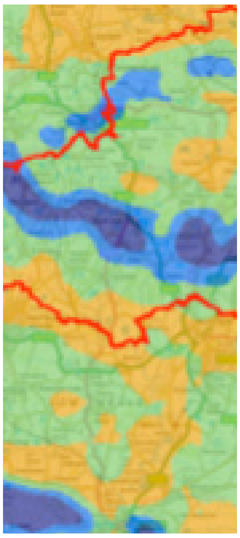
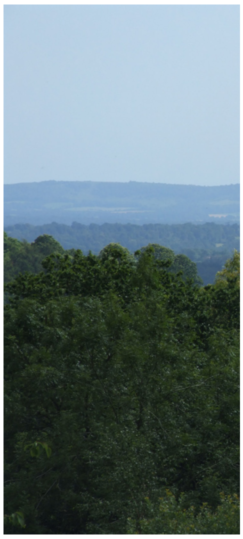
Wind Energy Regional Assessment for the High Weald AONB:

Investigating the reasons for wind energy in the High Weald and the technical and environmental constraints upon it

Furthering understanding of one of England's Finest Landscapes




A report for the High Weald Joint Advisory Committee

By the digital landscape cooperative

May 2009

The High Weald AONB Joint Advisory Committee provides guidance to local authorities and other bodies on implementing the statutory AONB Management Plan and on how local and government policy objectives can be accommodated without damaging the outstanding character of the nationally important landscape.

The High Weald Joint Advisory Committee's Research Programme

Furthering understanding of one of England's Finest Landscapes

The High Weald Joint Advisory Committee's management aims and priorities for the AONB are firmly based on an understanding of the fundamental and defining character of the whole area – that is, those components of natural beauty that have made the High Weald a recognizably distinct and homogenous area for at least the last 700 years and that will continue to define it in the future. It develops its understanding through undertaking work itself, through its specialist team, the AONB Unit, or by commissioning independent reports from others.

The primary purpose of its research programme is to better understand the components of natural beauty. The key components are:

- Geology, landform, water systems and climate: deeply incised, ridged and faulted landform of clays and sandstone. The ridges tend east-west and from them spring numerous gill streams that form the headwaters of rivers. Wide river valleys dominate the eastern part of the AONB. The landform and water systems are subject to and influence, a local variant f the British sub-oceanic climate.
- Settlement: dispersed historic settlements of farmsteads, hamlets and late medieval villages founded on trade and non-agricultural rural industries.
- Routeways: ancient routeways (now roads and Rights of Way) in the form of ridge-top roads and a dense system of radiating droveways. The droveways are often narrow, deeply sunken and edged with trees, hedges, wildflower-rich verges and boundary banks.
- Woodland: a great extent of ancient woods, gills and shaws in small holdings, the value of which is inextricably linked to long-term management.
- Field and heath: small, irregularly shaped and productive fields, often bounded by (and forming a mosaic with) hedgerows and small woodlands and typically used for livestock grazing. Small holdings and a non-dominant agriculture. Distinctive zones of heaths and inner river valleys.

By researching the key components – their history, development, distribution, special qualities, deterioration, damage and loss – we can develop an evidence base for the AONB Management Plan and other AONB policy and guidance.

The JAC's secondary purpose is to better understand how the High Weald landscape can contribute to society – food, energy, water provision, flood protection, recreation, biodiversity and fisheries – without damage to its natural beauty.

Further Information

High Weald AONB Unit
Woodland Enterprise Centre, Hastings Road, Flimwell, East Sussex TN5 7PR
T:01580 879500
E:info@highweald.org
W: www.highweald.org

HIGH WEALD JOINT ADVISORY COMMITTEE

Report author

The Digital Landscape Company

T: 0845 838 1868
W: www.thedlc.co.uk

Executive Summary

This study was commissioned by the High Weald Joint Advisory Committee to assess the resource for wind energy and various technical and environmental constraints upon it. The study was carried out by the digital landscape company who have been active in the wind energy industry since 2001 and have undertaken various other similar studies.

The Study was desk based and made use of ArcGIS digital mapping software to spatially model the wind resource against constraints using various degrees of separation distance. It focuses strictly upon the High Weald AONB area. It is exclusively a resource, technical and environmental assessment and makes no assessment of planning policy and landscape character.

The wind resource in the AONB is moderate, with an average wind speed of 6.25 metres per second with a majority of windspeeds between 5.7-6.6mps. Areas above 6.5mps were designated ‘search areas’ for the purposes of this study.

The High Weald AONB is a highly valued landscape, characterised by an undulating landscape with much woodland. Particular important features include sandstone outcrops, heathland and Gill woodland which occur throughout the area. There is also a significant number of designated areas of international to local importance.

The area also has extensive networks of roads, historic routeways and public rights of way as well as widespread settlements. No existing wind energy projects are known of within the AONB, however a number of proposed, projects under construction and operating projects are within a reasonable distance of the AONB boundary.

The cumulative impact of a widespread and large number of constraints upon search areas was significant. Large areas were effectively removed, leaving the potential for wind energy greatly reduced and highly fragmented.

In addition, the highest restrictions to wind energy may be the impacts of Gatwick Airport, the 2nd busiest airport in the UK, and various radar to the west of the AONB boundary. Any proposals within 30km of these facilities are automatically referred to the Civil Aviation Authority and individual operators. These restrictions effect the whole of the western half of the AONB and are considered to be significant.

The scale and widespread distribution of settlements, buildings, roads and public rights of way also has a very significant impact .

A notable gap in the study has been the paucity of data relating to the energy grid. There is some small impacts from proximity to power lines but this is incomplete. A major issue in any proposals viability is likely to be availability of a grid connection at a reasonable distance from the site. This data was not available for inclusion in this study.

Our conclusion is that the cumulative impacts of the range of constraints analysed in this study, suggest the High Weald AONB is unlikely to be a suitable area for large scale wind energy projects. The area is considered more suitable for single turbines or small clusters of upto 3 turbines, in the .75-2 mega watt capacity range. Site selection and site layout, to avoid or mitigate against the plethora of identified constraints (not withstanding those not covered in this study) is likely to be highly sensitive and problematic. The best potential maybe in community based projects or small scale industrial schemes.

The study was carried out at a macro regional scale. More localised and accurate data would be needed across a greater range of issues (actual windspeed, landscape character, ecology and planning) to assess individual wind energy proposals.

Contents

Maps

Introduction

Wind energy is now recognised as the fastest growing energy technology in the world with annual growth rates estimated around 30%, and some 3000 megawatts (MW) of new capacity installed in the last decade. As energy policy increasingly places emphasis upon renewable technologies, there is likely to be an increasing number of wind farm proposals affecting all regions where a reasonable wind resource can be found. In The UK these are often our important or protected landscapes, such as the High Weald AONB. Of six planning applications in AONB's since 2000 for grid connected wind farms, only one has been granted permission, a 3 turbine Cheverton Downs.

This study has been commissioned by the High Weald Joint Advisory Committee to assess the potential for wind energy as part of a broader study of potential renewable energy capacity in the High Weald AONB. The focus is therefore exclusively The High Weald AONB area.
The Authors, the digital landscape company, have been active in the wind industry since 2001 and have undertaken a variety of similar wind energy assessments across the UK.

Use of this document

This document is intended as technical background information, aiming to inform discussion, decision making and future policy. It should serve as a useful baseline of information which can be built upon and provide a basis for consultation with other public bodies and stakeholders.

This study could be viewed as one of the first stages of the site selection process typically carried out by developers. It focus's upon resource, technical and environmental considerations on a macro scale.

Limitations of the study

The following were beyond the scope of this study and therefore not assessed or considered :

- The merits for or against developing wind energy
- Current planning policies effecting the High Weald area and their implications
- Archaeology, although with careful design it is relatively easy to avoid disturbance or damage
- Potential for small domestic installations or offshore developments
- Landscape character and visual impact
- Detailed site-specific surveys of wind speeds, radar, noise, transport, shadow/flicker, ecology, etc
- Commercial or financial studies
- No attempt to 'designate' any areas as suitable for potential wind energy projects is intended.

Method Statement

The study was desk based and used the ArcGIS 9.1 Geographical Information System (GIS), a digital mapping application, to assess a wide range of digital data. Areas with windspeeds in excess of 6.5 metres per second and above were mapped and digitised identified in the first instance. These formed the basis of 'search' areas for further assessment of various environmental and technical 'constraints'. These were similarly identified, mapped and removed from the search areas. The remaining areas give an indication of the High Weald AONB's spatial capacity for wind energy.

Notes on Separation Distance

Separation distance (the distance a turbine or wind farm is away from features) is currently subject to considerable debate and interest. Principally a Health & Safety concern, a minimum separation distance aims to safeguard people and property from dangers such as ‘icing’ (ice forming on turbine blades and being thrown off at high velocity), structural collapse of the turbine tower, snapping of blades (both uncommon but potentially highly dangerous) and sudden distraction (a particular danger for drivers and equestrians).

The potential risk of damage and injury increases with the number of turbines and their proximity of buildings, structures, dwellings, roads, public rights of way, etc. Lobbyists in the UK point to increasing accident rates as more turbines are commissioned and quote distances of 400m for debris scattered from blade fracture. They suggest as much as a 2km separation from occupied buildings (as used in parts of Europe and the US, 2km from ‘communities’ in Scotland) and a 500m no-go-zone for the public (as used in France).

For the purposes of this study, a commercial wind turbine of 3MW has been used as the basis to determine suitable separation distances. A modern 3MW turbine may have a tower height of 105m and a height to tip of 150m, this study assumes a separation distance of 200m (at least) for rights of way and roads.

Various other specific distances have been used for buildings, urban areas, radar installations, airports etc. These are detailed in the text. The figures used are not intended as recommended distances for any future developments.

Separation distance is also often quoted in the form of a multiple of the turbine height or blade diameter.

Existing Wind Energy Sites

Map 1

Separation Distance : No firm guidance is given concerning separation distance between wind farms. Some planning discussion documents have quoted figures as high as 10km.

There are no notable wind energy sites within the study area. However, there are some sites close to the study area.

Little Cheyne Court is a large 26 turbine NPower wind farm on the Romney Marsh near Lydd, 6km from the Eastern edge of the study area.

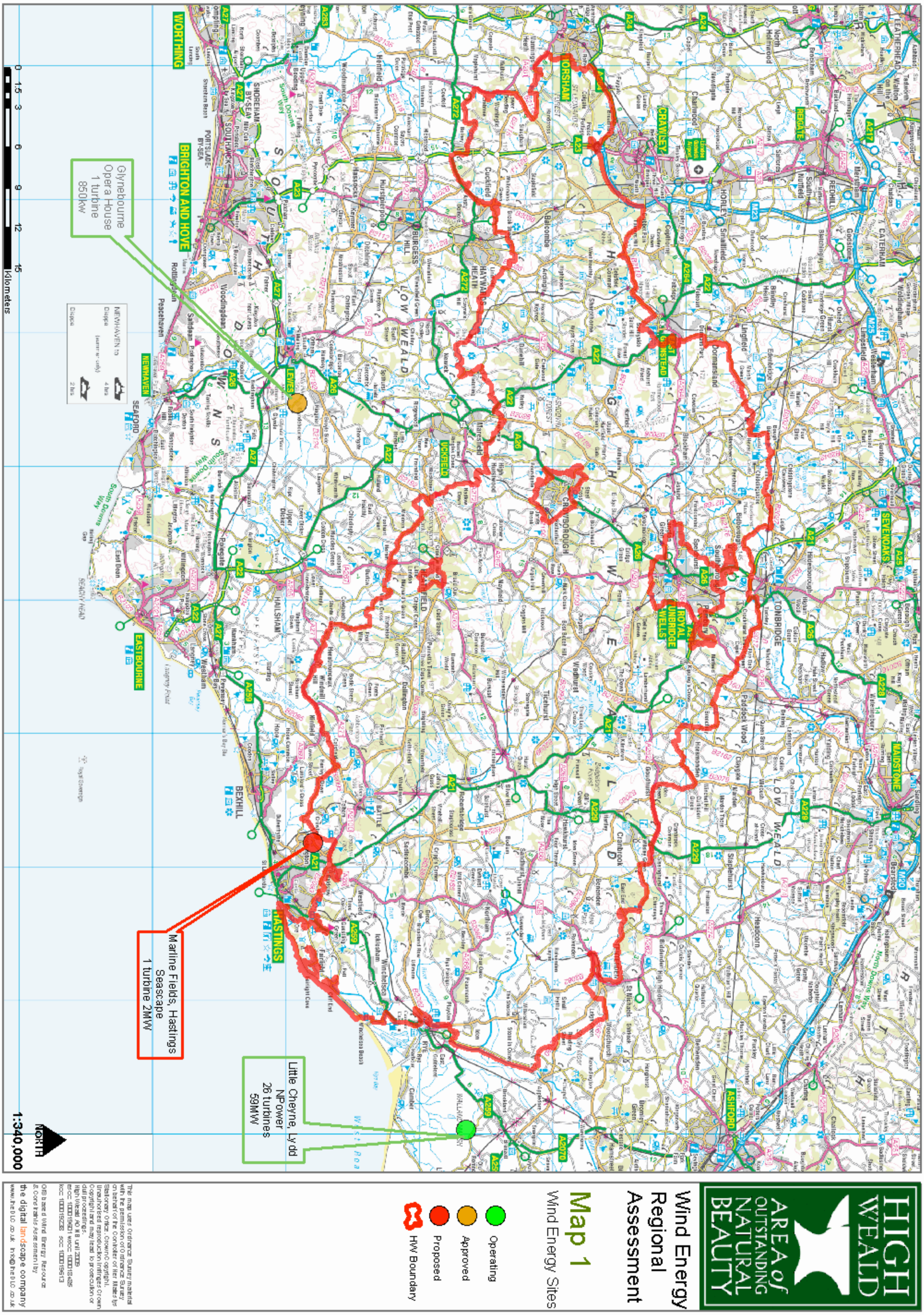
A single 850kw turbine is in the process of being erected at Glyndbourne Opera House near Lewes, off the southern edge of the study area.

A 2MW turbine has recently been proposed at Marline Fields, Queensway, nr Hastings, which is currently in the planning system.

