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Newark and Sherwood Landscape Capacity Study for Wind Energy Development

Prepared by LUC for Newark and Sherwood District Council
March 2014

Project Title: Newark and Sherwood Landscape Capacity Study

Client: Newark and Sherwood District Council

Version	Date	Version Details	Prepared by	Checked by	Approved by Principal
1	17 October 2013	Pilot Study	PDM/AK	RK	
2	5 December 2013	Draft Report	PDM/AK	RK	KA
3	19 December 2013	Consultation Draft	PDM/AK	KA	KA
4	28 March 2014	Final Report	PDM	KA	KA

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Scope and approach

The Newark and Sherwood Landscape Capacity Study for Wind Energy Development was undertaken between September 2013 and March 2014. The aim of the study was to assess the capacity of different landscapes within the district to accommodate further wind energy development. The project was overseen by officers of Newark and Sherwood District Council and Nottinghamshire County Council.

The study is based on the description and classification of the landscape presented in the Newark and Sherwood Landscape Character Assessment (updated 2013). This provides a characterisation of the district into broad landscape character types and more detailed policy zones. The relative sensitivity and capacity of each of the defined landscape character types was assessed. Landscape character does not change at administrative boundaries, and the study therefore considers the adjoining landscapes within Nottinghamshire, Lincolnshire and Leicestershire where they influence character within Newark and Sherwood.

Sensitivity is defined as *the relative extent to which the character and quality of the landscape is susceptible to change as a result of wind energy development*. Sensitivity was evaluated through application of a series of criteria, developed from published guidance and planning practice. These criteria were discussed and agreed with the steering group. Sensitivity was defined for a series of wind turbine heights, ranging from 15m up to 140m to represent the spectrum of turbine sizes which are currently operating or in the planning system.

The study does not represent a comprehensive assessment of heritage assets in the district. The study does address a number of landscape heritage designations including registered parks and gardens, conservation areas, and locally-protected landscapes around Laxton, Southwell and Sherwood Forest. The presence of these designations has informed the sensitivity assessment, but effects on these and other heritage assets, and their settings, will require to be assessed in detail on a project-specific basis.

For each landscape character type, guidance for development is set out to identify key sensitive features and characteristics which may influence siting and design of wind energy developments. Constraints and opportunities for development are included, taking note of turbines which are already operational, or unbuilt turbines which have planning consent.

Following the guidelines an evaluation of likely capacity is given, based on the sensitivity, heritage values, and existing and consented development within each landscape type. This leads to an overall statement of capacity for change for the LCT, in terms of the level of development likely to be acceptable, without significant change to landscape character.

The potential for further cumulative impact on landscape character is assessed with reference to computer-modelled theoretical visibility mapping, and to wind energy developments which are proposed but which have not yet been determined. This enables a judgement to be reached in terms of the remaining capacity within the landscape character type.

Findings

The assessment of landscape sensitivity has identified that the areas in the west and south of Newark and Sherwood are generally more sensitive to wind energy development, while those in the south-east are of lower sensitivity. The western landscapes are of more distinct character and diverse landform, with extensive broadleaf woodland cover. The wooded hills and dumble valleys in the south of the district also indicate higher sensitivity.

Other parts of the district are more intensively farmed, with gentler topography and a less distinctive pattern of traditional landscape elements. In the east of the district the flat landscape extends continuously into neighbouring areas, with long views. There are pockets of higher sensitivity within all these landscapes, associated with woodlands, rural villages, historic landscapes and local landforms.

The study also identifies that there are variations in sensitivity, often significant, within each of the assessed landscape character types. Overlaid on to this general pattern are areas of high heritage value, represented by a range of historic landscape designations which could be adversely affected by wind energy development.

The study concludes that there is some capacity for change across most of the district, though this is limited by a range of factors. Small areas of lower sensitivity have been identified with the potential to absorb a greater level of development, though still without wind turbines becoming a defining feature. For each landscape type, relevant siting and design guidelines are presented to ensure any development proposals address the aspects of the landscape which determine its sensitivity.

Limitations

The study presents a strategic view of the sensitivity and capacity of the landscape of the study area. It was undertaken at a district-wide scale, and a number of important caveats, or 'health warnings', are therefore set out below.

- The study is based on the broad landscape character types (LCTs) identified in the Newark and Sherwood Landscape Character Assessment. These LCTs may not recognise local variation in landscape character, and their boundaries are generally zones of transition rather than firm lines. Reference should be made to more than one LCT assessment in considering locations close to LCT boundaries. Regard should also be had to recommendations made for the more detailed landscape policy zones identified in the Newark and Sherwood Landscape Character Assessment.
- Capacity is not solely an inherent characteristic of the landscape, but is partly defined by the demand or need for development. The study does not seek to place defined limits on capacity, since the level of demand may increase or decrease in future depending on political and economic factors.
- The sensitivity and capacity assessments were undertaken based on the regional-scale LCTs, and may therefore overlook local detail and variation. For individual proposals, more detailed assessment of sensitivity and capacity may be appropriate, based on local landscape character studies.
- In identifying landscape sensitivity and capacity, the study has had regard to historical aspects of the landscape, but is not a historic environment study, and does not explicitly consider heritage assets or their settings.
- The landscape sensitivity and capacity assessments do not consider other environmental issues such as protected species, or technical constraints such as wind speed, which may affect planning for wind energy development.
- The study does not define 'search areas' where proposals for wind energy development will be looked upon more favourably. Reliance on this study is not a substitute for detailed examination of the potential effects of individual wind energy proposals on a case-by-case basis.
- The study is intended to be a tool to inform planning decisions. It does not provide guidance on specific proposals or sites, and is not intended to be used on its own to determine the suitability of a specific site for development. All proposals for wind energy development will continue to be judged on their own merits.

