



Guidance

ASSESSING THE CUMULATIVE IMPACT OF ONSHORE WIND ENERGY DEVELOPMENTS

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SECTION 1 INTRODUCTION AND SCOPE OF THIS GUIDANCE

Background

1. Renewable energy is an increasingly important part of Scotland's economic, social and environmental success. The pace of renewable developments has increased rapidly in recent years and windfarms are now familiar sights in many parts of the country. Scottish Natural Heritage (SNH) supports the development of onshore windfarms and recognises the many benefits they bring. However, their cumulative impacts on the natural heritage need to be carefully considered to ensure that these are acceptable.
2. The increasing development of on-shore windfarms has led to concerns about cumulative impacts in some locations as was illustrated in the debate in the Scottish Parliament on 1 December 2011. During the debate Fergus Ewing, Minister for Energy Enterprise and Tourism observed:

"The Scottish planning system is committed to delivery of increased renewable energy capacity. It also seeks to safeguard communities and the environment.....The main issue has perhaps been cumulative impact, which is already a key consideration in decision making. In determinations, planning authorities and the Scottish Government will continue to draw on planning policy and advice from SNH."
3. [Scottish Planning Policy](#) (SPP) highlights that cumulative impacts may present an eventual limit to the extent of onshore wind development and the increased need to consider cumulative impacts in the decision making process (SPP para 189). **This guidance therefore seeks to identify methodologies which can be used to assess cumulative impacts.**
4. **The guidance is aimed at public bodies, developers and consultants involved in onshore wind energy development. It sets out methods to be used to assess cumulative impacts on landscapes and birds.** It is not possible to provide generic advice on the significance of cumulative effects, which need to be assessed on a case by case basis against other [guidance](#).
5. Although the guidance concentrates on the particular issue of assessing the cumulative effects of more than one windfarm development, the methods may also be helpful when considering the cumulative impact of other forms of development. Impacts on other natural heritage interests, such as habitats and protected species require to be addressed on a case by case basis as it is not possible to provide meaningful generic guidance
6. Cumulative impacts are just one of many issues that have to be considered in order to make good development happen in the right places. We have produced guidance on a range of other issues to be considered during the design and assessment of windfarms. Further guidance and information, for example [Siting and Designing windfarms in the landscape](#) (SNH 2009), can be found on our [website](#).

What are cumulative impacts?

7. Cumulative impacts can be defined as the additional changes caused by a proposed development in conjunction with other similar developments¹ or as the combined effect of a set of developments, taken together. In practice the terms 'effects' and 'impacts' are used interchangeably.

Assessing cumulative impacts

8. A clear, transparent and detailed assessment process is needed to understand the impacts of a proposed windfarm development when it is seen alongside others in the area. The process needs to identify the overall impacts which may arise from a group of projects and distinguish the contribution of each individual project to these. The assessment should take account of existing windfarms, and those which are consented or at application stage. Some examples are provided in Box 1 below.

Box 1 Examples of cumulative effects

Imagine two separate developments, A and B. The cumulative effect of both developments taken together need not simply be the sum of the effect of A plus the effect of B; it may be more, or less. This is best demonstrated using some examples as shown below

- An isolated house A in the countryside has a visual impact, standing out in its natural setting. Another isolated house B has a similar visual impact, taken alone. However if the two houses are sited close together, the visual impact of the two together may be only a little greater than for either house A or B taken alone, as they will appear as a single cluster.
- Windfarm A sited on a ridge on one side of a valley is highly visible but acceptable, providing a single visual focus on an otherwise unremarkable skyline. A second windfarm B on a ridge on the other side of the valley would have a similar effect, if it were on its own. However, the effect of having two windfarms sited on either side of the valley may be to make the observer feel surrounded by development. The combined effect of both may be much greater than the sum of the two individual effects.
- Windfarm A gives rise to a low level of bird mortality, which lies well within the capacity of that bird population for regeneration and hence has little effect on the overall bird population level. The same would apply to a second windfarm B, taken on its own. However, the level of bird mortality caused by windfarms A and B taken together would exceed the capacity of the population for regeneration, in which case the population would go into decline. Whereas the impact of A and B, each on their own, was not of concern, the impact of A + B is to cause population decrease which is of concern.

9. In many parts of Scotland the level of windfarm development is now such that a large number of windfarms will have to be taken in to account. The examples above are necessarily simplified to illustrate the issues, but the principles for multiple developments are the same.

¹ Paraphrased from the Guidelines for Landscape and Visual Assessment (GLVIA), p85, paragraph 7.12.

Legislative context

10. In the Scottish development planning system, the overriding principle is that each application must be determined on its own 'individual merit'. There is also a presumption in favour of development which accords with the relevant development plan, although other 'material considerations' may outweigh the plan's policies. It is increasingly recognised that cumulative impacts may be considered as 'material considerations'. For example, while individual supermarkets may not threaten the viability of a town centre or the capacity of the road network, their combined effect could exceed local spending power or the threshold of existing infrastructure (roads, sewerage etc).
11. In addition, under the terms of the [EIA Regulations 2011](#), the potential for cumulative impacts is one of the aspects to be included in Environmental Impact Assessment (EIA). This is explained in more detail in [PAN 58](#). Consideration of cumulative and synergistic effects is also a requirement of the Strategic Environmental Assessment (SEA) Directive (2001/42/EC) which is transposed into Scottish legislation by the Environmental Assessment (Scotland) Act 2005 and through the Environmental Assessment of Plans and Programmes Regulation 2004 for proposals affecting more than one part of the UK. **Annex A** lists the key references to cumulative effects contained in Government and SNH guidance.

Our approach to renewable energy and cumulative impacts.

12. Our approach to renewable energy is set out in [Renewable Energy and the Natural Heritage \(2010\)](#) and is expanded by [02/02 Strategic locational guidance for onshore wind farms in respect of the natural heritage](#) (2009). Our approach is a supportive one, recognising the climate change, social and economic benefits that renewable energy can deliver.
13. The Strategic Locational Guidance identifies three broad zones of sensitivity to wind farms. Within these:
 - The zone of lowest natural heritage sensitivity is described as that with *"the greatest opportunity for development within which overall a large number of developments would be acceptable in natural heritage terms, so long as they are undertaken sensitively and with due regard to cumulative impact"*.
 - For the zone of medium natural heritage sensitivity, the guidance states that *"by careful choice of location...there is often scope to accommodate development of an appropriate scale, siting and design (again having regard to cumulative effects) in a way which is acceptable in natural heritage terms"*.
14. In this way SNH guidance already points firmly to the need to consider cumulative impacts, even in less sensitive locations.

SECTION 2: WHEN TO TAKE ACCOUNT OF CUMULATIVE IMPACTS

15. Cumulative impacts should be considered:
- in **strategic planning** (as part of the preparation of a strategic framework for windfarms) **and**
 - in **development management** (in the context of a site specific assessment).
16. Although the two forms of cumulative assessment share common principles, it is important to distinguish between the two distinct processes.

Assessing Cumulative impacts in strategic planning

17. Strategic cumulative impacts assessment should be undertaken as part of a planning authority's preparation of:
- Development Plan policies and Supplementary Planning Guidance;
 - Strategic Environmental Assessment; and
 - Renewable energy capacity assessments.
18. In all cases, the focus is on forward planning: setting out the vision for windfarm development; and determining the thresholds of acceptable change, where the most suitable locations for development are, and what might be an appropriate design and scale.
19. The strategic plans (often underpinned by a landscape capacity study) should consider a range of specific scenarios, in terms of the numbers, scale and distribution of windfarm developments to be accommodated. It should then make use of the resulting cumulative impact assessment to draw conclusions as to which of these scenarios is acceptable.
20. The area included within a strategic cumulative assessment should not be constrained by administrative boundaries. Effective assessments should cover the whole of a region, straddling more than one planning authority, or that of a natural heritage management unit such as a National Park or Firth Partnership area.
21. Planning authorities are encouraged by Scottish Planning Policy to:
- define broad areas of search suitable for large scale (>20MW) wind farms
 - identify the criteria they should meet through the development of Supplementary Planning Guidance.
22. This approach will have enhanced value if it is also associated with a view of the **capacity** of the area for such development and identification of the critical factors which are likely to present an eventual limit to development. We have recently published a [review of landscape capacity studies](#) which provides useful advice. Further guidance on critical factors can be found in our guidance '[Siting and Designing windfarms in the landscape](#)' (page 44).
23. Further guidance on cumulative impacts in strategic planning is also provided in:

- Process for preparing spatial frameworks for wind farms (Scottish Government 2011).
- [Siting and Designing Windfarms in the Landscape](#) – section 5 (SNH 2009).

Assessing cumulative impacts in development management

24. Cumulative impacts should be assessed where a proposed development involves:
- a new development in combination with one or more existing or approved but unbuilt development;
 - an extension to an existing or approved but unbuilt development;
 - more than one development proposed at the same time within an area; or
 - any combination of the above.
25. An assessment is most likely to be carried out by the prospective developer, as part of an Environmental Statement or environmental information, and reviewed by the determining authority (the planning authority or the Scottish Government) and consultees (such as SNH).

Which windfarms to include in the assessment

26. An assessment of cumulative impacts associated with a specific development proposal should encompass the effects of the proposal in combination with:
- existing development, either built or under construction;
 - approved development, awaiting implementation; and
 - proposals awaiting determination within the planning process with design information in the public domain. Proposals and design information may be deemed to be in the public domain once an application has been lodged, and the decision-making authority has formally registered the application.
27. The decision as to which proposals in the planning / consenting system should be included in an assessment is the responsibility of the determining authority. The determining authority may ask a developer to seek advice from SNH on which proposals are likely to have cumulative impacts on bird interests.
28. Our windfarm footprint map² can help to identify existing sites initially, but this is only updated every 12 months and may not show an up-to-date pattern. It does not show all small scale windfarm proposals which may also need to be included in a cumulative assessment.
29. We have therefore encouraged Local Authorities and the Scottish Government to log all existing, consented, applied for and formally scoped windfarm proposals on an accessible GIS system. This will allow information to be easily made available to developers and/or neighbouring Planning Authorities to use in consideration of cumulative impacts.
30. The cumulative impact assessment (including illustrative material) needs to distinguish between predicted effects in relation to each of the relevant

² available at <http://www.snh.org.uk/strategy/renewable/sr-rt01.asp>

scenarios. For example, a proposal in combination with existing and consented developments, or proposal in combination with existing, consented and planning application stage developments, etc.

