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Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Prepared by LUC for the Glasgow and the Clyde Valley Strategic Development Plan Authority
September 2014

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Inverclyde Report

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Executive Summary

Approach and methodology

The Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley was undertaken between September 2013 and May 2014. The aim was to provide a strategic view of landscape sensitivity to wind energy development, and available capacity for further development, across the Glasgow and the Clyde Valley Strategic Development Plan area. The project was overseen by a steering group comprising Glasgow and the Clyde Valley Strategic Development Plan Authority, Scottish Natural Heritage, and the eight constituent local authorities. The outputs of the study include an Overview Report and eight local authority reports.

The foundation of the study is the characterisation presented in the Glasgow and Clyde Valley Landscape Character Assessment (1999) which provides a regional-scale classification of the landscape. The relative sensitivity and capacity of each of the defined landscape character types was assessed.

Sensitivity was evaluated through application of a series of criteria, developed from guidance on the siting and designing of wind farms which has been published by Scottish Natural Heritage. These criteria were discussed and agreed with the steering group. Sensitivity was defined for a series of wind turbine heights, ranging from 15 m up to around 150 m to represent the spectrum of turbine sizes which are currently operating or in the planning system.

Alongside the sensitivity assessment, the relative value placed on the landscape was evaluated. For the purposes of this study, this has been based on the presence of regional and local landscape designations, including regional parks, special landscape areas, areas of great landscape value and similar. Note has also been taken of country parks and landscape-related heritage assets, particularly world heritage sites.

The underlying capacity of each landscape character type was evaluated based on the assessment of sensitivity and the indicators of landscape value. The underlying capacity of each character type is considered to be relatively continuous across each of the landscape character types.

The underlying capacity is affected to a greater or lesser extent by the presence of existing wind turbine development, and by consented and proposed future development. For the purposes of the study information was gathered on operational and consented development, and development within the planning system, in October/November 2013. This information was not updated during the project lifetime, and therefore represents a snapshot of a continually changing pattern of development. Developments at scoping stage were not considered.

Following analysis of the existing and proposed wind turbines within and around each character type, an evaluation was made of the remaining capacity for further development. This has been termed *current residual capacity*, since it is based on the examination of current patterns of development, which may change in the future. Current residual capacity is found to vary across landscape character types, depending on the local level of turbine development. Some landscape character types are therefore sub-divided and conclusions are presented in relation to smaller areas.

To examine the potential for cumulative effects at a wider scale, a strategic cumulative assessment was undertaken. This seeks to examine regional patterns of development, including consideration of existing and emerging clusters of development as well as currently undeveloped areas. The cumulative assessment compared patterns of development against the assessed capacity of the landscape. A number of representative viewpoints and routes were examined to identify the potential for cumulative impacts on views.

Findings relating to Inverclyde

From the findings of the sensitivity and capacity study and the strategic cumulative assessment, it is concluded that there is limited opportunity for large scale wind energy development to be successfully integrated into the Inverclyde landscape without substantial landscape and visual impacts. The presence of the Regional Park, and the proximity of the area to viewpoints in and around the Firth of Clyde, present constraints to the development of large scale turbines.

There are potential opportunities for smaller scale development at the fringes of the moorland, though with regard to the potential for cumulative effects which would arise from a dispersed pattern of many turbines. Locally, sensitivity to turbines will be reduced around the fringes of industrial areas along the developed raised beach which runs from Gourock to Port Glasgow.

Limitations

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

- The study is based on the Glasgow and Clyde Valley Landscape Character Assessment, which defines broad landscape character types (LCTs) and was undertaken at a scale of 1:50,000. 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.
- The sensitivity and capacity assessments were undertaken based on the regional-scale LCTs, and may therefore overlook local detail and variation. More detailed assessment of sensitivity and capacity may be appropriate, based on local landscape character studies, where these are available.
- Capacity is not solely an inherent characteristic of the landscape, but is partly defined by the demand or need for development which may change over time. 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 strategic cumulative assessment was undertaken at a regional scale, and does not attempt to report on every potential cumulative effect, focusing on broad patterns of development instead.
- The study aims to give a strategic overview of capacity for wind energy development across the Glasgow and Clyde Valley area, and is designed to be complemented by more detailed, local analysis of sensitivity or capacity in published or future studies at local authority level.
- The study is intended to be a tool to inform spatial planning and development management. 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. 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.

Use of this document

The guidance presented in this document is based on consideration of wind energy developments which were operational, consented or the subject of live planning applications at the time of writing, based on data gathered in October/November 2013. Patterns of development have already moved on, and will continue to change in future. In referring to the conclusions of this study, it is essential to take note of changes which have taken place since it was written. When considering cumulative development within the area, the relevant local authorities should be contacted for up to date information on the planning status of proposed wind farms.

The study draws conclusions on:

- the underlying sensitivity and capacity of the landscape, regardless of current development; and
- the current residual capacity of the landscape, based on the current level of development.

While the underlying sensitivity and capacity will not change, the current residual capacity will be affected by incremental future development. As new projects enter the planning system, and further turbines are constructed, the current level of development will change with implications for the remaining capacity of the landscape.

For example, if the current residual capacity of a landscape is judged to be low to a particular type of development, and further development of this type has been consented since this report was written, then there may be no further capacity remaining. Alternatively, where higher capacity has been identified, additional development may have had limited effect, with some of the residual capacity still remaining.

The report does not introduce a threshold beyond which development would be unacceptable, but sets out guidelines, in terms of constraints and opportunities, as to how any further development may be accommodated. Consideration of this guidance will be the key factor in determining how much of the current residual capacity remains. Decisions must be made on a case-by-case basis, drawing on the detailed information presented within this report.

1 Introduction

Background to the study

1.1 LUC was appointed in September 2013 to carry out a study of landscape sensitivity and capacity in relation to wind turbine development within the Glasgow and the Clyde Valley Strategic Development Plan (GCVSDP) area. The study presents a strategic view of landscape sensitivity and capacity in relation to landscape character, and offers an overview of cumulative effects across the area, to inform judgements as to where these may limit further development.

1.2 The study is required to examine the sensitivity of the landscape to wind turbine development at a range of scales. It is intended that the study will provide evidence to underpin the preparation of spatial frameworks and supplementary planning guidance on wind energy. It will also inform development management decisions for wind turbine proposals, as well as providing assistance to developers in terms of site selection.

1.3 The project was overseen by a steering group led by the Glasgow and the Clyde Valley Strategic Development Plan Authority (GCVSDPA), together with Scottish Natural Heritage (SNH) and representatives of the eight constituent local authorities.

Reporting

1.4 The study was undertaken as a single regional exercise, at a strategic scale covering the whole of the GCVSDP area. The findings are presented as a whole within a separate Overview Report.

1.5 This report details the specific findings in relation to Inverclyde Council. The findings do not vary from the Overview Report, but only the conclusions relevant to Inverclyde have been reported. Dedicated reports for the other seven local authorities are also available.

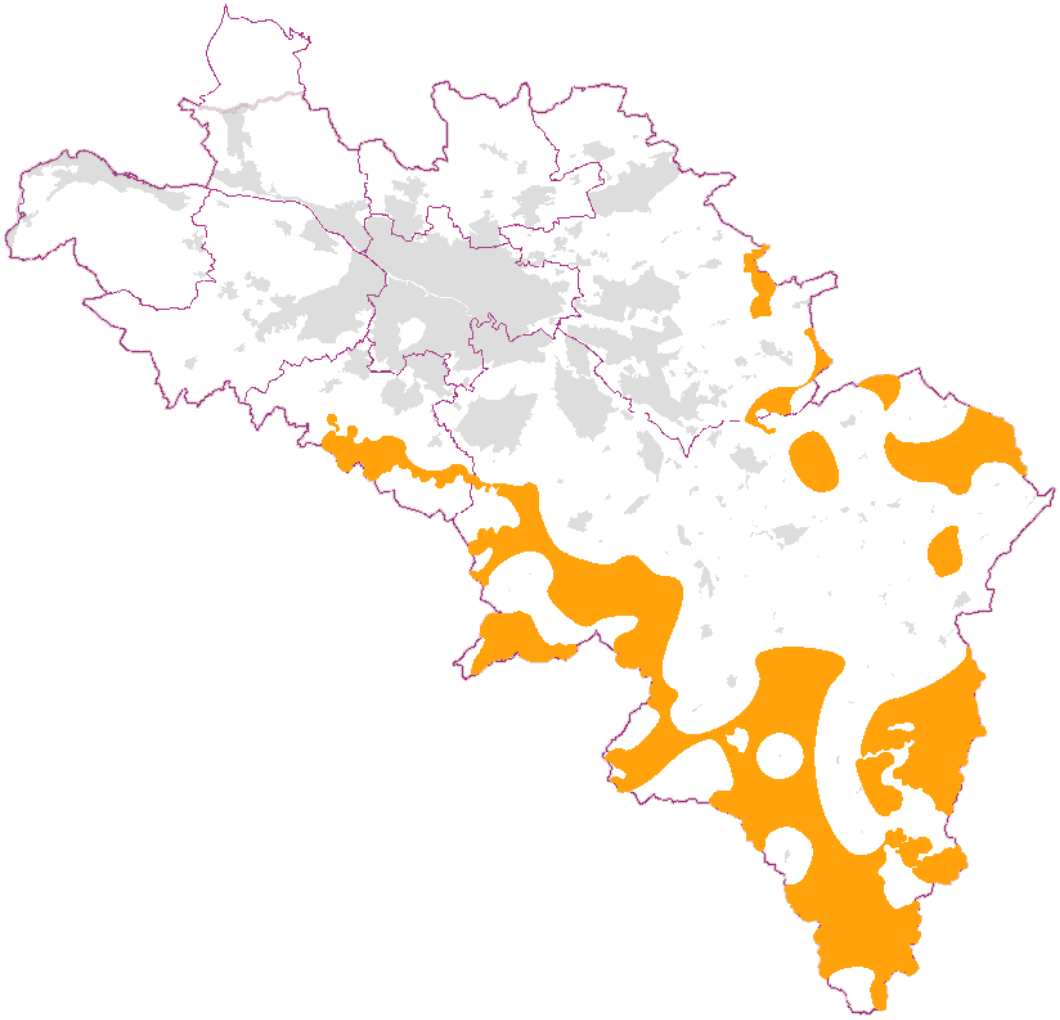
2 Background

Introduction

2.1 National and regional planning policy and guidance of relevance to the study are discussed in full within Section 2 of the Overview Report. This includes a review of Scottish Planning Policy and the GCVSDP documents and background reports.

2.2 At a strategic level, broad areas of search for wind farms of over 20 MW have been defined to inform the GCVSDP.[1] There are no broad areas of search within Inverclyde, as shown on **Figure 2.1**.

Figure 2.1 Broad areas of search defined in the GCVSDP



[1] GCVSDPA (2012) *Glasgow and the Clyde Valley Strategic Development Plan*.

Landscape capacity and sensitivity studies

2.3 Studies of direct relevance to the Inverclyde area are discussed below. Other capacity and sensitivity studies are considered in the Overview Report.

Ayrshire and Clyde Valley capacity study

2.4 The Ayrshire and Clyde Valley Windfarm Landscape Capacity Study (2004) presents a regional evaluation of landscape capacity across part of the present study area and the whole of Ayrshire.[2] The study included a criteria-based assessment of landscape sensitivity based on 'scoring' and separated into 'character sensitivity' and 'value sensitivity'. Development typologies are not described.

2.5 The second part of the study relied on GIS-based visibility analysis of 115 'sample locations' representing potential wind farm sites. The generated zones of theoretical visibility were then compared to the sensitivity assessment, and to population data, to provide indications of potential impact. The final stage modelled a number of scenarios illustrating potential strategies for delivering up to 800 wind turbines, to meet projected 2020 capacity requirements. The study did not draw a conclusion as to whether this or any other level of development would be acceptable across the study area.

2.6 While the report was presented with a number of important 'health warnings', some of the relevant conclusions are summarised below.

- The sensitivity assessment found that, of the GCVSDP area landscapes, those with the highest sensitivity were the Incised River Valleys and the Foothills character types, while the lowest sensitivity was applied to the Alluvial Plain and Fragmented Farmland types.
- The study found greater capacity for development in areas including Whitelee Moor, the upper Clyde Valley, parts of the Renfrewshire Hills, and the plateau moorland above Airdrie – it is notable that large wind farms have since been developed in two of these areas.

Clyde Muirshiel Regional Park

2.7 A 2010 study sets out the position of the Clyde Muirshiel Park Authority,[3] which is not a planning authority, that operational wind turbines have already adversely affected the regional park, and that further developments "*would have significant adverse impacts on the values that make the Regional Park distinct*" (page 1).

2.8 The study uses a series of criteria, including aspects of landscape as well as tranquillity, biodiversity, recreation, cultural heritage and climate change to demonstrate the multi-faceted importance of the park landscape. The present study recognises this importance through its designated status (see **Section 4**).

2.9 The Clyde Muirshiel study draws on the 2009 landscape capacity study for North Ayrshire,[4] which considered a broad buffer area including the regional park as well as most of Inverclyde. The stated aim of the study was to provide a more detailed picture of landscape capacity, and to identify areas where turbines could be sited with least impact.

2.10 Six typologies were identified, including extensions and single turbines. The sensitivity evaluation was based on landscape, perceptual qualities and views. Potential cumulative effects on views were analysed through examination of visualisations accompanying wind farm planning applications. The study concluded that there was no capacity for turbines in the 'Loch Thom area' which comprises most of the Regional Park within Inverclyde.

[2] Land Use Consultants (2004) Ayrshire and Clyde Valley Windfarm Landscape Capacity Study. Scottish Natural Heritage, Ayrshire Joint Structure Plan Committee and Glasgow and the Clyde Valley Structure Plan Joint Committee.
[3] Clyde Muirshiel Park Authority (2010) Framework Guidance Document for wind farm development proposals affecting Clyde Muirshiel Regional Park.
[4] Carol Anderson; Alison Grant (2009) Landscape Capacity Study For Wind Farm Development Within North Ayrshire. Phase One Report. North Ayrshire Council.

3 Methodology

Introduction

3.1 The study was undertaken at a regional scale and considered the whole of the GCVSDP area. The following section presents the detailed methodology as applied to the regional study.

3.2 The approach to the study was developed by LUC based on the requirements set out in the study brief. A method statement was prepared and circulated to the steering group and comments received were incorporated into the methodology.

3.3 The key sources of guidance for undertaking sensitivity and capacity studies include the landscape character assessment guidance published and its accompanying 'topic papers',[5] [6] and the more recent capacity study 'toolkit' from SNH.[7] These documents discuss general approaches and issues, but do not offer detailed or prescriptive guidance on how capacity studies should be undertaken. It is necessary to develop a project-specific approach based on the demands of the brief, informed by available guidance. The review of earlier capacity studies (**Section 2**) has also informed the development of the methodology.