Mitigation :

none

Source Data : British Wind Energy Association


HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 1
Wind Energy Sites
Operating
Approved
Proposed
HW Boundary
Glyndebourne Opera House 1 turbine 850kW
Marline Fields, Hastings Seascape 1 turbine 2MW
Little Cheyne, Lydd NPower 26 turbines 59MW
0 1.5 3 6 9 12 15 Kilometers
NORTH
1:340,000

# The Wind Resource in the High Weald	**Map 2a Wind Speeds map of High Weald** **Map 2b Wind speeds 6.5mps+**

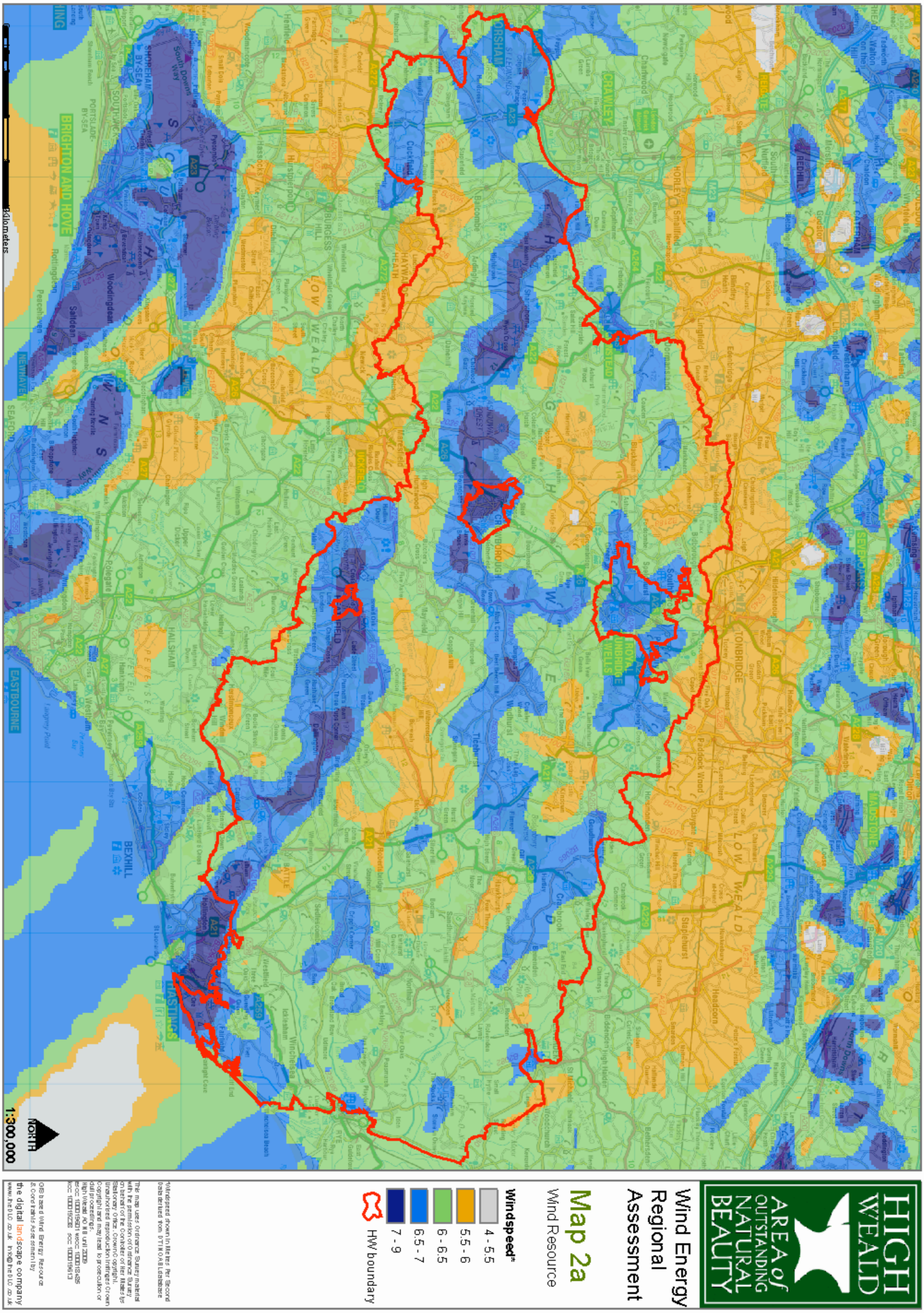
Issues : Requirement of consistent windspeeds in excess of 6-6.5 metres per second

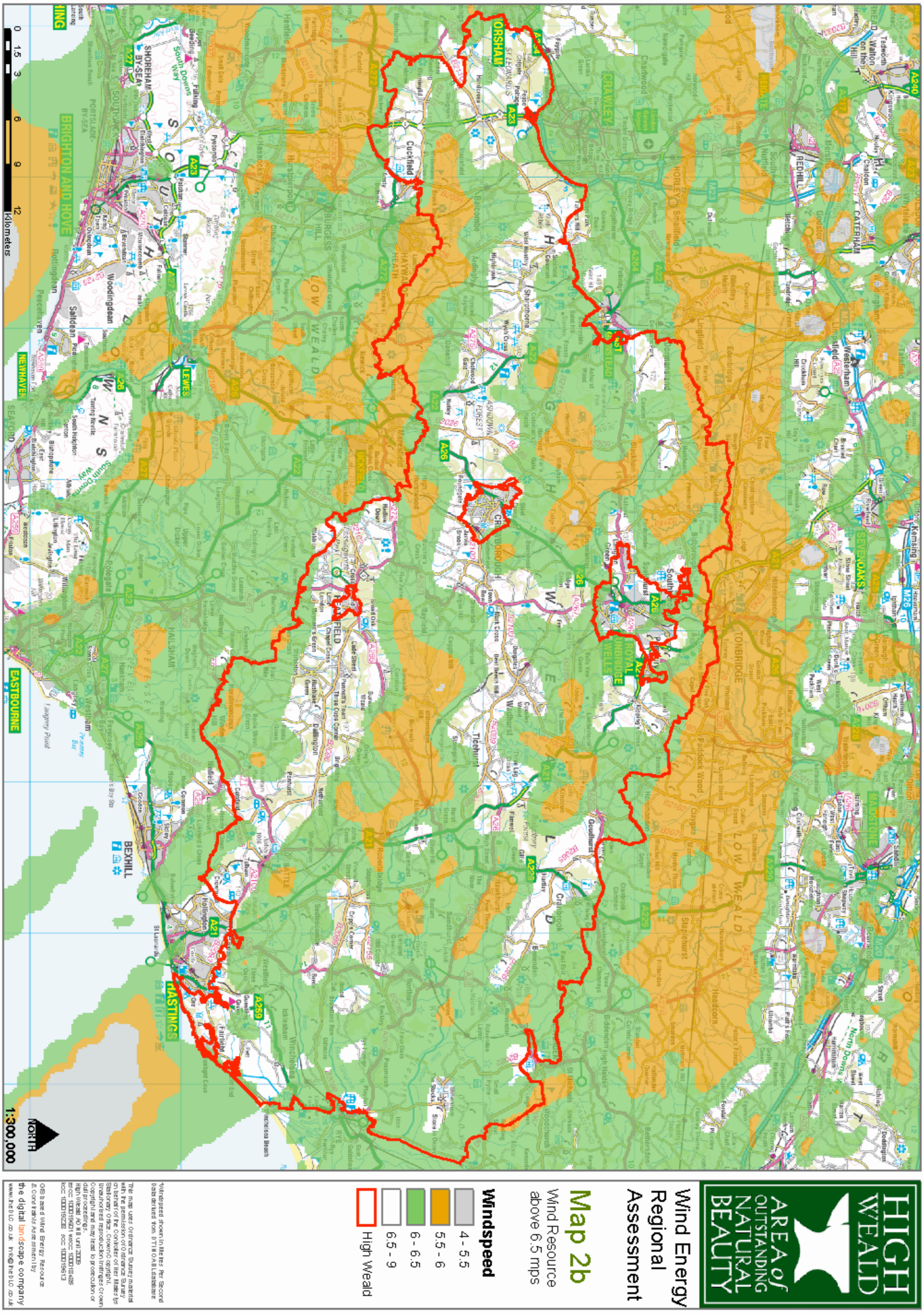
As with any other process exploiting natural resources, the main issue of concern for wind energy developments is the reliable availability of wind at speeds suitable for particular turbine designs. This is central to making any potential project economically viable.

This study has used the DTI's NOABL database of average wind speeds per square kilometre as the basis to map areas where wind speeds of 6.5 metres per second and above occur within the study area. These areas were designated the studys 'search areas'.

wind speeds at 100m above ground level are predominantly in the 5.7-6.6 mps range in the study area with two major corridors in excess of 7mps. The highest average windspeed is 8.6mps while the lowest was 4.2mps.

Source Data : Source Data : DTI NOABL database of average UK windspeeds, Windspeeds recorded in metres per second per km grid square


HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 2a
Wind Resource
Windspeed*
4 - 5.5
5.5 - 6
6 - 6.5
6.5 - 7
7 - 9
HW boundary
NORTH
1:300,000
Kilometers


HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 2b
Wind Resource above 6.5 mps
Windspeed
4 - 5.5
5.5 - 6
6 - 6.5
6.5 - 9
High Weald
the digital landscape company
0 1.5 3 6 9 12 Kilometers
NORTH
1:300,000

TV Transmission

Map 3

Issues : interference with TV reception

Separation Distance : 150 metres

One of the main concerns of householders and the BBC with wind energy development is possible interference with TV transmission.

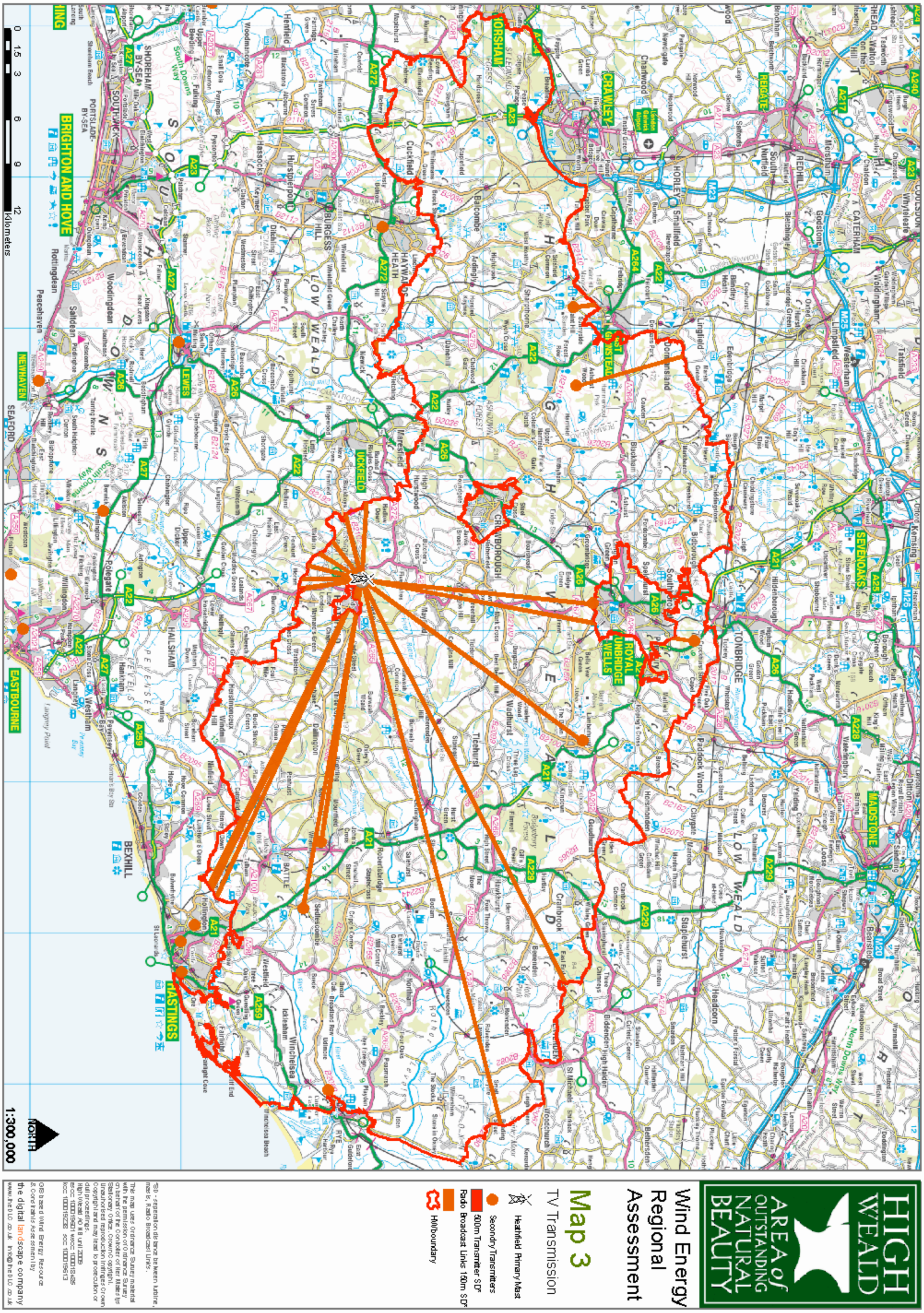
Primary and Secondary TV transmitter masts were mapped along with lines of sight between the Primary Transmitters and their associated group of Secondary masts. These lines of sight are known as Radio Broadcast Links (RBLs).

In general, wind turbines should not be sited either side of these RBLs. A buffer zone of at least 150m either side of the line of sight from the blade tip is required in order to avoid any potential interference.

Mitigation :

In certain cases it is possible to mitigate against interference using various electronic devices but this can be expensive and problematic and is best avoided if possible. The best mitigation is to avoid having turbines within 150m of RBLs.

Source Data : British Broadcasting Corporation


HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 3
TV Transmission
Heathfield Primary Mast
Secondry Transmitters
600m Transmitter SD*
Radio Broadcast Links 150m SD*
HW boundary
the digital landscape company
NORTH
1:300,000
Kilometers
0 1.5 3 6 9 12

## Aircraft and Radar	**Map 4**

Issues : danger to aircraft movements, interference causing clutter on radar

Separation Distances : Radars/Airports 30km consultative
Airfields 3km
Headcorn Area of Intense Parachute Activity 4.5km

Issues between aviation interests and wind turbines is a complex and hotly debated area. The study area lies adjacent to Gatwick Airport, the 2nd busiest civil airport in the UK and a number of smaller airfields occur within the study area. With over 30million passenger movements annually, Gatwick is the busiest single runway airport in the world.

Two thirds of the study area occurs within 30km of Gatwick Airport, its Pease Pottage radar installation and two Distance Measuring Equipment (DME) navigational aids. The CAA refer any proposed wind energy developments within these zones to consultation with individual Airport operators on a case by case basis to determine any issues.

Pease Pottage is home to a major National Air Traffic control ‘Primary Surveillance Radar’ (PSR) with a Secondary Surveillance Radar (SSR), mounted above it. These radar installations are used by Gatwick Airport for managing aircraft movements. Gatwick Airport also has an on-site radar.
The 30km zone indicates that any proposed wind turbine in this zone, maybe within the line-of-sight of the Pease Pottage radar, based on bare-Earth modelling. More detailed modelling using landform and height data and assessments of landscape features for shielding would be needed on a case by case basis.

There are various small airfields and gliding sites around or within the study area. It is usual for these types of site to have at least a 3km consultative zone. Headcorn, to the SE of the study area is an area of intense parachute activity, parachutists may drop anywhere within 4.5km of the site. Individual airfield operators would need to be consulted for any proposed wind energy developments near these sites.
These distances are those recommended in the CAA Policy and Guidelines on Wind Turbines.