1 Introduction

Background

1.1 LUC was commissioned by Newark and Sherwood District Council in September 2013 to undertake a study examining the sensitivity and capacity of the landscape of the district to wind turbine development at a range of scales. The study was overseen by a steering group of Newark and Sherwood District Council officers, with representatives of Nottinghamshire County Council.

1.2 There are presently two wind farms of five turbines in Newark and Sherwood, with several single turbines operating. There is increasing interest in development of medium and small-scale wind turbines, either as single turbines or small groups.

1.3 The study is required to inform future decisions on an increasing number of planning applications for wind turbines, and will play a role in steering such development to the most appropriate locations. The National Planning Policy Framework states that local authorities should "*consider identifying suitable areas for renewable and low carbon energy sources,*" including wind turbines.[1] This study presents part of the evidence base for the identification of such areas, and has informed the Council's Supplementary Planning Document on wind energy.

1.4 A pilot study was undertaken in October 2013, which developed a methodology and reviewed the available landscape baseline information. An example assessment was carried out, presenting the application of the proposed assessment criteria to one landscape character type. Following approval from the steering group on the approach a full draft report was developed. This enabled further feedback by the steering group which has been incorporated into this consultation draft.

1.5 A consultation draft report was prepared in December 2013. This was the subject of public consultation carried out by Newark and Sherwood District Council in January-February 2014. Following the consultation, representations were reviewed and these have informed this final report.

Study area

1.6 The study focuses on the landscape of Newark and Sherwood District, and the study area boundary is therefore contiguous with the district boundary. To ensure consideration of cross-boundary effects, a buffer area of 15 km around the district boundary was defined. Within this area, information on landscape character and wind energy development was collected. The study area and buffer area are shown in **Figure 1.1**.

[1] Department for Communities and Local Government (2012) National Planning Policy Framework. Paragraph 97.

Newark and Sherwood Landscape Capacity for Wind Turbines

Figure 1.1

Study Area

Study area

15km buffer area

Local authority boundaries

Map Scale @ A3:1:250,000

Newark and Sherwood District Council

LUC LDN 5874-01_002_Fig1-1_Study_Area 11/11/2013

Source: Ordnance Survey

2 Methodology

Approach

2.1 Following the inception meeting, the general approach to the study was agreed. This comprised the following key stages:

- Identification of the key characteristics of wind energy development and its potential effects on the landscape, to inform development of a methodology for the assessment of landscape sensitivity and capacity;
- Assessment of the sensitivity of the different landscape character types in Newark and Sherwood to wind turbine development at a range of scales;
- Preparation of siting and design guidelines for wind turbine development in each landscape character type, taking account of the assessed sensitivity of the landscape, and the effect of operational and consented development, and including consideration of landscape capacity; and
- Examination of proposed developments and consideration of their cumulative effect on assessed landscape sensitivity and capacity.

2.2 Each of these stages is discussed in more detail in the following sections.

Definitions

2.3 The distinction between sensitivity and capacity can be understood by thinking of sensitivity as an absolute value of a landscape. That is, the sensitivity of a landscape to a particular type of change will be constant, subject to the landscape itself remaining unchanged.

2.4 Capacity on the other hand is affected by context, including national and local policy. Notions of capacity may have to be flexible to accommodate policy-driven targets, changes in which will affect the relationship between capacity and sensitivity. To inform judgements of capacity, a robust and transparent assessment of landscape sensitivity is essential.

2.5 This study presents the findings of a detailed sensitivity study, which sets out the underlying sensitivity of the Newark and Sherwood landscape to wind turbine development at different scales. Capacity is dealt with through strategic advice on potential limits to the level of change within the landscape, based on the current picture of operational and proposed development.

Potential effects of wind energy development on the landscape

2.6 In order to minimise effects on the landscape through siting and design, it is important to first understand the characteristics of wind energy development and how they may affect the landscape. The following sections describe the features of wind turbines and associated development, and consider potential impacts on the Newark and Sherwood landscape. Existing policy and guidance is briefly reviewed and the current level of operational and proposed development is discussed.

2.7 The most detailed guidance currently available on wind farm siting and design has been published by Scottish Natural Heritage.[2][3] While primarily relevant to the Scottish landscape, these documents are widely referred to across the UK, and the following sections draw on the recommendations they contain as appropriate to consideration of Newark and Sherwood.

[2] Scottish Natural Heritage (2009) Siting and Designing Windfarms in the Landscape.
[3] Scottish Natural Heritage (2012) Assessing the cumulative impact of onshore wind energy development.

General features of wind energy development

2.8 The key components of wind energy development are the wind turbines, which may be grouped together into a wind farm. The majority of wind turbines consist of horizontal-axis three-bladed turbines, mounted on a steel tower. Other turbines, including two bladed turbines and vertical axis turbines, are available but less commonly deployed. Wind turbines are generally given planning permission for 25 years, although re-powering may take place after this period has elapsed, subject to further permission.

