigation Report	29th October 2010

Approvals

Approval Level	Authority	Name	Signature
Author	Osprey CSL	Annaliza Willis	
Internal Approval	Osprey CSL	Jon Arden	
Client Approval	Wind Ventures	Ross Glover	
Regulator			

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Date: 29th October 2010

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MANAGEMENT SUMMARY

Wind Ventures is proposing a wind development known as Treading near Wisbech in Lincolnshire. It is anticipated that Defence Estates (DE) would object to the development with respect to the expected impact on the Primary Surveillance Radar (PSR) at RAF Cottesmore.

Purpose and Scope

This document describes a solution proposed for mitigating the impact of the Treading Wind Farm turbines on the PSR system at RAF Cottesmore. The document describes the principles and technology involved in the use of a "holographic radar solution": a small scale sensor known as CH-InFill™ developed by Cambridge Consultants Ltd, which is designed for installation within the wind farm site itself.

Operating Principles

The principles behind the CH-Infill™ Holographic Radar solution can be summarised as follows:

- The sensor is located within or near to the wind farm and provides surveillance of a given volume surrounding the wind farm;
- The sensor has no moving parts and does not scan across a field of view like a traditional PSR. Instead, it transmits pulses simultaneously across the entire field of view and simultaneously receives returns from all directions. All targets are interrogated continually and the returns processed at a high update rate;
- In simple terms, the properties of wind turbines are clearly distinguishable from the features of an aircraft because they are always at a constant range and exhibit a very different Doppler profile to that representing a true moving object.

Integration

Integration of the data from the CH-InFill™ sensor into a given Air Traffic Control System requires a method of enabling the 'infill signal' to be seamlessly displayed to the Air Traffic Controller. Although a number of systems are under development to deliver this capability, it is believed that the Cyrrus Radar Video Signal Enhancer (RVSE) is the most mature and the one offered within this proposal.

The RVSE cuts out the video data from PSR in the region of the wind farm and replaces it with synthesised video based on Asterix plots from the CH-InFill™. The synthesised video is generated such that it appears to come from the primary radar and is synchronised with it thus producing a seamless transition from the Air Traffic Controller's point of view.

System Configuration for Treading Wind Farm

In order to provide an infill patch for Treading Wind Farm (for integration into the PSR system at RAF Cottesmore) the following system configuration is suggested:

- A single 16x16 CH-InFill™ sensor face;
- One Cyrrus RVSE component installed at RAF Cottesmore;
- A data distribution node enabling data to be distributed over:
    - Two data link/network connections.

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Date: 29th October 2010

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1. INTRODUCTION

1.1. Background

Wind Ventures are is proposing a wind development known as Treading near Wisbech, Lincolnshire. It is anticipated that DE will oppose the development citing the potential adverse impact on the PSR System located at RAF Cottesmore.

1.2. Purpose and Scope

This document describes a solution proposed for mitigating the impact of the Treading turbines on the two PSR systems. The document describes the principles and technology involved in the use of a "holographic radar solution": a small scale sensor known as CH-InFill™ developed by Cambridge Consultants Ltd, which is designed for installation within the wind farm site itself.

2. CH-INFILL™ HOLOGRAPHIC RADAR SENSOR

2.1. Operating Principles

The principles behind the CH-Infill™ Holographic Radar solution can be summarised as follows:

- The sensor is located within or near to the wind farm and it provides surveillance of a volume of airspace surrounding the wind farm.
- The sensor has no moving parts and does not scan across a field of view. Instead it transmits pulses simultaneously across the entire field of view and simultaneously receives returns from all directions. All targets are interrogated continually at the pulse repetition frequency, generating unambiguous, precision Doppler responses. The received signals are processed to identify the Doppler Spectrum and the 3D location of all moving objects within the 'bubble' of sensitivity. This is updated several times per second.
- Because the sensor gathers a great deal of information about each target and at a high update rate, moving objects are easily classified and unwanted returns are readily filtered out. In particular the properties of wind turbines are clearly distinguishable from the features of an aircraft and there is no risk of confusing the two.
- Outputs will be available in a standard Asterix (CAT034/CAT048) format for convenient integration with existing radar processing and display systems. Other desirable formats could be supported where required.