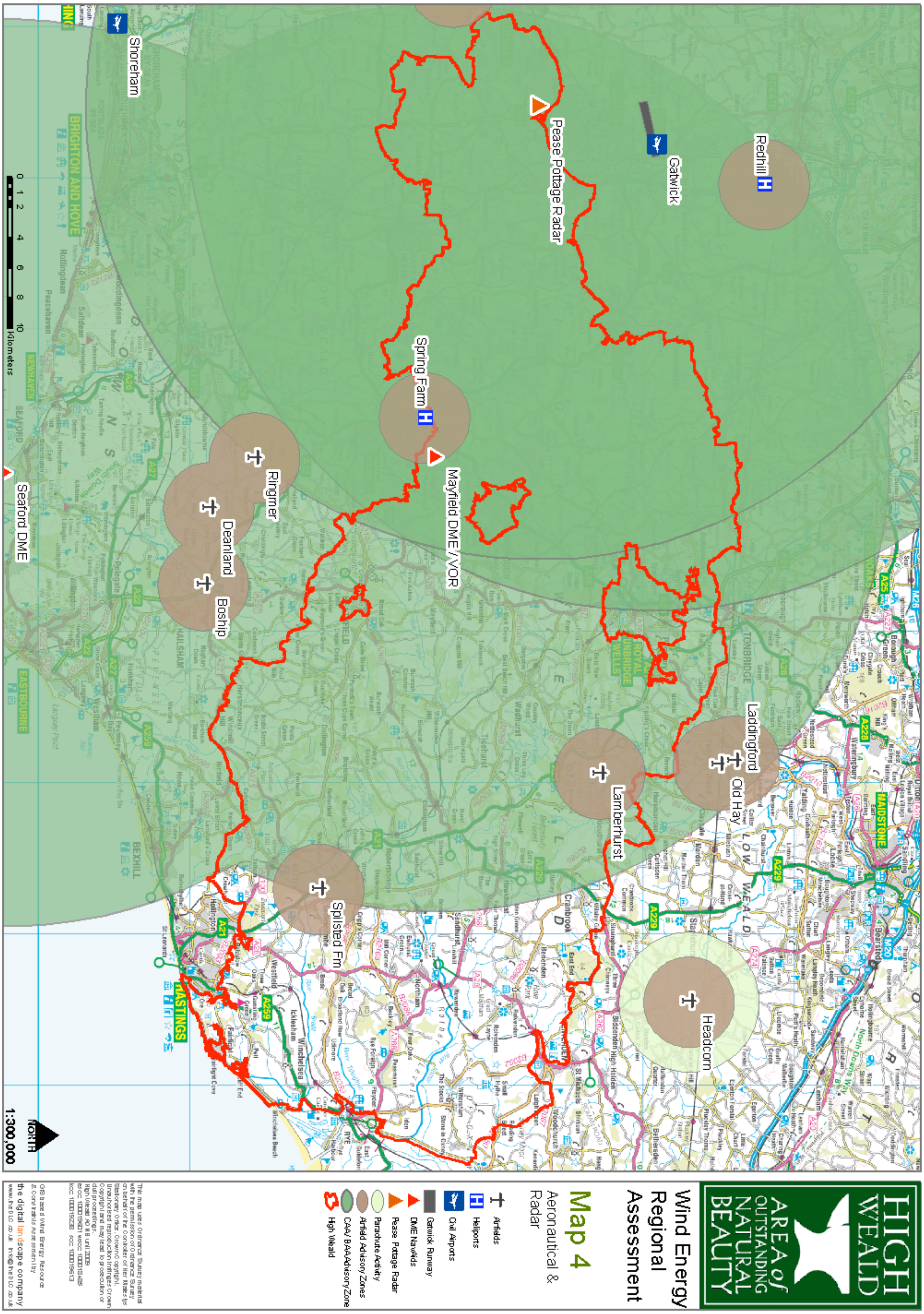
No MOD flying stations, tactical training areas or areas of low flying lie within or intersect the study area.

Mitigation :

In general, wind farms should not be sited within close proximity operational airports, heliports and other such areas or radar. Where turbines are sited on line-of-site with radar, there may be issues with clutter. Clutter effects from wind turbines are not yet fully understood, each wind energy development would have to be considered carefully on an individual basis.

Solutions to clutter include installing more radar, filtering signals via software and moving individual wind turbine locations. Training can also be given to Air Traffic Controllers on specific clutter issues.

Source Data : CAA, MOD



Redhill
Gatwick
Pease Pottage Radar
Shoreham
Spring Farm
Mayfield DME / VOR
Ringmer
Deanland
Boship
Seaford DME
Laddingford
Old Hay
Lamberhurst
Headcorn
Spilsted Frm
0 1 2 4 6 8 10 Kilometers
1:300,000
NORTH
HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 4
Aeronautical & Radar
Airfields
Heliports
Civil Airports
Gatwick Runway
DME NavAids
Pease Pottage Radar
Parachute Activity
Airfield Advisory Zones
CAA / BAA Advisory Zone
High Weald
the digital landscape company

Protected Areas

Maps 5a All Areas
5b International
5c National
5d Local

Issues : Damage or disturbance to statutory protected / locally important habitats, species, landscape features

Separation Distance : PPS22 states Regional planning bodies and local planning authorities should not create "buffer zones" around international or nationally designated areas and apply policies to these zones that prevent the development of renewable energy projects. Therefore, no separation distance has been applied.

The High Weald is characterised by a number of distinctive landscape features such as heathland and sandstone outcrops. There are also a large number of statutory designations such as SSSI's and locally important sites such as nature reserves.

Current Planning Policy Guidance (PPS22) is that developments should not be approved if they have an adverse effect on the integrity or the objectives of the site. In detail, for SPA's and SAC's guidance states that where wind farms are proposed, their development should not cause adverse effects on the integrity of statutory international sites (this includes indirect effects from outside the site).
The conservation objectives and/or reasons for notification or designation of sites of national wildlife importance (inc. indirect effects from outside the site) should not be adversely affected by the proposals.
On sites of regional or local nature conservation importance, wind farm developments should only be permitted should only be permitted if it can be clearly demonstrated that there are reasons for the proposal which outweigh the need to safeguard the nature conservation value of the site.

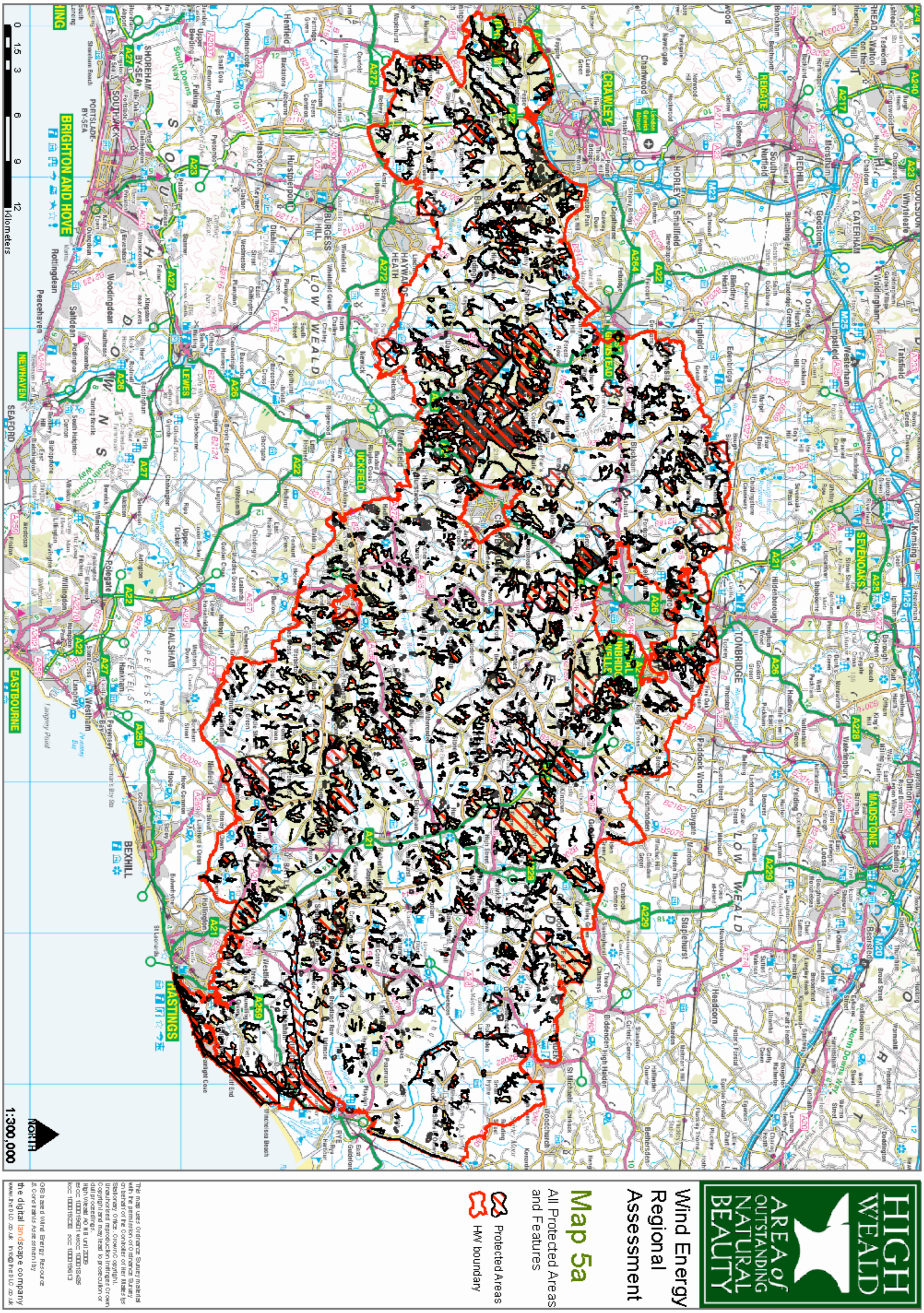
In all cases where development is permitted which would damage the nature conservation value of a site or feature, such damage should be kept to minimum and, where appropriate, conditions and/or planning obligations may be used to provide compensatory measures.

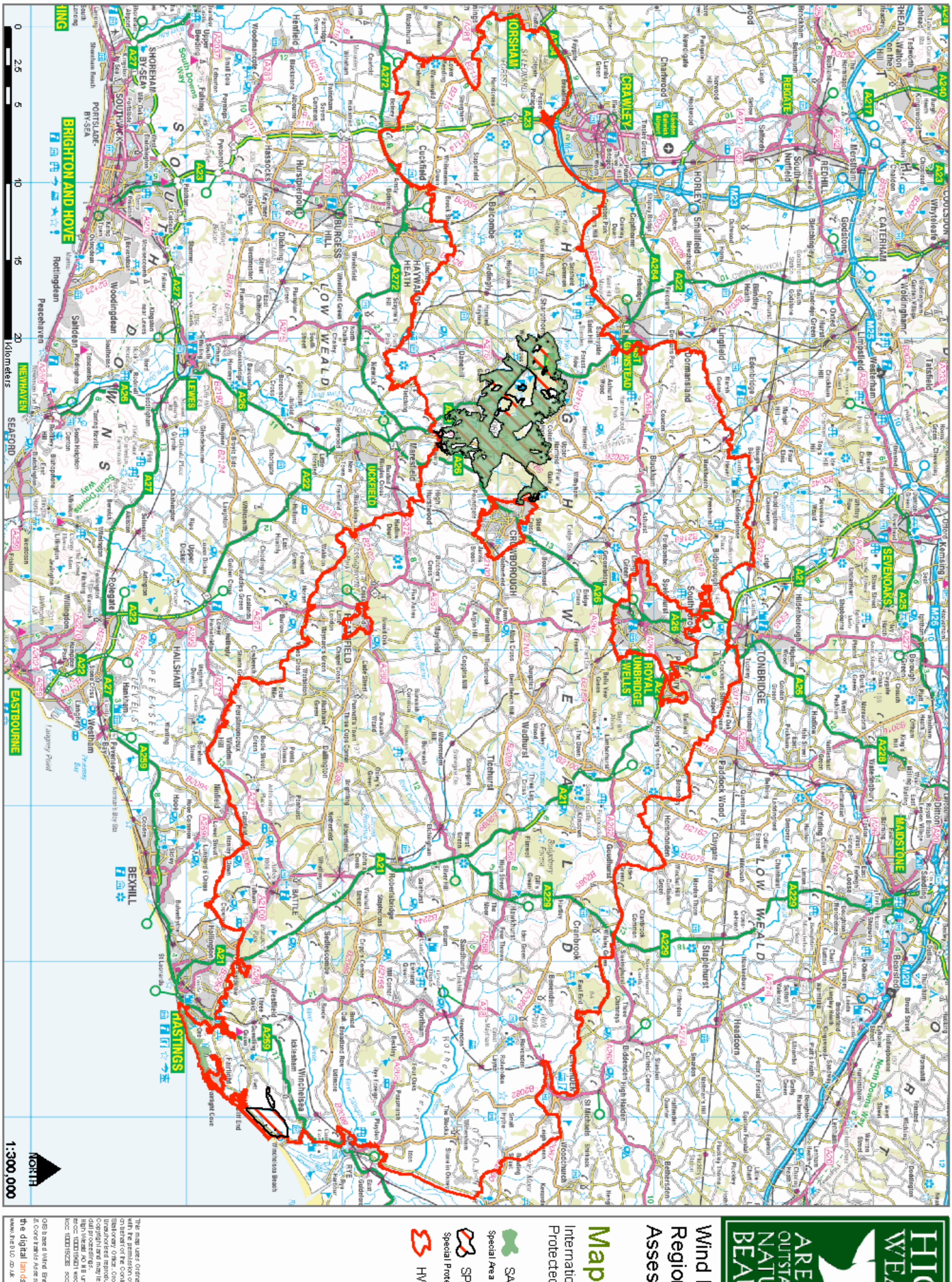
SNCI – Sites of Nature Conservation Importance
LWS – Local Wildlife Sites
SSSI – Sites of Special Scientific Interest
SAC – Special Areas of Conservation
SPA – Special Protected Areas
LNR – Local Nature Reserve

Mitigation :

Various mitigation measures are possible dependant on the habitat or species, including habitat enhancement. These would need to be decided on a case by case basis with the benefit of information gleaned from species surveys and an Environmental Impact Assessment. In practice, most developers would avoid these areas.