31. Occasionally it may be appropriate to include proposals which are in the early stages of development in an assessment, particularly where clusters of development or “hotspots” emerge. However, a degree of pragmatism is required to enable proposals to progress to determination.
32. Cumulative impact assessment can be expensive and time consuming, as it requires knowledge, at least in outline, of the effects of each existing or proposed development within the vicinity. We therefore only seek cumulative impact assessments where it is considered that a proposal could result in significant cumulative impacts which could affect the eventual planning decision. In some situations a Habitats Regulations Appraisal may be required and this may involve a wider consideration of in combination and other impacts.
33. **The key principle for all cumulative impact assessments is to focus on the likely significant effects and in particular those which are likely to influence the outcome of the consenting process.**

Timing of new proposals entering the planning / consenting system

34. Planning authorities are empowered under EIA Regulation 19 and Article 13 General Development Procedure (S) Order 1992³ to seek additional information from the applicant at any point in the determination of the application.
35. If an Environmental Statement which includes assessment of cumulative effects is nearing completion when a new planning proposal is submitted for another site in the same area, the decision-making authority may regard the new application as a material consideration.
36. However, a request at such a late stage may conflict with the applicant’s right for a decision within prescribed timescales. Thus, while it might be preferable for the potentially competing applications to be determined together, a planning authority might conclude that it would be unreasonable to defer determination of an outstanding application as successive new applications are submitted.
37. **Once an application has been submitted and is accompanied by a complete and satisfactory Environmental Statement, any further assessment to take account of new proposals is likely to cause delay. The determining authority may consider that it cannot reasonably *require* further cumulative assessment by the applicant. In some locations the level of development is such that cut off dates should be considered to enable applications to progress.**
38. The same circumstances may occur where an application becomes subject to Public Local Inquiry (PLI) proceedings. Because of the time delays inherent in the PLI process, a developer may opt to present new cumulative assessment for the PLI, updated to include all extant proposals at the time of the PLI.

³ or the relevant section of the Electricity Works EIA regulations.

39. Where an applicant makes a major change to a proposal already within the planning system, and a revised environmental assessment is required, the planning authority may wish to regard this as a revised application with a new submission date, requiring re-notification of consultees. If other proposals have entered the planning / consenting system since the original application date, it may be appropriate to request further cumulative assessment in combination with these new applications. Changes to a proposal which are minor in terms of scale, design or impacts are less likely to be regarded by the determining authority as requiring a resubmission.

Information from competing developers

40. Cumulative impact assessments normally require details of the impacts of each development separately, (e.g. data in respect of all relevant projects in relation to proposed turbine model, dimensions and detailed grid references of proposed turbine locations). Difficulties may arise if developers are unwilling to share information.
41. Environmental Statements, once submitted to the planning authority, are public documents but subject to copyright. The information may be used by other developers but it may not be copied without permission. There is no compulsion on a developer to release any data supporting the ES, unless the planning authority formally requires that information as part of its assessment.
42. The use of confidential annexes containing environmentally sensitive information on birds should be limited to the situations described in our guidance on [Environmental Statements and Annexes of Environmentally Sensitive Bird Information](#) (September 2009). Confidential annexes should not be used to 'hide' data from neighbouring developers.
43. **Planning authorities (and the Scottish Government) are encouraged to ask developers to cooperate over the exchange of information where cumulative assessment has been identified as important and data outwith publicly available Environmental Statements is needed in order to make such assessments.**

Our advice to decision-making authorities

44. Given that cumulative impacts can potentially present a significant constraint on wind farm development, it is important that our advice to planning authorities (and to the Scottish Government) conveys not only our views on the proposal in terms of its individual impacts, but also our view on cumulative effects. **Annex B** contains some scenarios of cumulative impacts and provides examples of wording that will be used in SNH responses.

SECTION 3: ASSESSING CUMULATIVE LANDSCAPE AND LANDSCAPE AND VISUAL IMPACTS

Introduction

45. The cumulative impact of windfarm development on landscape and visual amenity is a product of:
- the distance between individual windfarms (or turbines),
 - the distance over which they are visible,
 - the overall character of the landscape and its sensitivity to windfarms,
 - the siting and design of the windfarms themselves, and
 - the way in which the landscape is experienced.
46. The combination of single turbines and small clusters of turbines can raise the same issues. Where the cumulative effects of these are significant, they require assessment and this should be agreed at scoping stage.
47. The Guidelines for Landscape and Visual Impact Assessment ⁴ (GLVIA) refer to both the changes to landscape **and** visual amenity caused by the proposed development in conjunction with other developments, or with actions which occurred in the past, present or are likely to occur in the foreseeable future.

Cumulative landscape effects

48. Cumulative landscape effects can impact on either the physical fabric or character of the landscape, or any special values attached to it. For example
- Cumulative effects on the *physical fabric* of the landscape arise when two or more developments affect landscape components such as woodland, dykes, rural roads or hedgerows. Although this may not significantly affect the landscape character, the cumulative effect on these components may be significant – for example, where the last remnants of former shelterbelts are completely removed by two or more developments.
 - Cumulative effects on *landscape character* arise when two or more developments introduce new features into the landscape. In this way, they can change the landscape character to such an extent that they create a different landscape character type, in a similar way to large scale afforestation. That change need not be adverse; some derelict or degraded landscapes may be enhanced as a result of such a change in landscape character.
49. Windfarms may also have a cumulative effect on the character of landscapes that are recognised to be of *special value*. These landscapes may be recognised as being rare, unusual, highly distinctive or the best or most representative example in a given area. This recognition may take the form of national or local designations (for example, National Scenic Areas or Special Landscape Areas), citations in development plans, community plans or other documents, or be less formally recognised, such as Search Areas for Wild Land.

⁴ Second Edition, paragraphs 7.12 and 7.13

Cumulative effects on visual amenity

50. Cumulative effects on visual amenity can be caused by 'combined visibility' and/or 'sequential effects':

Combined visibility occurs where the observer is able to see two or more developments from one viewpoint. Assessments should consider the combined effect of all windfarms which are (or would be) visible from relevant viewpoints. Combined visibility may either be in combination (where several windfarms are within the observer's arc of vision at the same time) or in succession (where the observer has to turn to see the various windfarms).

- *Sequential* effects occur when the observer has to move to another viewpoint to see different developments. Sequential effects should be assessed for travel along regularly-used routes like major roads, railway lines, ferry routes, popular paths, etc. Sequential effects may range from *frequently sequential* (the features appear regularly and with short time lapses between) to *occasionally sequential* (long time lapses between appearances) depending on speed of travel and distance between the viewpoints.

51. Two windfarms need not be intervisible – or even visible from a common viewpoint – to have impacts on the landscape experience for those travelling through an area. For example, it may be necessary to consider the cumulative effects of windfarms on users of scenic road routes, or routes for walkers, along their full length within the agreed study area. The area within which a cumulative assessment is required should relate to the issues involved, and should not be limited by local authority boundaries.

52. Cumulative visual effects are discussed in more detail in the GLVIA. In general, impacts will vary in degree according to:

- the sensitivity of visual receptors;
- the landscape context (for example, an open landscape with wide panoramic views or an intimate landscape with enclosed views)
- the activity of the receptor (e.g. residents, visitors etc) and their number;
- the magnitude of cumulative change in terms of the scale, nature, duration, frequency of combined and sequential views (glimpses or more prolonged views; oblique, filtered or more direct views; time separation between sequential views);