2.9 The main visible components of a horizontal-axis wind turbine are:

- the tower, generally a tubular steel structure though lattice towers are occasionally used for smaller turbines;
- the nacelle, which contains the generating equipment; and
- the rotor blades, mounted on the hub at the front of the nacelle.

2.10 Depending on the scale and design of the turbine, the transformer may be located inside or outside the tower. If outside it will usually be contained in a small box-like structure adjacent to the tower base. The tower itself sits on a concrete foundation which is hidden from view underground.

2.11 Turbines are most commonly coloured light grey, which has been found to be less visually prominent when turbines are viewed against the sky. However, when turbines are seen against a land backdrop, which is common with smaller models, the light colour can make them appear more prominent.

2.12 Turbines are available in a wide range of sizes, from very small roof-mounted machines designed for domestic use, to large commercial structures. The tallest turbines currently operating in the UK are in the region of 130 m, although turbines up to 150 m have received planning consent.

2.13 Besides overall size the proportions of a turbine can also vary, particularly the length of the blades in relation to the height of the tower, and the size and shape of the nacelle. Where particularly short blades are mounted on a tall tower, or where long blades are placed on a short tower, the turbine may appear unbalanced or top-heavy. Larger turbines with longer blades tend to have slower rotation speeds than smaller models.

2.14 In addition to the turbines themselves, developments involving large scale wind turbines typically require additional infrastructure as follows:

- road access to the site and on-site tracks able to accommodate the specialised heavy goods vehicles (HGVs) which are needed to transport the long turbine components and heavy construction cranes;
- a temporary construction compound and lay-down area for major components;
- borrow pits, which may be opened on larger sites to provide construction materials for the access tracks, avoiding the need for transportation of material to the site;
- construction of a buried concrete foundation and an area of hardstanding next to each turbine to act as a base for cranes during turbine erection;
- underground cables connecting the turbines (buried in trenches, often alongside tracks);
- one or more anemometer mast(s) to monitor wind direction and speed, usually a slender lattice tower of the same height as the turbine hubs; and
- a control building to enable monitoring and operation, often combined with a small substation.

2.15 Lighting requirements depend on aviation and can be required on turbines. However, aircraft warning lights can be infra-red and therefore not visible to the naked human eye. Lighting has not been considered as part of the landscape sensitivity study, although guidance advises that if lighting is required on turbines for aviation purposes, infra-red lighting should be adopted where possible to minimise visual impacts at night.

2.16 The District Network Operator (DNO) is responsible for establishing a connection between the substation and the national grid. For larger schemes this connection is usually routed via

overhead cables on poles, but for smaller turbines may be routed underground. Since these are part of a separate consenting procedure these connections are not considered as part of the landscape sensitivity study.

Landscape effects of wind turbines

2.17 Wind turbines can be substantial vertical structures, and larger models will inevitably be highly visible within the landscape. The movement of the blades is a unique feature of wind energy developments, setting them apart from other tall structures in the landscape such as masts or pylons. Wind energy development may affect the landscape in the following ways:

- construction of large turbines and associated infrastructure may result in direct loss of landscape features;
- wind turbines are tall vertical features that may alter perception of a landscape, potentially affecting the apparent scale of landforms;
- movement of rotor blades may affect characteristics of stillness and solitude, as well as drawing the eye to turbines which may be a relatively small feature in the landscape;
- the presence of turbines may increase the perceived human influence on the landscape, particularly in terms of overt modern development, and this can particularly affect landscapes which have a strong sense of naturalness or tranquillity, or which form a setting to heritage assets;
- wind turbines, even at relatively small sizes, can appear large in the context of human-scale features such as domestic buildings and trees – at the largest scales turbines can be perceived as 'overwhelming' when close to residential properties;
- turbines on skylines may compete with existing landmark features for prominence where prominent skylines or landmark features are characteristic of the landscape; and
- in order to be as efficient as possible, turbines are often placed in elevated locations, where they may affect views from wide areas.

2.18 In undertaking any landscape sensitivity assessments it is necessary to acknowledge that varying attitudes to wind energy development are expressed by different individuals and constituencies. Aesthetic perceptions can be positive or negative depending on individual attitudes to the principle and presence of wind generation[5].

Cumulative issues

2.19 As larger numbers of wind farms are built, it is increasingly necessary to consider their cumulative effects. Guidance on the siting and design of wind farms and wind turbines suggests that a key consideration is understanding how different developments relate to each other, their frequency as one moves through the landscape, and their visual separation, with the aim of allowing experience of the character of the landscape in-between.[4] These kinds of issues will be considered in the landscape strategies for deploying wind energy in Newark and Sherwood.

Wind energy in Newark and Sherwood

Wind energy policy and guidance

2.20 The 1999 Wind Energy Supplementary Planning Guidance (SPG)[5] examined opportunities for and constraints to wind turbine development in the district, and set out policies against which wind farm applications will be determined. The SPG notes that higher wind speeds are more prevalent in the west of the district, but does not offer further locational guidance. It is stated that development should avoid unacceptable impacts on a number of designated landscapes including Sherwood Forest Heritage Area and the historic landscape around Laxton.

[4] Scottish Natural Heritage (2009) op. cit.
[5] Newark and Sherwood District Council (1999) Supplementary Planning Guidance: Wind Energy.