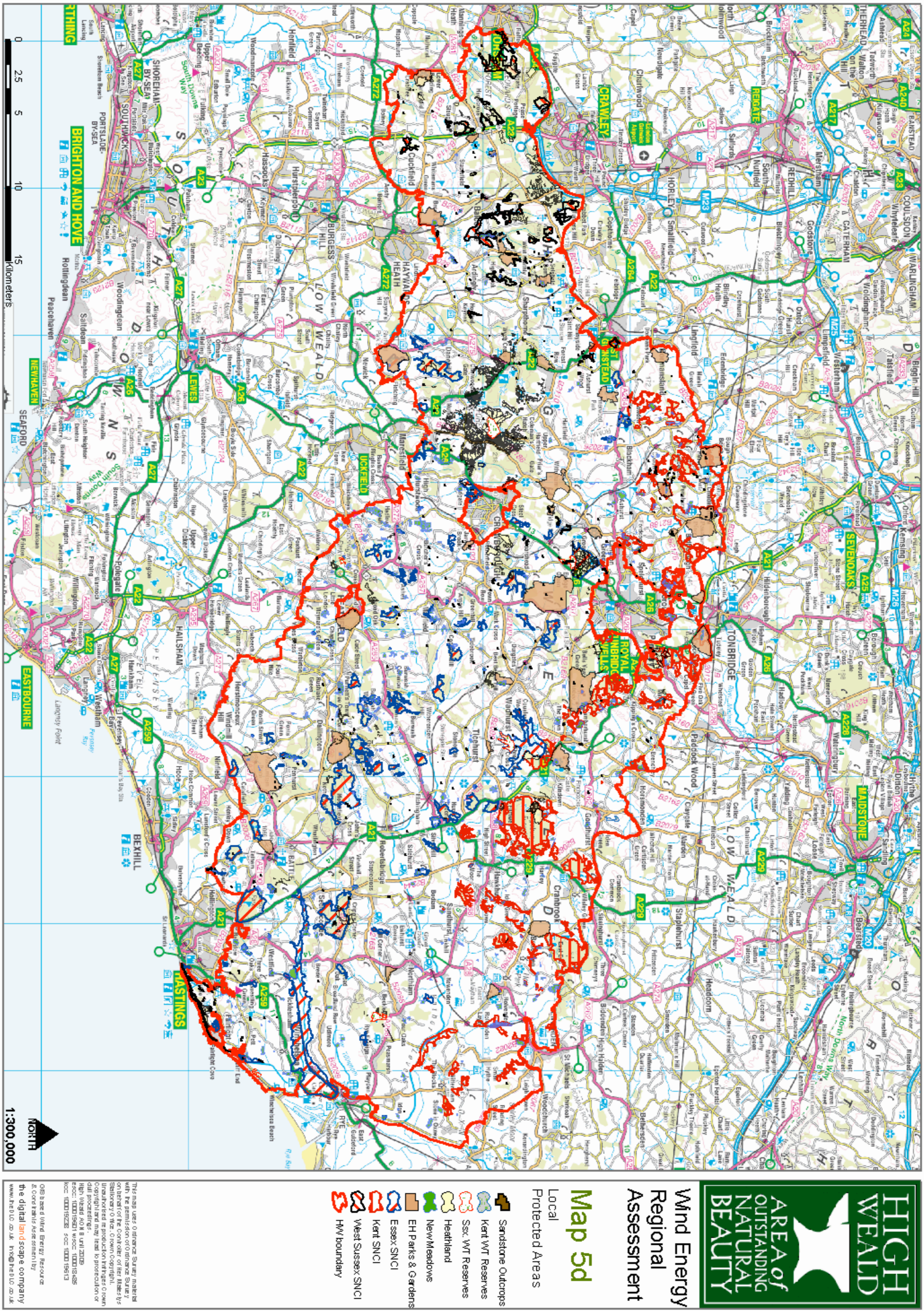
Source Data : High Weald AONB unit


Wind Energy Regional Assessment
Map 5a
All Protected Areas and Features
Protected Areas
HW boundary
NORTH
1:300,000
0 1.5 3 6 9 12
Kilometers
the digital landscape company



HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 5b
International Protected Areas
SAC
Special Area of Conservation
SPA
Special Protected Area
HW boundary
the digital landscape company
NORTH
1:300,000
Kilometers


HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 5c
National Protected Areas
National Trust
Woodland Trust
RSPB
SSSI
HW boundary
the digital landscape company
NORTH
1:300,000
Kilometers


HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 5d
Local Protected Areas
Sandstone Outcrops
Kent WT Reserves
Ssx. WT Reserves
Heathland
New Meadows
EH Parks & Gardens
Essex SNCI
Kent SNCI
West Sussex SNCI
HW boundary
the digital landscape company
1:300,000
NORTH
Kilometers

Public Rights of Way (PROW)

Map 6

Issues : Potential disturbance and danger from turbines in close proximity to PROWs.

Separation Distance : 200m

Turbines sited close to public rights of way may pose disturbance and possible danger to users. This has been a particular issue for horse riders.

Planning policy guidance (PPS22) state that there is to be no statutory distance from a wind turbine to a public right of way. However, safety of the public is an important issue. The minimum separation distance commonly quoted is height to tip+50m or 10% for small turbines.

The British Horse Society recommends a minimum distance of 4 times turbine height from Bridleways to avoid disturbance to horses and their riders. In practice distances of between 150+ have been commonly used in determining planning applications.

Given increasing turbines sizes and to anticipate increasing safety concerns, this study has adopted 200m as a minimum separation distance and removed these zones from search areas.

Visibility of turbines from PROWs has also been an issue in the past for some planning authorities although no specific planning policy guidance exits on this issue.

BOAT	Byway Open to All Traffic
BR	Bridleway
FP	Footpath
RUPP	Road Used as a Public Path

Mitigation :

Rights of Way could be diverted around turbines or new rights of way created. However this is a hotly debated area. The actual separation distance and mitigation measures adopted in any scheme would be subject to detailed micro assessments and consultation with the local Rights of Way Office and users.

Source Data : High Weald AONB Unit


Wind Energy Regional Assessment
Map 6
Public Rights of Way
HW boundary
200m SD*
PROW
Byway Open to All Trafic
Bridle Way
Footpath
Road Used as a Public Path
1:300,000
NORTH
Kilometers

Energy Infrastructure : Grid and Connection

Map 7

Issues : Proximity to powerlines and access to grid connection point

Separation Distance : 450m

After the availability of wind, perhaps the biggest issue for a wind energy developments viability is its proximity to a suitable grid connection. This is because construction costs for power lines and ancillaries can be extremely expensive. Wind farms need to be sited within an economically and technically feasible distance of a suitable grid connection.

The national and especially the local grid networks were designed to provide a conduit for energy generated in large centralised locations and distributed outwards to consumers. The grid was not designed with a host of smaller, ‘embedded generation’ in mind such as hydro or wind energy. Too much embedded generation in any one network can induce over capacity leading to instability and powercuts for consumers.

An important safety issue however, is the need to distance turbines away from powerlines in case of damage. The 2002 Electricity Safety, Quality and Continuity Regulations stated the need to safeguard existing over head lines and suggests a separation distance of at least 5 times the rotor diameter away from any OHL. It is expected that the National Gird will apply this policy to all future wind turbine applications from early 2009. Based on current 3MW turbine rotor diameter, this equates to a separation distance of 450m, which has been used in this study.

EDF is the DNO responsible for the local energy grid for the High Weald.

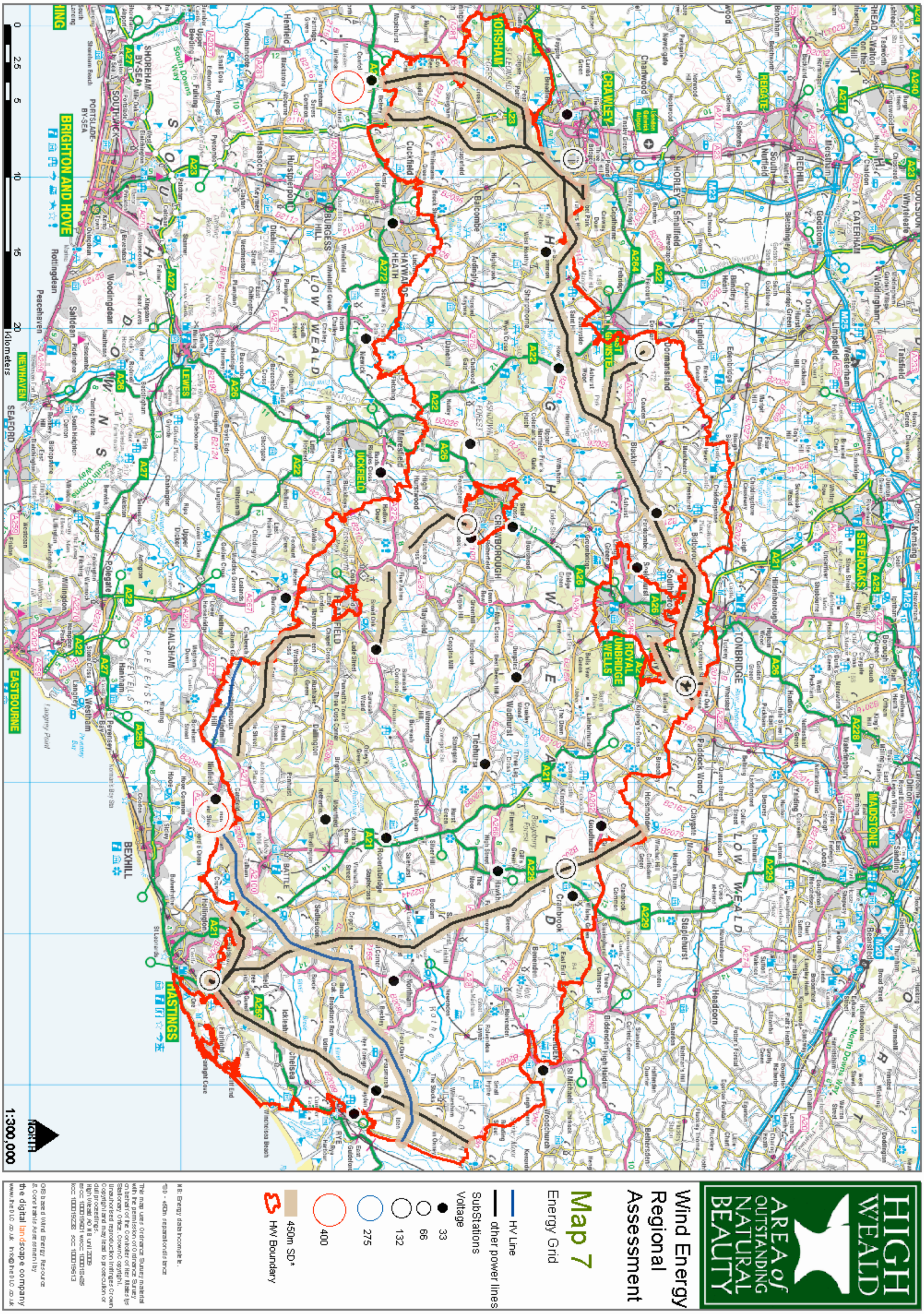
Mitigation :

Careful selection of a suitable site for the project and layout of turbines within it. Various agreements must also be reached for the grid connection and overhead lines, including the an agreement with the local DNO to connect the project to the grid, wayleave agreements with landowners and planning consent. In some circumstances power lines can be buried, but this is extremely expensive.

Source Data :

Unfortunately, electricity generation and distribution have been privatised for some time and obtaining information about the locations of sub-stations and the grid infrastructure is problematic at best. The National Grid are still responsible for the high voltage transmission network but a host of ‘District Network Operators’ are responsible for local networks and a host of others for supplying energy to consumers. All these behave competitively and regard such data as ‘commercially sensitive’.

In the course of this study, it was only possible to gain limited information of the medium to high voltage networks and some substations (400kv to 132kv). Local low voltage networks were not included in the study. The information should therefore be treated as incomplete.


HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 7
Energy Grid
HV Line
other power lines
SubStations Voltage
33
66
132
275
400
450m SD*
HW Boundary
NB: Energy data incomplete.
*SD - 450m separation distance
the digital landscape company
Kilometers
1:300,000
NORTH

# Woodland	**Map 8**

Issues : Potential areas for wind farms ? Protected Gill Woodlands

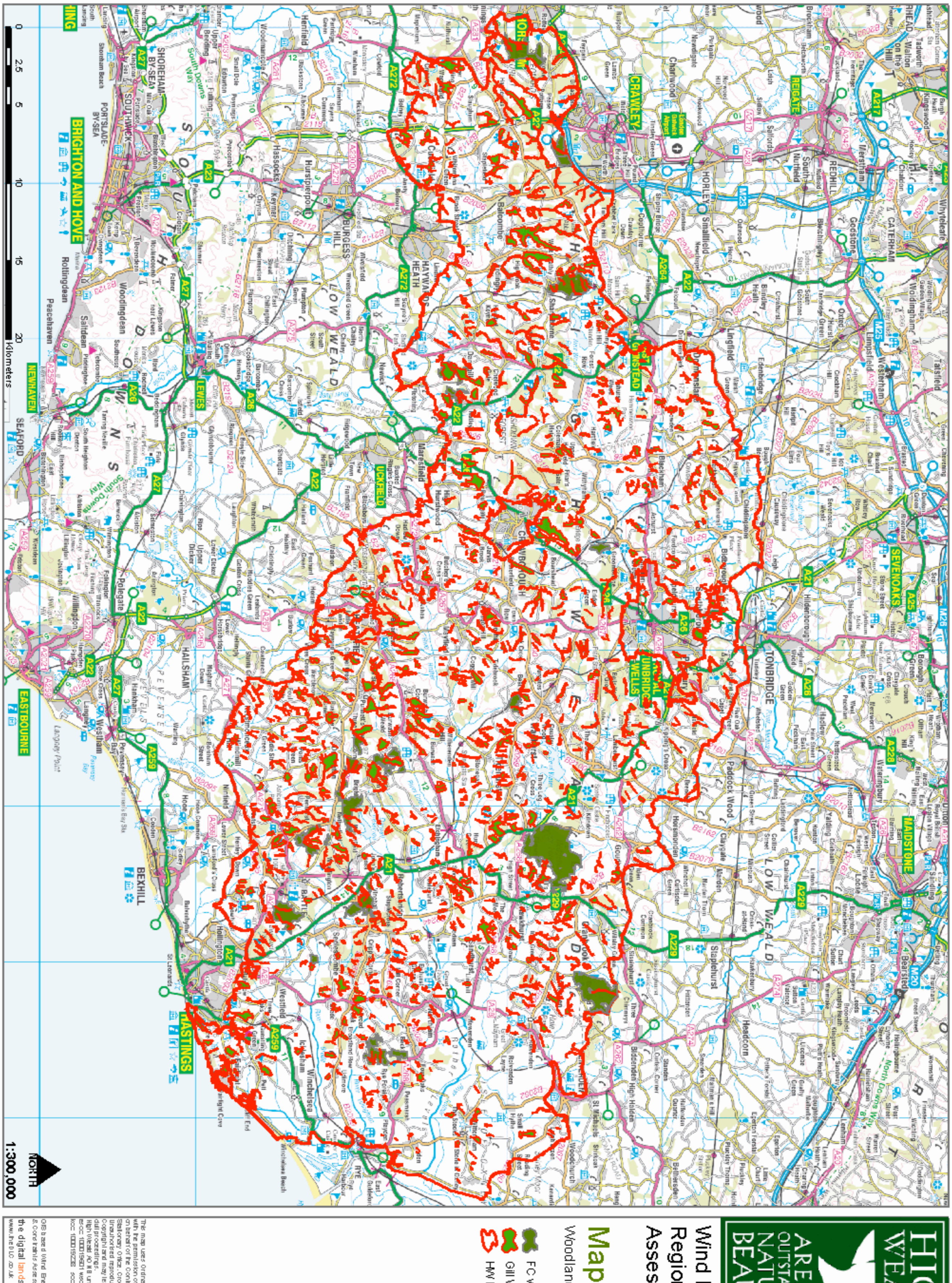
In Wales, the Welsh Assembly Government has identified 6 broad areas across the country potentially suitable for wind energy developments. Much of these areas include land managed by the Forestry Commission Wales. Similarly in Scotland, a number of large wind farms have been built within forests.