Perceived cumulative effects

53. Perceived cumulative effects may arise;

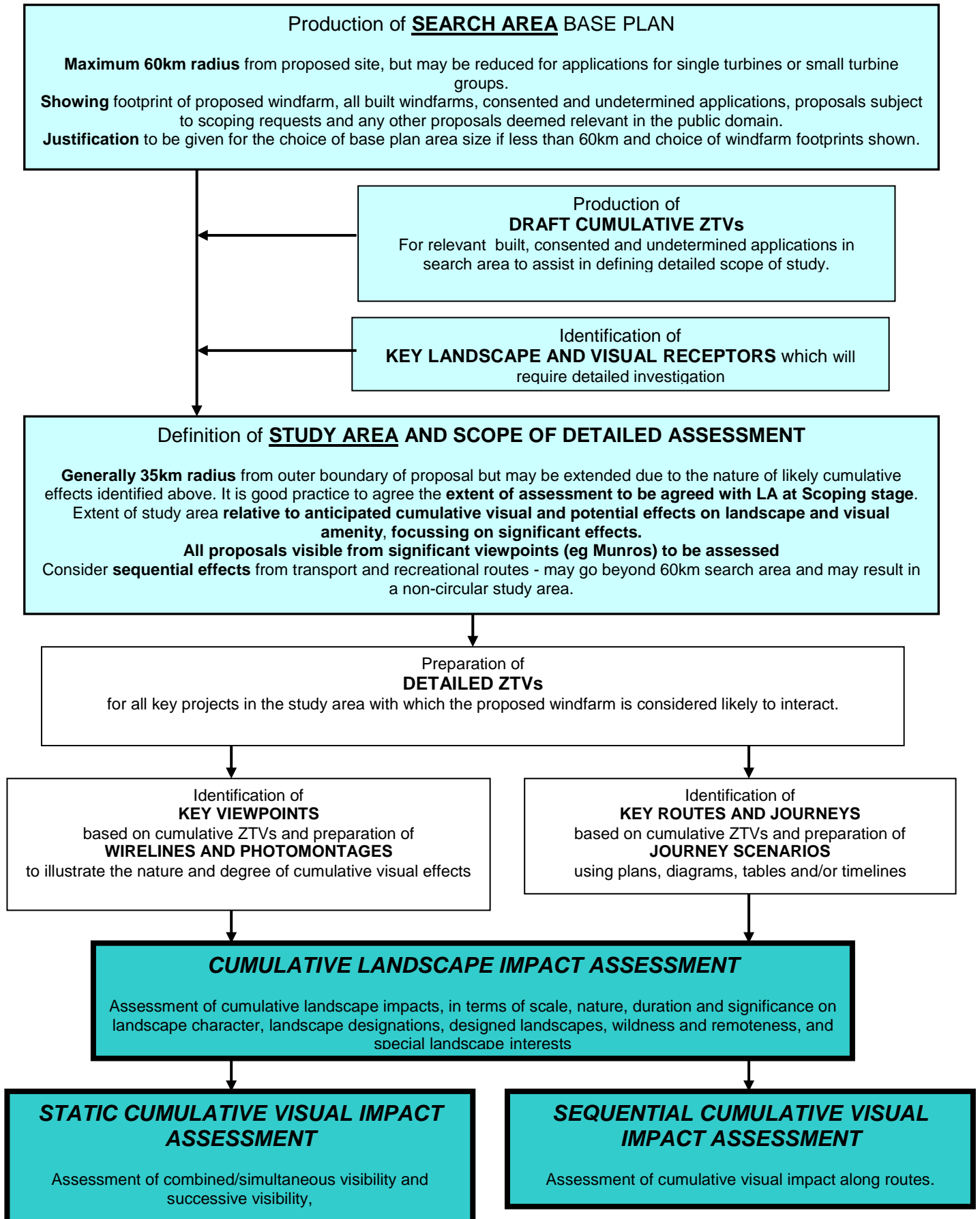
- where two or more developments are present but one or more is never seen by the observer, for example, because they are screened, or the observer is unable or unwilling to gain a viewpoint from where they would be seen. The observer is aware that other developments are present because, for example, they may have learnt about them or seen signs to them. This effect may be significant, but can also be mistaken, where the observer's information or interpretation of it is wrong, or

- where people have formed an opinion about wind farms generally without having seen one, for example through someone else's experience. They may use this perceived effect to express a negative opinion about a development proposal near where they live.
54. Few detailed perception studies have been undertaken to date and although there is a generally good understanding among planners and Local Authority councillors of perceived effects, it is unusual for them to be considered in the context of an individual decision. This issue is therefore most appropriately addressed within the scope of strategic environmental assessment or spatial planning.

Undertaking a Cumulative Landscape and Visual Impact Assessment

55. The purpose of a Cumulative Landscape and Visual Impact Assessment (CLVIA) is to describe, visually represent and assess the ways in which a proposed windfarm would have additional impacts when considered in addition to other existing, consented or proposed windfarms. It should identify the significant cumulative effects arising from the proposed windfarm.
56. The main requirement is an assessment which is proportionate to the impacts. All CLVIA should accord with the methodology outlined in the GLVIA. The emphasis, when undertaking CLVIA should always be on the production of relevant and useful information, highlighting why the proposals assessed have been included and why others have been excluded.
57. The flow chart in Figure 1 summarises the recommended CLVIA process for windfarms. The process is described in more detail below. **This is generic guidance only. The number of proposals in an area and the timing of applications give rise to development scenarios of varying complexity. Professional judgement should inform the scope of the study to be undertaken. SNH and Planning Authorities may also require different or additional information to assist in their assessment of cumulative landscape and visual impacts.**

Figure 1. Flow chart summarising CLVIA for windfarms



58. It is important to have a clear view of the context for a cumulative impact assessment in order to focus on those windfarms and/or issues where there is potential for a significant cumulative effect. A phased approach to defining the study area for a cumulative impact assessment is recommended.
59. The starting point for the assessment is preparation of a **search area base plan**. This should identify all the windfarm projects which are relevant for the subsequent CLVIA. The projects to be considered in the detailed assessment will be selected from the base plan.
60. A clear and legible search area base plan should be produced to show all of the following within a radius of up to **60 km** (depending on the individual proposal, smaller developments should use a smaller radius in agreement with the Planning Authority):
- any constructed or consented windfarm;
 - any undetermined windfarm application;
 - any windfarm proposal which has been subject to an EIA scoping request to the relevant authority; and
 - any other windfarm proposal that the Planning Authority, and/or SNH, considers relevant for study and which is within the public domain (eg as a result of a public announcement or community meeting).
- Note** – due to the very large number of small scale (fewer than 3 wind turbines) proposals currently in the system it may not be practical to include all of these in the search area base plan. The Planning Authority should be consulted for the most up to date information and to confirm which sites should be included
- Note** – installed, consented and proposed offshore windfarms should also be presented on the base plan to enable a decision on whether to include these in the assessment.
61. The precise **study area** should then be selected **from within** the search area base plan and agreed with the planning authority. The applicant must consider what the **key effects** will be within the search area, using these to propose the study area for more detailed assessment. Key considerations will include:
- Sequential effects on key routes
 - Intervisibility with other developments
 - The existing pattern of development
62. **The onus is on the applicant and their consultants to use the base plan and initial assessment to identify the likely key effects and use these to define an appropriate study area and methodology before approaching SNH for a view.**
63. Generally, for the current generation of turbine size, the study area should extend to a minimum of 35km from the outer margin of the windfarm in question. Our "[Visual Representation of Windfarms Good Practice Guidance](#)" suggests appropriate ZTV distances for smaller turbines⁵.

⁵ Table 2, Page 36 – note this guidance is currently under review

64. The size of the study area should also be influenced by the locations and ZTVs of other windfarms likely to interact with the new proposal; and by transport routes to be assessed for sequential effects. The study area may not be circular in shape but could be larger in some directions than others. Sequential impacts may need to be assessed for a distance of more than 60km from the proposed windfarm. This should be agreed at the scoping stage.

Scope of detailed cumulative assessment

65. The list of projects to be included in the detailed assessment should be clearly set out with an explanation of how the detailed scope has been determined (e.g. ZTV analysis, checking on site, previous applications). A checklist could be used to explain this: it would set the projects against a “menu” of priorities, including distance from the proposal, certainty of construction, etc. The relevant receptors (landscape character areas, designated landscapes, designed landscapes, visual receptors, including sequential routes through the study area) should also be listed.
66. The resulting scope should be discussed with the determining authority and SNH and agreed at the scoping stage. **At every stage in the process the focus should be on the key cumulative effects which are likely to influence decision making, rather than an assessment of every potential cumulative effect.**
67. The assessment should clearly describe the baseline conditions by identifying existing windfarms and the extent to which these have altered landscape character and affected sensitivity to windfarm development. This information should be produced as part of the baseline LVIA and then considered as part of the CLVIA. However, the CLVIA should then focus on the key cumulative changes likely to be brought about by the new proposal, i.e. on key routes, views or character areas.
68. The assessment should also identify the **sensitivity of the landscape and visual amenity** resource and the predicted magnitude of cumulative change arising from each of the relevant scenarios, for example:
- the proposed windfarm with existing operational windfarm developments and those under construction;
 - the proposed windfarm with existing and consented but unbuilt windfarm development;
 - the proposed windfarm with any application stage proposals, which could include those at scoping stage;
 - the proposed windfarm with any other windfarms, along with other proposals in the planning system.
69. Predicted visibility of cumulative windfarm development should be described, informed and depicted by supporting **wireline drawings** and, where relevant, **photomontages** which should clearly distinguish between each individual project and its status within the planning system. This is best done by annotation or illustration using a different colour for each individual windfarm. These and other illustrative tools are described further below.
70. The magnitude of cumulative change may be different from the magnitude of change brought about by the development when considered on its own. The aim

of the cumulative assessment is to identify the magnitude of additional cumulative change which would be brought about by the proposed development when considered in conjunction with other windfarms. A range of parameters should be considered, including:

- the number of other windfarm projects which would be visible in the landscape in each of the different scenarios (existing, consented or application stage);
- direction to each of the projects;
- distance to each of the projects;
- the number and height of turbines at each of the projects – which may also be expressed as the horizontal and vertical angle occupied by turbines – and any access tracks and grid connections; and
- duration of the change (i.e. age of constructed windfarms and the planning status of the projects).

‘Zone of Theoretical Visibility’ studies

71. ‘Zone of Theoretical Visibility’ (ZTV) analysis is the process of determining the visibility of an object in the surrounding landscape, using computer modelling and digital terrain mapping. It has a number of limitations, described within [Visual Representation of Windfarms Good Practice Guidance \(SNH 2006\)](#).
72. Cumulative ZTVs should be produced for all existing and consented developments as well as undetermined applications in the initial search area **with which the proposed windfarm is likely to interact to cause significant cumulative effects**. ZTVs provide a useful tool to assist in the refinement of the scope of a cumulative assessment. There are various ways in which the ZTVs can be presented, including the baseline and:
 - proposed site ZTV;
 - landscape character types and proposed site ZTV;
 - landscape designations and proposed site ZTV;
 - sequential routes and proposed site ZTV;
 - paired ZTV (i.e. application windfarm plus one other);
 - ZTVs which show a sub-set of projects: the proposal under consideration plus selected others – which may be chosen according to geographic proximity to one another, similarity in ZTV or in relation to status, i.e. both consented, or both at application stage;
 - comparative ZTV which illustrates the extent of additional visibility of new turbines where they are being proposed as part of a windfarm extension, or an alteration to an application.
73. Cumulative ZTVs should clearly show those areas from where one or more windfarms are likely to be seen. Each windfarm and its ZTV should be shown in a different colour and be clearly named. In the case of a ZTV showing three windfarms it will be possible to illustrate the overlapping areas using separate colours e.g. red, blue and yellow to represent each development (with corresponding overlaps of orange, green, purple etc.) or hatching in different directions.
74. Where four or more windfarms are involved, ZTVs may become difficult to interpret and a series of additional, separate cumulative ZTVs may be required to show the cumulative effects clearly.