2.21 A technical study undertaken in 2011 looked at opportunities for renewable energy deployment across the East Midlands.[6] The study identifies "*considerable commercial wind energy potential*" within Newark and Sherwood District (4.21). However the report focuses on 'technical potential', i.e. the total amount of potential that is theoretically available, rather than 'deployable potential', i.e. what can be practically delivered. The constraints applied to the high-level opportunity mapping include national-level cultural and natural heritage designations, but do not include consideration of landscape character. Chapter 6 of the report provides advice on identifying 'deployable potential' and recommends landscape sensitivity analysis as a useful tool in evaluating cumulative impacts.

2.22 The present study complements these earlier documents, providing a detailed, locally specific evidence base to help frame future policy on wind energy development in the district.

Wind energy development in Newark and Sherwood

2.23 Data supplied by Newark and Sherwood District Council (stated as correct to 24 February 2014) provides the current picture of operational and proposed wind energy development in the district. This data represents a point in time view of development, which is continually changing as applications are consented or refused, and new proposals come forward. The data is tabulated in **Table 2.1** and illustrated in **Figure 2.1**.

Table 2.1 Wind turbine development in Newark and Sherwood

Tip height	Planning status				
	Operational	Consented	Application	Scoping	Total
15 to 30 m	5	4	1	0	**10**
31 to 50 m	1	1	2	2	**6**
51 to 80 m	7	1	8	13	**29**
81 to 110 m	6	2	4	19	**31**
111 to 140 m	5	0	7	1	**13**
Total	**24**	**8**	**22**	**35**	**89**

2.24 The data indicate that there are 24 wind turbines currently operating in the district. These include the five-turbine Lyndhurst Wind Farm (125 m to tip) and the five-turbine Stonish Hill Wind Farm (103.5 m to tip). There is also a pair of turbines at Moorwood Farm (24.8 m to tip). The other operational machines are all single turbines with tip heights ranging from 25 m to 102 m.

2.25 A further eight turbines have planning consent. These are all single turbines or pairs of turbines, and five are less than 50 m to tip. Two consented turbines are 102 m to tip.

2.26 There are 22 turbines which are the subject of undetermined applications. Planning appeals are currently in progress in relation to three applications: a three-turbine cluster at Cotham Road (126.5 m to tip); two turbines at Brackenhurst College (77 m); and a single turbine near Wigsley (21.5m). Planning applications relating to 12 proposals are awaiting determination by Newark and Sherwood District Council. These are all for single turbines, with the exception of a four-turbine proposal at Cotham Road (130 m to tip). These undetermined proposals (appeals and applications) are mainly for turbines over 60 m.

2.27 The Council has received requests for screening or scoping opinions in relation to a number of further turbines. The majority are for turbines over 60 m, with several for turbines over 100 m.

[6] Land Use Consultants, Centre for Sustainable Energy and SQW (2011) Low Carbon Energy Opportunities and Heat Mapping for Local Planning Areas Across the East Midlands: Final Report. East Midlands Councils.

All are for single turbines or pairs of turbines. Several of these requests were submitted some time ago, and there is no certainty that scoping proposals will progress to application stage.

2.28 Wind turbines (operational and proposed) are located across the district, though there are fewer in the north-west and within the Trent valley. There is a loose concentration of turbines in the centre-west of the district: most of the operational turbines are located in the area between Mansfield, Southwell and Eakring. Proposed developments are more widely distributed, including a potential cluster of eight turbines immediately south of Newark, and a number of scoping-stage proposals in the Trent valley.

2.29 The data indicate a trend towards larger turbines, with few turbines proposed at under 50 m overall height.

Typologies

2.30 The brief and subsequent discussions indicate that a wide range of scales of development are to be considered, from small single turbines of 15 m,[7] to large commercial wind farms with several turbines of 100 m or more.

2.31 The 'size' of a wind energy development can be defined by the number of turbines, the height of turbines, or by reference to installed capacity. Capacity is less useful in landscape terms as there are many combinations of different turbines which could give the same output. The number of turbines is an important factor in determining the suitability of a proposal in its host landscape. However it is turbine height which is most likely to be the determining factor for the assessment of landscape sensitivity, since it is the scale of the turbine which generally defines whether or not it can be accommodated in the landscape. Where a large turbine cannot be accommodated due to incompatibility of scale, then this will apply whether one or many turbines are proposed.

2.32 Based on the preceding analysis of current trends and likely effects, **Table 2.2** sets out the range of heights considered, divided into classes or 'typologies' for ease of assessment. Generally, the steering group considered that these ranges represented the scales of development likely to be proposed in the area, and that the groupings represent turbines which would have broadly comparable levels of impact on the landscape.

Table 2.2 Wind turbine development typologies

Wind turbine typology	Height of turbines to blade tip
Small	15 to 30 m
Small-medium	31 to 50 m
Medium	51 to 80 m
Large	81 to 110 m
Very large	111 to 140 m

2.33 An assessment of sensitivity was undertaken in relation to each of the above typologies. Further information was then developed to inform siting and design in terms of these height typologies, and also in terms of wind farm size. Wind farm size was considered with reference to different numbers of proposed turbines, as set out in the groups below:

- Single turbine;
- Cluster of two or three turbines;
- Wind farm of four or five turbines;
- Wind farm of six or seven turbines; and

[7] Structures of less than 15 m fall under permitted development rights.

- Wind farm of eight to ten turbines.