Siting wind farms within forestry takes advantage of existing road infrastructure, natural screening from trees and minimal environmental impact. There may be similar potential in the High Weald.

Gill woodlands are important features of the High Weald, making a significant contribution to the character of the area. There is a presumption against any developments in these areas.

Consideration Should also be given to various species inhabiting woodlands. For instance, some bat conservation guidance suggests a separation distance for at least 200m distance to avoid disturbance. Goshawks, dormice and other protected species may also be present.

Source Data : Forestry Commission, HW AONB Unit


HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 8
Woodlands
FC woodlands
Gill Woodland
HW boundary
NORTH
1:300,000
Kilometers
the digital landscape company

Road Infrastructure and Historic Routeways

Map 9

Issues : proximity issues of distraction, public safety

Separation Distance : 200m

In order to ensure safety to the public, guidance from the Highways Agency recommends a separation distance from trunk roads and motorway boundary’s of the Turbine height + 10% for small scale projects and +50m for larger commercial scale turbines.

Planning Policy Statement 22 suggests a separation distance of the fall over height. In detail, the HA also recommends that visual distraction is kept to a minimum, including the effects of flickering and dazzle. A single continuous view of the development is preferable as sudden views of turbines may result in drivers taking their attention off the road. Turbines should also not be located in the immediate vicinity of complex junctions, sharp bends, crossing points and where accident black spots, especially rear-shunts.

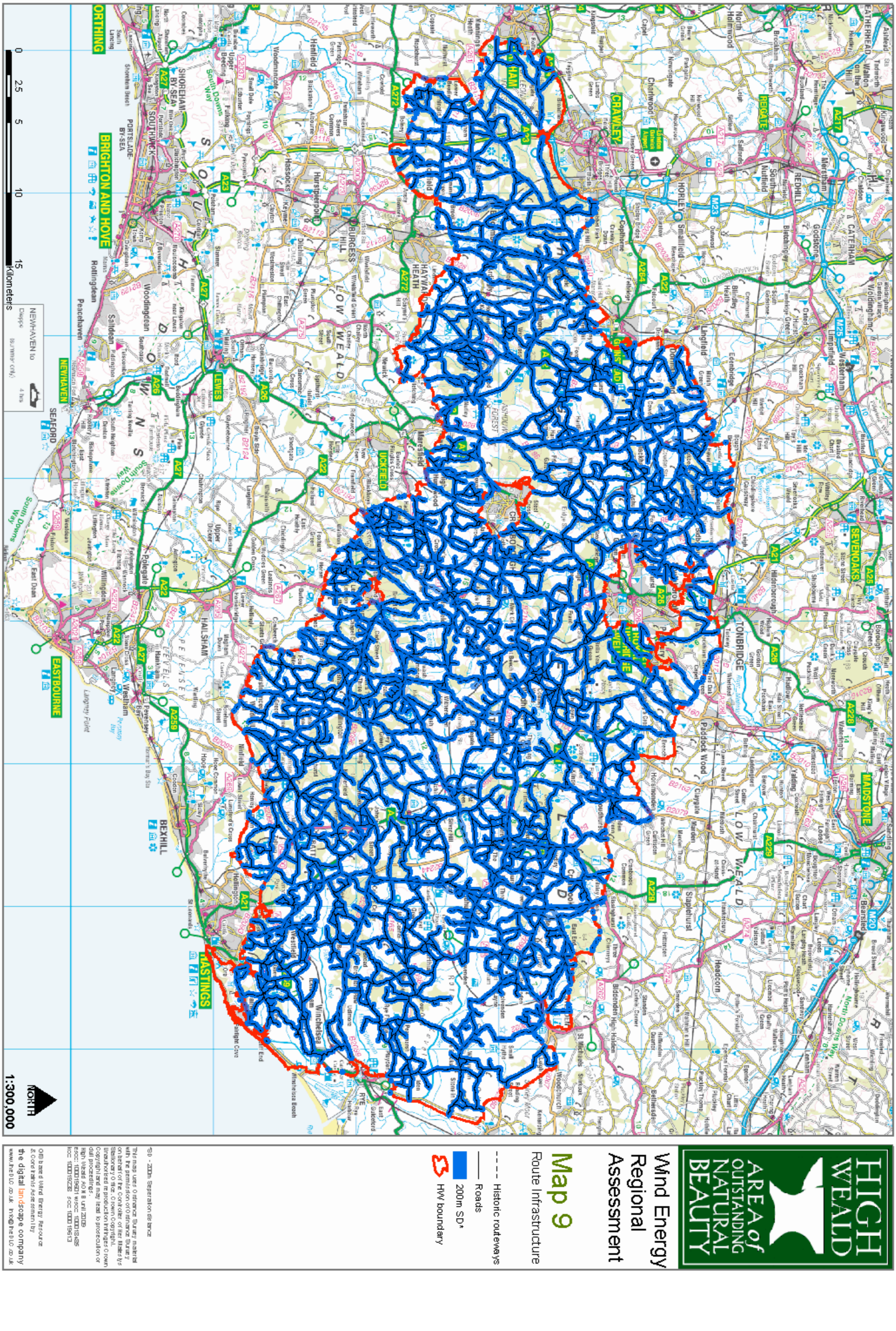
During the construction and decommissioning phases, there will be a requirement to move large pieces of equipment such as turbine blades and sections of tower. Roads will need to be carefully assessed for their suitability in terms of weight and width constraints.

Mitigation :

As 3MW turbines are now reaching upto 150m, a 200m separation distance has been used in this study as the minimum from all roads.

Developers would need to prepare a full transport assessment of the likely impacts of the development on the road network, covering construction, operation, decommissioning and mitigation.

Source Data : High Weald AONB unit


HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 9
Route Infrastructure
Historic routeways
Roads
200m SD*
HW boundary
*SD - 200m Separation distance
1:300,000
NORTH
Kilometers
0 2.5 5 10 15
the digital landscape company
www.tdlc.co.uk info@tdlc.co.uk

# The Built Environment	**Map 10a The Built Environment 10b with 500m SD**

Issues : Shadow/Flicker, Icing, Noise, House Price reduction

Separation Distance : 500m

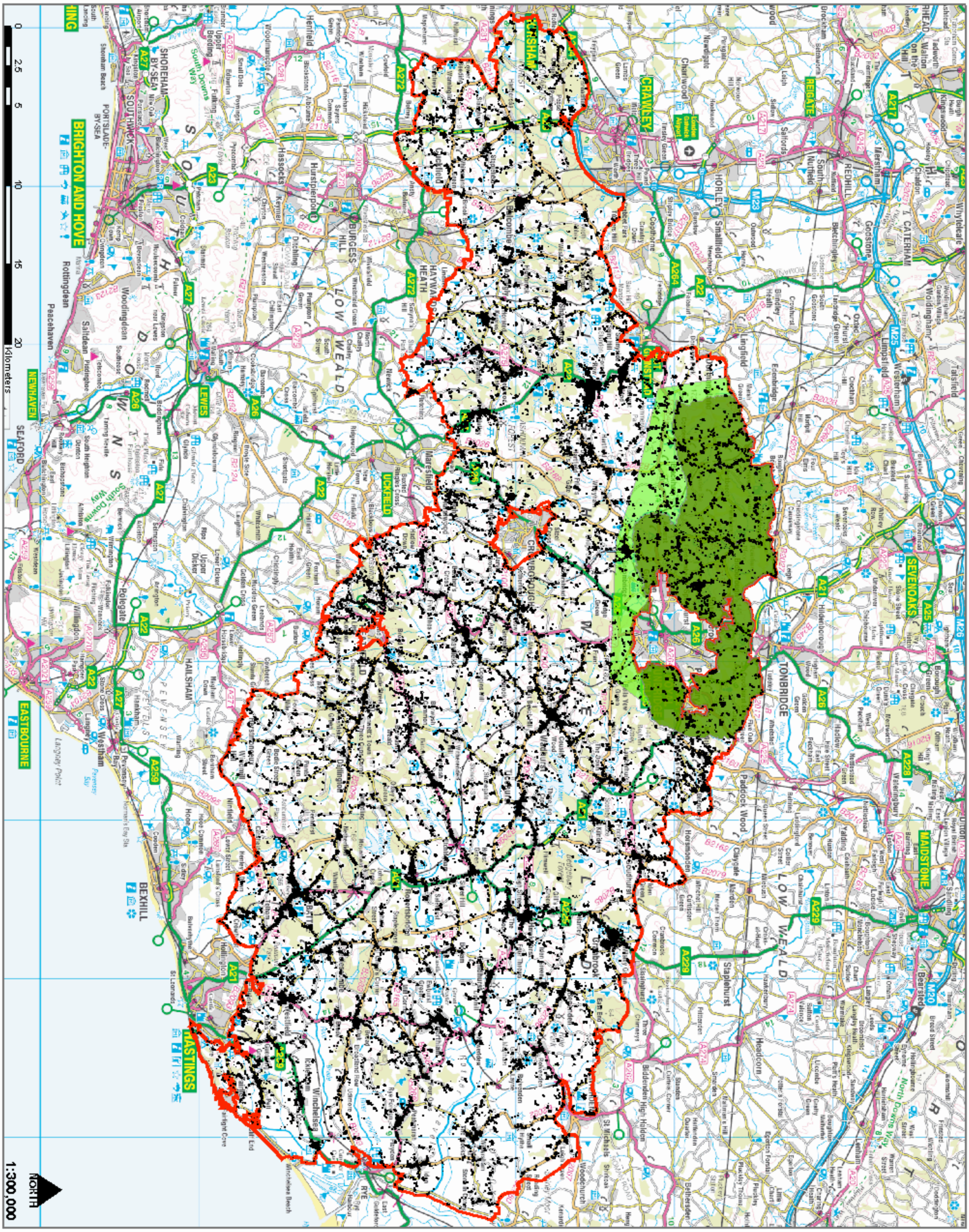
The prospect of wind turbines being built close to homes and buildings is a highly emotive issue and one which generates much debate. Safety issues have been raised about blade fractures, tower collapse and ice thrown from turning blades. Although uncommon events, they nevertheless pose a potential risk. Public health concerns have also been raised regarding noise, the effects of shadow / flicker and the dangers of increased heavy traffic movement during construction.

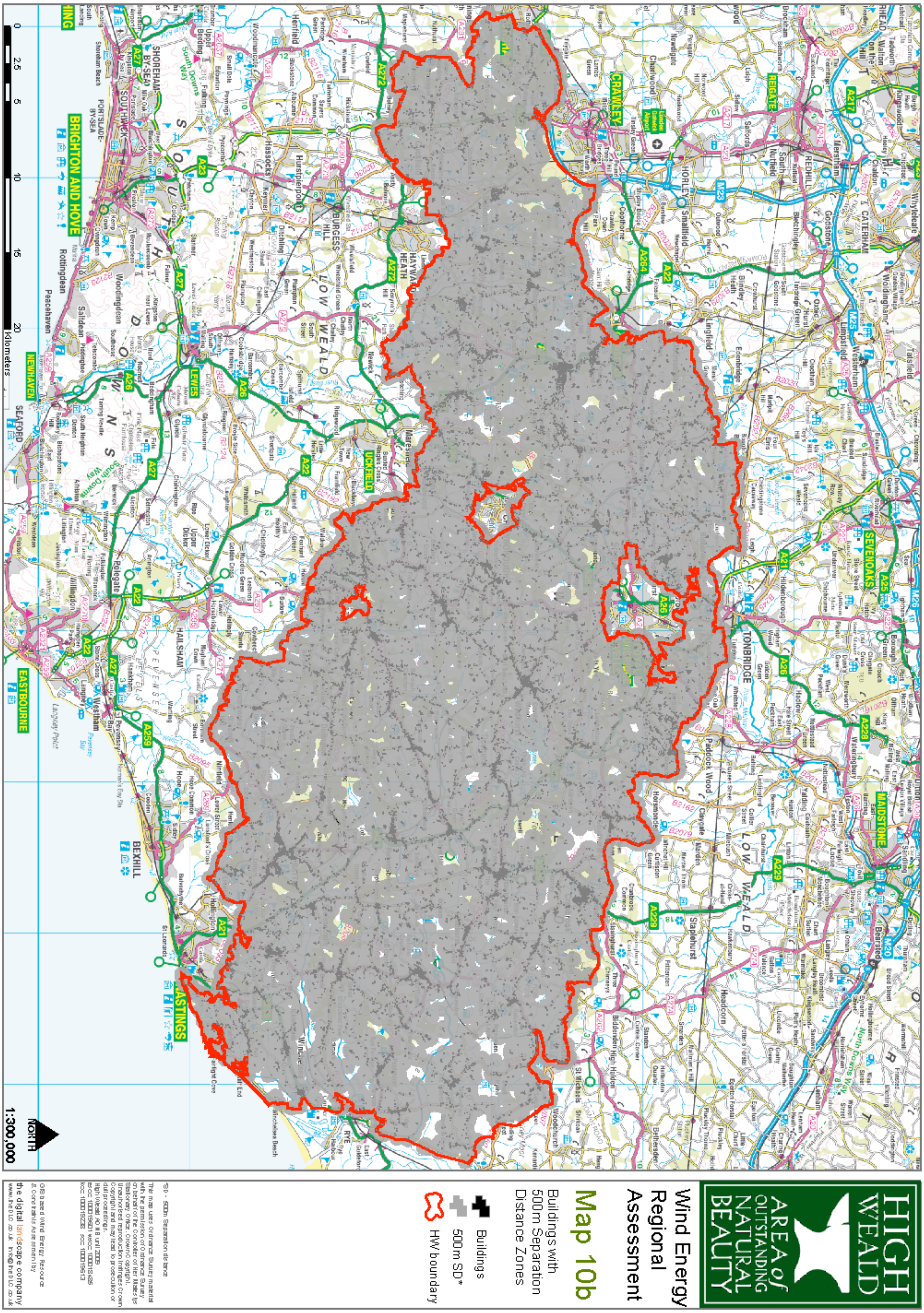
The British Wind Energy Association recommends a separation distance of between 500-800m from occupied buildings. This study has used the minimum 500m distance. In Scotland, the figure used is 2km.