75. **Agreement on groupings of windfarms for separate cumulative ZTVs should be reached with the relevant planning authority(ies) and SNH.**
76. Early drafts of ZTVs can help the Planning Authority and SNH to advise on the selection of viewpoints for stationary cumulative impact assessment and routes for sequential cumulative assessment. **These should be provided for pre-application requests for advice and/or meetings, and included in scoping requests where possible, even if some sites are missing.**

Selecting viewpoints and assessing fixed positions for cumulative visual effects

77. Locations for viewpoints should be identified by the applicant and agreed with the Planning Authority in consultation with SNH. Detailed guidance on viewpoint selection is contained in [Visual Representation of Windfarms Good Practice Guidance \(SNH 2006\)](#).
78. The selection of cumulative viewpoints should be based on an analysis of the draft cumulative ZTVs, ideally at the initial scoping stage of the LVIA so that, as far as possible, viewpoints are selected which will serve **both** the LVIA and CLVIA. All relevant data may not be available at the outset. Additional viewpoints may be required once such data are available and have been analysed. In areas where there have already been a number of windfarm proposals it may be useful to select viewpoints that have been used for previous windfarm CLVIAs. In many locations the level of development is such that most viewpoints will now be cumulative in nature.
79. Viewpoints should be chosen to represent the following fixed position cumulative visual impact scenarios:
 - *Combined or simultaneous visibility* occurs where the observer is able to see two or more developments from one viewpoint, without moving his or her head. A 90 degree arc of view should be shown and the effects represented as described below; and
 - *Successive or repetitive visibility* occurs where the observer is able to see two or more windfarms from one viewpoint but has to move his or her head to do so. Visualisations, such as 180 or 360 degree arc of view wirelines, will be useful in assessing these effects. Supporting text or tables to describe the effects will be needed.
80. A degree of pragmatism is required to limit the number of viewpoints to those which are likely to provide useful information to inform decision making.

Sequential visual assessment and selection of routes for analysis

81. *Sequential cumulative effects on visibility* occur when the observer would see the proposed windfarm with other developments, either simultaneously or in succession, when moving through the landscape.
82. Routes to be assessed should be defined and agreed with the Planning Authority as part of the baseline LVIA. The extent of these study routes should be informed by the 60km search area base plan drawing and the cumulative ZTVs.

They may extend beyond this in some situations, for example particularly important or busy travel routes, or particularly sensitive locations.

83. A “**journey scenario**” should be considered for routes that may have significant cumulative effects, and the description of available views and how these may be affected by the proposal may note:
- direction of view (‘direct’, ‘oblique’, ‘aligned on route’, or ‘looking NW of route’ etc.); and
 - distance from nearest turbine; and
 - distance over which the effect would occur.
84. It can also be helpful for the assessment to identify the likely duration of the predicted effect. For example, ‘assuming an average driving speed of ‘x’, this effect will be apparent for approximately ten minutes between 12 and 8 km from the nearest turbine’. The journey scenario can be illustrated in various ways as described below.

Cumulative assessment of single turbines, or small groups of turbines

85. Single or small groups of 2 or 3 commercial scale wind turbines raise specific issues for cumulative effects and their appraisal. These include:
- when cumulative issues occur with both larger windfarm development and/or other single/small scale development;
 - multiple small scale and single turbine developments being proposed in a particular region, with complex cumulative effects arising; and
 - introduction of development to landscape types which have not yet been subject to larger windfarm development.
86. SNH guidance on the preferred approach to cumulative assessment of single or small groups of turbines can be found in “[Assessing the impact of small scale wind energy proposals on the natural heritage](#)” (SNH, March 2012). This sets out indicative levels of information to be submitted by developers which, although less than that expected for larger proposals, should be of a suitable standard to enable easy appraisal by consultees.
87. Assessment of micro renewables proposals (<50kw) is detailed in our guidance “[Micro renewables and the natural heritage](#)” (SNH, October 2009). Applications at this scale are unlikely to require, or be included in CLVIA.
88. Further guidance on the siting and design issues related to small to medium turbine development (15-50 metres height to blade tip) is also available on our [website](#).

Illustrative Methods

89. The predicted cumulative effects should be clearly portrayed in accordance with GLVIA (2002) and [Visual Representation of Windfarms Good Practice Guidance \(SNH 2006\)](#). All relevant proposals should be depicted (where practical) in all of the relevant illustrative material (i.e. wireframes, photomontage, study area map).

90. The range of illustrative tools which can help in cumulative landscape and visual impact assessment is constantly evolving. Some of the available tools which have been found to be of particular value are described below.
- **Wireline views** are most commonly used to show installed, consented and as yet undetermined applications in combination. It is important that the turbines, or clusters of turbines, are clearly presented and numbered, using different colours to distinguish between windfarms as necessary. Interpretive text and data should be positioned carefully to avoid cluttering the wirelines. A separate appendix showing wirelines with numbered turbines may be appropriate.
 - **Photomontages** will usually be of most value for views within 15km of a windfarm site. However this will depend on the specific windfarm design and environmental conditions and consequently this parameter should usually be discussed and agreed with the determining authority and consultees.⁶
91. In some circumstances it may be useful to show more distant developments in both wirelines and photomontages. Where these are so distant that they cannot meaningfully be displayed on the illustration, a note showing the location and approximate extent of the development will suffice.
92. Where the baseline has changed, it will often be necessary to provide up to date photographs from viewpoints. For example, if other windfarms (or indeed other forms of development) have been built since the original photography was taken.
93. A '**wind rose**' diagram, shaded to show the direction (arc of view) and distance of windfarms visible for 360 degrees, can often be helpful, especially from important summit viewpoints.
94. Sequential effects can also be illustrated in several ways:
- **plan** showing visibility of different projects from a route denoted by coloured arrows on mapped base;
 - **diagram** showing visibility of different projects from a route. This could take the form of a colour-coded timeline linked to the colours used in the ZTV;
 - **table** showing predicted visibility by length of route affected by each project, including commentary text on every 10km explaining where each project is visible and the nature of this visibility;
 - colour coded **sequential bar chart** or "timeline" showing distance, duration of view and whether it is direct, oblique, screened, etc., with the colours for each windfarm matching those used in the ZTV. An analysis of the significance of such quantitative data is needed.
95. Computer generated moving images ("drive throughs") or **videomontage** techniques may also be appropriate to assist CVIA, particularly in respect of cumulative sequential effects. This technique may be particularly applicable to assessment from moving receptors such as trains or ferries or in assessing windfarm extension applications where different turbines with different heights and rotor speeds are being used. Alternatively, a series of static images could be produced and viewed in time sequence.

⁶ Visual Representation of Windfarms Good Practice Guidance (SNH 2006), paragraph 205 – note this guidance is currently under review

Description and assessment of cumulative landscape impacts

96. The study of potential cumulative landscape effects and related impacts should include the description and assessment of the following issues:

- **Effects on landscape character.** The cumulative (i.e. additional) effect of proposed development on existing landscape character should be described, particularly in relation to key landscape characteristics. It is likely that as more windfarms are developed they will begin to be perceived as a key landscape characteristic and will therefore change the landscape character. These effects should be objectively assessed in accordance with standard landscape character assessment guidelines (Land Use Consultants for SNH and Countryside Agency, 2002, GLVIA 2002).

Consideration should also be given to related effects on sense of distance, scale and focal points in the landscape. Relative scarcity of Landscape Character Type may also be considered as part of the assessment, especially where there are few examples of a certain Type which remain unaffected by windfarm development.

- **Effects on sense of remoteness or wildness.** The existing experience of remoteness and wildness should be described and the cumulative effects of development analysed. This should include effects on the peripheries, and therefore the setting of any wild land areas, to ensure that their extent is not diminished. Useful reference can be made to SNH's policy on '[Wildness in Scotland's Countryside](#)' (SNH, 2003) and '[Assessing the Impacts on Wild Land](#)' (SNH 2007). We are currently revising our wild land mapping and updated mapping and information is expected to be available later in 2012.
- **Effects on other special landscape interests .** The effects of additional development on the objectives, key characteristics, qualities and integrity of any relevant landscape designation should be analysed and described as should effects on other interests in the landscape. For example, this may include consideration of the effects on the landscape setting of settlements or other cultural interests (such as designed landscapes) and associations with the landscape (GLVIA 2002).

97. Other issues that are not identified above may also be relevant for assessment of cumulative landscape effects depending on the location and these should be agreed with the Planning Authority.

Description and assessment of cumulative visual impacts

98. The study of potential cumulative visual effects and related impacts should include the description and assessment of:

- **Effects on range of visual receptors in the study area.** This may include residential settlement; outdoor recreational facilities (informal and formal) and routes through the study area.
- **Effects on views of the landscape.** For each of the relevant receptors, consider if any additional impacts on visual amenity derive from the new turbines and how this relates to other wind farms visible from the same location. For example, would the new turbines be seen above the skyline,

whilst existing wind farms are backclothed by landform? if so, what is the relationship between the turbines and the skyline?.

- **Relationships between windfarms.** Consideration should be given to the relationship between the various windfarms in the view in terms of layout, turbine hub height, rotor dimensions and related rotation speed.

99. In presenting the findings of the assessment there is a risk of focussing on a quantitative assessment of the effects. **This will be helpful, but a qualitative analysis of these is required to fully appraise the effects.** The production of extensive quantitative analysis alone is not sufficient.