Definitions and principles

3.4 Landscape sensitivity is concerned with the inherent character of the landscape, and the likelihood that this character would be changed by the introduction of development. The sensitivity of a given landscape will vary according to the type of change which is proposed. 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*" (paragraph 4.2).

3.5 This indicates that the study must examine 'aspects' of landscape character, and how these could be affected by wind energy development. For the purposes of this study, we have defined 'sensitivity' as follows:

Sensitivity is the relative extent to which the character of the landscape is susceptible to change as a result of wind energy development at different scales.

3.6 Landscape capacity is related to landscape sensitivity, but the two are distinct. Capacity has been defined in the Landscape Character Assessment Guidance:

"*Landscape capacity refers to the degree to which a particular landscape character type or area is able to accommodate change without significant effects on its character, or overall change of landscape character type. Capacity is likely to vary according to the type and nature of change being proposed*" (page 53).

3.7 Capacity seeks to define the *level of change* in character which a landscape can accommodate, and beyond which the character of the landscape would change. From this it could be inferred that the level of change should be a distinct threshold or amount of development which can be accommodated.

[5] Swanwick, C. and Land Use Consultants (2002) Landscape Character Assessment Guidance for England and Scotland. Countryside Agency and Scottish Natural Heritage

[6] Swanwick, C. (2006) Landscape Character Assessment Topic Paper 6: Techniques and Criteria for Judging Sensitivity and Capacity. Countryside Agency and Scottish Natural Heritage.

[7] Scottish Natural Heritage (n.d.) A Guide to Commissioning a Landscape Capacity Study.

3.8 However, when considering wind energy developments there is no such threshold, since it is widely accepted that all commercial scale wind turbine developments will result in changes to landscape character. Any such threshold must therefore be dictated by need, i.e. an ultimate level of development which must be accommodated in the study area. This question, essentially "how much change in the landscape are we prepared to accept?" is outside the scope of the present study.

3.9 The SNH 'toolkit' on landscape capacity studies notes the difficulties of quantifying capacity for wind energy development in terms of a threshold. Reasons for this include:

- Changing technology;
- High visibility of wind turbines;
- Difficulty in predicting the nature, scale and type of future development; and
- Changing cumulative picture.[8]

3.10 Topic Paper 6 suggests that the assessment of capacity must combine judgements of sensitivity and landscape value, informed by consideration of the specific type of change proposed. The present study therefore focuses on an assessment of landscape and visual sensitivity at a strategic scale, and combines this with indicators of landscape value. Based on consideration of these factors, a judgement about landscape capacity for wind turbine development can be made. For the purposes of this study, we have defined 'landscape capacity' as follows:

Capacity is the inherent ability of a landscape to accommodate the types of change expected to arise from the introduction of wind energy development at different scales, without resulting in an overall change in character type.

3.11 While noting the difficulty of defining a threshold, the study is required to indicate areas which are approaching the limit of cumulative capacity. Further judgements must therefore take into account development which is already present in the landscape, and to a lesser extent development which will potentially be present in the landscape in the near future.

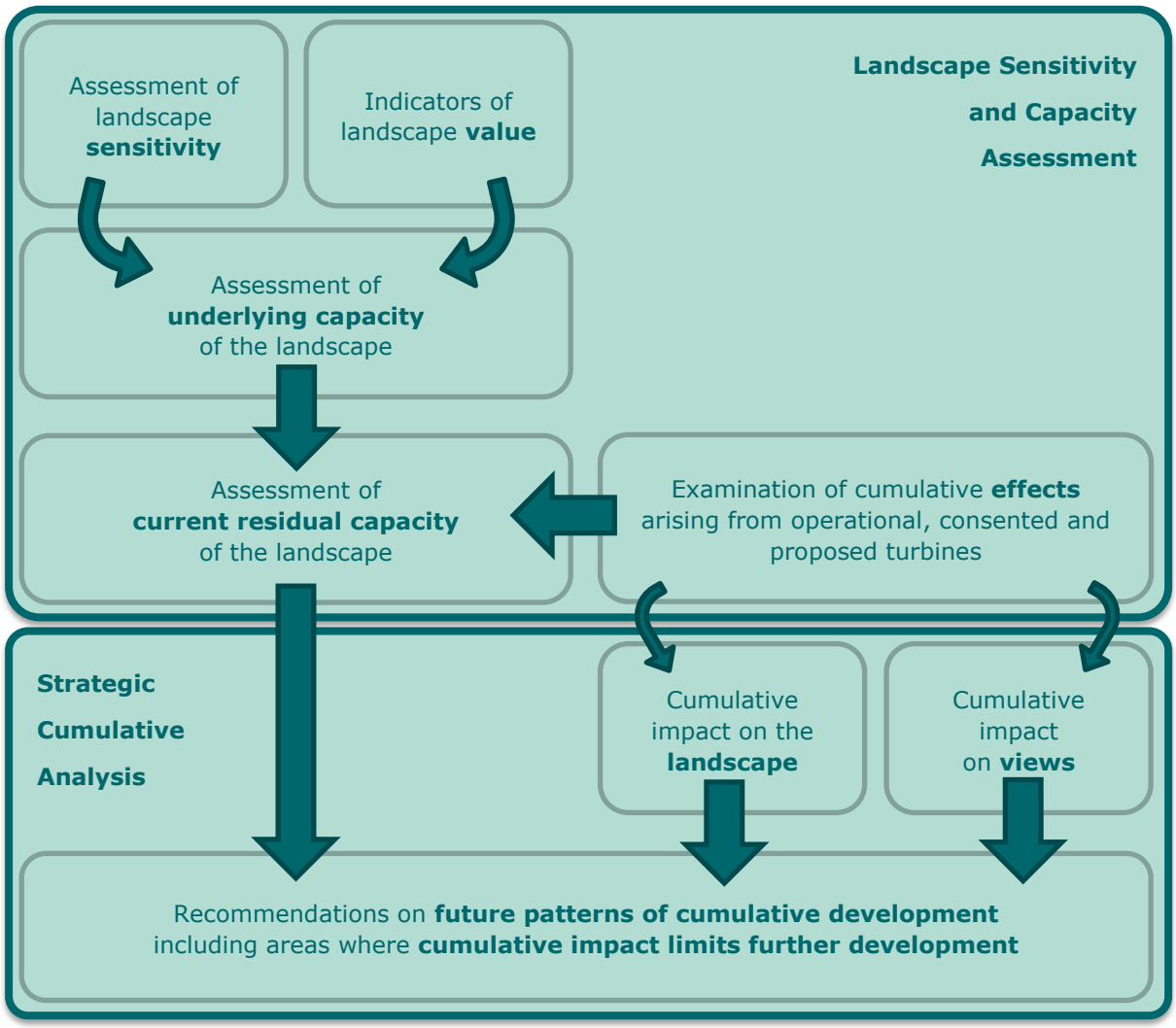
3.12 The components of the methodology must therefore be:

- An understanding of the development type(s) proposed, and how they may affect landscape character;
- A robust, criteria-based approach to the evaluation of landscape sensitivity;
- An indication of landscape value;
- A combination of these judgements to give an indication of capacity;
- An examination of current and potential future levels and patterns of wind turbine development to determine residual capacity; and
- An overall evaluation of cumulative impact at a strategic scale, to determine where the level of cumulative impact is likely to place a limit on further development in any areas.

[8] Scottish Natural Heritage (n.d.) A Guide to Commissioning a Landscape Capacity Study. Pages 20-21.

Summary of methodology

3.13 The diagram below presents a summary of the stages in the methodology.



Study area

3.14 The focus of the study was on the landscapes and potential wind energy developments within the eight GCVSDP council areas, defined as the **core area**. The part of West Dunbartonshire which falls within the Loch Lomond and the Trossachs National Park does not form part of the core area.

3.15 It is important to bear in mind that landscape and visual issues continue uninterrupted across administrative boundaries, and the study must recognise the potential for cross-boundary effects beyond the GCVSDP area, particularly in relation to cumulative issues. A **buffer area** was therefore adopted. Following discussion with and feedback from the steering group, it was agreed that the simplest solution would be the adoption of a 15 km wide buffer around the core area.

3.16 Where the term **study area** is used, this refers to both the core area and the buffer area. **Figure 3.1** illustrates the extent of the core area and the buffer area.

3.17 Suggested distances at which potentially significant effects on views may arise from wind turbines are set out in Table 2 of the SNH guidance on Visual Representation of Wind Farms (2006). These distances, up to 35 km for the largest turbines, were considered as a means to define a buffer but in practice it is turbines which are closer to potential receptors which will have a bearing on the perception of cumulative effects. This has been borne out in other recent studies; for example the South Lanarkshire Spatial Framework and Landscape Capacity for Wind Farms also adopts a 15 km buffer.

3.18 The landscape of the GCVSDP area is relatively contained, with higher ground surrounding the Clyde basin. As such the landscapes of the core area and those in the buffer are often visually unrelated. Intervisibility mapping (see below) has been carried out to establish those areas within the buffer area which are most relevant to examination of the core area, and those which are not and need not be examined further.

3.19 Consideration of sequential effects, focusing in particular on the principal road corridors entering and leaving the core area, may require larger distances to be incorporated. For sequential assessment, the distance beyond the core area was determined on a case-by-case basis, informed by the intervisibility mapping.

3.20 The study does not draw conclusions or make recommendations in relation to the landscapes of the buffer area. However, these areas are used for the gathering of baseline data which may affect judgements as to the sensitivity and capacity of landscapes in the core area.

Intervisibility mapping

3.21 Computer-generated theoretical intervisibility mapping was used to determine the relative level of visibility of different turbine heights across the core area, assisting with the consideration of the potential landscape implications of different development types.

3.22 The analysis comprises a GIS-based calculation of the number of 'source points' which are theoretically visible to viewers within the study area. The viewshed is calculated from a viewer height of 2 m above ground level. The 'source points' are arranged in a 500 m grid covering the whole of the core area. To examine the relative visibility of different turbines, the 'source points' are assigned different heights. Visibility maps have been generated for three different heights, representing the range of turbines under consideration, as follows:

- **Figure 3.2** shows theoretical visibility of ground level (0 m), indicating the most 'visible' landscapes, and highlighting visual relationships between the core area and the buffer area;
- **Figure 3.3** shows theoretical visibility of turbines of 80 m to tip, broadly in the middle of the range of heights being considered; and
- **Figure 3.4** shows theoretical visibility of turbines of 150 m to tip, at the upper extent of the range of heights being considered.

3.23 The intervisibility mapping is based on a 'bare ground' topographical model, which takes no account of the screening effect of buildings, vegetation and small localised variations in topography. The maps therefore indicate theoretical visibility only. Colours shown are relative to the highest level of visibility, which is different in each case.

3.24 Areas of lower visibility are not necessarily of inherently lower sensitivity to development, nor vice-versa. The intervisibility mapping has informed the consideration of sensitivity to different development typologies as part of a wider analysis of landscape and visual characteristics.

3.25 The maps indicate where greatest theoretical visibility of turbines in the core area would occur, shaded in red, and areas where visibility would be more limited, shaded blue. Intervisibility mapping is discussed in relation to each LCT in **Section 5** of this report.

Potential effects of wind energy development on the landscape

3.26 In order to determine sensitivity, 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 Glasgow and Clyde Valley landscape.

General features of wind energy development

3.27 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 repowering[9] may take place after this period has elapsed, subject to further permission.

3.28 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.

3.29 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.

3.30 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. Smaller turbines may be darker grey or black.

3.31 Turbines are available in a wide range of sizes, from very small roof-mounted machines designed for domestic use, to large commercial structures. At 147 m to tip, the turbines at Calder Water wind farm in South Lanarkshire are among the tallest currently operating in the UK.

3.32 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.

3.33 Large, commercial-scale turbines are uniformly of three-bladed design, with a relatively standardised form and appearance. Smaller turbines are more varied in design, including two-bladed models which can appear less balanced, particularly when seen in conjunction with three-bladed turbines. Smaller turbines also show a greater variety of nacelle forms and colours, as well as occasional use of lattice towers in place of tubular towers.

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

[9] Repowering refers to the replacement of turbines at the end of their useful life, and often involves installation of larger machines on the same site.

- 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 site to provide construction materials for the access tracks, avoiding the need for transportation of material to the site;
- 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.

3.35 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 unaided 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.

3.36 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

3.37 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, including forestry;
- 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, remoteness 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 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 overbearing when they are sited very close to viewers, including residents;
- 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.

3.38 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 energy generation.

Cumulative issues

3.39 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.[10] These issues were considered in the strategic evaluation of cumulative effects (**Section 6**).

Development typologies

3.40 There are several substantial wind farms in the study area, with continued demand for further large-scale sites. At the same time, the feed-in-tariff has driven an increase in smaller-scale developments and single turbines. The study must therefore consider a very wide range of potential development types and the interaction between them.

3.41 Wind energy development 'typologies' therefore need to be defined, to allow the sensitivity assessment to be flexible enough to consider the most appropriate scales of development in each area.

3.42 The brief suggests consideration of turbine heights from 15 m to 150 m, although the 'size' of a wind energy development can be defined in a number of ways, including turbine numbers and power output as well as height. Power output is less useful in landscape terms as there are many combinations of different turbines which could give the same output. Discussion with the steering group indicated greater concern in relation to turbine height than turbine numbers.

3.43 **Table 3.1** sets out the turbine height typologies which were agreed following these discussions. These five typologies cover the range of turbine heights currently operating and proposed within the core area, ranging from small turbines often associated with farms, to the largest commercial models currently proposed. Turbines over around 150 m are not specifically considered in the study since, while such turbines have been built in Europe, there are no confirmed plans to deploy machines of this scale in Scotland. Where proposals involve turbines of heights within 5 m of a cut-off between two typologies, it is recommended that the guidance provided for both typologies is taken into account. For example, a proposal for 78 m turbines will need to be considered against the conclusions for both medium and large typologies.

Table 3.1 Wind turbine development typologies

Turbine typology	Height range
Small turbine	15-30 m to tip
Small-medium turbine	31-50 m to tip
Medium turbine	51-80 m to tip
Large turbine	81-120 m to tip
Very large turbine	over 120 m to tip, up to around 150 m

3.44 In terms of turbine numbers, the study considers a range of development scales, though this is dealt with in a less formal way than for turbine height, since height is the key factor in determining the compatibility of a proposal with its landscape. The following scales of development have been considered:

- single turbines;
- cluster of turbines (2-5 turbines); and

[10] Scottish Natural Heritage (2009) Siting and Designing Windfarms in the Landscape.

- wind farm (6+ turbines).

3.45 The study also requires consideration of extensions to and repowering of existing schemes. These are addressed more generally by reference to compatibility with existing developments, particularly in terms of turbine scale, rather than through the definition of additional development types. The appropriateness of repowering will depend primarily on the height and number of turbines proposed, rather than the prior existence of a wind farm, and as such these schemes can be considered as though they are 'new' developments.

Assessment of landscape sensitivity

3.46 The sensitivity of the landscape is assessed by examining the key characteristics of each landscape character type (LCT) with reference to a series of sensitivity criteria.