Planning policy guidance will have a major effect on the siting of turbines around settlement envelopes, in greenfield areas, brownfield sites and in proximity to dwellings. It was beyond the scope of this study to assess policy relating to the High Weald and its possible impacts on wind energy development.

Mitigation : Turbines should be sited where they do not pose significant impacts of noise, shadow flicker and fall over.

Source Data : High Weald AONB unit


HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 10a
Built Environment
Development boundaries
Metropolitan Greenbelt
Buildings
Greenbelt
HW boundary
the digital landscape company
NORTH
1:300,000
Kilometers


HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 10b
Buildings with 500m Separation Distance Zones
Buildings
500m SD*
HW boundary
*SD - 500m Separation distance
the digital landscape company
www.thedlc.co.uk info@thedlc.co.uk
0 2.5 5 10 15 20 Kilometers
NORTH
1:300,000

Constraints and Impacts

As yet, there are no commercial wind energy developments in the High Weald, however there are two single turbine projects (one under construction, one in planning) and a large operational wind farm close to the AONB boundary. Any proposed wind energy developments in the area would be unlikely to be affected by these sites.

Impact upon possible wind energy development : LOW — MAP 1 Existing Wind Energy Sites

The BBC's Heathfield Primary TV transmitter lies to the south of the area and there are a number of radio-broadcast links (RBLs) to secondary transmitters across the eastern half and southern parts of the area. Their presence places restrictions on wind energy development due to possible signal interference, especially in the immediate vicinity of the Heathfield Transmitter. Proposals in the south east and eastern half of the area would be somewhat constrained by the number of RBLs, although electronic measures (signal relays) or careful turbine siting may mitigate against interference.

Impact upon possible wind energy development : MODERATE — MAP 3 TV Transmission

There are a number of aeronautical sites (Map 4) in the western half of the study area including Gatwick Airport, the Pease Pottage Primary Surveillance Radar and the Mayfield DME navigation aid. These are potentially a serious restriction to any proposed wind energy developments in the west of the area due to their proximity to extremely busy airspace and possible interference with important radar installations. The CAA will require any proposals within 30km of Gatwick/Pease Pottage/Mayfield to consult with airport and radar operators at the earliest opportunity and assess the level of impact upon radar and air traffic safety.

Two airfields, one at Lamberhurst and another near Sedlescombe on the A21, also potentially restrict any wind energy developments within 3km.

In our view, it is unlikely that a suitable site would be found in the western half of the area for a large scale development. Single turbine or small-cluster developments may be possible if there is (a) sufficient screening (hills, forests, buildings etc) between the turbines and line of site with radar installations and (b) no danger to aircraft.

Impact upon possible wind energy development : HIGH — MAP 4 Air and Radar

As an AONB, the High Weald hosts a significant number of important sites and habitats. These span the breadth of designations, from local sites to sites of international importance. Sites vary considerably in sizey and are widespread throughout the area. Ownership and management is undertaken by a similarly diverse range of public and private bodies. It is presumed that developers would avoid proposals to erect turbines within these areas, indeed any such proposals would be rejected by a host of interested stakeholders.

The size and spatial distribution of these areas has a significant impact upon the the potential for wind energy, greatly fragmenting and reducing potential areas. Additionally, while there is specifically no set separation or 'buffer' distance in planning policy guidance around these sites, in practice there is a presumption to protect their integrity which may well require a suitable separation distance from turbines.

Impact upon possible wind energy development : HIGH — MAPs 5a-5d Protected Areas

The High Weald has an extensive network of public rights of way such as footpaths and bridleways criss-crossing the whole of the area. There is currently much debate regarding health and safety concerns among PROW users, particularly equestrians. While accidents involving turbines are rare, they may pose some risk. Currently there is no statutory separation distance between turbines and PROW. However, guidance suggests 3-4 times height to blade tip, which with modern 3MW turbines equates to a separation of 200 metres, Extrapolating such a separation distance to all the PROWs in the region creates a significant restriction to the potential for wind energy, due to the size of the area involved and further fragmentation of search areas.

Impact upon possible wind energy development : HIGH — MAP 6 PROW

A significant issue for the financial viability of any proposed wind energy development, is the availability of a connection to the National Grid within a suitable distance of the site. Unfortunately, it was not possible to obtain sufficient data of powerline and substation infrastructure to speculate on grid implications for proposed wind energy projects. The National Grid recently adopted a figure of 450m as the recommended distance turbines are located from overhead lines of 450m. Indications are that this would not have a significant impact upon search areas although data on overhead lines was limited.
With the dense population and high number of business/industrial sites in the area, it is assumed that single turbine or small cluster developments would be able to obtain a viable grid connection.

Impact upon possible wind energy development : LOW MAP 7 Energy

An important characteristic of the High Weald are its extensive tracts of woodland. An important component of these are ancient gill woodlands which occur in small steep sided valleys. The High Weald hosts nearly all the gill woodland occuring in SE England. Work is ongoing to identify and locate these woodlands, but a significant number have been found. Again, they occur right across the area and are of varying size. It is assumed that there is a presumption against any development in these areas, restricting the opportunities for developing wind energy through further fragmentation of search areas across the region.
There are also a number of Forestry Commission woodlands in the area. A number of wind energy developments in Scotland and Wales have been sited in FC woodlands, taking advantage of natural screening by trees, good access and low impacts upon important sites and ecology There maybe similar opportunities in the High Weald.

Impact upon possible wind energy development : MODERATE MAP 8 Woodlands

As with any densely populated region, the High Weald is criss-crossed with a very extensive network of roads of all classes. These can be narrow, twisty and heavily used. While access to sites maybe presumed to be good, such characteristics may impede getting compoents such as blades and tower sections to the site. Site availability is restricted by The Highways Authority recommended separation distances. For small scale projects a seperation distance of turbine height+10% and +50m for larger commercial scale turbines. This equates to a distance of some 200m for modern 3mw turbines and represents a significant restriction when applied to all roads in the region.
There are also remnants of historic routeways throughout the region. It is presumed that these routes would be similarly protected from any proposed development.

Impact upon possible wind energy development : HIGH MAP 9 Roads

The High Weald is a highly populated area and has an extensive network of scattered settlements which vary greatly in size from small isolated dwellings to significant urban areas such as Battle (c.6000 pop).
Significant areas of Greenbelt also occur to the north of the area with accompanying restrictions on the type and scale of allowed developments. These are likely to impact upon any proposed wind energy developments, although small single turbines may be more easily accomodated.
The most significant impact comes when the minimum 500m separation distance is applied to buildings. This has a huge impact upon search areas and is considered a serious restriction.

Impact upon possible wind energy development : VERY HIGH MAPs 10a, 10b Roads

The Wind Resource and Constraints

GIS digital mapping software was used to compare areas with wind speeds in excess of 6.5 mps (search areas) against the constraints identified in this study. Modelling techniques were used to remove constraints from the search areas.

The wind resource in the High Weald AONB is moderate, with an average windspeed of 6.25 metres per second based on the industry standard NOABL dataset. A maximum of 8.6mps is recorded for the High Weald and a low of 4.2mps, using this data.

NOABL gives a macro indication of average windspeeds and is useful for macro level analysis. More accurate data is required by developers during the site selection process which would involve erection of meteorological monitoring masts to record actual windspeeds over a long period. Erection of wind monitoring masts would be subject to the normal planning process.

Wind speeds for the High Weald and surrounding area are shown on map Map 2a.
Areas with wind speeds in excess of 6.5 mps are shown on Map 2b. These were designated as 'search areas' showing a potential for wind energy, for the purposes of this study.

Some constraints had a very significant impact upon the search areas. These served to drastically reduce and fragment search areas. Principally, these were :

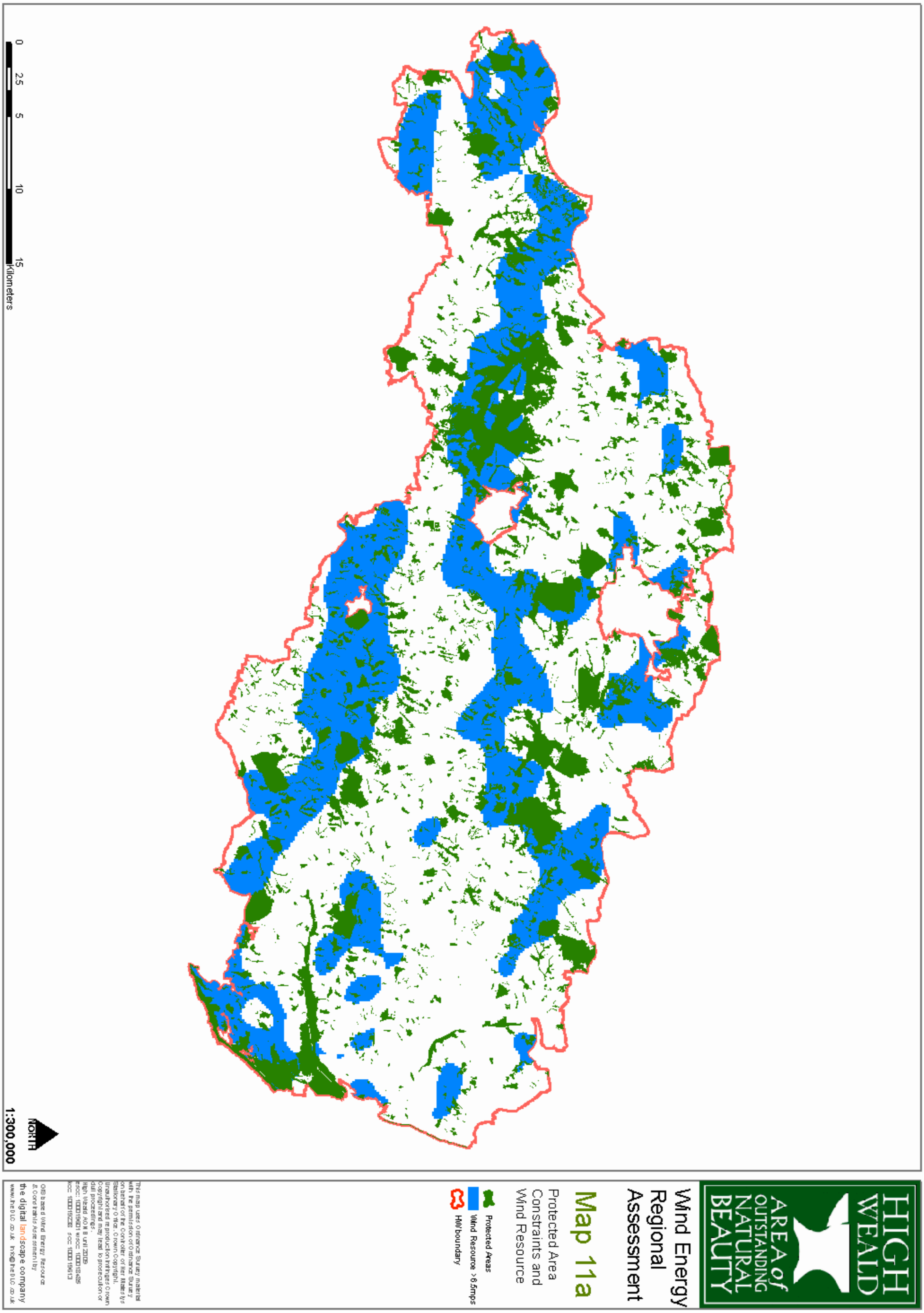
- Number and spatial extent of protected areas — Map 11a
- Road and Public Rights of Way networks — Map 11c
- CAA consultative zones for aeronautical and radar — Map 11d
- The built environment — Map 10b

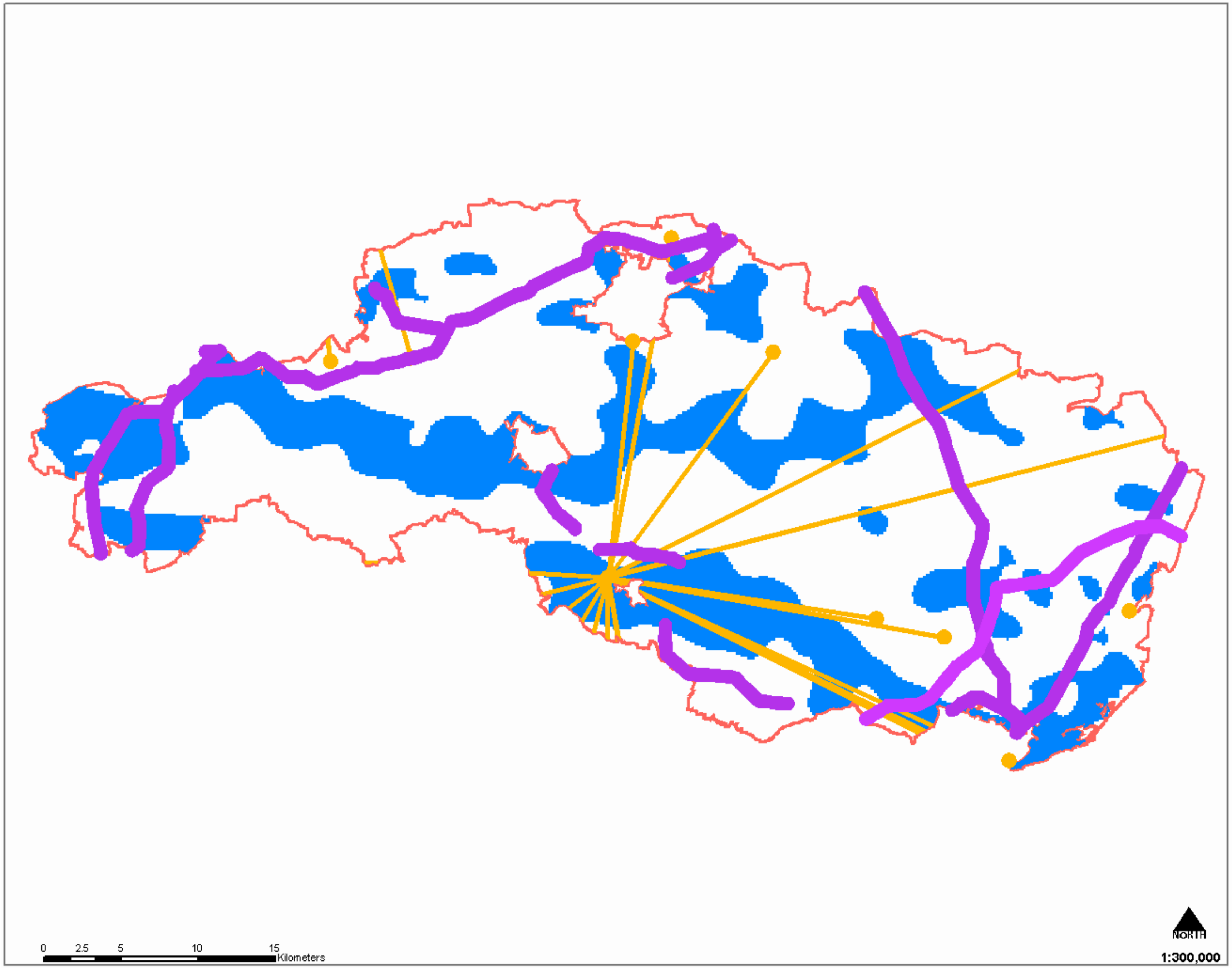
The study has used the full separation distances as recommended in a range of guidance documents, including PPS22, on the siting of wind turbines. In practice, on a micro scale it may be found that compromises can be reached between turbine locations and separation distances from features, sites buildings etc. For instance, the full separation distances may not be thought to be required in cases such as :

- An affected footpath is actually little used and in a remote area
- Natural screening hides the turbines from view from a nearby road
- A householder is happy with a distance of 459m rather than the recommended 500m

Any such compromises would need to be agreed between the developer, the planning authority and interested stakeholders on a site by site basis.