Offshore windfarms

100. There are proposals for offshore wind farms in Scottish Territorial Waters and within two 'Round 3' zones off the east coast. In some locations it may be necessary to consider onshore and offshore wind farms in the same CLVIA. This is due to both the scale of the offshore proposals and their potential to affect the same views, receptors and landscapes as onshore windfarms.

When will cumulative impacts on landscape lead to an SNH objection ?

101. The decision on whether to object to a proposal on the grounds of cumulative impacts is complex. The key consideration for SNH is whether or not the impacts of the proposal(s) on the natural heritage raise issues of national interest, as set out in our guidance on [Identifying natural heritage issues of national interest in development proposals](#).

Summary

102. This guidance has been updated to address the fact that in many areas of Scotland, CLVIA will require the assessment of large numbers of windfarms. In some cases more than 40 windfarms have been included in the assessment. The level of information generated can distract attention from the most significant cumulative effects which are likely to influence the consenting decision. **Assessments should therefore focus on the most significant cumulative effects and conclude with a clear assessment of those which are likely to influence decision making.**

SECTION 4: ASSESSING CUMULATIVE IMPACTS ON BIRDS

Background to wind farm impacts on birds

103. Operational wind farms are known to have a number of impacts on birds and bird populations. These impacts have been documented at wind farms both onshore and offshore, and can apply to one or more bird species. These are well described in the scientific literature and include:
- collision with turbine blades (moving and stationary);
 - displacement of birds due to loss of suitable feeding and/or breeding/wintering habitat;
 - disturbance within and around the turbine envelope; and
 - creating a barrier to dispersal, regular movements or migration.
104. These impacts are usually addressed in Environmental Impact Assessments (EIA) for all sensitive bird species that are present on, or adjacent to, the proposed wind farm site. [Guidance](#) published on the SNH website identifies which species should be prioritised for assessment. This is mainly based on species' conservation and legal status, both nationally and internationally.
105. However, the issue of cumulative impacts of multiple developments on sensitive species populations has received limited attention. There are many reasons for this including a lack of clear, agreed methodologies by which to undertake such assessments. A range of difficulties have been encountered which makes the process both complex and difficult to interpret.
106. The purpose of this guidance is to set out a biologically robust approach to making cumulative assessments which satisfy both planning and legal concerns. The guidance is restricted to onshore wind farms. Similar principles apply in offshore settings but these are being addressed by COWRIE⁷ for the offshore environment. The Department of Energy & Climate Change (DECC) have also commissioned work to produce guidance on assessing cumulative impacts of onshore wind farms. Our guidance will be reviewed and amended as knowledge, understanding and practice develops.

The nature of cumulative impacts

107. Cumulative impacts result from effects arising from two or more developments. Effects may be:
- **additive** (i.e. a multiple independent additive model), or
 - they may interact in ways that lead to cumulative impacts that are **antagonistic** (i.e. the sum of impacts are less than in a multiple independent additive model) or
 - **synergistic** (i.e. the cumulative impact is greater than the sum of the multiple individual effects e.g. CEFAS (2001), Foden, *et al.* (2010)).
108. While antagonistic or synergistic models may occur in real-life settings, the approach adopted in this guidance is the simpler additive model which sums impacts from different developments. However, summing impacts can lead to individual errors being compounded and in some cases (such as collision

⁷ [Collaborative Offshore Windfarm Research into the Environment](#)

mortality) correction may need to be made when receptor populations are small.

109. It is important that cumulative impacts on birds are quantified in Environmental Statements. This provides comparable data that can be combined to investigate cumulative impacts. For example, impacts on golden plover might be quantified in terms of the number of presumed territories lost (either from displacement or from habitat loss) and assessing cumulative impact simply becomes a matter of summing the individual development impacts across the geographical range being considered.
110. In practice some effects, such as levels of disturbance or the barrier effect, may need considerable additional research work to assess impacts quantitatively. A more qualitative process may need to be applied until this quantitative information is available, e.g. from post-construction monitoring or research.

Types of cumulative impacts

111. **Collision risk** for sensitive species is frequently calculated for onshore wind farm applications in Scotland. This uses the Band Model (Band *et al.* 2007) as part of the assessment process.
112. Collision Risk Modelling (CRM) produces indicative figures for annual losses (individuals per annum) or a total sum over the lifetime of the wind farm (typically 25 years). CRM values are summed for each species across all the wind farms where calculations have been made. It is important that comparison is made on **annual** rates of collision mortality and not total estimated mortality, to adjust for the different timescales over which wind farms will be developed.
113. Birds encountering wind farm developments may take avoidance action. This can be divided into two very different behavioural responses:
 - **Behavioural avoidance** is when a bird close to an operational wind farm reacts to prevent a collision. Such behaviour implies that a bird sees a moving turbine blade, evaluates the potential risk and takes action to prevent what might be a fatal collision.
 - **Behavioural displacement** operates at a different level, in that a bird may, over time, change its range use, territory use or flight pattern between roosting areas and feeding areas, so that the range use (or flight paths) no longer brings birds into the vicinity of an operational wind farm.
114. It is the result of these behaviours which determine what, if any, impacts are likely to arise from a wind farm development proposal:
 - **Displacement** effects result in a loss of habitat for a species, and this is likely to be long term unless birds habituate to the development. Displacement is different to disturbance, the latter being short term and may occur primarily during construction, though operational disturbance should not be discounted.
 - The level of **disturbance** caused to birds is more difficult to assess because it relies on predictions of how birds will respond behaviourally.

Scenarios which assume 100% disturbance within a pre-determined distance of turbines can be derived for key species using conservative threshold disturbance distances (Whitfield & Ruddock, 2007). Empirical evidence is lacking for most species but some indication of real displacement distances can be taken from Pearce-Higgins *et al.* (2009).

- Assessments rarely address issues of **habituation** so may exaggerate actual losses from the development area. Disturbance effects may also be non-linear in their impact, with birds tolerating levels of disturbance up to a critical threshold above which they will avoid the development area. Qualitative assessments (see later) may be all that is possible in these situations.

The barrier effect

115. There have been few attempts to quantify the risks to bird movements from the **barrier effect**.
116. Wind farms may act as a barrier to species that commute between a nocturnal roost site or breeding area and a feeding locality (for example wintering geese, breeding red-throated divers and colonial breeding gulls). Under this scenario birds may be forced to move round the wind farm (e.g. Masden *et al.* 2009), or gain altitude and fly well above turbine height. Regularly undertaking such movements clearly has an energetic cost.
117. Increasing numbers of turbines (resulting from several developments along such routes) could act either as an impermeable barrier to movement (as the energetic cost of going round the turbines is too high), or may force birds to fly through the turbine envelope, thus exacerbating the collision risk.
118. Wind farms placed across migration corridors, or at key landfall sites for migrants, may also act as a barrier. Many migrants that fly at turbine height during migration (for example species of waterfowl), may have limited reserves of energy to climb above, or pass round, wind farm sites on route.

Habitat loss

119. The amount of habitat lost to tracks, hard-standings, buildings, quarries and other infrastructure associated with the development, is relatively simple to calculate. There will, however, be indirect habitat loss that arises from disturbance and displacement. This may be more difficult to quantify, especially if effects develop over time.
120. Behavioural effects, such as a reluctance to hunt within the turbine footprint (e.g. Walker *et al.*, 2005; Fielding & Haworth 2010) may lead to effective habitat loss even though the habitat remains suitable. It will also be important to determine the loss of habitat that might occur over time through management or hydrological changes as well as possible impacts from disturbance by both site-based operations and improved access by visitors.
121. It is important to note that, although direct habitat loss may be small for all but the biggest wind farms, indirect habitat loss may be a significant factor.

In combination impacts

122. Cumulative impact assessments should not be restricted to other wind farm developments but should include all plans or projects in the area, such as mineral extraction, built development, power lines, telecommunications masts, forestry or recreational pressures. Any associated development (i.e. grid

connections or track construction) should be considered within the cumulative impact assessment.

123. Long term or chronic impacts may be difficult to factor in but, where such impacts have an adverse impact on the species conservation status, they must be considered as part of the assessment process. For species subject to hunting pressure, levels of shooting mortality may also be relevant, although the poor quality of data on hunting bags may mean that such assessments are limited in their value.

Species Priorities

124. Information on which species should be considered when assessing impacts is set out in guidance on [Assessing significance of impacts from onshore wind farms on birds outwith designated areas](#). A list of sensitive species is given at **Annex C**.
125. The cumulative assessment within most wind farm Environmental Statements should be limited to the species which use the site at some point during their lives. All the species in Annex C are sensitive to impacts arising from wind farm construction and receive a high level of national and international legislative protection. **It is important at scoping stage that the developer seeks advice to confirm that there are no other species present in the area that might, exceptionally, also merit assessment.**
126. Where there is connectivity between the development and the qualifying interests of a [Special Protection Area](#) (SPA), these qualifying interests must be assessed in the Environmental Statement to inform a [Habitats Regulations Appraisal](#) (HRA). Further guidance will be published early 2012 on the [SNH website](#) to assist with this but advice should be sought from SNH at an early stage as to whether there is potential for connectivity with any SPA interests.
127. The Environmental Statement (ES) must include cumulative impact assessment for the full range of species that may be affected. Identifying the range of species likely to be present and likely to be affected is best done at scoping as there may be species for which an individual wind farm appears to be relatively unimportant but, when considered in combination with others nearby, could have an impact that is significant on a wider scale.
128. Cumulative assessments should be considered as part of the overall EIA and HRA processes and not as a *post hoc* assessment. However, survey work can always uncover different species on or adjacent to the site and these may need to be factored in at a later stage.
129. Data collection and presentation should be standardised as far as possible in accordance with SNH guidance on [wind farm survey methodology](#). However, where new information on avoidance rates becomes available, a degree of *post hoc* analysis may be need, using standard and up-to-date avoidance rates.