3.47 **Table 3.2** presents the criteria which have been adopted for this study, following discussion with the steering group. The criteria are informed by the review of the potential effects of wind energy development, and by the principles set out in a range of published guidance on landscape and visual assessment and wind energy.[11] [12] [13] [14] They have been developed from criteria employed by LUC in previous studies.

3.48 The criteria relate to the key aspects of landscape character and visual amenity which may be affected by wind energy development, and which can therefore be used as 'indicators' of sensitivity. **Table 3.2** includes examples of landscape characteristics which indicate higher or lower sensitivity in relation to each criterion, and a brief rationale for the inclusion of each.

Table 3.2 Criteria for Assessing Landscape Sensitivity to Wind Farm Development

Characteristic	Aspects indicating lower sensitivity to wind turbine development	⟷	Aspects indicating higher sensitivity to wind turbine development
LANDSCAPE CRITERIA			
Landform and scale: patterns, complexity and consistency	Large scale landform Simple or featureless Absence of strong topographical variety Smooth, regular and convex or flat and uniform	⟷	Small scale landform Distinctive and complex Recognisable scale indicators Strong topographical variety Irregular or rugged
Larger wind turbines will generally be less dominant in larger-scale landscapes, which are simpler in form and where there are fewer features of 'human scale'. In smaller-scale landscapes, larger turbines can appear overbearing and out of place. Buildings, trees and other features can act as 'scale indicators', potentially emphasising the size of wind turbines. Smaller turbines may relate better to smaller scale landscapes, where there may be potential to utilise topography for screening purposes.			
Land cover: patterns, complexity and consistency	Simple and consistent Predictable Large-scale and/or regular patterns	⟷	Complex or varied Unpredictable Small scale and/or irregular patterns
Areas of simple land cover, such as open moorland, present fewer scale indicators against which turbine size may be judged. Distinctive patterns in the landscape, particularly where these are of smaller scale, are more susceptible to being interrupted by wind turbine development. There may be more opportunity to design smaller turbines so as to fit into landscape pattern without interrupting it, and sensitivity may be reduced.			

[11] Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment. 3rd edition. Routledge.
[12] Scottish Natural Heritage (2009) Siting and Designing Windfarms in the Landscape.
[13] Swanwick, C. (2006) Topic Paper 6: Techniques and criteria for judging capacity and sensitivity. Countryside Agency and Scottish Natural Heritage.
[14] Scottish Natural Heritage (2012) Siting and Design of Small Scale Wind Turbines of between 15 and 50 metres in height.

Characteristic	Aspects indicating lower sensitivity to wind turbine development	⟷	Aspects indicating higher sensitivity to wind turbine development
Settlement and man-made influence	Concentrated settlement pattern Presence of contemporary structures eg infrastructure or industrial elements	⟷	Dispersed settlement pattern Absence of modern development, presence of small scale, historic or vernacular settlement
A settled, man-modified landscape is likely to be less sensitive to further human intervention than one which has little modern development and only scattered settlement. Industrial landscapes are likely to be least sensitive in this context. However, the presence of settlement indicates potentially sensitivity visual receptors, and will present scale indicators against which turbine size may be judged.			
Movement	Prominent movement, busy	⟷	No evident movement, still
Due to the dynamic nature of wind turbines, landscapes where movement is a feature are likely to be less sensitive than those which are still. Examples of movement in the landscape include traffic on busy roads, airports and shipping lanes.			
VISUAL CRITERIA			
Skylines	Simple predictable skylines Presence of existing vertical features Obscured skylines	⟷	Complex unpredictable skylines Uninterrupted horizons Prominent skylines
This criterion is related to landform and scale, with simple skylines generally having fewer scale indicators against which to judge wind turbine height. Turbines placed on more complex skylines are likely to give rise to a visually confusing appearance. Where man-made features such as masts or pylons are already present on the skyline there may be reduced sensitivity to further intervention, although there is a risk of creating 'clutter' where features of different sizes and forms are viewed together. Skylines which are prominent features in views are likely to be of higher sensitivity, regardless of form. Small turbines may interrupt skylines as well as larger turbines. Some open skylines may be more sensitive to multiple smaller interruptions than to a single larger development, particularly in larger-scale landscapes.			
Key views, vistas and landmark features	Obscured landmarks, views towards/ from landmarks, absence of vistas Indistinctive or industrial settings	⟷	Prominent key landmarks, views towards/ from landmarks or key vistas Distinctive settings or public viewpoints
Where open views are an important characteristic within a landscape, wind turbines may have a detrimental impact. There may be particular views or viewpoints looking outward, or landmarks which are features in wider views. In either case the landscape may be susceptible to change as a result of turbines interrupting views. Landscapes in which there are few long views, such as wooded areas or undulating landscapes, are less sensitive in terms of this criterion.			
Receptors	Unpopulated areas Inaccessible with few recreational receptors	⟷	More densely populated or many receptors Landscape focused recreation and/ or visitor attraction
The most sensitive visual receptors are generally considered to be residents at home and in their communities, and people accessing the landscape for recreational purposes, such as walkers and cyclists. Settled landscapes have higher numbers of residential receptors, although unpopulated areas may attract more recreational users. Sensitivity will depend on the balance of these types of receptors. Areas where opportunities for access are actively promoted, such as long-distance paths and country parks, are considered more sensitive.			
Inter-visibility with adjacent landscapes	Limited views into and out of landscape Weak connections, self-contained area and views Simple large scale backdrops	⟷	Prospects into and out from high ground or open landscapes Contributes to wider landscape Complex or distinctive backdrops
In contrast with the key views criterion, which is concerned with views within an area, this criterion examines views in and out of a landscape, and its relationship with adjacent areas. Intervisibility maps have been generated (see **Section 3.32**) to illustrate the relative visibility of different parts of the study area. Of particular sensitivity are landscapes which form part of the setting of adjacent landscapes, for example a distinct ridge adjacent to a valley.			

Characteristic	Aspects indicating lower sensitivity to wind turbine development	⟷	Aspects indicating higher sensitivity to wind turbine development
Importance of **natural and cultural heritage features** to the landscape	Limited association between landscape(s) and/or features	⟷	Strong association between landscape(s) and/or features
Features of natural and cultural heritage importance are often designated in their own right, and the purpose of this study is not to give detailed guidance on the sensitivities of these features. However, in some cases the natural and cultural interest of an area is readily apparent in the landscape, and contributes to the sensitivity of the landscape itself. Examples include large-scale historic environment features, such as intact designed landscapes, or areas of apparent natural heritage interest, such as deciduous native woodland.			
Perceptual aspects: sense of remoteness, tranquillity, or wildness	Close to visible or audible signs of human activity and development Low levels of wildness, as indicated on SNH mapping	⟷	Physically or perceptually remote, peaceful or tranquil High levels of wildness, as indicated on SNH mapping
The landscapes of the study area vary from densely built up areas to relatively remote moorlands. SNH have produced mapping to illustrate relative wildness across Scotland, based on a range of criteria (see **Section 4**). While there are very few genuinely remote areas of 'wild land' character in the study area, there are landscapes which are important for their relative tranquillity in comparison to the nearby settled areas. Landscapes which are more tranquil or wild are likely to be more sensitive to the introduction of man-made structures such as wind turbines.			

Application of the criteria

3.49 A description of each LCT in relation to each criterion is presented, leading to a determination of sensitivity in relation to each criterion. This informs an overall assessment of sensitivity to each development height typology for each LCT. In arriving at an overall assessment, the range of criteria must be carefully balanced. Several of the criteria overlap, and some recognise qualities which are essentially opposites. No consistent weighting of criteria is applied, rather the key characteristics of the LCT are used as a guide to the relative importance of criteria. Together with observations made in the field, this allows a judgement to be made on sensitivity to the range of development typologies.

3.50 The levels of sensitivity are defined in **Table 3.3**.

Table 3.3 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-medium	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.
Medium	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.
Medium-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.

3.51 These levels of sensitivity enable immediate comparison of landscape types across the study area. The findings are relative to the landscapes of the core area. That is, the levels of sensitivity are not absolute, but illustrate a distribution between the most and least sensitive landscapes within the GCVSDP area.

3.52 The assessment has been undertaken at a strategic scale appropriate to the examination of this regional area, and the results do not take into account all local variations. Where appropriate the findings make reference to other more detailed landscape sensitivity assessments.

Field work

3.53 The sensitivity assessment was initially undertaken as a desk-based review, following which field work was undertaken to confirm understanding of landscape character and sensitivity. The purpose of the site visits was to:

- Confirm the landscape baseline, in terms of any updates to key characteristics required;
- Identify visibility and key views from and to each character type/area;
- Identify potentially sensitive landscape features;
- Confirm and supplement the findings of the sensitivity evaluations;
- View existing wind energy development in the landscape and gain an understanding of the type of effects which are already present, including cumulative effects; and
- Identify locations for the training field visit at the project close.

3.54 Following the field work the sensitivity assessments and findings were confirmed and finalised.

Landscape value

3.55 The European Landscape Convention,[15] adopted in the UK in 2006, confirms that all landscapes are important, and are valued by different people for different reasons. Value, unlike sensitivity, is not an inherent property but is placed on a landscape by society. For the purposes of a capacity study, the aim is to determine how much change can be accommodated within a landscape without compromising the value placed upon it.

3.56 The present study, which is strategic in nature, uses existing landscape designations as an indicator of landscape value. There are no nationally designated landscapes in the study area, though there are a number of local designations defined by the local authorities. These have been selected at different times for different reasons and purposes, and as such are not directly comparable. Designations are reviewed in **Section 4**, and it is clear that not all have detailed citations or defined 'special qualities'. However, they do highlight parts of the core area which are known to be of value. The local designations are therefore referred to under the LCTs in which they occur, and the extent to which their reasons for designation would be affected by wind turbine development is briefly explored.

3.57 Value can also be represented by other types of designation, including those related to cultural heritage and biodiversity, although these considerations are outside the scope of the present study. Other potential indicators of value, including wildness and tranquillity, have been incorporated into the assessment of sensitivity and are not therefore included again, to avoid 'double counting'.

Combining the judgements: landscape capacity

3.58 The findings of the study in relation to landscape sensitivity and landscape value are not combined in a rigid matrix since the relationships between these aspects is not linear. Judgements of capacity are made through careful balancing of each of these factors, which are not consistently weighted. In each case detailed justification is given for the level of capacity which is assessed.

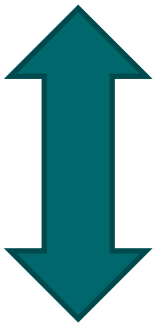
3.59 Generally, areas with higher sensitivity and higher value are assigned lower capacity for development. Conversely, areas with lower sensitivity and lower value are assigned higher capacity. The study does not seek to define a 'threshold', such as a level of sensitivity beyond which capacity would not be identified, since the relationship between sensitivity and capacity is not linear.

3.60 The capacity of each LCT is summarised as 'higher', 'moderate', or 'lower'. These terms do not correspond to strictly defined categories, but are stages on a continuum. Indicators which may lead to an assessment of higher or lower capacity are presented in **Table 3.4**.

3.61 The identification of lower capacity does not imply that no wind farms would be acceptable, nor does the identification of higher capacity imply that any given proposal could be accommodated. The assessment has examined capacity relative to the study area, rather than as an absolute measure.

[15] Council of Europe (2000) European Landscape Convention. Council of Europe Treaty Series no. 176.

Table 3.4 Indicators of higher or lower capacity

Capacity	Indicators
Higher capacity	Landscapes of lower sensitivity and value, where wind turbines of the typology under discussion may be acceptable, with reference to the scale and form of the landscape, and the likely visibility of the development from sensitive receptors.
Moderate capacity	
Lower capacity	Landscapes of higher sensitivity and value, where wind turbines of the typology under discussion would not be easily accommodated within the scale and form of the landscape, or would be more visible from sensitive receptors.

Underlying and residual capacity

3.62 The outcome of combining the judgements of landscape sensitivity and value is an assessment of the **underlying capacity** of the landscape. This underlying capacity is considered to be relatively consistent across each LCT, albeit that there will be local variations in levels of sensitivity and value. However, the underlying capacity is clearly affected by operational development, and may be further affected by development which is consented or proposed. This development may occupy some of the underlying capacity, reducing the capacity which is available for future development.

3.63 The term **current residual capacity** has been adopted for this study. Current residual capacity is the level of capacity which remains, once operational, consented and proposed development has been considered. This measure of capacity is more likely to vary within LCTs, since levels of development will differ across each area, with different effects on the underlying capacity. It is important to note that this is *current* residual capacity, based on the pattern of development which was current at the point when the study was undertaken, and which will continue to change.

3.64 The analysis of cumulative development is based on data provided by the local authorities. The data was mapped according to the planning status and tip height of the turbines, and this is discussed in **Section 4**. The study has sought to include all operational and consented wind turbines, and those with valid planning applications, which are over 15 m overall tip height. Proposals at scoping stage, i.e. prior to submission of a planning application, were not considered. Further data was gathered for operational, consented and proposed wind turbines in the buffer area.

3.65 The pattern of cumulative development within and adjacent to each LCT was examined, and the level of development compared to the underlying capacity, to arrive at an evaluation of current residual capacity for each LCT. Where there are significant variations in levels of development, LCTs have been subdivided into areas and current residual capacity is assessed for each area. Where there are no, or very few, operational, consented or proposed turbines, only the underlying capacity is reported.

Siting and design guidance: opportunities and constraints

3.66 The assessment of current residual capacity informs siting and design guidance, including identification of opportunities and constraints drawing on the sensitivity and capacity analysis. If residual capacity is identified, the guidance seeks to indicate where and how additional renewable

energy development could be accommodated in terms of siting, layout and design. Guidance aimed at minimising cumulative effects is also provided. The guidance is strategic and broad-brush in nature, and must be supplemented by more detailed analysis to identify potentially suitable sites.

Strategic cumulative assessment

3.67 To give a wider perspective on potential cumulative effects across the core area, a strategic analysis of wind energy development was undertaken. This analysis relies on the same data referred to above, and described in **Section 4**. The wind turbines are sorted into operational, consented and proposed development.

3.68 Operational wind turbines are part of the existing landscape. The impacts of developments which have received planning consent, whether built or unbuilt, have been considered in the planning system and found to be acceptable. As such the combination of operational and consented development presents a 'baseline' level.

3.69 The study then looks ahead to developments in the planning system, and how they may affect the landscape if built, in order to reach conclusions about how much further change could be acceptable. The pattern of proposed development is compared to the assessed capacity across the core area, and against a series of representative viewpoints. The study draws a distinction between cumulative *effect*, which occurs where more than one development is visible, and cumulative *impact*, which takes account of landscape and visual sensitivities.

Cumulative zones of theoretical visibility

3.70 Cumulative zone of theoretical visibility (CZTV) analysis was applied to determine areas which are already experiencing high levels of cumulative visibility, based on operational schemes, and areas which are likely to experience high levels of cumulative visibility based on proposed schemes. CZTVs are computer-generated and depict maximum visibility, since they are based on 'bare earth' terrain modelling which does not consider screening by vegetation, buildings, and local topographical variation.