2.34 It was agreed with the steering group that developments of more than ten turbines are unlikely to be accommodated within the landscapes of Newark and Sherwood, mainly due to the settled nature of the area, and have not therefore been considered. Similarly, it was considered that proposals for turbines over 140 m were unlikely. However, it is recognised that larger proposals, in terms of height or number, could come forward in future. Any such proposal must very clearly demonstrate that the key sensitivities of the receiving landscape are not unacceptably impacted. The sensitivity of the receiving landscape to a development larger than 140 m or ten turbines is likely to be somewhat greater than the sensitivity assessed for the largest development types considered within this study.

Assessment of landscape sensitivity to wind turbines

2.35 There is currently no published method for evaluating sensitivity of different types of landscape. Our method therefore builds on available guidance published by the Countryside Agency and Scottish Natural Heritage including the Landscape Character Assessment: Guidance for England and Scotland[8] and Topic Paper 6 that accompanies the Guidance,[9] as well as LUC's considerable experience from previous and ongoing studies of a similar nature.

2.36 Paragraph 4.2 of Topic Paper 6 states that:

"*Judging landscape character sensitivity requires professional judgement about the degree to which the landscape in question is robust, in that it is able to accommodate change without adverse impacts on character. This involves making decisions about whether or not significant characteristic elements of the landscape will be liable to loss... and whether important aesthetic aspects of character will be liable to change.*"

2.37 For the purposes of this study, we have defined 'sensitivity' as follows:

Sensitivity is the relative extent to which the character and quality of the landscape is susceptible to change as a result of wind energy development.

2.38 Wind turbine development will affect different characteristics of the landscape in different ways. It is therefore important to understand the nature and sensitivity of different components of landscape character, and to set these out and assess them in a consistent and transparent fashion. In order to do this, a set of criteria were used to highlight specific landscape and visual characteristics which are most likely to be affected by wind farm development.

2.39 The criteria were based on current good practice, developed by LUC through experience of carrying out work within this field and informed by information presented in a number of guidance documents relating to landscape sensitivity, LVIA, and wind farm development.

Assessment criteria

2.40 **Table 2.3** sets out the criteria which were used to evaluate the sensitivity of landscape character types to wind turbine development, and the aspects of the landscape which were considered to indicate higher or lower sensitivity.

2.41 For each criterion, a short explanation is provided as to why it is indicative of sensitivity to wind energy development, and what key characteristics of the landscape will be considered. Information sources are given for each criterion. The examples provide more detail as to what level of sensitivity will be assessed for landscapes displaying certain characteristics: these are examples only, based on generic descriptions. The five defined levels form stages on a continuum, rather than clearly-separated categories. Any given landscape may or may not fit neatly into one category, and an element of professional judgement is therefore required.

[8] Countryside Agency and Scottish Natural Heritage (2002) *Landscape Character Assessment: Guidance for England and Scotland* CAX 84.
[9] The Countryside Agency and Scottish Natural Heritage (2004). *Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity.*

Table 2.3 Sensitivity assessment criteria

Landform and scale				
A simple, smooth, gently sloping or flat landform is more likely to be able to accommodate wind energy development than a landscape with a dramatic rugged landform, distinct landform features (including prominent headlands and cliffs) and/or pronounced undulations. Larger scale landforms are likely to be less sensitive than smaller scale landforms since, in the latter case, turbines may appear out of scale, detract from visually important landforms and/or appear visually confusing due to turbines being at varying elevations. Information sources: Landscape Character Assessment; Ordnance Survey maps; fieldwork.				
Examples of sensitivity ratings				
Lower sensitivity		⟷		**Higher sensitivity**
An extensive flat lowland landscape or elevated plateau, often a larger scale landscape with no distinctive landform features	A simple, gently rolling landscape, likely to be of medium-large scale, without distinctive landform	An undulating landscape, perhaps also incised by valleys, likely to be of medium scale	A landscape with distinct landform features, and/or irregular in topography (which may be large in scale), or a smaller scale landform	A landscape with a distinctive, rugged landform or dramatic topographical features (which may be large in scale), or a small scale or intimate landform

Land cover pattern and presence of human scale features				
Simple, regular landscapes with extensive areas of consistent land cover are likely to be less sensitive to wind energy development than landscapes with more complex or irregular land cover patterns, smaller and / or irregular field sizes, and landscapes with frequent human-scale features that are traditional to the landscape, such as red-brick villages, farmsteads, small farm woodlands, trees and hedges. This is because larger wind turbines may dominate traditional human scale features within the landscape. Information sources: Landscape Character Assessment; Ordnance Survey maps; Google Earth (aerial photography); fieldwork.				
Examples of sensitivity ratings				
Lower sensitivity		⟷		**Higher sensitivity**
An open, continuous landscape with uniform land cover and lacking in human-scale features	A landscape of large open fields, little variety in land cover, with occasional human-scale features such as trees and domestic buildings	A landscape with medium sized fields, some variations in land cover and presence of human-scale features such as trees and domestic buildings	A landscape with irregular or small-scale fields, variety in land cover and presence of human-scale features such as trees and domestic buildings	A landscape with a strong variety in land cover, and complex patterns, containing numerous human-scale features