Map 11e shows the remainder of the search areas, broadly indicating the remaining potential for wind energy on a macro scale.


HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 11a
Protected Area Constraints and Wind Resource
Protected Areas
Wind Resource >6.5mps
HW boundary
the digital landscape company
0 2.5 5 10 15
Kilometers
NORTH
1:300,000



HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY

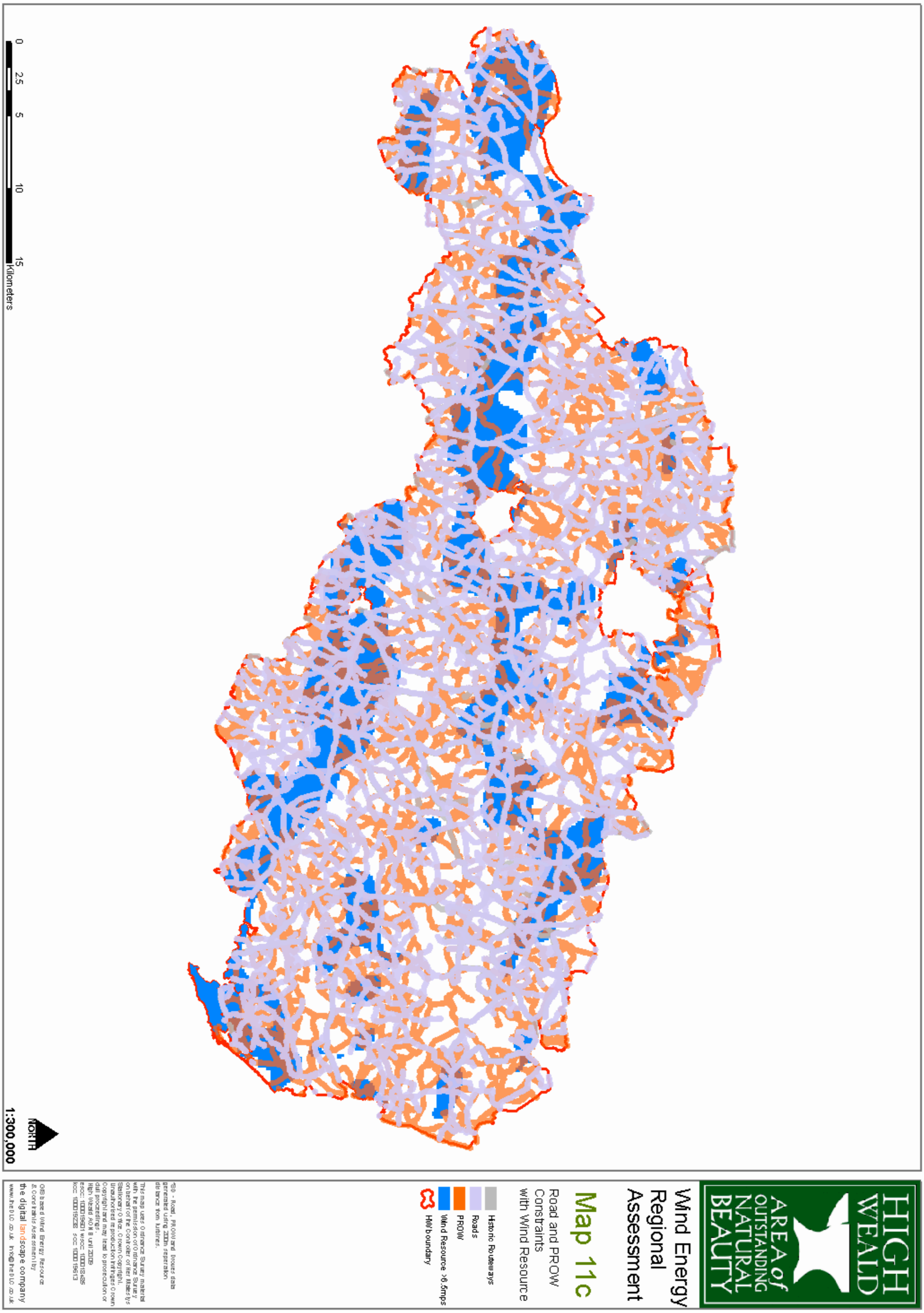
Wind Energy Regional Assessment

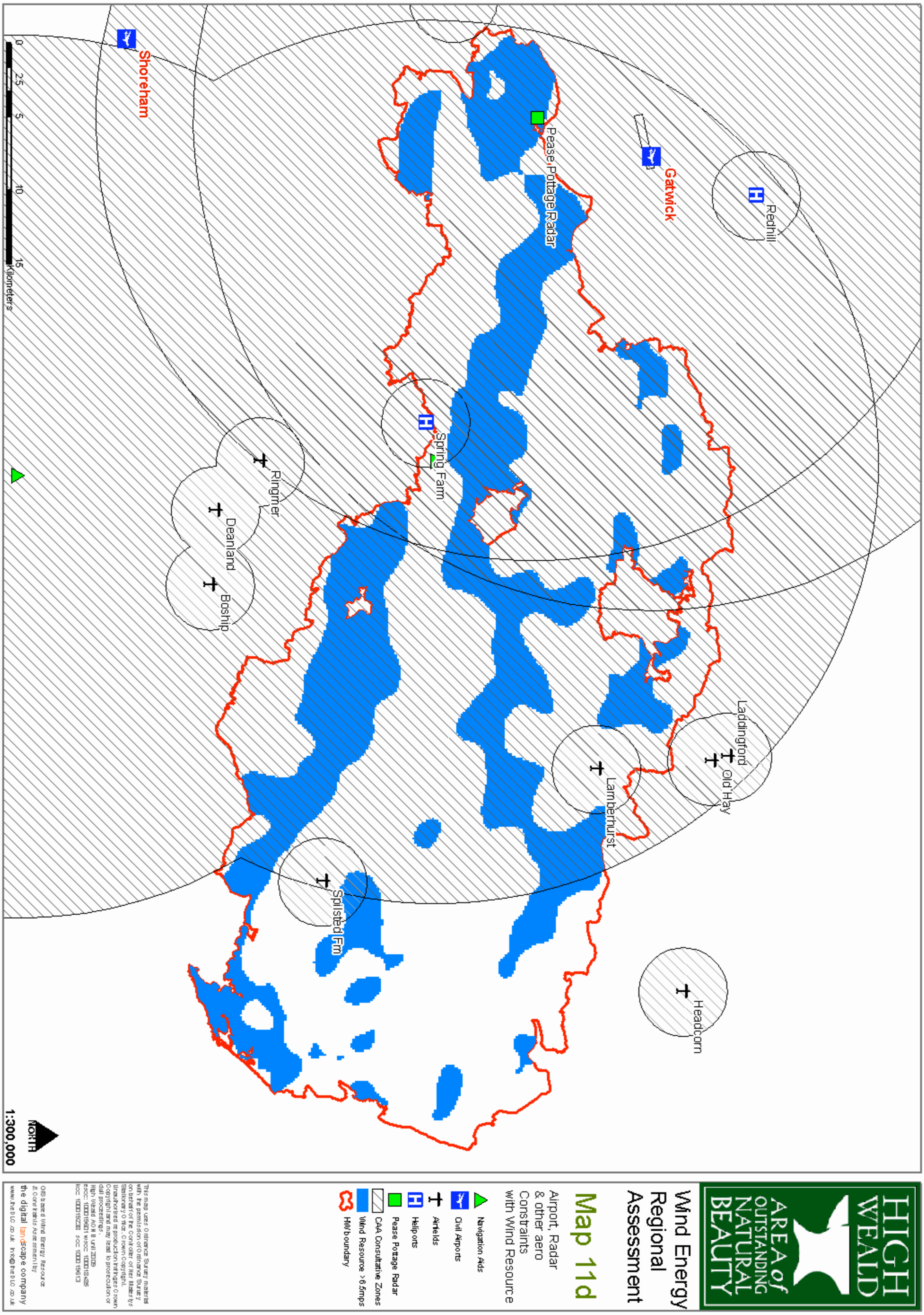
Map 11b

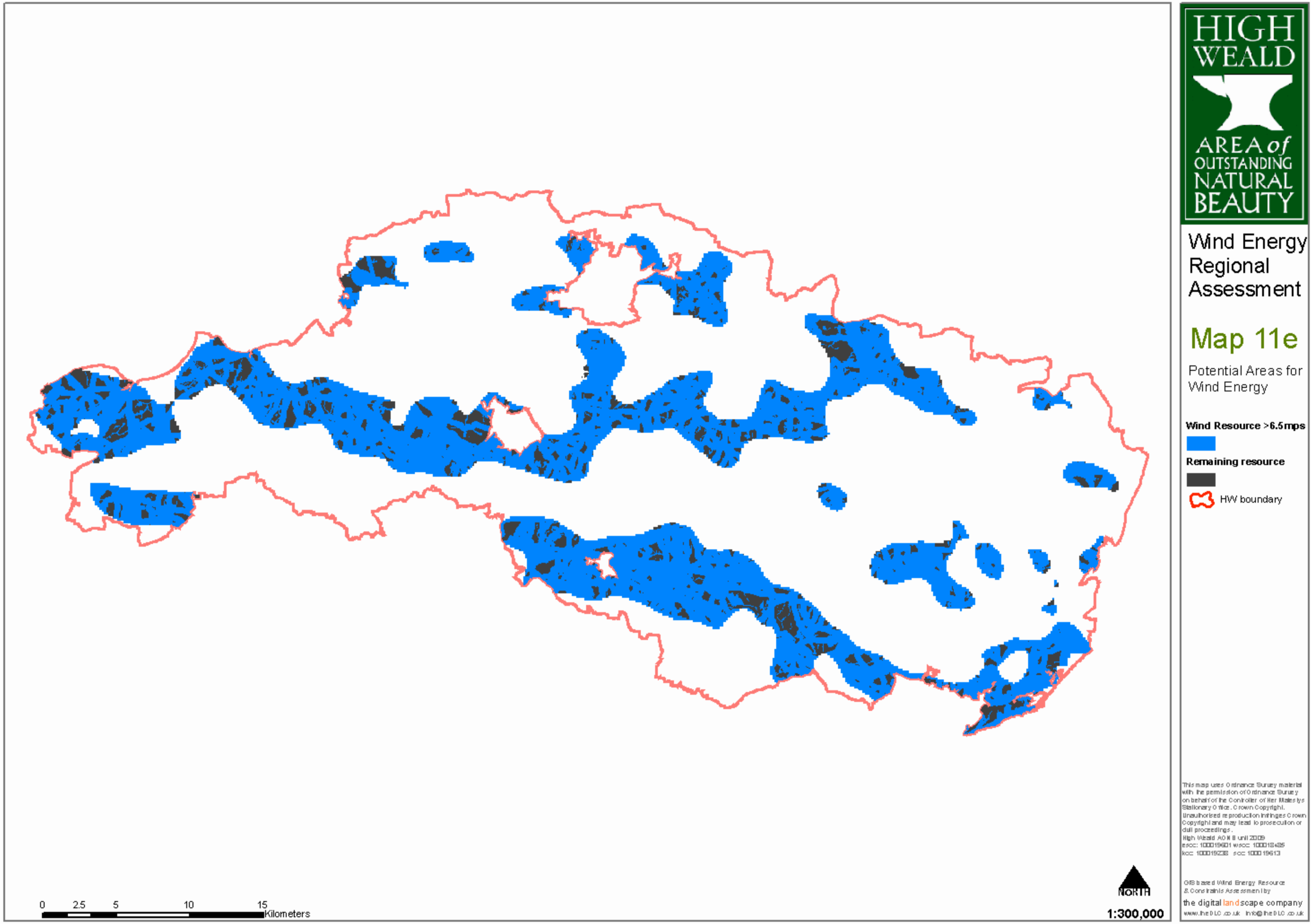
Transmitter, RBL, Powerline Constraints with Wind Resource

- Radio Broadcast Links
- Transmitters
- Powerline
- Wind Resource >6.5mps
- HW boundary

GIS based Wind Energy Resource & Constraints Assessment by
the digital landscape company
www.theDLC.co.uk info@theDLC.co.uk


0
2.5
5
10
15
Kilometers
NORTH
1:300,000
HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 11c
Road and PROW Constraints with Wind Resource
Historic Routeways
Roads
PROW
Wind Resource >6.5mps
HW boundary
the digital landscape company


HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 11d
Airport, Radar & other aero Constraints with Wind Resource
Navigation Aids
Civil Airports
Airfields
Heliports
Pease Pottage Radar
CAA Consultative Zones
Wind Resource >6.5mps
HW boundary
Shoreham
Gatwick
Redhill
Pease Pottage Radar
Spring Farm
Ringmer
Deanland
Boship
Laddingford
Old Hay
Lamberhurst
Headcorn
Spilsted Fm
0
2.5
5
10
15
Kilometers
NORTH
1:300,000
the digital landscape company


HIGH WEALD
AREA of OUTSTANDING NATURAL BEAUTY
Wind Energy Regional Assessment
Map 11e
Potential Areas for Wind Energy
Wind Resource >6.5mps
Remaining resource
HW boundary
This map uses Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationary Office. Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings.
High Weald AONB unit 2009
esoc: 100019601 wsoc: 100018485
koc: 100019238 soc: 100019613
GIS based Wind Energy Resource & Constraints Assessment by
the digital landscape company
www.theDLC.co.uk info@theDLC.co.uk
0 2.5 5 10 15 Kilometers
NORTH
1:300,000

Summary

This study has identified a resonable wind resource in the High Weald AONB and a range of significant constraints. The study was carried out on a macro regional scale. Any proposed wind developments would need to assess the wind resource and constraints in more detail and at a more localised level. It may be that at this micro level, adverse impacts upon buildings, habitats, etc are minimal or can be mitigated.

However, given the number and cumulative scale of constraints, we consider the High Weald unlikely to be suitable for large scale commercial wind energy. We do not rule out some potential for wind energy, although this is qualified by the limitations in the scope of this study.