Scale at which impacts should be assessed

130. The issue of the scale at which impacts are assessed has been dealt with in other SNH guidance, and will not be discussed in detail here. In summary, the impacts of wind farm (and other) developments on any species population can be assessed at a number of scales, ranging from the very local (e.g. on the

wind farm site); at a regional scale, such as a Natural Heritage Zone (NHZ); and at a national (i.e. Scottish), scale.

131. Given that our prime concern is to maintain the conservation status of the species population at the national scale, we aim to assess impacts upon a species' population size, its population trend and its natural range within Scotland. Therefore, we are interested in how wind farms (individually and cumulatively) are likely to affect the species either nationally, or regionally where regional impacts have national implications (where a specific region holds the majority of the national population for example). Impacts on designated sites such as SSSI or SPAs are considered separately, according to existing guidance.
132. Developments that are likely to have an effect on a SPA or Ramsar site, either alone or in combination with other plans or projects, need to be subject to a Habitats Regulations Appraisal.
133. For wind farms which do not have an impact on designated sites, SNH guidance on '[Assessing significance of impacts from onshore windfarms on birds outwith designated sites](#)' (known as the 'Wider Countryside Guidance') highlights the relevance of the Natural Heritage Zone (NHZ) as the basis for the geographical range selection. We are currently⁸ undertaking a review of the population status of key, priority species for assessment in each of the 21 Natural Heritage Zones, which will support the assessment of impacts and their magnitude within EIA.

When will cumulative impacts on birds lead to an SNH objection?

134. The decision to object to a proposal on the grounds of cumulative impacts is complex. The key consideration for SNH is whether or not the impacts of the proposal(s) on the natural heritage raise issues of national interest, as set out in our guidance on [Identifying natural heritage issues of national interest in development proposals](#).

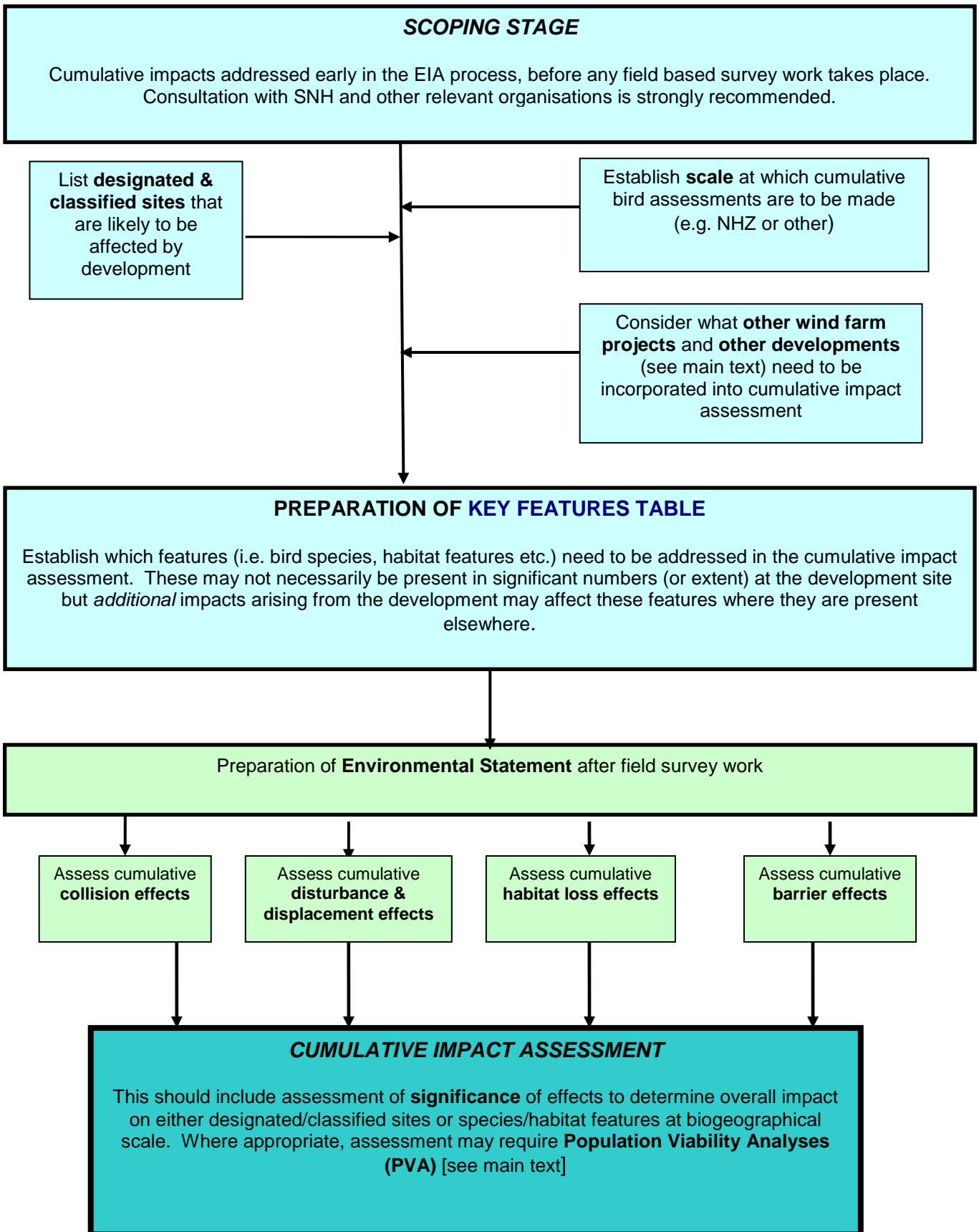
Assessing Cumulative Impacts

135. Consideration of the cumulative impact assessment should begin at the scoping stage. In addition to identifying and addressing the impacts on species found in significant numbers on or near the proposed development site, the process should also identify species that may be affected by other developments within the area of cumulative assessment. For example, a site may have low numbers of a particular species. Effects on the site itself may be minimal but, because neighbouring sites host significant numbers of the species, an assessment of the additional impact is required.
136. It may help to prepare a **Key Features Table** at an early stage. This summarises the species and sites potentially affected by the proposed development. The concept of this Table is developed in the COWRIE Guidance on assessing cumulative impacts of offshore wind farm developments (King *et al.* 2009).

⁸ The review is currently in progress for a range of species. For the latest situation readers are recommended to contact the [SNH ornithological contact](#) point.

137. Agreement on key species and features likely to be at risk will include:
- identification of key sites (SPAs and SSSIs) which may be affected;
 - definition of the relevant biogeographical population (e.g. NHZ or national level);
 - agreement and guidance on key methods used to assess impacts; and
 - guidance on data collection and analysis, particularly the treatment of 'risk' and the precautionary approach for collision risk modelling.
138. To assist with a standardised approach to scoping, parameters for early discussion could be easily defined. The flow chart below sets out the process in outline.

Figure 2. Flow chart summarising cumulative assessment for birds



Assessing the significance of cumulative impacts

Impacts on birds within or affecting designated sites

139. The need to consider the impacts of proposals on European sites is described in detail in The Habitats Regulations and [Revised Guidance Updating Scottish Office Circular 6/1995 \(SEERAD June 2000\)](#).
140. Any development that may affect a Natura site (including any Special Protection Area) requires a Habitats Regulations Appraisal (HRA). This Appraisal considers whether the work is related to management of the site for nature conservation but, as wind farm developments do not come into this category, the key steps in a HRA are:
 - to consider whether a proposal is likely to have a significant effect on a European site (either alone or in combination with other plans or projects) and, if so;
 - whether it can be determined that the proposal will not have an adverse effect on site integrity (this is the stage at which the Appropriate Assessment (AA) is undertaken).
141. Para Information to inform the HRA should be provided by developers within the Environmental Statement.
142. For an Special Protection Area (or a Ramsar site), cumulative impacts arising from other wind farm proposals and projects that could affect the site, must be incorporated into the overall assessment. The principle of this assessment is to determine that the proposal will not have an adverse effect on site integrity, including species' conservation status, whether singly or in combination with other developments. The assessment of significance, and process of determining any impact on site integrity, is described in detail in our online [guidance on habitats regulations appraisal](#).

Impact on birds outwith designated sites

143. The concept of favourable conservation status (FCS) should be used outside designated sites to determine whether an impact on a sensitive species is likely to be significant. The concept of FCS is articulated in European Directives, such as the Habitats Directive and the Environmental Liability Directive⁹. The conservation status of a species includes consideration of the sum of the influences acting on it, which may affect its long-term distribution and abundance, within the geographical area of interest.
144. A species' conservation status is favourable where:
 - a species' population dynamics indicate that the species is maintaining itself on a long-term basis as a viable component of its habitats; and
 - a species' natural range is not being reduced, nor is likely to be reduced for the foreseeable future; and
 - there is (and will probably continue to be) a sufficiently large habitat to maintain its population(s) on a long-term basis.
145. A cumulative adverse impact should be judged as significant at the national level where it would adversely affect the favourable conservation status of a

⁹ See Environmental Liability (Prevention and Remediation) (Scotland) Regulations 2008: A Quick Guide <http://www.scotland.gov.uk/Publications/2008/05/14161737/50>

sensitive species or prevent a sensitive species that is recovering from reaching favourable conservation status. The premise here is that impacts from a number of developments, when assessed cumulatively, may exceed some threshold value (e.g. for loss of habitat or loss of breeding birds from collision), beyond which the impact becomes unacceptable.