3.71 CZTVs provide a preliminary means of identifying potential areas of cumulative visibility, but do not represent the intensity or nature of the impact. There may be areas of high cumulative visibility where cumulative impacts do not occur, for example, because the turbines theoretically visible are in fact viewed across a great distance. Further analysis of cumulative patterns of visibility is therefore carried out in order to take account of size, proximity and visibility of wind energy developments.

3.72 The patterns of visibility identified by the CZTVs were compared against the findings of the landscape capacity assessment to provide an indication of where potential cumulative impacts are occurring, and where they may occur in future given current trends. This analysis seeks to identify which LCTs are experiencing, or are likely to experience, the greatest or least cumulative impacts.

3.73 The CZTVs were also compared against a visual baseline, defined as a series of key routes and viewpoints. A list of key viewpoints was selected as a representative sample of locations where people may appreciate the landscape, for example hills, public viewpoints and country parks. Due to the strategic scale of the study, the number of viewpoints was limited to a sample of approximately equal geographical distribution. Settlements and major roads were also considered. Further detail on the CZTV analysis is given in **Section 6**.

3.74 The following criteria are considered in coming to a judgement on cumulative impacts:

- The number of wind farms visible;
- Distance and direction to the wind farm(s);
- The extent of each wind farm likely to be viewed;
- The visual separation of the wind farms from one another; and
- The relative turbine size and extent of each proposal.

Limits of cumulative capacity

3.75 It is necessary to determine where in the core area the limits of capacity are being reached. That is:

- where the level of cumulative effect from operational and consented development is of such a level that there is no additional capacity for further development; and
- where the level of cumulative effect from proposed development, in addition to operational and consented development, may be of such a level that there is no additional capacity for further development.

3.76 These issues are examined by comparing the assessed capacity of the landscape with the level of cumulative *effect*, as described above. By carrying out this comparison, an impression can be gained not only of how much development is present or visible, but how much this matters to the landscape in question. This provides the information on cumulative *impact*.

3.77 As noted above, there is no firm threshold. However, where high levels of cumulative effect are occurring in landscapes with lower capacity, it is likely that cumulative impacts will be higher, and that this will potentially limit further development in these areas.

4 Landscape Baseline

Landscape Character Types

4.1 The sensitivity and capacity study presented in **Section 5** is based on the Glasgow and Clyde Valley Landscape Character Assessment (GCVLCA),[16] which defines 21 broad landscape character types (LCTs). Of these LCTs, four are found within the Inverclyde area, as listed below and shown on **Figure 4.1**:

- LCT 1 Raised Beach;
- LCT 6 Rugged Upland Farmland;
- LCT 12 Upland River Valleys; and
- LCT 20 Rugged Moorland Hills.

4.2 Seascape character areas have been identified for the Firth of Clyde, in a 2013 study.[17] The Inverclyde coast is classified as part of the *Upper Firth of Clyde Seascape Area*, between Skelmorlie and Cloch, and the *Inner Firth of Clyde Seascape Area*, between Cloch and Port Glasgow. Although the present capacity study is based on the GCVLCA, the seascape assessment has informed the judgements of sensitivity in relation to coastal landscapes.

Landscape designations

4.3 Landscape designations, defined for the purpose of protecting the character and quality of the landscape itself, are indicators of the value placed on landscapes by society. The following sections briefly discuss the regional and local landscape designations which are present within the Inverclyde council area. These designations are mapped on **Figure 4.2** and are referred to in the consideration of LCTs (**Section 5**).

4.4 Country Parks are also referred to in **Section 5** where relevant, and sites listed on Historic Scotland's Inventory of Gardens and Designed Landscapes have also been referenced where they contribute to the wider character of the landscapes in which they occur.

Clyde Muirshiel Regional Park

4.5 Clyde Muirshiel is one of three Regional Parks in Scotland. Designated in 1990, it covers 28,000 ha in Inverclyde, Renfrewshire and North Ayrshire. The purpose of Regional Parks is to "*provide the oversight and resources needed to integrate recreation with other activities, to undertake wider landscape and habitat management, and to promote the area for the benefit of residents and visitors.*"[18]

4.6 The aims of the Park Authority which manages the area are defined as:

- "*To conserve and enhance the natural beauty, biodiversity and cultural heritage of Clyde Muirshiel Park;*
- *To encourage and enable learning, understanding and enjoyment of Clyde Muirshiel Park; and*
- *To promote and foster environmentally sustainable development for the social and economic well-being of the people and communities within the Clyde Muirshiel Park area*."[19]

[16] Land Use Consultants (1999) Glasgow and the Clyde Valley landscape assessment. Scottish Natural Heritage Review no. 116.
[17] Alison Grant and Carol Anderson (2013) Seascape / Landscape Assessment of the Firth of Clyde. Carried out on behalf of the Firth of Clyde Forum.
[18] Scottish Natural Heritage (2012) Parks and reserves – places managed for people and nature. Page 13.
[19] Clyde Muirshiel Park Authority (2010) Park Strategy 2008 – 2011: Extension to 2012. Page 6.

4.7 The Regional Park does not have a defined set of 'special qualities' which it seeks to protect, but it is nevertheless highly valued for its scenery and tranquillity.

West Renfrew Hills Scenic Area

4.8 The Inverclyde Local Plan (2005) includes Policy HR5 West Renfrew Hills Scenic Area. This area, first identified in 1981, is described as a "*scenic area of regional importance*". Its presence requires a sensitive approach to development, including consideration of the scale, siting and design of proposals. The designation is carried forward into the Inverclyde Local Development Plan Proposed Plan (2013).

Wildness

4.9 SNH has produced nationwide mapping of relative wildness, based on an analysis of four aspects: absence of modern artefacts; perceived naturalness; remoteness from roads and ferries; and rugged or challenging terrain.[20] This mapping indicates that the Renfrewshire Heights have some of the highest levels of wildness within the study area, centred on Waterhead Moor and extending north to Duchal Moor and Leap Moor in Inverclyde. By contrast, the more developed coastal areas, and the Strathgryffe area to the east, show limited relative wildness.

Visual baseline

4.10 The visual baseline for the strategic cumulative assessment (**Section 6**) comprises locations where people view the landscape. Groups of people who are most sensitive to their visual environment are usually considered to be residents in their homes and communities, and people accessing the countryside for recreation, e.g. hill walkers.

4.11 A series of key viewpoints was selected to represent recreational users of the landscape, including locations where potentially sensitive viewers have views of the landscape of the core area which may be affected by present or future wind energy development. Viewpoints were discussed with the steering group, including Inverclyde Council, and a list of 21 locations was agreed. Two of the representative viewpoints are of relevance to the examination of cumulative effects within Inverclyde. These viewpoints are listed in **Table 4.1** and are located on **Figure 4.3**.

Table 4.1 Representative viewpoints

	Location	Local authority	Grid reference	Reason for selection
1	Cornalees Bridge Centre	Inverclyde	224696 672048	One of the main access points for the Clyde Muirshiel Regional Park
2	Dumbarton Castle	West Dunbartonshire	239937 674489	Elevated point on the Clyde, panoramic views from the castle

[20] http://www.snh.gov.uk/docs/A810729.pdf

Wind turbine development

4.12 To inform the assessment of cumulative effects, data has been gathered on existing and proposed wind energy development across the study area, as discussed in the Overview Report. Data was gathered in October/November 2013 and has not been updated, it therefore represents a snapshot of a continually changing pattern of development. The total numbers of wind turbines in Inverclyde, as of November 2013, are summarised in **Table 4.2** below.

Table 4.2 Wind turbines in Inverclyde (October 2013)

	Operational and under construction	Consented	Proposed (valid planning application or appeal)	Total
Small (15-30 m)	6	4	None	**10**
Small-medium (31-50 m)	None	6	None	**6**
Medium (51-80 m)	None	3	None	**3**
Large (81-120 m)	None	None	None	**0**
Very large (over 120 m)	None	None	None	**0**
Total	**6**	**13**	**0**	**19**

4.13 Development within 15 km of Inverclyde, located in both the core area and the buffer area, has also been considered in the study. Existing and proposed development in and around Inverclyde is shown in **Figure 4.4**, and **Figure 4.4a** overlays wind energy development onto the landscape character types. Patterns of development are discussed in detail in the strategic cumulative assessment (**Section 6**).

4.14 Within 15 km of Inverclyde, there is limited wind turbine development. To the north and west, around the fringes of the Loch Lomond and the Trossachs National Park there has been some interest, though there are no schemes currently in the planning system. A few small and medium turbines have been proposed on Bute. To the south in Ayrshire is a cluster of wind farms including Kelburn, Wardlaw Wood and Millour Hill. These lie within the Regional Park, between 10 and 13 km south of the Inverclyde boundary. To the south-east the closest turbines are at Neilston Community wind farm, while there are no operational or proposed developments within the neighbouring areas of Renfrewshire and West Dunbartonshire.

5 Sensitivity and Capacity Assessment

Introduction

5.1 The following sections report the findings of the sensitivity and capacity assessment in relation to the LCTs which occur within Inverclyde. The sensitivity and capacity assessment was undertaken at a regional scale, and the following sections are therefore tailored to report on issues related to Inverclyde only. The findings in relation to sensitivity are general across the GCVSDP area, while the conclusions on capacity are specific to the Inverclyde landscape.

5.2 As noted in **Section 4**, the following LCTs are discussed in this report:

- LCT 1 Raised Beach;
- LCT 6 Rugged Upland Farmland;
- LCT 12 Upland River Valleys; and
- LCT 20 Rugged Moorland Hills.

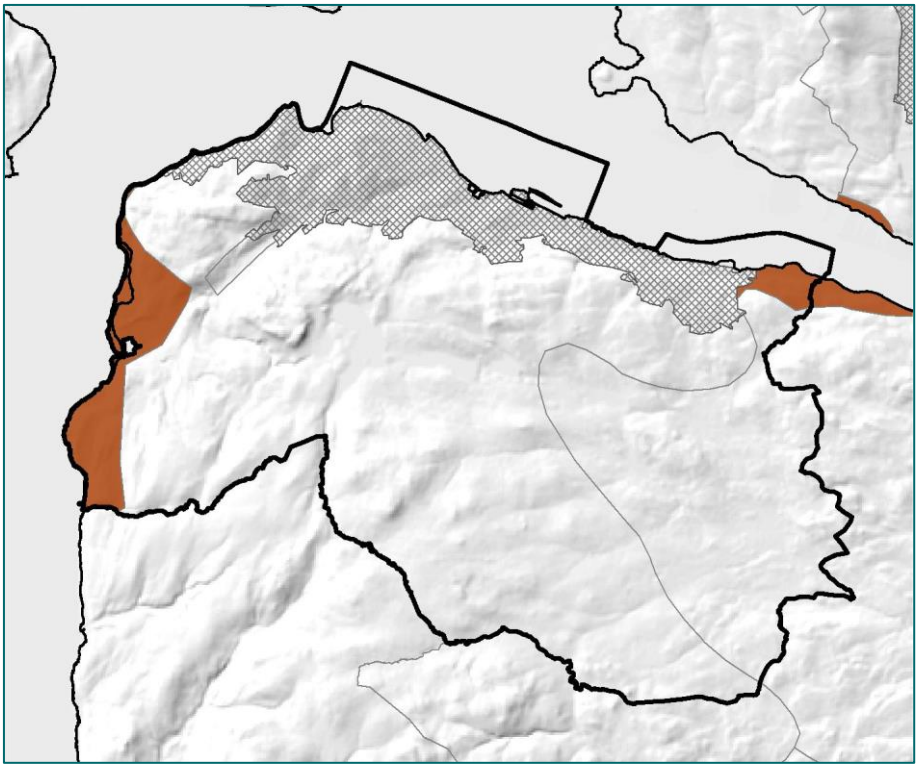
LCT 1 Raised Beach

Location and Extent

5.3 Raised beaches are the result of post-glacial sea level changes, resulting in a distinctive scarp set back from the coastline, which represents the former cliff, with a level platform of the former beach in front.

5.4 This LCT occurs along the western coast of Inverclyde and also on the north coast to the east of Port Glasgow. It comprises a narrow strip of land including the former beach platform and cliffs, and some areas above the cliff line. The flat platforms have long been used for transport, settlement, and industry.

Figure 5.1 Raised Beach (refer to Figure 4.1 for more detail)



Key Characteristics

5.5 The key characteristics, features and qualities of this LCT, as defined in the GCVLCA, are:

- steep scarp, representing the former cliff line, and narrow platform, representing the former beach;
- 'hanging' broadleaf woodland on many of the steeper slopes;
- coastal settlements;
- defensive sites, castles, historic houses and designed landscapes;
- dominance of horizontal landscape elements; and
- prominent area with extensive views.

5.6 No significant changes have been identified to this area since 1999. There are no operational wind turbines in this LCT.

Table 5.1 Assessment of LCT1 Raised Beach

Refer to **Table 3.2** for full details of the evaluation criteria.

	Lower sensitivity		←→	Higher sensitivity	
Landform and Scale					■
	The landscape is of a small scale, comprising a linear coastal or estuarine edge forming narrow platforms, backed by steep escarpments. The distinctive topographical shape appears as a dramatic, defensive setting, in views across the Clyde. The landform has a strong horizontal dimension due to its linearity and relationship with the Firth of Clyde / Clyde Estuary.				
Land Cover			■		
	Historically, the *Raised Beach* LCT would have been covered with hanging broadleaved woodland, and remnants of this are an important feature. In other areas the slopes have been developed or, where slopes are more gentle, parts of the scarp are farmed.				
Settlement and Man-made Influence	■				
	Settlement, industry and transport are highly influential in this landscape, much of which is associated with ship building or port facilities. Many settlements echo the shape of the LCT, long and linear along the coastline, occupying both flat platforms and steep slopes.				
Movement	■				
	The level of movement in the LCT reflects the concentration of settlement and transport in the area. A number of major roads pass through this LCT, including the A78 and A770.				
Skylines			■		
	The steep slopes of the former cliff lines enclose the low platforms, forming a short field of distance in views inland. The skyline in views from the coast opens out from the western coast of Inverclyde, across to Argyll and Bute.				
Key Views, Vistas, Landmarks				■	
	Views within the *Raised Beach* LCT are predominantly those across or along the Clyde, including framed views along the estuary, and more open views west towards the Cowal Peninsula. Landmarks include various modern and historic elements of different scales, including castles, forts, and historic houses, ships, harbours and warehouses.				
Receptors				■	
	The area is well populated and there are high numbers of receptors, including those living in the area and those visiting as tourists to attractions such as castles and historic houses, and people using coastal routes.				
Inter-visibility with Adjacent Landscapes				■	
	As this LCT is located on the coast and includes steep enclosing topography, views in and out of this landscape tend to be across water, while neighbouring inland LCTs may have less inter-visibility despite being nearer. There are important views of this area from Argyll and Bute, such as from Dunoon.				
Natural and Cultural Heritage Features				■	
	The landscape contains a number of cultural heritage features including forts, castles, historic houses and designed landscapes, many of which are highly visible in the landscape. Deciduous woodlands are of natural heritage interest.				
Perceptual Aspects		■			
	While the area includes many visible and audible man-made features, it does also comprise more tranquil settings, such as those associated with policy landscapes, and coastal edges.				