2.2. Radar Detection Volume

Holographic Radar can be configured for specific ranges and detection volumes dependent on the size of the infill patch required. It is anticipated that a single quadrant 16x16 CH-InFill™ sensor (see System Description Section 3) will have a maximum range of 14,000metres and vertical coverage up to 35,000ft.

Figure 1 illustrates an example of the 3D volume of coverage that could be provided by the CH-InFill™ sensor. The shape is roughly described as a curved cylindrical volume with the centre of curvature fixed at the location of the PSR and the base located at the wind farm site.

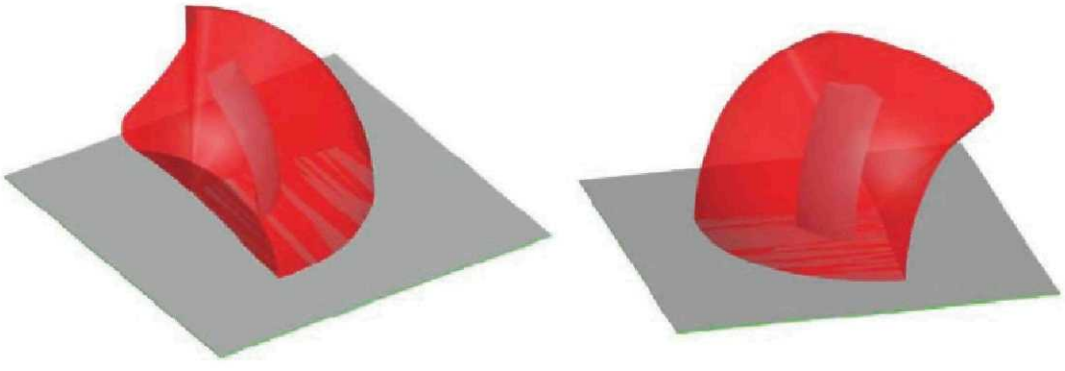


Figure 1 – Holographic Radar: 3D Volume of Coverage

2.3. Infill Patch

The infill patch can be designed to be any shape that fits around the wind farm and is within the detection volume. This example volume is shown as a projected arc with its origin defined by the position of the PSR at a given aerodrome.

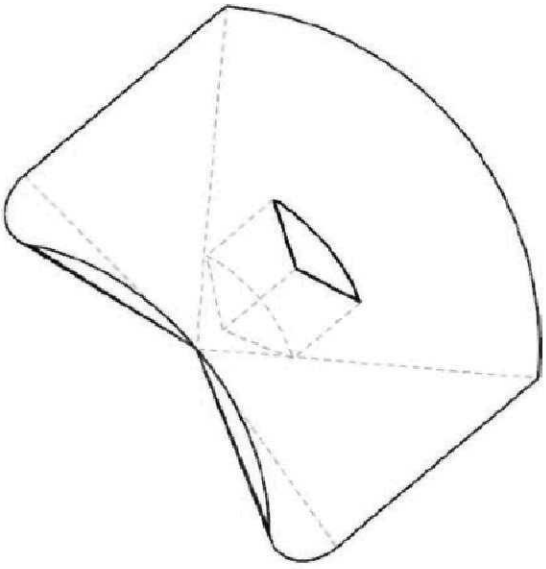
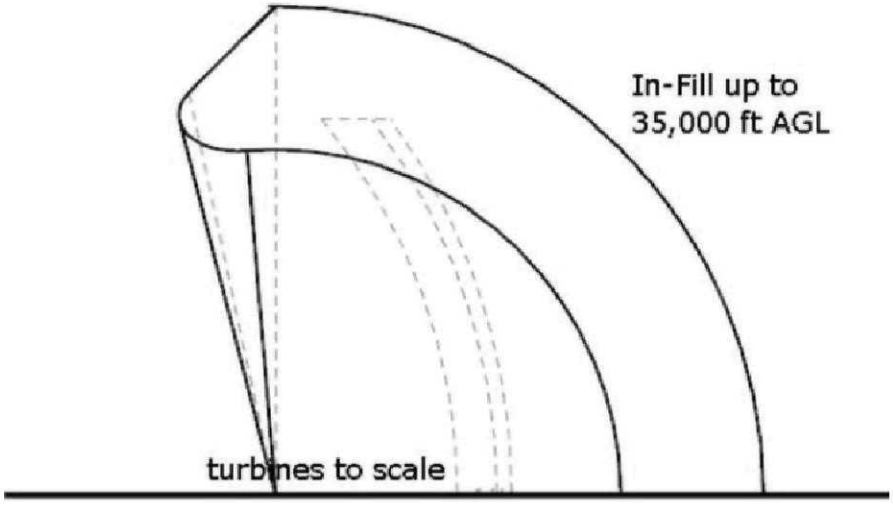