146. Information on additional mortality, any loss of habitat, nesting or feeding territory, and any expected loss resulting from displacement in the population likely to arise from the development should be available from all relevant environmental statements, or from developers directly. These impacts should be set out in the context of information on the total population number and distribution (where known), current annual mortality and the area of suitable habitat for the species within the Natural Heritage Zone (NHZ).
147. SNH will assist developers in obtaining relevant information *where possible*, especially in circumstances where changes in outcomes from modelling work have been identified or (for example) where parameters such as avoidance rates have changed.
148. The effects of **disturbance** can be difficult to quantify. Birds may either move from the area or they may remain, and if they do move, then effects may be transitory or they may be sufficiently severe for long term impacts to arise (e.g. causing birds to abandon an area) but assessing the transition point at which dispersal behaviour changes will be a matter of judgement unless there is previous research or experience.
149. The [SNH report on disturbance distances](#) provides a basis for these judgements. Most disturbance will arise during construction but some operational disturbance is also possible, although habituation may also occur. Assessing disturbance on the basis of disturbance distances is therefore likely to offer a precautionary approach.
150. For a species that is prone to **displacement** by wind turbines, the main impact may be a loss of habitat which will translate into a reduction in the number of birds in the area. This on its own may not affect favourable conservation status (which reflects viability, range and adequacy of habitat to keep the population viable) if birds are displaced into other areas with sufficient capacity to absorb them. However, if the cumulative loss of habitat is significant and widespread, then it should be regarded as reducing the natural range of the species.
151. Direct **loss of habitat** should be considered and, while this may be relatively easy to quantify, the difficulty arises in assessing at what level habitat loss becomes significant. Setting arbitrary thresholds is not considered appropriate (such as the loss of 1% or more of the available habitat) and it will require case-specific judgements to be made, as part of the EIA to assess the significance of any impact. This type of habitat loss does not include indirect loss of habitat (i.e. through displacement).
152. Where mortality from **collisions** can be assessed, simple deterministic population modelling (or where appropriate stochastic modelling such as Population Viability Analysis (PVA)) can be used to model population trends. In many cases, the quality of data for sophisticated analyses may not be available, but simple deterministic models, for example those based on Leslie Matrices, are often relatively easy to construct to examine different scenarios or likely impacts of additional mortality. COWRIE has provided detailed

assessment of PVA models (McLean *et al.*, 2007), which may be used in making such assessments.

153. For a species that is prone to collision risk, the main impact may be added mortality. At low levels, the effect of such collision risk may be negligible in comparison with natural mortality. However, when considered in conjunction with other sources of additional mortality, especially from other wind farms, it may initiate a population decline that cannot be reversed unless the impact is removed.
154. When assessing cumulative mortality from multiple developments, it is important to note that simply summing collision mortality across all developments may **overestimate** cumulative mortality, as once a bird has been removed from a population due to collision with one development, it cannot collide again. This is particularly pertinent where population sizes are small (i.e. ≤ 50 breeding pairs) and mortality can represent a significant proportion of the population. Mortality tends to be proportionately lower for larger populations and, under these circumstances, summing mortalities may provide a valid approximation.
155. Further information on how to correct cumulative mortality calculations for losses is available in Maclean & Rehfish (2008). For example if we have a population of 20 breeding pairs of a particular species in an area with multiple wind farm developments, then if one pair is lost due to collision mortality with one wind farm, that will mean that there are fewer birds remaining in the population that are then subject to a risk of further collision mortality.
156. Where a species is already in decline, the test of significant adverse impacts should be whether the proposal would add *significantly* to the factors driving the decline and to the difficulty of taking action to reverse the decline to achieve favourable condition. In some circumstances, minor adverse impacts from a wind farm proposal, while theoretically adding to existing impacts that may lead to a decline in a species' population, may in themselves be so trivial in comparison with existing mortality or habitat changes that they may be deemed not to add significantly to the existing impact.
157. In considering distribution, it is important to be aware of the wider distribution within the geographical area. These may include both strongholds and gaps, both of which add complications in using the change of distribution as an indicator of significant loss at a very local level. Stronghold areas should not be prioritised for special protection unless they are designated sites for the species in question, or are recognised as productive, source areas that are important for the maintenance of the species within the NHZ. A stronghold area will usually withstand a level of impact on the species but impacts that jeopardise the status of the strongholds might constitute an impact on the natural range. On the other hand marginal populations outside the main stronghold areas may have a special ecological importance, e.g. being a location that facilitates immigration into, or emigration from, the region. In such areas, any adverse impact may translate into an impact on the NHZ as a whole.

Measuring cumulative impacts

158. The purpose of this guidance is to provide advice on cumulative impacts that apply in the longer-term. Short-term impacts during the construction phase may add to operational impacts but, because they are by their nature

temporary, they should be assessed separately. In many cases, management approaches will mitigate construction related impacts. Only where construction-related impacts turn out to be longer term should they be included in the assessment of impacts from operational wind farms. For example, short-term disturbance may lead to long term loss of a species from an area if it is slow to re-colonise vacant habitat.

159. Cumulative impacts are best assessed quantitatively for each eligible species. The four main impacts described earlier can be quantified:
- **Collision mortality** expressed as the number of birds of a particular species killed (usually per annum) for any particular development.
 - **Disturbance** can be expressed as the number of territories lost, or number of birds displaced, from the wind farm footprint. It can also be the extent of habitat that is (indirectly) lost as a result of disturbance. Units of measurement must be standardised across all wind farms included in the cumulative impact assessment. Displaced birds cannot collide with wind turbines and acceptance of a collision risk implies limited displacement (even if birds manage to evade moving turbine blades).
 - The **barrier effect** is more difficult to quantify. One approach is to identify the proportion, or percentage, of a species' dispersal or migration route that is occupied by wind farm developments. For individuals of a species that move within a narrow, predictable corridor, e.g. between a roost and a specific feeding location, even a single wind farm placed along the route will (or could) act as a virtual barrier (e.g. see Masden *et al.*, 2009) For species moving along a broader front such as a migration front, a combination of wind farms set roughly perpendicular to the migration axis could act as a barrier for birds migrating at turbine blade height. A shift in a migration route may be trivial in terms of increased energy expenditure (e.g. Masden *et al.* 2009) but a daily 'detour' may add significantly over time to the overall expenditure of energy.
 - **Displacement** due to direct habitat loss is relatively easy to quantify, as this can be measured in terms of hectares of habitat lost. Using data from the Environmental Statement on putative densities for the species concerned, loss of numbers can be calculated, where appropriate with confidence intervals. It is more difficult to calculate impacts arising from indirect habitat loss, such as habitat change or behavioural displacement, as these effects are less predictable without a solid foundation using individual-based modelling (e.g. Kaiser *et al.* 2006), species-habitat modelling, or radio tracking of individuals.
160. Cumulative impacts should be summarised in a table or a spreadsheet, with a separate worksheet for each species. An example is given in **Annex D**. The benefit of a spreadsheet is that the table of impacts will automatically be updated as additional wind farms are added, and various permutations of wind farm order can be developed (see later). We hold some of the required data, but it will be for developers to source and verify all data required from SNH and other sources.
161. Additional information, such as the date the consent was given or planning application was formally submitted, the turbine number, total turbine area (with buffer) should be included in the table. Other parameter values could be added where these would add value to the utility of the spreadsheet.
162. Tabulations of cumulative impacts are 'living' documents which must take account of new information or changes in important parameters (such as

avoidance rates). As post-construction studies are completed and published, generic conclusions should also be factored in where these have a material effect on earlier cumulative assessments (for example, we have revised the default avoidance rate from 95% to 98%). Earlier proposals for which CRM figures were based on 95% will require re-evaluation.

163. A critical issue when considering cumulative impacts is the order in which developments are factored in.
 - Developments that are already operational, and those that are consented, and likely to be built should be considered first as the impacts arising from these are unavoidable (once mitigation has been factored in). These are the critical projects that must be included.
 - Applications that have been formally submitted to a planning authority or Scottish Government but have yet to be determined, and applications that are awaiting submission (i.e. there is an environmental impact assessment) should be factored in last of all. It should be recognised that data from such assessments will not necessarily be in the public domain unless an application has been submitted but has yet to be determined.
164. The same principles apply to other developments though their impacts will not necessarily include all of the range of impacts identified by wind farms. For example, a new power line may increase collision risk but would probably present little additional disturbance or habitat loss (unless birds avoid the power line altogether).
165. Cumulative assessment is an ongoing process. As new wind farms are proposed, or applications are determined, the spreadsheet can be updated as appropriate, until the point of submission of a valid application for consent.
166. Judgements on cumulative impacts may also be affected by mitigation or enhancement measures which are provided to offset some of the resulting adverse impacts arising from wind farm construction. Assessments need to be undertaken once tabulation of cumulative impacts have been carried out, though any such benefits that are factored in need to be demonstrable, or subject to a high degree of confidence that they will, in fact, lead to such benefits.

Data needs

167. Under normal circumstances, we will expect the developer to undertake the cumulative impact assessment as part of the EIA process. However, it is recognised that developers will need access to data for such assessments, and that access to such data will not always be possible.
168. Data for cumulative impact assessments will generally be derived from environmental statements. Unless there is good reason not to do so, figures will be accepted as presented in the various source environmental statements. Developers should also refer to the SNH response letters to ensure they have the agreed figures, as there are occasions where we disagree with the information presented in Environmental Statements.
169. Data from environmental statements for most wind farm developments will, in general, have been lodged with SNH. We will make such data available to other developers, bearing in mind issues such as commercial confidentiality and environmental sensitivity, when this will materially assist a developer in undertaking a cumulative assessment. However, data from other

developments (such as non EIA developments which we have not commented on) may need to be gathered from other sources.