Sensitivity

5.7 Whereas the strong human influence, high levels of movement, and limited relationship to adjacent LCTs inland indicate reduced landscape sensitivity to development, the topography of the landscape is distinctive and provides an important indicator of scale. From a visual perspective the LCT is of higher sensitivity. There are high numbers of receptors, some important open views across water from Argyll and Bute, and a relatively high presence of cultural heritage features. Medium, large or very large turbines could affect perception of the former cliff landforms in views from across the Clyde.

Table 5.2 Sensitivity of LCT1 Raised Beach

Turbine typology	Sensitivity
Small turbine (15-30 m to tip)	**Medium**
Small-medium turbine (31-50 m to tip)	**High-medium**
Medium turbine (51-80 m to tip)	**High**
Large turbine (81-120 m to tip)	**High**
Very large turbine (over 120 m to tip)	**High**

Landscape value

5.8 The Raised Beach along the west coast of Inverclyde lies partly within the edges of the Clyde Muirshiel Regional Park. The wooded slopes above Wemyss Bay and Lunderston Bay lie at the north-west fringes of the Regional Park.

Underlying capacity

5.9 The sensitivity of this landscape, combined with the higher value of parts of the area, indicate lower capacity for wind turbine development, with no capacity at medium, large or very large scales.

Cumulative development and current residual capacity

Inverkip area

5.10 There are two consented turbines at the edge of this LCT, both located east of Wemyss Bay at the transition between the raised beach and the Rugged Moorland Hills. It is likely that these small-medium turbines will be visible from across the Clyde, in combination with the pylons which climb the hillside at this point. Overall, including consideration of cumulative development, there is very limited capacity for wind energy development in this area except at the small typology. There is some capacity for small turbines, well-sited so as not to affect perception of the raised beach, i.e. by diminishing the apparent elevation of the scarp.

Inner Firth area

5.11 There is a single small turbine operating at the east end of Greenock. Most of the Inner Firth area within Inverclyde is included in the Finlaystone inventory-listed designed landscape. There is little or no capacity for turbines within this physically restricted area.

Constraints

5.12 The narrow, horizontal form of the *Raised Beach* areas, combined with high visibility in views across open water, is such that large turbines are likely to appear out of scale. Even medium turbines placed on the raised beach platform can diminish the perception of the scarp, with larger turbines potentially rising above it.

5.13 Turbines of any scale placed on higher ground, i.e. on or above the escarpment, will be set against the skyline when seen from within the LCT, and would be prominent in views across and along the Clyde. The escarpments are particularly sensitive to the location of vertical elements which break the skyline. The apparent height of these elements is emphasised due to their elevation above lower-lying settled areas on the raised beach platform.

5.14 There is a potential for cumulative effects to arise if turbines within this LCT are viewed in combination with turbines in the adjacent upland landscapes. The linear nature of the *Raised Beach* means than sequential effects must be considered. Care should be taken that incremental development of individual turbines along the Raised Beach does not lead to a detrimental cumulative effect on the escarpment skyline, particularly when seen across water.

Opportunities

5.15 Whilst a number of industrial or man-made elements exist within the LCT, these tend to be wide and flat (such as major roads, harbours or warehouses) rather than tall vertical structures. Small turbines will therefore be best accommodated within these flatter parts of the LCT, associated with agriculture or industry, and taking opportunities for screening from buildings and trees.

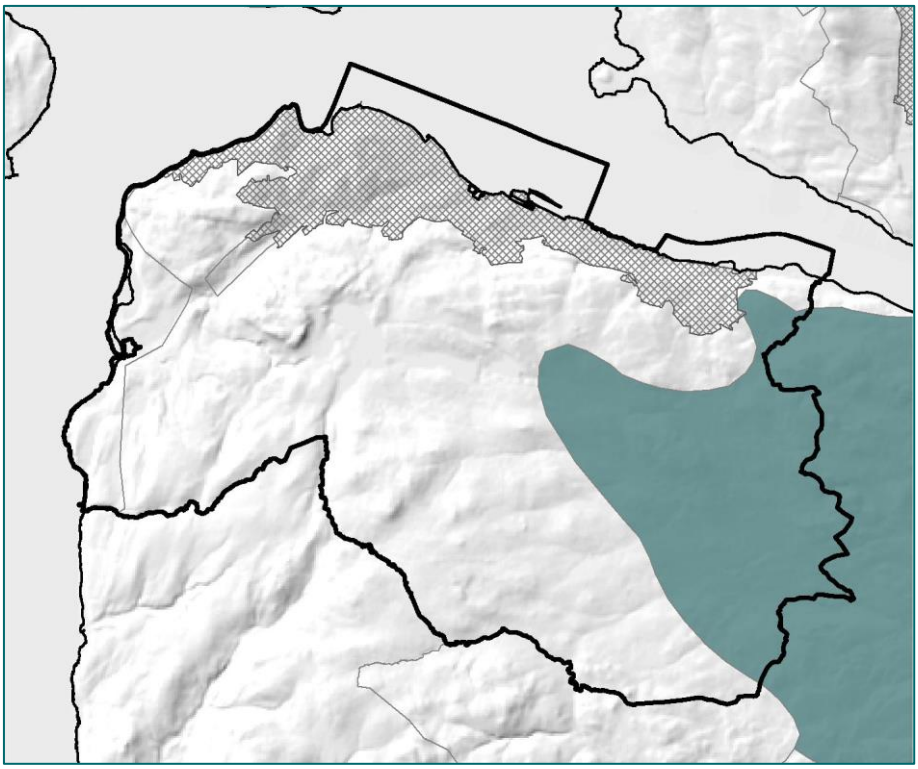
LCT 6 Rugged Upland Farmland

Location and Extent

5.16 This LCT represents a transitional landscape between sheltered valleys and open moors, and is characterised by rugged, hummocky landforms and craggy bluffs.

5.17 The character type covers the eastern part of Inverclyde, including Strathgryffe and Kilmacolm. This landscape continues eastward into Renfrewshire.

Figure 5.2 Rugged Upland Farmland (refer to Figure 4.1 for more detail)



Key Characteristics

5.18 The key characteristics, features and qualities of this LCT, as defined in the GCVLCA, are:

- rugged landform comprising rocky bluffs and shallow troughs;
- dominance of pastoral farming; and
- tree cover often emphasising landform, for example concentrated on bluffs and outcrops.

5.19 No major changes to this landscape since 1999 have been identified. There are no operational turbines in the LCT within Inverclyde.

Table 5.3 Assessment of LCT6 Rugged Upland Farmland

Refer to **Table 3.2** for full details of the evaluation criteria.

	Lower sensitivity		←→	Higher sensitivity	
Landform and Scale				■	
	This LCT is a rugged, hummocky landscape of steep, craggy bluffs interspersed with gentler farmland, and is small to medium in scale. The valley of Strathgryffe is relatively enclosed.				
Land Cover			■		
	Land cover is typically improved pasture or occasional arable land, with rougher pasture on high ground and moorland edges. There are large woodlands, with many of the rugged hillocks covered in stands of beech or pine.				
Settlement and Man-made Influence		■			
	The LCT contains the settlements of Kilmacolm and Quarriers Village to the east, though there are scattered farms and dwellings across the area. Other human influences include electricity infrastructure in Strathgryffe and occasional masts.				
Movement			■		
	There is some movement related to traffic travelling along the A761, and the landscape is settled and farmed, though less busy to the west.				
Skylines			■		
	Skylines are relatively complex in more rugged areas, becoming smoother and simpler where the landform is more plateau-like. There are some low but relatively distinctive landforms. Elsewhere there are power lines and masts seen on the skyline.				
Key Views, Vistas, Landmarks		■			
	Views are relatively contained within western areas of this landscape, which are fringed by higher ground. The valley of Strathgryffe channels views locally. This landscape offers many attractive views over undulating wooded farmland. There are some distinctive landforms though few are highly prominent as landmarks. The church tower at Quarriers Village is a local landmark.				
Receptors			■		
	There are farms and villages, as well as the larger settlement of Kilmacolm. There are recreational receptors e.g. visitors to golf courses and users of the railway path cycle route through Strathgryffe (NCN Route 75).				
Inter-visibility with Adjacent Landscapes				■	
	The Strathgryffe area has important relationships with the Rugged Moorland Hills (LCT20) to the west, and longer views to the Kilpatrick Hills to the north. To the east the Rugged Upland Farmland continues, though there are fewer long views in this direction.				
Natural and Cultural Heritage Features		■			
	Beech hedgerow trees are a distinctive feature in many parts of this landscape, often associated with estate landscapes. Around Kilmacolm there are several substantial houses with policy landscapes of varying extent.				
Perceptual Aspects		■			
	Human activity and development are visible across this settled and farmed landscapes, particularly around Kilmacolm. To the west there is more tranquillity approaching the moors.				

Sensitivity

5.20 The sensitivity assessment suggests that this LCT will be of lower sensitivity to small or small-medium turbines, particularly the more human-influenced areas. However the rugged and smaller-scale areas of landscape are more sensitive to turbines generally. Large or very large turbines in this area are likely to be highly visible in the wider landscape, with large numbers of receptors nearby.

Table 5.4 Sensitivity of LCT6 Rugged Upland Farmland

Turbine typology	Sensitivity
Small turbine (15-30 m to tip)	**Medium**
Small-medium turbine (31-50 m to tip)	**Medium**
Medium turbine (51-80 m to tip)	**High-medium**
Large turbine (81-120 m to tip)	**High**
Very large turbine (over 120 m to tip)	**High**

Landscape value

5.21 This landscape is not designated, though the Strathgryffe area is on the fringe of the Clyde Muirshiel Regional Park, and is valued for its outdoor recreational opportunities. Other areas are valued at a local level.

Underlying capacity

5.22 The sensitivity of this landscape, combined with the indicators of value, suggest that there is moderate to lower capacity for wind energy development at small or small-medium scales, with limited capacity for medium or large development and no capacity for very large turbines. While turbine of different sizes may be accommodated in the landscape, it will be important to avoid the confusion that would arise from a range of sizes in the same area.

Cumulative development and current residual capacity

5.23 Within Inverclyde there is a single medium turbine consented in western Strathgryffe, as well as further medium and small-medium consented turbines in the neighbouring Rugged Moorland Hills (LCT20). This area is a relatively enclosed valley, and is close to the edge of Clyde Muirshiel Regional Park. As such it is likely to be of locally higher sensitivity to large turbines and clusters/wind farms, though further single turbines may be accommodated in upland fringe areas, away from the most intricate parts of the landscape. The current level of wind turbine development does not alter the general conclusion on capacity for this area, although local landscape sensitivity suggests limited capacity for medium turbines and little or no capacity for large or very large turbines.

Constraints

5.24 The high ground facing the River Clyde around Port Glasgow, above the Raised Beach (LCT1) as viewed from West Dunbartonshire, is relatively prominent and will be more vulnerable to the impact of wind energy development.

5.25 Rugged, rocky landform is a key characteristic of this LCT, and local areas which clearly exhibit this character will tend to be more sensitive than less characteristic farmland areas within the LCT. Overhead power lines are prominent features across parts of this LCT, and turbines in close proximity to pylons may give rise to cumulative effects on landscape and views.

5.26 Consideration should be given to the potential for impacts, cumulative and otherwise, on the landscape of the Clyde Muirshiel Regional Park.

Opportunities

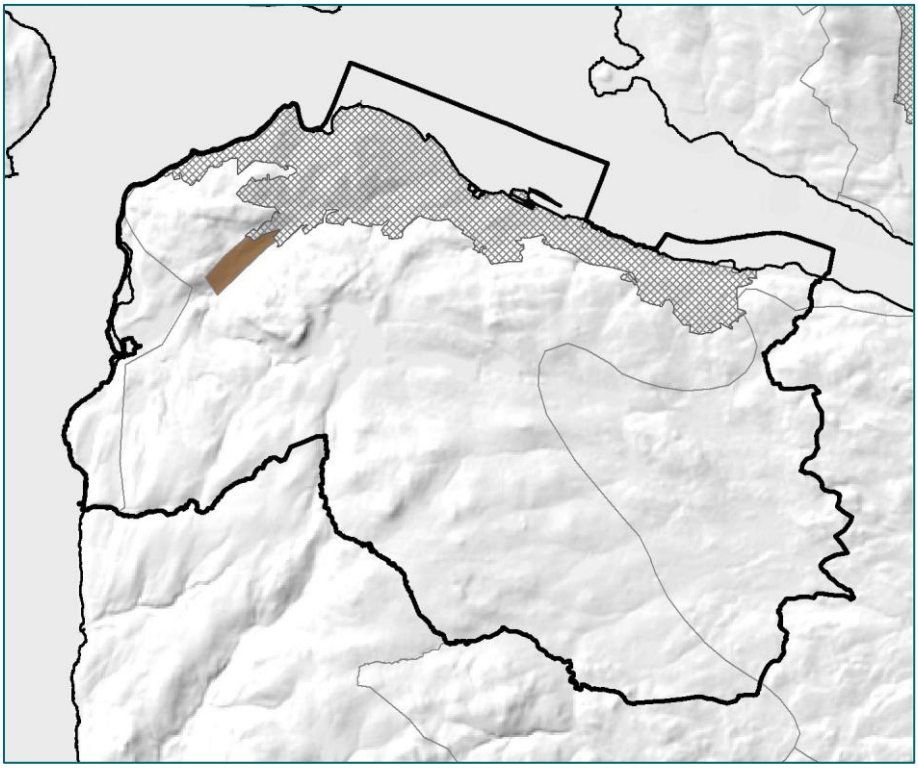
5.27 The opportunities within this landscape lie in the more upland fringe areas, where the landscape is larger in scale and less distinctively rugged, and where settlement is more limited. These areas could accommodate sensitively sited single turbines and small groups of turbines, though as above cumulative effects with consented turbines in this area will be a principal consideration.

LCT 12 Upland River Valley

Location and Extent

5.28 This LCT occurs in a small area between Inverkip and Greenock, in Inverclyde. The valley has a south-west to north-east orientation, and a strong relationship with the surrounding moorland.

Figure 5.3 Upland River Valley (refer to Figure 4.1 for more detail)



Key Characteristics

5.29 The key characteristics, features and qualities of this LCT, as defined in the GCVLCA, are:

- a series of valleys formed along fault lines through the Plateau Moorlands;
- strong contrast between the wooded and settled character of the valley and the exposed enclosing uplands; and
- transition from the exposed upper reaches to more sheltered lowland areas.