Skylines				
Prominent and distinctive and/or undeveloped skylines, or skylines with important landmark features, are likely to be more sensitive to wind energy development because turbines may detract from these skylines as features in the landscape, or draw attention away from existing landform or landmark features on skylines. Important landmark features on the skyline might include historic features or monuments as well as landforms. Where skylines are affected by development, e.g. through the presence of electricity pylons, the addition of turbines may lead to visual confusion, and as such this may not be a consistent indicator of reduced sensitivity. Information sources: Landscape Character Assessment; fieldwork.				
Examples of sensitivity ratings				
Lower sensitivity		⟷		**Higher sensitivity**
A landscape in which skylines are not prominent, and there are no important landmark features on the skyline	A landscape in which skylines are simple, flat or gently convex and/or there are very few landmark features on the skyline – other skylines in adjacent LCTs may be more prominent	A landscape with some prominent skylines, but these are not particularly distinctive – there may be some landmark features on the skyline	A landscape with prominent skylines that may form an important backdrop to views from settlements or important viewpoints, and/or with important landmark features	A landscape with prominent or distinctive undeveloped skylines, or with particularly important landmark features on skylines

Perceptual qualities				
Landscapes that are relatively remote or tranquil tend to be more sensitive to wind energy development, since turbines may be perceived as intrusive. Landscapes which are relatively free from overt human activity and disturbance, and which have a perceived naturalness or a strong feel of traditional rurality, will therefore be more sensitive. Qualities such as tranquillity can be found even in settled areas, where the influence of overtly modern development is reduced. Wind turbines will generally be less intrusive in landscapes which are strongly influenced by modern development, including settlement, industrial and commercial development and infrastructure. Information sources: Landscape Character Assessment; CPRE's Tranquillity and Intrusion mapping; Ordnance Survey maps, fieldwork.				
Examples of sensitivity ratings				
Lower sensitivity		⟷		**Higher sensitivity**
A landscape with much human activity and modern development, such as industrial areas	A rural or semi-rural landscape with much human activity and dispersed modern development, such as settlement fringes	A rural landscape with some modern development and human activity, such as intensive farmland	A more naturalistic landscape and/or one with little modern human influence and development	A tranquil landscape with little or no overt sign of modern human activity and development

Scenic qualities				
Landscapes that have a high scenic quality will be more sensitive than landscapes of low scenic quality. Scenic qualities can include contrasts and combinations of landform and landcover which together contribute to attractive views. Scenic qualities may be recorded in the Landscape Character Assessment, or may be referenced in tourist material. Scenic viewpoints may be marked on Ordnance Survey maps. Scenic quality is also considered in the field. Information sources: Landscape Character Assessment; OS maps; tourist literature; fieldwork.				
Examples of sensitivity ratings				
Lower sensitivity		⟷		**Higher sensitivity**
A landscape without attractive character, with no pleasing combinations of features, visual contrasts and/or dramatic elements, such as an industrial area or derelict land	A landscape of limited attractive character, with few pleasing combinations of features, visual contrasts and/or dramatic elements	A landscape of intermittently attractive character, with occasional pleasing combinations of features, visual contrasts and/or dramatic elements	A landscape of attractive character, with some pleasing combinations of features, visual contrasts and/or dramatic elements	A landscape of consistently attractive character, with pleasing combinations of features, visual contrasts and/or dramatic elements

Intervisibility				
The relative visibility of a landscape may influence its sensitivity. An elevated landscape such as a hill range or plateau, which is viewed from other landscapes, may be more sensitive than an enclosed landscape, since any turbines will be more widely seen. Landscapes which have important visual relationships with other areas, for example where one area provides a backdrop to a neighbouring area, are considered more sensitive than those with few visual relationships. The extent of intervisibility may be modified by the importance of these views to appreciation of the landscape, and whether adjacent landscapes provide a setting for one another. Information sources: Landscape Character Assessment; fieldwork.				
Examples of sensitivity ratings				
Lower sensitivity		⟷		**Higher sensitivity**
An enclosed, self-contained landscape, or one with weak connections to neighbouring areas	A landscape with limited connections to neighbouring areas, and/or where adjacent landscapes are not visually related	A landscape which has some intervisibility with neighbouring areas, and/or where relationships between adjacent landscapes are of more importance	A landscape which is intervisible with several areas, and/or where adjacent areas are strongly interrelated	A landscape which has important visual relationships with one or more neighbouring areas

Assessment process

2.42 The landscape sensitivity study is based on an evaluation of key aspects of landscape character assessment. The key characteristics of each landscape character type (LCT), as set out in **Section 3**, were assessed against each of the criteria to arrive at a judgement as to their potential sensitivity to wind turbine development.

2.43 For each LCT, the assessment provides:

- a summary description of the LCT against each of the assessment criteria;
- an overall discussion on landscape sensitivity for the LCT;
- a list of key landscape attributes that would be sensitive to wind energy development;
- sensitivity ratings for different turbine heights; and
- observations on landscape sensitivity to different cluster sizes.

2.44 Each LCT assessment includes a judgement on landscape sensitivity to each of the turbine height typologies (**Table 2.3**) with full justification. Sensitivity is judged on a five-point scale from 'high' to 'low' as set out in **Table 2.4**.

2.45 The relationship between the evaluations against the individual criteria in **Table 2.3**, and the judgements of landscape sensitivity, is not a linear one. The process is based on professional judgement, using the individual criteria as indicators of sensitivity only. The relative importance of each criterion varies between LCTs; key characteristics may identify where a particular criterion is more important, and should therefore be given greater weight in the judgement of sensitivity. In all cases, the landscape is more sensitive to larger turbines than to smaller turbines.