Figure 2. Plan View of detection volume with the infill patch at ground level (in bold).

Figure 2 shows the position of the turbines relative to the infill patch. A side view is shown in Figure 3 with the turbines to scale.



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The diagrams in Figures 1 and 2 represent an example where the CH-InFill™ radar is located in the centre of the wind farm and the infill patch footprint is arc shaped; actual location of the sensor and patch characteristics for Treading will be determined in consultation with Wind Ventures and DE.

3. SYSTEM DESCRIPTION

3.1. Physical Components

The holographic radar sensor comprises the following physical entities:

- The Sensor Assembly: Mounted on top of a small building within the location of the wind farm;
- The Processor Assembly: Situated within the same small building, in environmentally protected conditions.
- Engineering Terminal.

3.2. Sensor Assembly

Key features of the Sensor Assembly are:

- A single transmitter on top of the unit transmitting 1.3GHz pulses at a repetition frequency of 7 kHz. A single transmitter will illuminate the entire surveillance volume required of the sensor;
- Up to four receiver faces of size 8x8 or 16x16 depending on size of wind farm and the required coverage height. Signals are transmitted to the Processor Assembly via a fibre optic link.

3.3. Processor Assembly

The Processor Assembly contains the Radar Data Processor and the communications interface. It is based on commercial-of-the-shelf PC based hardware with additional high speed parallel processing engines. Conventional environmental protection will be required for the Processor Assembly.

The software processing stages comprise the following:

- *Time to frequency domain conversion*. Using Fast Fourier Transform (FFT) this converts the received signals into a large number of Doppler bins (typically 1024). The output of this process is a 4D array generated several times per second – with the dimensions being row, column, range and Doppler Frequency;
- *Beam-forming*. Using spatial FFTs, the value from each antenna element are transformed into a set of beams. Up to 256 beams would be formed for each face of a full system or 64 beams per 16x16 face. These beams allow the direction and elevation of the target to be measured accurately. The output of this process is another periodically updated 4D array indexed by azimuth, elevation, range and Doppler frequency.
- *Peak Detection*. Using thresholding operations, the output of the beam-former is used to identify detected Candidate targets. This will include all aircraft within the surveillance volume as well as turbine blades and many other sources of clutter. Detection is carried out in a 2D surface in which slant range is one dimension and Doppler or slant-range-rate is the other. This is a critical stage at with the unique characteristics of aircraft and turbines are exploited to discriminate between their returns. Turbine blades generate temporally peaked

signals with a wide range of Doppler components at a constant range. Aircraft generate persistent returns whose compact Doppler spectrum predicts their smoothly varying range.