In our view, the most appropriate wind energy developments maybe single turbine or small-clusters of upto 3 turbines, probably of 1.5 or 2.0 MW capacity. These typically have hub heights above 60m and blade diameters around 70m. We expect any such development would require extremely sensitive site selection and site layout in order to avoid the impacts this study has identified. In an important and densely populated area, small scale and community owned/part owned projects may offer the best oppertunities.

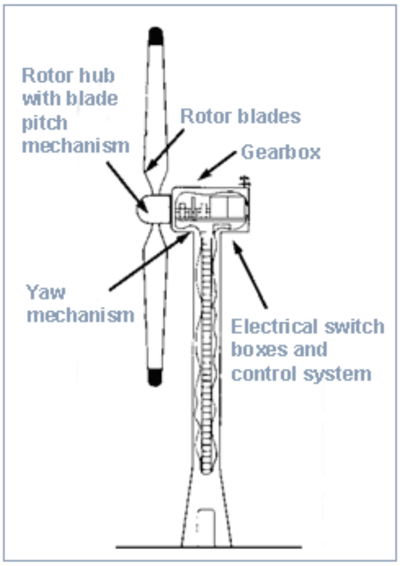
Coldham Wind Farm

appendix one - wind turbines

Wind Turbines are a new and unique form in our landscape. They are a feature of interest not least because of their movement. Technology has improved rapidly over the last 28 years, unfortunately the UK no longer leads the field in turbine design largely due to a lack of public and private support for the industry. However, the UK has one of the largest potentials for generating wind energy in Europe.

Anatomy of a wind turbine :

Tower
Blades Sensors
Nancell or Hub housing :
Generator and gearbox
Control system



Wind Turbines can be deployed :

Individually	Single Turbines
Small Scale	Clusters of 2 – 12 turbines
Medium Scale	Development of 13 – 24 turbines
Large Scale	Large development of 25+ turbines

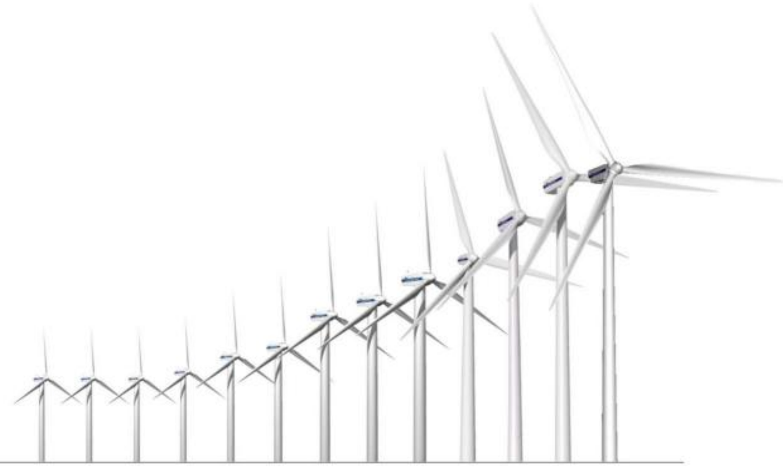
The layout of the site is very carefully designed around getting the most from the available wind and various other factors. Large wind farms can have over one hundred turbines and cover many square kilometres and there are many such examples in Wales, Scotland and all over Europe. Site Selection is a highly complex process involving a large number of considerations :

- Land availability; a landowner must be identified who is prepared to allow the development and the site must be large enough to accommodate sufficient turbines and ancillary equipment.
- Wind resource; the site must have an adequate wind resource, typically 6-6.5+ metres per second
- Electrical connection; connecting the project to the local electricity grid must be technically feasible and economically viable given the distance involved
- Access; there must be adequate access to the site from the road system without the need for costly and disruptive road modifications.
- Policy and Planning; Local planning policy should offer a reasonable likelihood of the proposal getting planning permission
- Proximity to dwellings; The site should be a sufficient distance away from dwellings so as not to pose a nuisance or danger through turbine/blade failure, icing, noise, shadow/flicker, visual impact etc
- Aircraft/Radar; The CAA and individual airports should be consulted from the outset to assess and mitigate against danger to aircraft, aeronautical users and radar interference
- TV/Microwave; The site layout should be designed so as not to adversely affect microwave (mobile phone) and TV/Radio transmission.
- Landscape and ecological considerations; The scheme must have minimal impact upon important species, habitats, landscapes and features.

All of these issues would require detailed (and costly) surveys to determine the extent of impact (low, moderate or high). Decisions are made by local planning authorities on a case by case basis, drawing on technical information provided by the developer, policy documents, advice from statutory consultees and stakeholder concerns. The effects of cumulative development should also be considered and may be an increasing issue.

One of the most debated concerns regarding wind turbines is visibility. However there is a great deal of colour choice available for towers and blades. Off white is perhaps the most widely used and a matt finish can be used to reduce glare and reflection. Variations in height of + or – 20m will generally not make a significant impact upon visibility. A commonly overlooked aspect of wind turbines is they are not permanent structures and have lifespans around 20-25 years after which they can be replaced ('repowered') or decommissioned.

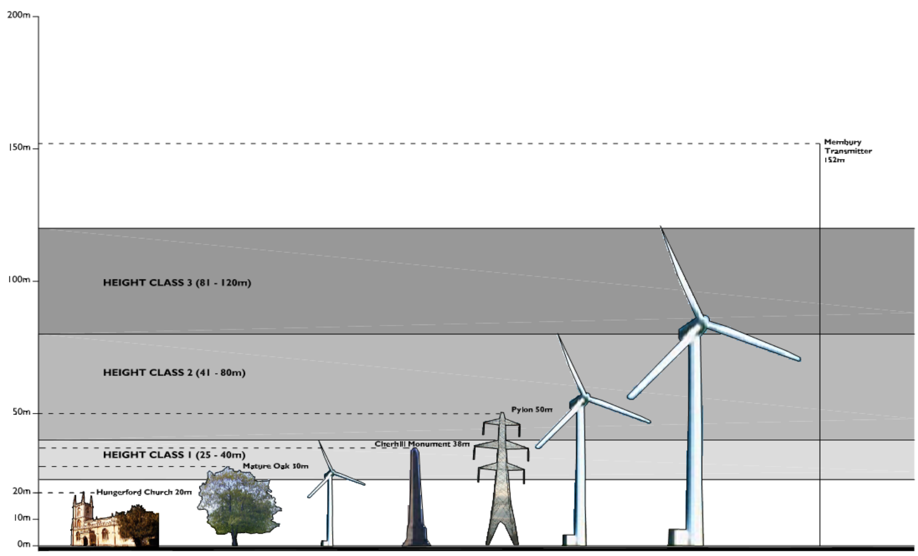
Turbines for commercial applications are usually distinguished by their generating capacity, quoted in megawatts. Generally, the larger the turbine, the larger the MW generating capacity.



Product/Rotor diameter (m)	V15	V17	V19	V20	V25	V27	V39	V44	V47	V52	V66	V80	V90
Year of installation	1981	1984	1986	1987	1988	1989	1991	1995	1997	2000	1999	2000	2002
Capacity (kW)	55	75	90	100	200	225	500	600	660	850	1750	2000	3000
MWh/year	217	265	301	346	481	647	1304	1581	1947	2530	4705	6768	9152

Vestas Turbine evolution

Turbines for installation on land currently vary from 850KW – 3MW with the most common in the 1.3-2MW range. Such turbines have tower heights around 80m with blade diameters around 60m, with total heights to the blade tip around 125m. The largest modern turbines currently available for deployment on land are 3MW with towers in excess of 130m high. With blade diameters of around 80m, total height to tip can be in excess of 150m.



Continued improvements in turbine design are expected to produce turbine designs for use on-shore with capacities in excess of 5MW and tower heights of 130m. Offshore turbines may exceed 7MW.

Manufacturers include Vestas, Nordex, GE, Mitsubishi, Bonus

appendix two - air traffic control radar and wind turbines

The effects of wind turbines of radar equipment is at presently poorly understood and highly variable due to local conditions. The principle issue is that wind turbines can appear as ‘clutter’ on the radar, interfering with signal returns from aircraft. This can lead to difficulties for radar operators interpreting the information on the radar.

Radar’s
The primary purpose of ATC radar’s is to detect and display aircraft positions and movement. Data is gathered from from both primary and secondary radar installations and software combines these signals so that a single target is displayed. This process may be affected by ‘radar clutter’ especially when aircraft are turning.

Line-of-Sight Analysis
LSA helps determine if proposed wind turbines could be detected by a specific radar installations. The higher the wind turbines, the more likely they are to be detected by a radar. However various factors may screen the turbines from the radar and reduce or prevent detection such as forestry, buildings, landscape features and the landform.

Clutter
Radars also detect and display unwanted items, such as masts and tall trees. This unwanted data is called clutter. Clutter can appear in various forms, can be constant or intermittent. Various factors effect clutter such as the capabilities of the radar equipment and the type of feature producing the clutter. It is part of the radar operators job to understand and interpret the clutter appearing on their screens.

Clutter Sources
Air Traffic Control Radars are fitted with Moving Target processing resulting in stationary sources of clutter usually being filtered out. Moving sources of clutter include :

- Waves
- Clouds and rain
- Trees moving in wind
- Birds and insects
- Road and rail traffic
- Wind turbine blades

Mitigation
There was been much debate between the CAA, the MOD and wind energy developers of the issue of radar clutter. A study by the Department of Trade and Industry (DTI) in 2003 concluded that there are various hardware and software measures that can reduce or eliminate the effects of wind turbines on radars. These solutions include deploying more radar, filtering the radar software, or altering individual wind turbine locations. Training can also be given to Air Traffic Controllers regarding specific issues. These solutions vary on the site-specific situation.

appendix three - community projects

An alternative to commercial wind energy are community based projects, which are suited to single turbine or small cluster developments. Community projects may be a suitable avenue to developing wind energy in the High Weald.

Bro Dyfi Community Wind Project
is in Mid-Wales, near to Centre for Alternative Technology in Machynlleth. A second-hand 75 kW wind turbine was purchased through a community shares scheme, with 55 local shareholders and installed 2003. It is incorporated as a community energy co-operative and there is also community energy fund.

Gigha
A 3x225kw turbine community project on the Scottish Island of Gigha known as The Dancing Ladies of Gigha. A Limited Company was set up by the community trust and the project was funded by combined grant, equity and loan finance.

Findhorn
Findhorn is an eco-village in NE Scotland. It has long had a single 100kw turbine and 3 more second-hand turbines were recently installed

Baywind Energy Co-operative
A long running co-operative based in the Lake District with local and national shareholders and a 5 turbine windfarm at Harlock Hill. Recent expansion has seen the purchase of one turbine from the large Haverigg II windfarm. Baywind has spawned various spin out projects and an energy efficiency scheme in the local area.
Baywind Energy Co-operative Ltd, Unit 33, Trinity Enterprise Centre, Furness Business
Park, Barrow in Furness, Cumbria LA14 2PN
Tel 01229 821028, fax 01229 826075

Energy4all
Umbrella spin off from Baywind. which has helped establish a number of organisations, including:
www.energy4all.co.uk

Westmill Wind Farm Co-operative, based in Oxfordshire
www.westmill.coop

Fenland Green Power Co-operative which is to purchase 2 wind turbines from the Deeping St Nicholas wind farm in the Fens.
www.fens.coop

Boyndie Co-operative in Aberdeen which purchased a stake in a 7 turbine Boyndie Wind Farm.
www.boyndie.coop

Others :
Cwmni Gwynt Teg
Gigha Renewable Energy Company

References :

British Horse Society, Wind Farms - Policy statement, 2008

British Wind Energy Association (BWEA), http://www.bwea.com/ref/faq.html

BWEA/TCPA, Planning for Wind Energy – Informing local development documents, May 2005

CAA, Policy and Guidelines on Wind Turbines, Feb 2009

Cambridge Sub Regional Partners, Delivering Renewable Energy in the Cambridge Sub Region, Final Report 2004

Cotswold Conservation Board, Renewable Energy Projects – Position statement, Oct 2005

Dulas/TXU, Parham Airfield Wind Farm Design and Access Statement, May 2007

Elliott Summers, Operational Effects of Wind Farm Developments on ATC Procedures for Glasgow-Prestwick International Airport, Jan 2001

English Nature / RSPB / WWF-UK / BWEA, Wind farm development and nature conservation - A guidance document for nature conservation organisations and developers when consulting over wind farm proposals in England, March 2001

ETSU - Wind energy, defence & civil aviation interests working group, Wind Energy & Aviation Interests – interim guidance, 2002

ETSU - Wind energy, defence & civil aviation interests working group, Potential Effects of Wind Turbines on Navigational-Systems, 2002

Glyndebourne Opera House, Turbine planning application, http://www.glyndebourne.com/about/wind_turbine/glyndebourne_wind_turbine_mill_plain/

Highways Agency, Network Strategy - Spatial Planning Advice Note: SP 04/07, Planning Application for Wind Turbines Sited Near to Trunk Roads, updated July 2007

KEMA, Turbine design trends case study (webpod), Jan 2007

Land Use Consultants, Wind Turbine Development in Huntingdonshire, Final Report, March 2005

North Energy Associates Ltd, A community wind turbine for Appleton and Spauton - Feasibility Study produced for the Appleton and Spaunton Community Energy Group, Final Report, May 2006

North Hambleton Windfarm Action Group, http://www.nhwag.org/index.html

North Wessex AONB, A study of the Landscape Sensitivities and Constraints to Wind Turbine Development, March 2006

Nuon, Airfield Wind Farm – Community Update, Summer 2008

ODPM (2004) Planning for Renewable Energy – A Companion Guide to PPS22, 2004

ODPM, PPS22 - Planning for Renewable Energy, 2004

Pager Power Ltd, North Energy Associates Ltd, Proposed Wind Turbine at Glyndebourne Opera House - Gatwick Airport Aviation Impact Assessment, Dec 2006

Peter Brett Associates for Plymouth & South West Co-operative Society Limited, Sherford Refined Wind Turbine Study and Renewable Energy Strategy, February, 2007

Vestas, V90-3.0MW - an efficient way to more power, 2008

Wind Energy Regional Assessment
for The High Weald AONB

A report for the High Weald Joint Advisory Committee (JAC) Investigating the resource for wind energy in the High Weald and the technical and environmental constraints upon it.

By the digital landscape company

May 2009

About the DLC

Digital Landscapes has been active in the wind industry since 2001. We are unique in blending GIS digital mapping and IT skills with practical experience in countryside management, renewable energy, forestry and recreation.
We were pioneers in applying GIS to the site selection of wind energy and have developed the concept of constraints mapping. We have undertaken a number of wind energy regional resource assessments, local site selection studies and also contribute to Environmental Impact Assessments of individual proposals. We support community projects and the sensitive location of wind energy schemes.
Digital Landscapes also works in the countryside, recreation and forestry sectors, applying GIS to a wide range of issues. We also provide installation, administration, training and support for GIS and Small Business I.T networks.

the digital landscape company
t 0845 838 1868
w www.thedlc.co.uk