5.30 No major changes to these characteristics have been identified. It is noted that the Upland River Valley in Inverclyde is set within Rugged Moorland Hills (LCT20) rather than Plateau Moorlands. There are no operational turbines within this LCT.

Table 5.5 Assessment of LCT12 Upland River Valley

Refer to **Table 3.2** for full details of the evaluation criteria.

	Lower sensitivity		←→	Higher sensitivity	
Landform and Scale					
	This valley is small in scale, and is narrow with steep side slopes. Even where shallow and more open there is a sense of enclosure. Occasional craggy hills mix with moorlands to frame the valley.				

	Lower sensitivity		←→	Higher sensitivity	
Land Cover			■		
	The floodplain of the valley is occupied by the extensive IBM premises, with improved pasture on the valley sides, and rougher grazing higher up. There are limited areas of broadleaf woodland and coniferous plantations, though shelter belts and roadside trees give the area a wooded character.				
Settlement and Man-made Influence			■		
	The valley serves as a key transport corridor, carrying the A78 and the railway. The extensive IBM premises and associated car parks are a major feature in the valley. To the north is the edge of Greenock. By contrast the rugged hills to either side are undeveloped.				
Movement			■		
	The valley provides an important transport corridor and contains the A78, though this is screened by roadside planting.				
Skylines				■	
	The skylines are formed by the valley sides, which tend to be formed by relatively rugged moorland, particularly to the south, and are open and mostly uninterrupted. The nature of this narrow valley is such that the skyline is always prominent and often close at hand.				
Key Views, Vistas, Landmarks				■	
	Views within the valley are framed by the valley sides, and are therefore restricted. From higher on the slopes, the whole of the valley can be seen. Sequential views are available from roads through the valleys.				
Receptors			■		
	Receptors include residents on the south-western fringes of Greenock and in scattered farmsteads, as well as road users. Recreational receptors will also be present, with the valleys used as access points for walks into the neighbouring uplands.				
Inter-visibility with Adjacent Landscapes		■			
	Inter-visibility is comparatively lower in the valleys than in the surrounding upland plateaux. There are few outward views, though the valleys are overlooked by neighbouring landscapes.				
Natural and Cultural Heritage Features				■	
	There are few cultural heritage features in this valley, though it has long been an important transport link. There are areas of deciduous woodland on valley sides.				
Perceptual Aspects			■		
	The influence of development and transport is relatively high in this valley, though the contrast with the adjacent moorland slopes is notable.				

Sensitivity

5.31 The small-scale, contained nature of this landscape indicates increased sensitivity to turbines. While some locations are less sensitive to small or small-medium turbines, for example the more human influenced areas, the majority of this landscape would be highly sensitive to large or very large turbines due to the scale and enclosure, and the presence of receptors within the valleys.

Table 5.6 Sensitivity of LCT12 Upland River Valley

Turbine typology	Sensitivity
Small turbine (15-30 m to tip)	**Medium**
Small-medium turbine (31-50 m to tip)	**High-medium**
Medium turbine (51-80 m to tip)	**High**
Large turbine (81-120 m to tip)	**High**
Very large turbine (over 120 m to tip)	**High**

Landscape value

5.33 This landscape is not subject to any landscape designation, although the hills overlooking the valley from the south, and Bargane Hill to the west, are within the Clyde Muirshiel Regional Park.

Underlying capacity

5.34 The higher sensitivity of this landscape, combined with the valued nature of adjacent landscapes, suggests that there is no capacity for wind turbine development at most scales. The scale and enclosure of this valley landscape limits capacity for all but the smallest developments, with no capacity for medium, large or very large turbines.

Cumulative development and current residual capacity

5.35 The small valley between Greenock and Inverkip contains no consented or proposed developments. The surrounding hills are part of the Rugged Moorland Hills (LCT20). The only turbine potentially visible is a consented small-medium single turbine to the north-west. The hills to the south of this valley are within the Clyde Muirshiel Regional Park. Cumulative effects on the valley landscape are unlikely, given current patterns of development. The capacity of this small area is likely to be restricted mainly by its scale and extent, though there are no other developments which would alter the underlying capacity.

Constraints

5.36 The physically constrained nature of this valley landscape is unlikely to offer scope for development at anything other than the smallest scale.

5.37 The contrast between the valley and hills, and the transitional edges, are both listed as key characteristics of this LCT. Skylines at the valley edges are key features of the valleys, and will be particularly sensitive where they appear in key views.

5.38 The valley is a transport corridor, and sequential effects on views from this route must be carefully considered, including the effects of turbines beyond the extent of the valley.

Opportunities

5.39 Smaller scale development could be sited in association with development in more open parts of this LCT.

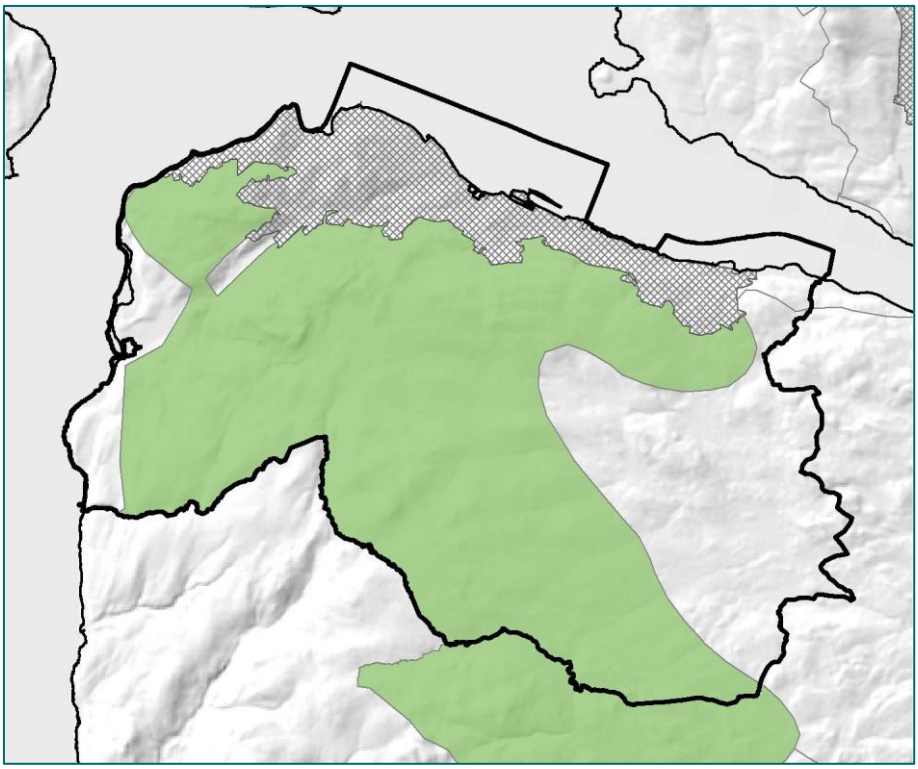
5.40 There are opportunities to site small turbines on valley sides, though these should be carefully designed to avoid effects on the perceptions of the valley, including sense of enclosure and depth.

LCT 20 Rugged Moorland Hills

Location and Extent

5.41 This LCT extends across a large upland area referred to in the GCVLCA as the Renfrewshire Heights. The LCT occupies the central and southern parts of Inverclyde, extending south into Renfrewshire and North Ayrshire. This landscape is underlain by resistant basalt geology, leaving rugged moors with summits up to 500 m.

Figure 5.4 Rugged Moorland Hills (refer to Figure 4.1 for more detail)



Key Characteristics

5.42 The key characteristics, features and qualities of this LCT, as defined in the GCVLCA, are:

- distinctive upland character created by the combination of elevation, exposure, rugged landform, moorland vegetation and the predominant lack of modern development;
- this area has a sense of apparent naturalness and remoteness which contrasts strongly with the farmed and developed lowland areas; and
- presence of archaeological sites on hilltops and sides.

5.43 No significant changes to these key characteristics have been identified. There is one small operational turbine within the moors, at Dowries above Loch Thom, and three small operational turbines at the fringes of the area. There are wind farms within the Renfrewshire Heights beyond Inverclyde, in North Ayrshire.

Table 5.7 Assessment of LCT20 Rugged Moorland Hills

Refer to **Table 3.2** for full details of the evaluation criteria.

	Lower sensitivity		←→	Higher sensitivity	
Landform and Scale			■		
	This is a large scale landscape. Relatively high summits for the study area, and emphasised by proximity to low-lying valleys and coastal areas. Often a simple landscape of moorland hills, there are occasional strong features within the hills, and distinctive scarp slopes along the coastal edges.				
Land Cover	■				
	Open land cover of grass and heather moorland, without enclosure except at its farmed edges. Some areas of coniferous plantation but generally an open landscape. Small areas of woodland are associated with gullies and coastal braes, and in more settled areas.				
Settlement and Man-made Influence				■	
	Very limited settlement except at its fringes. Human influence is limited to coniferous plantations and reservoirs. Pylons cross the moors and have a local influence. Densely settled areas lie very close to this landscape, though this serves to highlight their relative lack of human influence.				
Movement				■	
	Movement is not a feature of this landscape, which is still and not traversed by major roads, with the exception of the A78 and railway corridor north-east of Inverkip. From the edges of the moors there are views down into and across more settled areas, including roads, railways, and movement on the Clyde.				
Skylines				■	
	Skylines are generally simple and uninterrupted, and are a prominent feature within this open landscape. More rugged features within the hills introduce complexity to the skyline in some areas. Pylons and masts have occasional influence on the skyline.				
Key Views, Vistas, Landmarks				■	
	These moorlands are open and offer long views across rolling plateaux. Within the hills are landmark features including distinctive scarps and hilltops. It is a landscape with several accessible viewpoints.				
Receptors				■	
	Though unpopulated, this LCT has high levels of recreational use and many opportunities for outdoor access, due to proximity to large population centres. The Regional Park has several key locations including Cornalees Bridge.				
Inter-visibility with Adjacent Landscapes					■
	The edges of these areas provide important backdrops to neighbouring landscapes and settlements along the Clyde. There are broad prospects out from the high points within this landscape, looking east across the Glasgow Basin, and north and west over the Clyde to Argyll.				
Natural and Cultural Heritage Features				■	
	There are a number of significant archaeological features within these hills, and on lower slopes. Large parts of the extensive peatland and heather moorland within this landscape is protected for its natural heritage value. There are important areas of native woodland.				
Perceptual Aspects					■
	Wildness mapping produced by SNH indicates that this area has some of the strongest wildness character in the study area. Contrast with adjacent densely populated urban areas increases the sense of apparent naturalness.				

Sensitivity

5.44 Although the underlying landform and simple landcover of this LCT suggests lower sensitivity, the majority of characteristics indicate higher sensitivity to wind turbines. Key sensitivities include the higher level of recreation use within each of the three areas, and their relative wildness, in contrast to the nearby urban areas. These hills contain distinctive scarps which are highly visible in the wider landscape, and which provide important backdrops to the adjacent lowlands.

5.45 The Renfrewshire Heights contrasts with the raised beach landscapes to north and south. Wind turbines could interrupt this key relationship if placed on the edges of the hills, which are therefore the most sensitive part of this LCT.

5.46 Those areas which are set back from the highly visible edges of the hill groups are of locally reduced sensitivity, although turbine development in these interior locations could diminish the relative wildness which is a key characteristic of this LCT. Lower slopes will be less sensitive to small turbines where these would have more localised effects, and would not be seen to disrupt the scale of the hills in wider views.

Table 5.8 Sensitivity of LCT20 Rugged Moorland Hills

Turbine typology	Sensitivity
Small turbine (15-30 m to tip)	**Medium**
Small-medium turbine (31-50 m to tip)	**High-medium**
Medium turbine (51-80 m to tip)	**High**
Large turbine (81-120 m to tip)	**High**
Very large turbine (over 120 m to tip)	**High**

Landscape value

5.47 In Inverclyde, most of this LCT falls within the Clyde Muirshiel Regional Park, and a small area within this is designated as the West Renfrew Hills Scenic Area. The Regional Park is of high value for recreation as well as its natural heritage interests.

Underlying capacity

5.48 The sensitivity of this landscape, combined with the high value placed upon it, suggest that this LCT has lower capacity for wind turbine development at all scales, with little or no capacity for medium turbines and no capacity for large or very large turbines.

Cumulative development and current residual capacity

5.49 There are several small and small-medium turbines consented in this area, mostly at the fringes of the LCT. One turbine is close to the summit of Burneven Hill, south of Gourock, and there are two consented turbines near Cornalees. At the eastern edge, two medium turbines have been consented south of Port Glasgow. There are no proposed turbines in this area. This LCT extends into North Ayrshire to where the operational Kelburn, Millour Hill and Wardlaw Wood wind farms are located, 10 km to the south.

5.50 The area is almost all within the Clyde Muirshiel Regional Park, and large-scale development is likely to be visible from across the Firth of Clyde, from Helensburgh and parts of the National Park. Capacity in this landscape is restricted to small-medium or small turbines, following the pattern of smaller-scale development at the edges of the area, and seeking to protect the remote qualities of the interior.

Constraints

5.51 Medium, large and very large turbine typologies are unlikely to be successfully accommodated within this landscape. The prominent scarp slopes and uplands associated with the LCT will render large turbines highly visible across the wider landscape. Some of the key skylines, for example the ridges above the raised beaches, are of particular importance to the settlements and landscapes they overlook.

5.52 The Rugged Moorland Hills contain some of the highest levels of wildness in the study area. This is a highly valued resource given the close proximity to densely settled urban areas. Larger turbine developments within the hills, or prominently sited developments at all scales, would tend to erode this important aspect of this LCT.

Opportunities

5.53 Single turbines or clusters (2-5 turbines) in the small or small-medium typologies could potentially be sited at the fringes of the LCT, where the open upland gives way to enclosed farmland and, in some areas, settlement fringe landscapes.

5.54 There will be limited locations where single turbines or clusters (2-5 turbines) of small or small-medium, , set well back from the prominent edges of these hills, can be sited in such a way that their visibility in the wider landscape would be reduced. Any proposals would need to demonstrate a high level of care in siting and design.

5.55 Within the Renfrewshire Heights the northern edge of the LCT is more developed, and has an important interface with the settled raised beach landscape along the Clyde. The fringes of this area are locally less sensitive to wind turbine development placed in the context of past and present engineering and industrial land uses, where features such as cranes were and still are a presence in views.

6 Summary and Conclusions

Summary of sensitivity and capacity

6.1 The findings of the sensitivity and capacity assessments for the LCTs which lie within Inverclyde are summarised in **Table 6.1**. The findings on capacity are drawn from the narrative text developed for each LCT and area, and are provided here for comparison purposes. Reliance should not be placed on the text in **Table 6.1** without reference to the more detailed discussions in **Section 5**.

6.2 Landscape sensitivity is illustrated in **Figures 5.21** to **5.25**. The areas into which the LCTs have been subdivided for the purpose of reporting current residual capacity are shown on **Figure 5.26**.