- *Tracking and Classification*. The candidate targets are tracked and classified according to their detection histories. Because their properties are so different, there is no risk of confusing a wind turbine with an aircraft. The processor has the capacity to track and classify a large number of candidate targets allowing for many points per turbine.
- *Output Conversion*. Finally, the aircraft tracks are converted into the required output format (currently planned to be Asterix CAT048). Options are available at the conversion stage to apply slant range correction to position the output in the same frame of reference as any given PSR.

3.4. Engineering Terminal

The engineering terminal is a simple PC or laptop system capable of remotely connecting to the sensor via a dial up connection (if necessary) or over an IP network that is accessed via ADSL or equivalent. This would be for the purposes of monitoring.

3.5. Physical and Technical Characteristics

1. Transmitter:
    - Frequency of Operation: 1.26-1.35GHz;
    - Peak Transmission Power: 7.5kW;
    - Duty Cycle: <2%;
    - Antenna: Slotted Waveguide;
    - Dimensions: 230mm high (roof mounted);
    - Power Consumption: 500W;
    - Weight: <10kg;
    - Mounting Height: <3m AGL;
    - Safety Distance (long term): 1metre;
2. Receiver:
    - Array Elements: 16x16
    - Array Dimensions: 2mx2m, sloped 45°;
    - Weight: <500kg;
    - Mounting Height: >2m AGL;
    - Power Consumption: <1kW;
3. Radar Data Processor:
    - Dimensions: <600x450x250mm;
    - Weight: <25kg;

- Output Data Format: Asterix Cat034/048.

3.6. System Performance

Table 1 presents the performance parameters of the CH-InFill™ 16x16 array.

Parameter	CH-InFill™ 16x16
Maximum Range	10km
Minimum Range	150metres
Range Resolution	120metres
Range Accuracy (3σ)	36metres
Field of View (Azimuth)	360°
Field of View (Elevation)	90°
Resolution in Azimuth and Elevation	6°
Accuracy in Azimuth and Elevation (3σ)	1°
Target Size (RCS)	$1m^2$
Maximum Target Velocity	300m/s
Minimum Target Velocity	10m/s
Doppler Resolution (slant range rate)	1 -3 m/s
Update Rate	5- 10Hz

Table 1. Performance Parameters

3.7. Communications Requirements

Figure 4 illustrates the communication links between the CH-InFill™ radar and the Air Traffic Control System at each affected aerodrome or service provider. In this instance the actual data interface between the CH-InFill™ and the Air Traffic Control System is provided by a Cyrrus Radar Video Signal Enhancer (RVSE) - see Section 4.1. However, there are a number of similar systems under development and Wind Ventures would agree the precise supplier details during the Mitigation Implementation phase of the Project.

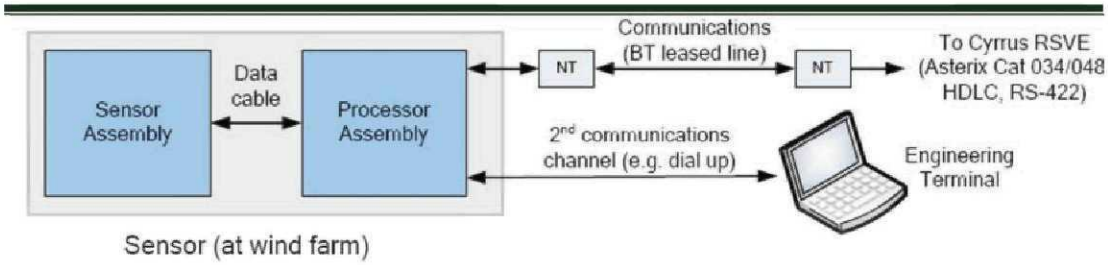


Figure 4. Sensor and communication channels.

3.8. Communications Requirements

The system requires the availability of a permanent 64Kbps data link from the CH-InFill™ sensor at the wind farm site to the RVSE. This would deliver the 3D plot data from all aircraft within the CH-InFill™ surveillance volume (i.e. all aircraft within the vicinity of the wind farm). Compatibility with the RSVE is assured using the data format Asterix CAT034/CAT048 over an HDLC/RS-422 link. The data could be transmitted over a BT Kilostream leased line with the CH-InFill™ connecting directly to the BT Network Termination (NT) at the wind farm site and the RVSE connecting to the BT NT at the affected aerodrome or service provider.