Table 2.4 Sensitivity definitions

Sensitivity Level	Definition
High	Key characteristics and qualities of the landscape are highly vulnerable to change from wind turbines. Such development is likely to result in a significant change in character.
High-moderate	Key characteristics and qualities of the landscape are vulnerable to change from wind turbines. There may be some limited opportunity to accommodate wind turbines without significantly changing landscape character. Great care would be needed in locating turbines.
Moderate	Some of the key characteristics and qualities of the landscape are vulnerable to change from wind turbines. Although the landscape may have some ability to absorb development, it is likely to cause a degree of change in character. Care would be needed in locating turbines.
Moderate-low	Fewer of the key characteristics and qualities of the landscape are vulnerable to change from wind turbines. The landscape is likely to be able to accommodate turbines with limited change in character. Care is still needed when locating turbines to avoid adversely affecting key characteristics.
Low	Key characteristics and qualities of the landscape are robust in that they can withstand change from introduction of wind turbines. The landscape is likely to be able to accommodate wind turbines without a significant change in character. Care is still needed when locating wind turbines to ensure best fit with the landscape.

2.46 The assessment was carried out initially as a desk-based exercise, drawing on information in the landscape character assessment and other sources identified for each criterion. This was followed up with field work to view each LCT in the field and make any additional observations. Field work

was particularly important for criteria such as skylines, which may not be consistently described in the available documentation, and also assists with verification of desk-based material. The field visits informed the development of the siting and design guidance.

2.47 The sensitivity assessment identifies the underlying sensitivity of the landscape, as it appears at the time of the survey. It therefore considers operational development but not potential cumulative change, which is examined separately.

Guidance for development

2.48 Siting and design guidelines were developed for application across the district, and for each LCT. The former are 'generic' guidelines which can apply to any proposal in the district, while the LCT guidelines provide more detail at a level specific to local landscape character.

2.49 The LCT-specific guidelines draw on a series of key issues identified from the sensitivity assessment. The siting and design guidelines include consideration of potential cumulative effects arising from operational and consented development.

Capacity: change in the landscape

2.50 Following the guidelines, an evaluation of likely capacity is given, based on the sensitivity, heritage values, and existing and consented development within each landscape type. This leads to an overall 'aim' for the LCT, in terms of the level of development likely to be acceptable, without significant change to landscape character, and given the current level of pressure for development of turbines. This is set out in terms of one of four broad landscape definitions of the level of change within each LCT. These levels are defined in **Table 2.5** below.

Table 2.5 Levels of wind energy development in the landscape

A **landscape without wind energy** is considered to be an LCT within which no wind energy developments are located. There may, however, be views of wind energy developments located in neighbouring types of landscape. Some landscapes in this category may be able to accommodate small scale turbines, for example associated with farm buildings, and this is clearly set out where this is the case.
A **landscape with occasional wind energy** is considered to be an LCT within which a very small number of wind turbines are located. In this landscape, the wind energy developments are usually clearly separated and whilst each development influences the perception of the landscape at close proximity, they do not have a defining influence on the overall experience of the landscape (developments would not result in a significant cumulative impact on the LCT as a whole). The LCT would not be dominated by wind turbines.
A **landscape with wind energy** is considered to be an LCT within which several wind energy developments are located; where the landscape may be perceived as having wind turbines visible in more than one direction; and/or where wind energy developments have a strong influence on the character of the landscape *but* are not the defining characteristic of the landscape character. It will still be possible to appreciate the character of the landscape without wind turbines dominating every view within the LCT.
A **wind farm landscape** is considered to be an LCT where turbines are the defining influence on the landscape character of the area. All other landscape features are seen in the context of extensive wind energy development.

2.51 The above categories are 'visions' for how wind energy development could be deployed within the Newark and Sherwood landscape in order to steer development towards more appropriate locations and away from more sensitive landscapes. The determination of the category into which an LCT is placed depends upon the assessed level of sensitivity to each development typology,

including consideration of each criterion and the level of present cumulative effect. Where appropriate the determination also refers to the policies identified for each policy zone within the landscape character assessment.

2.52 These categories are based on the current level of operational and consented development, and as such they may need to be revised in future as pressures for development change.

2.53 The scale and spatial pattern of development that might be accommodated *within* an LCT will be informed by both the generic guidance, and the LCT-specific guidance, and will also be dependent on other constraints. Each landscape strategy applies to an LCT in isolation, albeit that cross boundary effects have been considered. However, the relationship between developments in different LCTs will also need to be taken into account in detailed consideration of individual assessments.

Examination of cumulative effects

2.54 Based on the data provided by the Council, cumulative zone of theoretical visibility (ZTV) maps were produced to demonstrate the patterns of existing and potential future turbine visibility across the district. ZTVs were calculated using a computer program and working with a 'bare earth' digital terrain model which does not take account of trees, woodland or buildings in determining visibility. The ZTVs were calculated to the following distances, to reflect the greater potential for wider impacts associated with larger turbines:

- Small: 5 km
- Small-medium: 15 km
- Medium: 20 km
- Large: 30 km
- Very large: 35 km

2.55 The patterns of visibility were compared against the landscape sensitivity baseline to provide an indication of potential cumulative effects. This sought to identify where cumulative development could affect the most sensitive landscapes, as well as areas of lower sensitivity where a greater degree of change may be considered acceptable.