170. We can also help to identify those developments that need to be incorporated in to the cumulative assessment. Assessment of which developments should be included will be part of the scoping exercise.
171. In some cases, it may be necessary to consider **offshore** wind farms, where these may have an impact on terrestrial species populations (e.g. some gulls that use inland and coastal habitats).
172. During the SNH 2009 Cumulative Impact Assessment Sharing Good Practice Event, it was suggested by some participants that a centralised database be established to summarise impacts from different wind farms. In relation to consented wind farms, we have recently issued guidance on [post-consent monitoring of wind farms](#) that addresses this issue. However, it will be more difficult to incorporate data from wind farms that have not yet received consent and, for this, data may have to be sourced from the relevant developer.
173. The Scottish Windfarm Bird Steering Group has also recently been established. The group aims to gather, collate and assess data from constructed windfarms across Scotland and it is hoped that this will greatly assist in cumulative impact assessments in the future by providing greater access to data as well as reduced uncertainty over impacts. The group can be contacted through the research co-ordinator Gina Martin¹⁰. It is therefore essential that other wind farms and developments that should be included in any cumulative assessment are identified as early as possible (during the scoping process) so that relevant data can be acquired. This can be reviewed as part of the development process but, again, reinforces the importance of cumulative assessments as part of the overall assessment process and not as a *post hoc* exercise once the work for the EIA is complete.

Summary

174. Cumulative impacts are an essential component of any environmental assessment of a windfarm's impact on bird populations. Cumulative impact assessment begins at scoping, when issues of scale, sensitive species and effects to be assessed should be discussed and agreed with SNH.
175. It is assumed that cumulative impacts are additive, though there are circumstances (one is identified in this guidance) where this will not be the case. However, the simple additive approach is the key starting point for cumulative impact assessment for birds.
176. A cumulative impact that is considered to compromise a species status nationally (as defined in the SNH guidance - [Identifying natural heritage issues of national interest in development proposals](#)) – may raise concerns sufficient to trigger a SNH objection to the development.

A full list of references from section 4 is available in **Annex E**

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Annex A: Key references to cumulative effects in Government and SNH publications

- DTI (2000) *Cumulative Effect of Windfarms*. (Prepared by ETSU)
- Dumfries and Galloway Council (1999) *Structure Plan Technical Paper (1999)*
- Land Use Consultants on behalf of SNH and the Countryside Agency (2002) *Landscape Character Assessment: Guidance for England and Scotland*
- Scottish Executive (1999) *Environmental Impact Assessment Regulations 1999 Circular 15/99* (<http://www.scotland.gov.uk/library2/doc04/eia-00.htm>)
- SNH (2010) *Renewable Energy and the natural heritage*
- SNH (2002) *Policy Statement 02/02; Strategic Locational Guidance for Onshore Wind Farms in Respect of Natural Heritage*
- SNH (2002) *Search Areas for Wild Land* (map) (available at <http://www.snh.org.uk/pdfs/polstat/wsc-m3.pdf>)
- SNH (2003) *Policy Statement 02/03: Wildness in Scotland's Countryside*
- SNH (Nov 2003) *Guidance on Scoping Issues for EIA 3rd draft*
- SNH (2009) *Siting and Designing Windfarms in the Landscape*
- SNH (2006) *Visual Representation of Windfarms – Good Practice Guidance*
- SNH (2007) *Assessing the Impacts on Wild Land*
- SNH (2008) *Natural Heritage Assessment of Small Scale Wind Energy Projects which do not require formal EIA*
- The European Parliament (1992) *Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora*. (Habitats Directive)
- The European Parliament (2001) *Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment*. (SEA Directive)
- The Landscape Institute and Institute of Environmental Management and Assessment(2002) *Guidelines for Landscape and Visual Impact Assessment 2nd Edition* Spon Press
- The Scottish Government (1998) *Planning Advice Note 58 – Environmental Impact Assessment*. (<http://www.scotland.gov.uk/Publications/1999/10/pan58-root/pan58>)
- The Scottish Government (2005) *Environmental Assessment (Scotland) Act 2005* (www.opsi.gov.uk/legislation/scotland/acts2005/pdf/asp_20050015_en.pdf)
- United Kingdom Government (1992) *The Town and Country Planning (General Development Procedure) (Scotland) Order 1992*
- United Kingdom Government (2004) *Environmental Assessment of Plans and Programs Regulations 2004*.

Annex B: Example SNH wording on cumulative effects

Five examples illustrate SNH advice on cumulative effects may be presented to the planning authority or other decision-maker. These examples do not set out preferred model wordings, but indicate the logic underlying the advice. Where the below examples refer to SNH objections, the assumption has been made that the impacts of the proposal(s) raise natural heritage issues of national interest and SNH has applied its balancing duty as appropriate. The examples are simplified to illustrate the approach.

- (a) A is an existing wind farm. B is proposed at application stage. We would not object to B on its own, but in combination with A, the cumulative impact is such that we would object.

SNH advises against B on the grounds of the cumulative natural heritage impact of B when combined with A.

- (b) A is an existing wind farm. B is proposed at application stage. We would object to B on its own. Moreover, in combination with A, the cumulative impact(s) of A and B is also significant enough for us to object.

SNH objects to B on the grounds of

- (i) the natural heritage impacts of B; and*
- (ii) the cumulative natural heritage impact which would result from the combined presence of A and B.*

In such a circumstance, it will be important to clarify whether the cumulative impact involves any *additional impact*, further to the impacts of A and B taken separately.

- (c) A and B are proposed windfarms, at application stage. We would not object to either A or B on their own. However, the combined effect of A and B is such that we would object.

SNH does not object to either development A on its own or development B on its own; however SNH advises against both A and B being given consent, on the grounds of the cumulative natural heritage impact of A and B.

- (d) A is a proposed windfarm at planning application stage. B is a windfarm at design stage, not yet a planning application but in the public domain through a scoping or screening request. SNH would not object to A. Early appraisal suggests however that B would have less impacts on the natural heritage than proposal A. However, SNH would object to A+B because of cumulative impacts.

SNH does not object to development A, though we highlight any natural heritage impacts. SNH would object to A+B because of cumulative impacts. SNH may recommend that there is a need for a strategic view of preferred areas and appropriate scales of renewables development within the area.

The terms of any advice by SNH should be based solely on the natural heritage impacts of the proposed development, with reference as relevant to the supporting policy context. Given that development B is in the public domain, it may be regarded as a material consideration and the weight to

be accorded to it by the planning authority will depend upon how advanced that proposal is. SNH should encourage a more strategic view by the planning authority as a basis for decisions.

- (e) A is a proposed windfarm, at application stage. Before A is determined, a second windfarm proposal B is lodged as a planning application. SNH would not object to A. Appraisal suggests however that B would have less natural heritage impacts. However SNH would object to A+B because of cumulative impacts.

SNH does not object development A, though we highlight any natural heritage impacts. SNH recommends that decisions on A and B should be taken concurrently.

Any advice by SNH will be based solely on the natural heritage impacts of the proposed development A, with reference as relevant to the supporting policy context. SNH will not oppose application A as a means of seeking deferral of a decision on the grounds that the later proposal, yet to be considered by the planning authority, might have less impacts on the natural heritage. However, the new application is a material consideration, and the potential cumulative effect of the two proposals should be considered by the determining authority. SNH may encourage the determining authority to consider both applications together, at which point SNH would confirm its position regarding cumulative effects and indicate which proposal would have the least natural heritage impacts.

These five examples are not intended to be comprehensive. In many locations, cumulative assessments must now consider large numbers of proposals. Where this is the case, it may no longer be feasible to present our advice in this manner. If this is the case we will offer clear advice on what the key cumulative impacts are (i.e. those which are likely to determine the outcome of a consenting decision). In other situations, the respective developments may be subject to decision by different decision-making bodies – for, example, adjacent planning authorities or one planning authority and the Scottish Government.

We will aim to be clear about our views on the current proposal, taking into account the cumulative effects with existing or consented windfarms. We will also advise on the cumulative effects of the current proposal in association with new proposals in the planning system, and be clear as to the likely natural heritage impacts of each proposal.

Annex C: Widespread species potentially at risk of impacts from onshore wind farms.

Widespread Species	Breeding / wintering	EU Birds Directive: Annex I	EU Birds Directive: Migratory	WCA Schedule 1	BoCC Red List	Notes
Red-throated diver	Br	*	*	*		
Black-throated diver	Br	*	*	*		
Whooper swan	W	*	*	*		
Greylag goose	Br/W		*			
Pink-footed goose	W		*			
Greenland white-fronted goose	W	*	*	*		
Barnacle goose	W	*	*	*		
Red kite	Br/W	*		*		
Hen harrier	Br/W	*		*	*	
Goshawk	Br/W	*		*		
Golden eagle	Br/W	*		*		
Osprey	Br	*	*	*		
Merlin	Br/W	*		*		
Peregrine falcon	Br/W	*		*		
Black grouse	Br/W				*	
Golden plover	Br	*				
Dunlin	Br	*	*			<i>C.a. schinzii</i>
Curlew	Br					On priority BAP list
Greenshank	Br		*	*		
Short-eared owl	Br/W	*				

Restricted range species potentially at risk of impacts from onshore wind farms.

Restricted Range Species	Breeding / wintering	EU Birds Directive: Annex I	EU Birds Directive: Migratory	WCA Schedule 1	BoCC Red List	Notes
Slavonian grebe	Br	*	*	*		
Bewick's swan	W	*	*	*		
Bean goose	W		*			
Light-bellied brent goose	W	*	*			
Honey buzzard	Br	*	*	*		
White-tailed eagle	Br/W	*		*	*	
Marsh harrier	Br/W	*	*	*		
Corn crake	Br	*	*	*	*	
Whimbrel	Br		*	*		
Arctic skua	Br		*			
Great skua	Br		*			
Nightjar	Br		*		*	
Chough	Br/W	*		*		
Scottish crossbill	Br/W	*		*	*	

Annex D: Cumulative impact assessment for bird species - Example matrix

Cumulative Impact Assessment for Wind Farm: {name}											
Species							NHZ				
							Designated Sites(s)				
Site	Date	Collision mortality		Displacement effects		Barrier effects		Habitat loss		Turbine number	Turbine Area
			Σ		Σ		Σ		Σ		
Cumulative Effect (Σ)											

Annex E References from section 4 Cumulative impacts on birds

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- Whitfield, P. & Ruddock, M. (2007). *A Review of Disturbance Distances in Selected Species*. Natural Research Report to SNH.