3.9. Logistics Support and Remote Monitoring

Logistics support and remote monitoring of the CH-InFill™ system would be facilitated by a second communications channel designed to allow the temporary connection of the engineering terminal. Ideally this would provide an IP connection between the engineering terminal and the Radar Data Processor and could be implemented over a dial-up connection (if necessary) or over an IP network accessed by ADSL or equivalent. The higher data rates of the IP network would obviously facilitate much more efficient monitoring of the system.

3.10. Other Communications Requirements

Given the predicted impact of the Treading Wind Farm turbines, there will be no requirement for data from the CH-InFill™ to be distributed to other Air Traffic Service providers other than RAF Cottesmore.

3.11. Communications Integrity

A Safety Case will be developed for the CH-InFill™ radar which will indicate the level of availability and integrity required of the sensor and its communications. The design of the system allows for multiple levels of redundancy in sensors and communications to be incorporated where required by the Safety Requirements.

4. INTEGRATION

4.1. Cyrrus RVSE Overview

Integration of the data from the CH-InFill™ sensor into a given Air Traffic Control System requires a Cyrrus Radar Video Signal Enhancer (RVSE) to be integrated into the existing radar processor and/or display system.

The RVSE cuts out the video data from PSR in the region of the wind farm and replaces it with synthesised video based on Asterix plots from the CH-InFill™. The synthesised video is generated such that it appears to come from the primary radar and is synchronised with it thus producing a seamless transition from the view point of the Air Traffic Controller. Figure 5 shows how the CH-InFill™ is integrated using the Cyrrus RVSE.

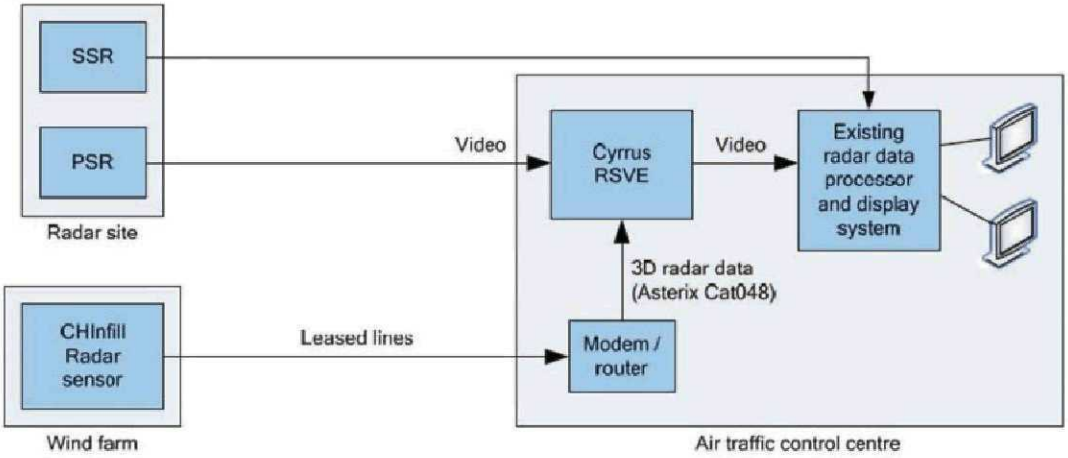


Figure 5. Integration of CH-InFill™ into existing Air Traffic Control System

4.2. Achieving Seamless Integration

The outputs from the CH-InFill™ are inherently 3D, enabling accurate slant range correction with respect to the PSR frame of reference. This virtually eliminates any offsets in the displayed track as an aircraft crosses the boundary into the infill region. With a 2D infill, slant range errors are likely to cause visible offsets in the track, particularly at extreme altitudes.