Table 6.1 Summary of sensitivity and capacity in Inverclyde

LCT	Turbine Typology	Sensitivity	Underlying Capacity	Residual Capacity
1 Raised Beach	Small turbine	**Medium**	Lower capacity for wind turbine development, with no capacity at medium, large or very large scales.	*Inverkip area* Some capacity for small turbines only . *Inner Firth area* Little or no capacity for turbines within this physically restricted area.
	Small-medium turbine	**High-medium**		
	Medium turbine	**High**		
	Large turbine	**High**		
	Very large turbine	**High**		
6 Rugged Upland Farmland	Small turbine	**Medium**	Moderate to lower capacity for development at small or small-medium scales, with limited capacity for medium or large development and no capacity for very large turbines.	Limited capacity for medium turbines and no capacity for large or very large turbines.
	Small-medium turbine	**Medium**		
	Medium turbine	**High-medium**		
	Large turbine	**High**		
	Very large turbine	**High**		
12 Upland River Valley	Small turbine	**Medium**	Lower capacity for wind turbine development at all but small scale, with no capacity for medium, large or very large turbines.	As underlying capacity.
	Small-medium turbine	**High-medium**		
	Medium turbine	**High**		
	Large turbine	**High**		
	Very large	**High**		

LCT	Turbine Typology	Sensitivity	Underlying Capacity	Residual Capacity
	turbine			
20 Rugged Moorland Hills	Small turbine	**Medium**	Lower capacity for wind turbine development at all scales, with little or no capacity for medium turbines and no capacity for large or very large turbines.	Capacity in this landscape is restricted to small-medium or small turbines, following the pattern of smaller-scale development at the edges of the area, and seeking to protect the remote qualities of the interior.
	Small-medium turbine	**High-medium**		
	Medium turbine	**High**		
	Large turbine	**High**		
	Very large turbine	**High**		

Summary of strategic cumulative assessment

6.3 The strategic cumulative assessment examined patterns of development across the study area to identify potential cumulative effects occurring beyond the LCT scale and in some cases beyond the local authority scale. The assessment is reported in full in the Overview Report, and the findings relevant to Inverclyde are presented here.

6.4 The assessment was undertaken at a strategic scale and does not examine every potential cumulative impact. Rather, the assessment seeks to examine regional patterns of development, including consideration of existing and emerging clusters of development, and undeveloped areas which remain between such clusters. The assessment seeks to recommend where future development could be fitted into this pattern, either by building on existing clusters or by protecting important open areas.

6.5 The methodology for the assessment is set out in **Section 3**. The assessment only considers turbines of over 50 m to tip height (i.e. medium and larger typologies), and considers two 'scenarios': firstly operational and consented developments which form a baseline of acceptable impact; and secondly operational, consented and proposed developments. The latter scenario is speculative, since it includes undetermined proposals, but it reflects the current pattern of development pressure. Data on operational, consented and proposed wind energy development was gathered in November 2013, and therefore represents a snapshot of a continually changing pattern of development. The data are summarised in **Section 4**.

6.6 The assessment has been informed by examination of cumulative zone of theoretical visibility (CZTV) maps and comparison with the assessed sensitivity of the landscape, and by examination of potential cumulative impacts on views from a number of representative viewpoints and routes across the study area.

Patterns of development

6.7 There is a dispersed pattern of operational and consented turbine developments across Inverclyde. There are six operating turbines, all of which are in the small typology (less than 30m). Two of these are within built-up areas, and the others are within the Rugged Moorland Hills (LCT20). There are thirteen consented turbines, as of November 2013. There is a pair of consented turbines at High Mathernock, one of which, at 67 m, is the largest proposed in Inverclyde. Another turbine of 54 m is located at Cairncurran to the south. The other consented proposals are for small or small-medium turbines.

6.8 With the exception of two turbines at Cornalees, the consented turbines are all located at or close to the outer edges of the Rugged Moorland Hills, along both the eastern interface with the Rugged Upland Farmland (LCT6) around Strathgryffe, and on the western edge above the Raised Beach coast (LCT1).

6.9 At the time when the data were collected, there were no active planning applications for wind energy developments in Inverclyde.

6.10 Inverclyde is therefore experiencing relatively limited pressure for wind energy development, as compared to other parts of the GCVSDP area. The landscape types which occur within Inverclyde have been assessed as being of relatively high sensitivity, particularly to larger turbines, and the presence of the Regional Park designation further limits capacity for development. These factors have contributed to the refusal of past wind farm proposals on Corlick Hill.

Cumulative ZTVs

6.11 The cumulative ZTV for operational and consented turbines is shown in **Figure 6.1**. This indicates that turbines over 50 m are likely to be theoretically visible over much of eastern Inverclyde, including the three medium turbines consented around Strathgryffe. Relatively higher levels of visibility are indicated on parts of Duchal Moor and high ground to the south-east, since wind farms including Kelburn, Middleton and Whitelee are theoretically visible from this area. Since all of the operational and consented development is to the south or south-east, the northern and western parts of Inverclyde have little or no theoretical visibility of turbines over 50 m.

6.12 The cumulative ZTV for operational, consented and proposed turbines is shown in **Figure 6.2**. This indicates a very similar pattern of theoretical visibility. Based on the current levels of proposed development, the distribution of turbines over 50 m in and around Inverclyde will barely change. The proposed three-turbine scheme at Ascog on Bute will introduce some views of turbines to western parts of Inverclyde, where there are open views along the Firth of Clyde.

Viewpoints

6.13 The following sections describe the representative viewpoints which are listed in **Table 4.1** and shown on **Figure 4.3**. The CZTV maps (**Figures 6.1** and **6.2**), and the underlying visibility data on which they are based, were examined to identify consented and proposed development which may be visible from these locations in future. No wireframe visualisations have been generated as part of the study. Full details of the viewpoint analysis can be found in the overview report.

Viewpoint 1 Cornalees Bridge Centre

6.14 The Cornalees Bridge Centre is relatively low-lying, beside a reservoir in the Rugged Moorland Hills (LCT20). From the summit of nearby Dunrod Hill (298 m), a much wider view can be gained, looking south and west across the Firth of Clyde, and north across Rosneath with the Arrochar Alps behind. To the east there are views across Loch Thom and into Strathgryffe towards Kilmacolm. Southward views are restricted by the rising ground of the Renfrewshire Heights.

6.15 The closest operational turbine is a small turbine at Downies, above Loch Thom, some 3 km to the south-east. Consented turbine likely to be visible include those nearby at Cornalees Farm (small) and Shielhill (small-medium). To the north-west a small-medium turbine has been consented near the mast at Leitchland, 4 km away. Further afield to the east, medium scale consented turbines at High Mathernock and Cairncurran may be visible, in the transitional landscape between the moors and the Rugged Upland Farmland LCT. Kelburn Wind Farm is 16 km to the south but is not seen from this area due to intervening topography. There are no proposed turbines likely to be visible from this location.

6.16 From this viewpoint, the dispersed nature of small-scale development within Inverclyde will be apparent. Single turbines or pairs of turbines will be viewed in relative isolation, with no larger schemes visible. At present, the moors around Cornalees form part of a wider landscape around the Firth of Clyde which is unaffected by large-scale wind turbines. The development of further turbines within the central part of the Inverclyde moorlands, which this viewpoint overlooks, could lead to a reduction in the apparent wildness.

Viewpoint 2 Dumbarton Castle

6.17 Dumbarton Castle is sited on a prominent volcanic rock on the Firth of Clyde. The elevated summit of the rock is frequented by visitors to the castle, and overlooks a long stretch of the firth, as well as the town of Dumbarton. The view is most open to the west, looking down the Clyde to Cowal. To the north there are views along the Vale of Leven to the mountains of the National Park. Views to the north-west, north-east and south are generally contained by rising ground.

6.18 At present there is no prominent wind energy development visible in this view. Two consented turbines at High Mathernock, some 8 km to the west-south-west, will be theoretically visible on the ridge above Port Glasgow. There are no turbines currently proposed that are likely to be visible from this location.

6.19 Dumbarton Castle stands within the inner Firth of Clyde, which at present represents an area without views of large turbines. The raised beach and its hinterland to the south, viewed across the Clyde, is particularly prominent in views from this location, and turbines placed here could have an impact on views. To the west as the raised beach becomes more developed, so the ridge behind becomes higher and more prominent in views from the castle and from the Firth of Clyde generally.

Routes

6.20 In Inverclyde, where there are few large turbines, main routes have limited visibility of turbines, and this is not considered likely to change based on the observed patterns of development pressure. There are currently no large turbines which affect the experience of travelling on the A78 around Inverclyde or the western M8. Similarly, there are few views of turbines from the Inverclyde Railway Line which follows the south of the Clyde and the North Clyde Line on the opposite side.

Overall Conclusions

6.21 The study found that the landscapes of Inverclyde are of relatively high sensitivity to wind turbine development, particularly at the medium and larger typologies. Similarly high levels of sensitivity were assessed for the Raised Beach (LCT1), Upland River Valley (LCT12) and Rugged Moorland Hills (LCT20). The Rugged Upland Farmland (LCT6) which occupies eastern Inverclyde was judged to have slightly lower relative sensitivity to small-medium and medium turbines.

6.22 Clyde Muirshiel Regional Park covers extensive areas of Inverclyde, coinciding with most parts of the Rugged Moorland Hills LCT. The value placed on the Regional Park, and the Scenic Area designation, contributed to the assessment of underlying capacity for this LCT in particular. Across Inverclyde, the level of underlying capacity has been found to be relatively low for all wind turbines. This rises to moderate capacity for small or small-medium turbines in the Rugged Upland Farmland, an area which extends eastward into Renfrewshire.

6.23 There is little development within Inverclyde at present which affects this assessment, and the levels of current residual capacity are therefore very similar to the underlying capacity throughout. Inverclyde occupies a position at the join of the inner and outer Firth of Clyde, and currently lies in an area without views of large turbines. The small number of consented turbines are unlikely to erode this state, though views within the Firth will be sensitive to larger-scale development.

6.24 From the findings of the sensitivity and capacity study and the strategic cumulative assessment, it is concluded that there is limited opportunity for large scale wind energy development to be successfully integrated into the Inverclyde landscape without substantial landscape and visual impacts. The presence of the Regional Park, and the proximity of the area to viewpoints in and around the Firth of Clyde, present constraints on the development of large scale turbines.

6.25 There are potential opportunities for smaller scale development at the fringes of the moorland, though with regard to the potential for cumulative effects which would arise from a dispersed pattern of many turbines. Locally, sensitivity to turbines will be reduced around the fringes of industrial areas along the developed raised beach which runs from Gourock to Port Glasgow.

Appendix 1
Guidance for small-scale development

The following provides some generic guidance on siting small-scale wind energy development, focussing on minimising landscape and visual effects. It is recognised that turbines need to be sited and designed to ensure a reasonable output. In all cases the findings of the sensitivity assessment for the relevant LCT should be considered when considering potential sites for wind energy development. This is not an exhaustive list of factors for consideration, but focuses on the points of most relevance to the Glasgow and Clyde Valley landscape.

Further detail is provided in the SNH publications *Siting and Designing Wind Farms in the Landscape* (2009) and *Siting and Design of Small Scale Wind Turbines of between 15 and 50 metres in height* (2012).

When considering small-medium and medium single turbines, and clusters of such turbines, it should be borne in mind that, while their landscape and visual effects are much less than those of larger commercial-scale development, these effects can be proportionally large in relation to both the size of the development, and the benefit gained in terms of energy output.

The following general guidance relates to minimising impacts on the landscape.

- Ensure that wind energy development does not override or subsume the key characteristics of the landscape as recorded in the Glasgow and Clyde Valley Landscape Character Assessment or in more detailed landscape character assessments.
- Consider siting turbines so they are perceived as part of other built development, or are seen in association with a building group where effects on amenity allow, creating an association between generation and consumption. For example, there may be some opportunity to site small or small-medium single turbines in relation to farm buildings or community buildings, with larger scale single turbines sited in relation to larger businesses or industrial sites. Development should be commensurate with (or reflect) the scale of the associated buildings.
- Site wind energy developments away from dramatic landforms or valued distinct landform features (including prominent steep slopes).
- Seek to avoid impacts on areas which are free from overt human influence and modern development, and which are valued for their perceived rural tranquillity, including where areas are located close to settlements, such as the incised valleys.
- Consider opportunities for locating turbines on reclaimed, industrial and man-made landscapes, particularly where this can be linked to landscape restoration, or in association with business parks or industrial estates, where other landscape sensitivities are not compromised.

The following general points relate to minimising impacts on views and visual amenity.

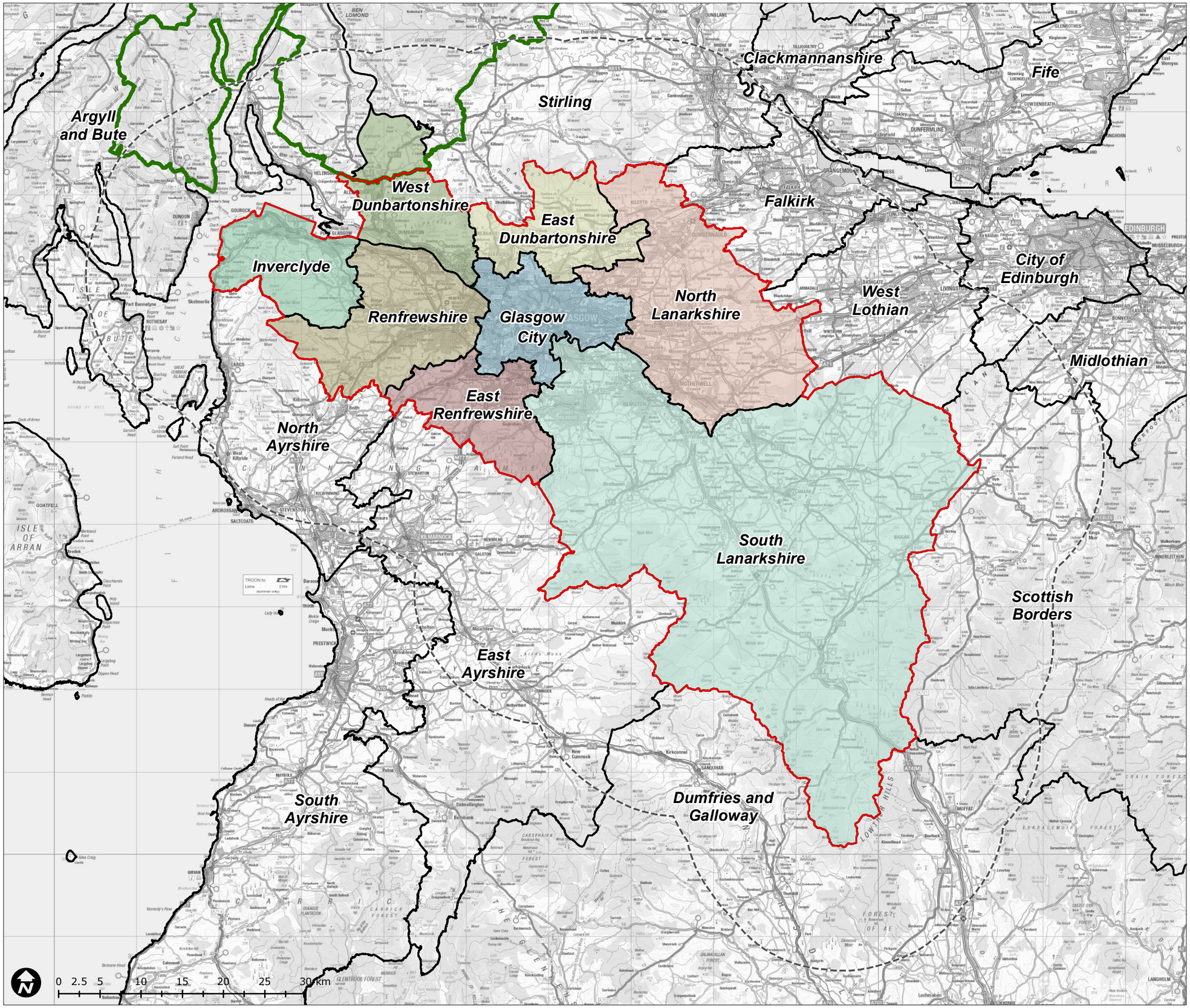
- Significant effects on views from important viewpoints, including hill summits, popular outlooks, or views with heritage significance, should be avoided where possible, or minimised through careful siting.
- It is generally less distracting to see a substantial part of a turbine rather than blade tips only – this may be a particular consideration for views from sensitive viewpoints or those frequented by a larger number of viewers.
- It is preferable to site turbines where they do not distract from views of, or prevent the appreciation of, landmarks including natural and built features.
- It is preferable to site turbines in locations where they do not conflict with other man-made skyline features, such as pylons, and where the addition of turbines could create visual confusion.
- Consider sites where areas of existing vegetation and woodland could screen views of small turbines, or at least screen ground-level features of wind energy developments (such as fencing, tracks and transformers).
- Avoid selecting sites on important undeveloped or distinctive skylines or ridge lines, or skylines with important cultural or historic landmark features.