2.56 When considering potential cumulative effects, the following criteria were applied:

- the number of wind turbines within the LCT;
- the number of additional wind turbines potentially visible from the LCT, and their direction and distance;
- the visual separation of the turbines from one another; and
- the relative size of operational and proposed turbines.

2.57 There are potentially innumerable combinations of different turbine scales and locations which may give rise cumulative effects, and it is not possible to consider all of these in a strategic study such as this. The cumulative analysis can only provide a general overview of the potential level of effect to be anticipated, and has informed further guidance for the siting and design of additional development within each LCT.

2.58 Potential developments are discussed in relation to turbine height, and number of turbines. Where existing wind farms are present, consideration should also be given to extensions which may be small individually, but would create a larger grouping. In this instance turbine typology should be applied to the group as a whole (existing plus extension), in order to consider the total scheme. For example, a three-turbine extension to a four-turbine development should not be considered as a three-turbine cluster, but the whole development should be considered as a seven-turbine wind farm.

Newark and Sherwood Landscape Capacity for Wind Turbines

Figure 2.1

Wind Energy Development Within Newark and Sherwood

ID	Location
1	Baulker Poultry Farm, Farnsfield
2	Belle Eau Park, Bilsthorpe
3	Brackenhurst College, Southwell
4	California Farm, Mill Lane, North Clifton
5	Caunton Road, Maplebeck
6	Combs Farm Farnsfield
7	Combs Farm, Combs Lane, Farnsfield
8	Copt Hill Farm, Ricket Lane, Blidworth
9	Cottage Farm, Cross Lane, Blidworth
10	Coultas Cover Farm, Kirklington Road, Eakring
11	Coultas Farm, Kirklington Road,Eakring
12	Featherstone House Farm, Bilsthorpe
13	Field off Brecks Lane, Elston
14	Field off Ollerton Road, South Muskham
15	Field3835, Long Lane, Farndon
16	Field9672, Cottage Lane, Long Lane, Farndon
17	Fosse Road, Farndon
18	FR 4340 off Normanton Road Weston
19	FR0778, Off Ossington Road, Carlton on Trent
20	FR1719, Ollerton Road, Little Carlton
21	FR2255, Thorpe Lane, Farndon
22	FR4149, Old Rufford Road, Farnsfield
23	FR4340 Normanton Road
24	FR4374, Kneesall
25	FR6423 Ollerton Road Caunton
26	FR6597, Cotham Road, Hawton
27	FR8199,Ossington Road, Carlton on Trent
28	FR8884, Cotham Road, Hawton
29	FR8895 Hopyard Lane, Bathley
30	FR9254 Adj AIT Weston
31	FRN0446 Tuxford Road Egmanton
32	FRN1237 Wadnall Lane Weston
33	FRN2005, Pecks Lane, Gunthorpe
34	FRN7864 Main Street, Maplebeck
35	FRN8297 Wolfeyhill Lane, Edingley
36	FRN9128 Gainsborough Rd Langford
37	Gainsborough Road, Langord
38	Hill Farm, Chapel Lane, Epperstone
39	Inkersall Grange Farm, Inkersall Grange Road
40	Inketrsall Farm, Inkersall Lane, Bilsthorpe
41	Kelham Road, Kelham
42	Kirklington Road, Hockerton
43	Land adj Newark Concrete, Quarry Farm, Newark
44	Land adj The Watershed Gables Dr, Hockerton
45	Land adj Upton Lodge, Hockerton Road, Upton
46	Land at Brecks Farm Maplebeck
47	Land at Hawthorne Hill Farm, Thorney
48	Land at Wigsley Old Airfield, North Scarle Road
49	Land at Woodside Farm, Newark Rd, Hockerton
50	Lurcher Farm, Mansfield Road, Farndon
51	Lyndhurst, Blidworth Road, Rainworth
52	Moor Farm, Moor Lane, Thorney
53	Moorwood Farm, Swinderby Road, South Scarle
54	New Holbeck Road Farm, Halam
55	Noble Foods, Oakham Farm, Walesby
56	Norwood, Mansfield Road, Blidworth
57	Plot Farm, Brown Wood Lane, Thorne
58	Potter Hill Farm, Potter Hill Road, Collingham
59	Rufford Forest Farm, Kirklington Road, Farnsfiel
60	Staple Quarry Landfill Site, Cotham
61	Stonish Hill, Eakring Road, Bilsthorpe
62	Stud Farm Rufford
63	Sunrise Cottage, Hockerton Lane, Upton
64	Trentholme Farm, Back Lane, North Clifton

Study area

Wind farm groups

Operational
- 18 - 30m
- 31 - 50m
- 51 - 80m
- 81 - 110m
- 111 - 130m

Consented
- 18 - 30m
- 31 - 50m
- 51 - 80m
- 81 - 110m
- 111 - 130m

Application
- 18 - 30m
- 31 - 50m
- 51 - 80m
- 81 - 110m
- 111 - 130m

Scoping
- 18 - 30m
- 31 - 50m
- 51 - 80m
- 81 - 110m
- 111 - 130m

Map Scale @ A3:1:140,000

Newark and Sherwood District Council

LUC LDN 5874-01_002_Fig2-1_Wind_energy_development_V3 28/03/2014

Source: Ordnance Survey, Newark and Sherwood District Council