The update rate from the CH-InFill™ is potentially very high (<5Hz) and can be set to the maximum that is handled by the RVSE. This ensures that the synchronised video is generated very accurately (i.e. reduces the extent of any track predictions that are required) and that it responds rapidly and reliably to aircraft manoeuvres.

CH-InFill™ provides complete coverage of the region immediately above the wind farm – there is no gap in coverage at low level such as might occur with a terrain masked infill solution (i.e. using an alternative PSR source).

5. INSTALLATION AND CONFIGURATION FOR TREADING

5.1. Introduction

The CH-InFill™ system is designed to be installed within the boundaries of the wind farm site, inside a small and conventional, environmentally protected building. Provision should be made for power supply and data link/network connection requirements.

5.2. System Configuration for Treading Wind Farm

At this stage, there is no turbine design layout available; however, the size of the infill patch for the Treading site has been estimated to be a rectangle measuring 3000metres by 2000metres[1]. This estimate assumes turbines might be placed close to the physical site boundaries and allows for extended clutter either side of the turbine. Cambridge Consultants Ltd have indicated that a single 16x16 sensor face would be sufficient to encompass a site of this size and infill up to an altitude of approximately 35,000ft.

5.3. Additional Components and Communications Links

A data server node installed at the site of the CH-Infill™ and one data links (BT Kilostream Leased line or similar) will also be required to enable the distribution of the data to the Cyrrus RVSE components.

5.4. Security

The sensor installation will be enclosed by security fencing and will be provided with the appropriate security services. The extent of the security measures will be defined in consultation with Wind Ventures and DE.

5.5. Microwave Radio Emissions

Microwave emissions attributable to the CH-Infill™ are well below the levels recommended for the general public by the ICNIRP (International Commission on Non-Ionizing Radiation Protection).

Figure 6 shows the radiation levels to which a person would be subjected from the CH-InFill™ transmitter at a given distance (ground level), with comparison to the radiation levels that would typically be experienced from a mobile phone mast. The ICNIRP limit for the general public of 6W/m2 is also shown.

[1] Note that this is an approximate measurement of the site as per the given boundaries and does not negate the need for actual survey of the site to determine the physical footprint of the development once turbine layout has been finalised.

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Date: 29th October 2010

Osprey Consulting Services Ltd

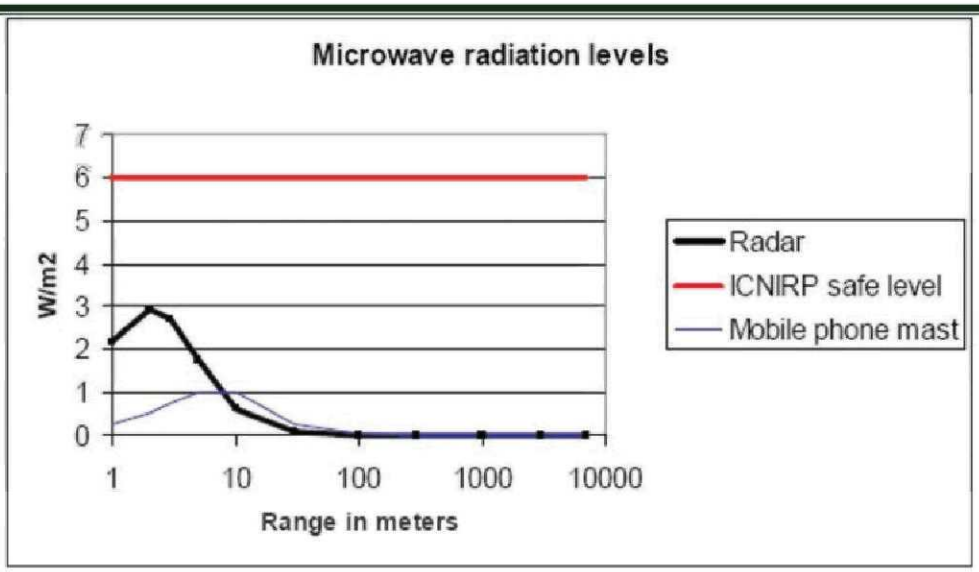
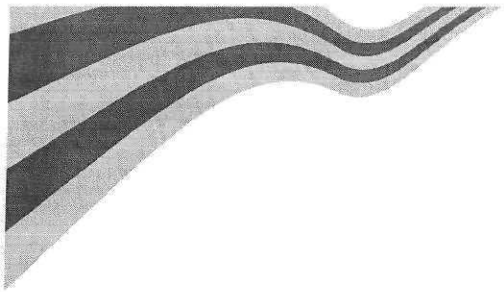