When considering the potential for cumulative impacts, the following guidelines may be particularly relevant.

- Avoid siting smaller turbines in close proximity to existing large turbines where contrasts of scale could occur. This may also affect longer views where smaller turbines appear in the foreground, and may lead to a confusing visual image.
- Consider the visual relationship between larger wind farms which are seen on upland and high ground, with smaller turbines and single turbines in farmland areas. Seek to maintain the distinction between the types of development which are present within these types of landscape. Transitional locations between upland and farmland may therefore be sensitive if development leads to the blurring of boundaries.
- Avoid siting smaller turbines of different design in close proximity, which could lead to unattractive visual contrasts. Design elements including height, rotor diameter, number of blades, tower construction and nacelle shape should all be considered.
- Colour smaller turbines appropriately: pale grey may be less suitable for turbines which will be primarily viewed against a background of trees, as opposed to the sky.

In all cases, the key aims should be to ensure compatibility between the proposed development and the receiving landscape, and to minimise the extent and likely significance of effects on views and landscape character.

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley



Glasgow and Clyde Valley Strategic Development Plan Area

- Core Area
- 15km from Core Area
- Loch Lomond & The Trossachs National Park

Local Authority

- East Dunbartonshire
- East Renfrewshire
- Glasgow City
- Inverclyde
- North Lanarkshire
- Renfrewshire
- South Lanarkshire
- West Dunbartonshire

Figure 3.1

Map Scale @ A3:1:450,000

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Intervisibilty with the Core Area (ground level)

Core Area

15km from Core Area

Local Authority Boundary

Intervisibility

High : 1431

Low : 0

Non Technical Note

This figure illustrates the relative visibility of a grid of points placed across the Glasgow and Clyde Valley landscape, illustrating the locations where ground level is most visible (red) and least visible (blue). The map is based on a bare-ground terrain model. See Section 3 of the report for more detail.

Note

Intervisibility calculates number of points visible within 15km. The points are arranged in a 500m grid covering the whole of the Core Area. The viewshed is calculated to 0m for each point, from a height of 2m above ground level.

The visible extent for each point is set to 15km.

The terrain model is bare ground and derived from OS Terrain 50 height data.

The earth curvature and atmospheric refraction have been taken into account.

Figure 3.2

Map Scale @ A3:1:200,000

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Intervisibilty with the Core Area (80m)

Core Area

15km from Core Area

Local Authority Boundary

Intervisibility

High : 2714

Low : 0

Non Technical Note
This figure illustrates the relative visibility of a grid of imaginary turbines, 80m in height, placed across the Glasgow and Clyde Valley landscape, illustrating the locations where such turbines would be most visible (red) and least visible (blue). The map is based on a bare-ground terrain model. This map does not represent the visibility of any existing or proposed turbines. See Section 3 of the report for more detail.

Note
Intervisibility calculates number of points visible within 15km. The points are arranged in a 500m grid covering the whole of the Core Area. The viewshed is calculated to 80m for each point, from a height of 2m above ground level.

The visible extent for each point is set to 15km.

The terrain model is bare ground and derived from OS Terrain 50 height data.

The earth curvature and atmospheric refraction have been taken into account.

Figure 3.3

Map Scale @ A3:1:200,000

LUC

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Intervisibilty with the Core Area (150m)

Core Area

15km from Core Area

Local Authority Boundary

Intervisibility

High : 2830

Low : 0

Non Technical Note

This figure illustrates the relative visibility of a grid of imaginary turbines, 150m in height, placed across the Glasgow and Clyde Valley landscape, illustrating the locations where such turbines would be most visible (red) and least visible (blue). The map is based on a bare-ground terrain model. This map does not represent the visibility of any existing or proposed turbines. See Section 3 of the report for more detail.

Note

Intervisibility calculates number of points visible within 15km. The points are arranged in a 500m grid covering the whole of the Core Area. The viewshed is calculated to 150m for each point, from a height of 2m above ground level.

The visible extent for each point is set to 15km.

The terrain model is bare ground and derived from OS Terrain 50 height data.

The earth curvature and atmospheric refraction have been taken into account.

Figure 3.4

Map Scale @ A3:1:200,000

LUC

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde Landscape Character Assessment

- Core Area
- Local Authority Boundary
- Loch Lomond & The Trossachs National Park

Landscape Character Type

- 1. Raised Beach
  - a. Inner Firth
  - b. Inverkip
- 2. Floodplain
- 3. Urban Greenspace
- 4. Rolling Farmland
  - a. Blantyre
  - b. Kirkintilloch and Cumbernauld
  - c. Lanark
- 5. Plateau Farmland
  - a. Airdrie to Shotts
  - b. Barrhead to East Kilbride
  - c. Carluke, Auchengray and Newbigging
  - d. Cumbernauld to Airdrie
  - e. East Kilbride to Strathaven
  - f. Lesmahagow
- 6. Rugged Upland Farmland
  - a. Neilston
  - b. Renfrewshire
  - c. Strathgryffe
- 7. Fragmented Farmlands
- 8. Incised River Valleys
- 9. Green Corridors
- 10. Broad Valley Lowland
- 11. Broad Urban Valley
- 12. Upland River Valleys
  - a. Douglas Valley
  - b. Duneaton Valley
  - c. Inverkip
  - d. Levern Valley
  - e. Upper Avon Valley
- 13. Broad Valley Upland
- 14. Upland Glen
- 15. Foothills
  - a. Biggar and Elsrickle
  - b. Tinto
- 16. Drumlin Foothills
- 17. Old Red Sandstone Hills
- 18. Plateau Moorlands
  - a. Avon Valley to the Duneaton Water
  - b. Cumbernauld to Shotts
  - c. Forth
  - d. Harelaw Dam to the Avon Valley
- 19. Moorland Hills and Ridges
- 20. Rugged Moorland Hills
  - a. Campsie Fells and Kilsyth Hills
  - b. Kilpatrick Hills
  - c. Renfrewshire Heights
- 21. Southern Uplands
  - a. East of the Clyde and Daer Water
  - b. South of Wintercleugh
  - c. West of the Clyde and A702
- Urban

Figure 4.1

Map Scale @ A3:1:100,000

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Landscape Designations

- Core Area
- Local Authority Boundary
- Loch Lomond & The Trossachs National Park

West Dunbartonshire

- Local Landscape Area

East Dunbartonshire

- Regional Scenic Area

Inverclyde

- West Renfrew Hills Scenic Area
- Clyde Muirshiel Regional Park

Figure 4.2

Map Scale @ A3:1:200,000

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Viewpoints

- Core Area
- Local Authority Boundary
- Loch Lomond & The Trossachs National Park
- Viewpoint

1. Cornalees Bridge Centre
2. Dumbarton Castle
3. Duncolm, Kilpatrick Hills
4. Castle Hill, Bearsden
5. Ruchill Park
8. Castle Semple Country Park
9. Gleniffer Braes
10. Neilston Pad

Figure 4.3

Map Scale @ A3:1:200,000

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Wind Energy Development in the Core Area and Buffer Area

- Core Area
- 15km from Core Area
- Local Authority Boundary

Operational

- 15 - 30
- 81 - 120
- 121 - 152

Under Construction

- 81 - 120
- 121 - 152

Consented

- 15 - 30
- 31 - 50
- 51 - 80

Appeal/Public Inquiry

- 51 - 80
- 81 - 120

Application Submitted

- 15 - 30
- 31 - 50
- 121 - 152

Figure 4.4

Map Scale @ A3:1:200,000

LUC

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Wind Energy Development and Landscape Character

- Core Area
- 15km from Core Area
- Local Authority Boundary

Operational

- 15 - 30

Consented

- 15 - 30
- 31 - 50
- 51 - 80

Landscape Character Type

- 1. Raised Beach
- 2. Floodplain
- 6. Rugged Upland Farmland
- 10. Broad Valley Lowland
- 12. Upland River Valleys
- 19. Moorland Hills and Ridges
- 20. Rugged Moorland Hills
- Urban

Figure 4.4a

Map Scale @ A3:1:100,000

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Landscape Sensitivity to Small Turbines

- Core Area
- Local Authority Boundary
- Loch Lomond & The Trossachs National Park

Sensitivity to Small Turbines (15-30 m to tip)

- Low
- Medium-Low
- Medium
- Urban

Landscape Character Type

1. Raised Beach
2. Floodplain
6. Rugged Upland Farmland
10. Broad Valley Lowland
12. Upland River Valleys
19. Moorland Hills and Ridges
20. Rugged Moorland Hills

Note
Mapping shows underlying landscape sensitivity only, please refer to the text for details of landscape capacity assessments.

Figure 5.21

Map Scale @ A3:1:100,000

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Landscape Sensitivity to Small-Medium Turbines

- Core Area
- Local Authority Boundary
- Loch Lomond & The Trossachs National Park

Sensitivity to Small-Medium Turbines (31-50 m to tip)

- Low
- Medium
- High-medium
- Urban

Landscape Character Type

1. Raised Beach
2. Floodplain
6. Rugged Upland Farmland
10. Broad Valley Lowland
12. Upland River Valleys
19. Moorland Hills and Ridges
20. Rugged Moorland Hills

Note
Mapping shows underlying landscape sensitivity only, please refer to the text for details of landscape capacity assessments.

Figure 5.22

Map Scale @ A3:1:100,000

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Landscape Sensitivity to Medium Turbines

- Core Area
- Local Authority Boundary
- Loch Lomond & The Trossachs National Park

Sensitivity to Medium Turbines (51-80 m to tip)

- Medium-low
- High-medium
- High
- Urban

Landscape Character Type

1. Raised Beach
2. Floodplain
6. Rugged Upland Farmland
10. Broad Valley Lowland
12. Upland River Valleys
19. Moorland Hills and Ridges
20. Rugged Moorland Hills

Note
Mapping shows underlying landscape sensitivity only, please refer to the text for details of landscape capacity assessments.

Figure 5.23

Map Scale @ A3:1:100,000

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Landscape Sensitivity to Large Turbines

- Core Area
- Local Authority Boundary
- Loch Lomond & The Trossachs National Park

Sensitivity to Large Turbines (81-120 m to tip)

- Medium
- High
- Urban

Landscape Character Type

1. Raised Beach
2. Floodplain
6. Rugged Upland Farmland
10. Broad Valley Lowland
12. Upland River Valleys
19. Moorland Hills and Ridges
20. Rugged Moorland Hills

Note
Mapping shows underlying landscape sensitivity only, please refer to the text for details of landscape capacity assessments.

Figure 5.24

Map Scale @ A3:1:100,000

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Landscape Sensitivity to Very Large Turbines

- Core Area
- Local Authority Boundary
- Loch Lomond & The Trossachs National Park

Sensitivity to Very Large Turbines (over 120 m to tip)

- High
- Urban

Landscape Character Type

1. Raised Beach
2. Floodplain
6. Rugged Upland Farmland
10. Broad Valley Lowland
12. Upland River Valleys
19. Moorland Hills and Ridges
20. Rugged Moorland Hills

Note
Mapping shows underlying landscape sensitivity only, please refer to the text for details of landscape capacity assessments.

Figure 5.25

Map Scale @ A3:1:100,000

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Cumulative Zone of Theoretical Visibility: Operational or Consented Turbines

- Core Area
- 15km from Core Area
- Local Authority Boundary
- Turbine > 50m and Operational, Under Construction or Consented

Number of Turbines Visibile

- 1 - 28
- 29 - 70
- 71 - 125
- 126 - 188
- 189 - 258
- 259 - 333
- 334 - 435
- 436 - 658

Notes

The ZTV is calculated to turbine tip height from a height of 2m above ground level.

The ZTV extents for all windfarms are based on SNH guidance (Visual Representation of Windfarms: Good Practice Guidance, SNH, 2006).

The terrain model is bare ground and derived from OS Terrain 50 height data.

The earth curvature and atmospheric refraction have been taken into account.

Figure 6.1

Map Scale @ A3:1:200,000

LUC

GLASGOW and the CLYDE VALLEY strategic development planning authority

Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley

Inverclyde

Cumulative Zone of Theoretical Visibility: Operational, Consented or Proposed Turbines

- Core Area
- 15km from Core Area
- Local Authority Boundary
- • Turbine > 50m and Operational, Under Construction, Consented or Application Submitted

Number of Turbines Visibile

- 1 - 28
- 29 - 70
- 71 - 125
- 126 - 188
- 189 - 258
- 259 - 333
- 334 - 435
- 436 - 1,001

Notes

The ZTV is calculated to turbine tip height from a height of 2m above ground level.

The ZTV extents for all windfarms are based on SNH guidance (Visual Representation of Windfarms: Good Practice Guidance, SNH, 2006).

The terrain model is bare ground and derived from OS Terrain 50 height data.

The earth curvature and atmospheric refraction have been taken into account.

Figure 6.2

Map Scale @ A3:1:200,000

LUC

GLASGOW and the CLYDE VALLEY strategic development planning authority