Figure 6. Radiation levels from transmitter

Figure 6 shows that at no point will the maximum radiation levels be considered unacceptable i.e. it would be no more than 3 W/m2 and will drop down to 0.009 W/m2 at 100m and 0.00007 W/m2 at a distance of 1km.

Appendix 16.4 - NATS Response



NATS

NERL Safeguarding
Mailbox 27
NATS (En Route) Plc
Corporate & Technical Centre
4000 Parkway
Whiteley
Hampshire
PO15 7FL

T: 01489 444687
F: 01489 444013
E: natssafeguarding@nats.co.uk

Dear Sir/Madam,

Thank you for your enquiry regarding Wind Farm pre planning.

NATS are committed to supporting Wind Farm developers with planning activities and, in order to improve this process, NATS has introduced three new services which are aimed at helping developers prepare for formal planning applications. The benefits of these advisory services include advance warning of any potential impact on ATC operations, related major issues and therefore a smoother formal application process.

These advisory processes are not mandatory and do not replace the formal submission of applications to the relevant planning authorities nor do they replace NATS obligations under the Safeguarding Directives incorporated in the Town and Country Planning Act. These new processes are self assessment; technical assessment and pre-planning consultation

Self Assessment

This is a free service which outlines the potential areas where the siting of Wind Farms could affect NATS' ATC operations. The provision of this information will enable developers to make their own initial assessment of the likely success or failure of a formal application. This service comprises a number of downloadable maps and associated software and is provided on the British Wind Energy Association Web site which can be found at: -http://www.bwea.com/aviation/nats.html.

The blade tip heights represented on these maps are 20, 40, 60, 80, 100, 120 and 140 metres. It is not feasible to generate images for all possible blade tip heights. These heights are believed to be representative of the heights of the majority of potential developments. For developments with heights other than those specified but in the region of 20–140m a certain amount of interpolation is possible between the images provided. This service and the associated 3rd party software are free.

If after downloading the software and undertaking a self assessment you need additional assistance, NATS provides two additional chargeable services; the technical assessment and pre-planning consultation.

Technical Assessment

This is a high level assessment only and is intended to give a non-binding indication of the impact of a windfarm. It takes a safeguarding perspective limited to the technical elements of NATS navigation, communication and surveillance infrastructure to identify whether a proposed development would impact the service they provide and confirmation, or otherwise, of the outcome. In addition to the assessment, developers are able to have a short dialogue with NATS to understand the detail of the impact. The cost of this service is £750.00 (+VAT).

It is important to note that this service does not include any operational assessment which would be required to identify the effect on the provision of ATC of any technical impact.

Pre-Planning Consultation
The pre-planning consultation service is intended only to assist Wind Farm Developers in de-risking their planning applications prior to formal submission, it does not replace the statutory process, nor does it guarantee future acceptance or rejection of a formal application.

However, this assessment is a comprehensive pre-planning consultation service which comprises a full technical and operational assessment of the proposal. In the technical assessment, the scenario is applied to the tools map, and expert examination of the

NATS

outcome is undertaken. Similarly, a full operational assessment is undertaken which looks at similar operational issues. These two elements are then considered together to give the overall assessment of the likely impact, or otherwise, and where possible suggestions are made to mitigate the impact.

A report is provided which contains the source findings and the summary position and any observations to mitigate the impact where appropriate.

The cost of this service is a fixed fee of £9,450 (+VAT) per development site. Note: Where a technical assessment has already been completed and where the application is unchanged, the cost of the technical assessment will be discounted from the above cost.

I have attached a pre-planning consultancy agreement form and NATS standard Terms and Conditions for your information. If you wish to use either the technical assessment or the pre-planning consultation service, please indicate which one, and sign and return the agreement in the envelope provided along with a document containing all the relevant windfarm details as defined in the attached agreement. Alternatively, if you have any other questions relating to NATS safeguarding services please write to me and I will be pleased to assist.

Yours faithfully

NATS Safeguarding Office

NATSsafeguarding@nats.co.uk
Encl. Application form & Terms & Conditions

Appendix 16.5 - Secondary Mitigation Proposal Response

MINISTRY OF DEFENCE

David Jones
Senior Safeguarding Officer – Engagements
Defence Estates, Kingston Road,
Sutton Coldfield, West Midlands, B75 7RL
Telephone (MOD): +44 (0)790 175 1770
Facsimile (MOD): +44 (0)121 311 2218
E-mail: david.jones2@de.mod.uk

Ross Glover
Wind Ventures Limited
37-43 Balgrave Street
Reading
RG1 1PZ

Ref. 6776

10 Dec 2010

Dear Ross,

Re: Treading Wind Turbine Development Mitigation Proposal

Thank you for your proposal to mitigate the unacceptable interference that the proposed Treading wind turbine development (formerly known as Sutton St Edmunds) will have on the Primary Surveillance Radar (PSR) at RAF Cottesmore. The MoD has considered your proposal with a whole host of operational considerations in assessing the operational risks that it will pose to air traffic control operations.

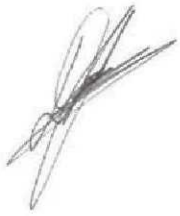
In this instance the MoD is able to accept your mitigation proposal. Provided Wind Ventures and the MoD can come to an agreement on a suitable planning condition, the MoD is prepared to remove its objection to the Treading wind turbine development. I have included a draft at Annex A for your consideration.

I would like to take this opportunity to remind you that while the MoD is prepared to accept your proposed mitigation solution for the RAF Cottesmore PSR and agree a suitable planning condition, it remains sceptical of Wind Ventures' ability to achieve it. The MoD is unaware of any such mitigation solution successfully implemented in an aviation and technical environment similar to that of RAF Cottesmore. However, the MoD cannot argue that your proposed mitigation solution has 'no prospect' of being achieved within the life of the planning consent.

I look forward to receiving your comments on the draft condition included at Annex A.

Kind regards,

DE
DEFENCE ESTATES



Annex A – Draft Planning Condition for Treading Wind Turbine Development

(1) For the purposes of this condition, the Radar Mitigation Scheme ("the Scheme") means a scheme proposed by the developer whose purpose will be to mitigate the impact of the development upon the operation of the Primary Surveillance Radar at RAF Cottesmore ("the Radar") and the air traffic control operations of the MoD that are reliant upon the Radar at the date upon which this condition is approved by the local planning authority ("the Authority"). The Scheme will set out the appropriate measures to be implemented to that end.

(2) No development shall commence unless and until "the Authority" has approved the Scheme in writing. Before approving the Scheme, the Authority shall consult the MoD as to the Scheme's suitability and shall take into consideration the MoD's views as to whether the scheme adequately addresses the MoD's concerns regarding the impact of the development upon air safety.

(3) No turbines shall become operational unless and until all measures required by that time in accordance with the Scheme have been carried out to the satisfaction of the Authority and before authorising the operation of the turbines, the Authority shall consult with the MoD.

(4) In the event that the Authority authorises the operation of the turbines, the developer shall thereafter comply with all other relevant provisions made in the Scheme.