Technical Appendix 5.1

Landscape and Visual Impact Assessment (LVIA) Methodology

SCOTTISHPOWER RENEWABLES

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5 Landscape and Visual Impact Assessment Methodology

5.1 Introduction

1. This methodology for the Landscape and Visual Impact Assessment (LVIA) has been produced in accordance with best practice by suitably qualified Landscape Architects that are Chartered Members of the Landscape Institute (CMLI).

2. The assessment considers two distinct but closely related areas: landscape character and visual amenity.

   - The landscape assessment considers the effects of a proposed development on landscape character and landscape as a resource; and
   - The visual assessment considers the views that are available to people who may be affected by a proposed development and their perception and responses to changes in these views.

5.2 Guidance

3. In addition to the legislation, policy and guidance set out in **Chapter 2: EIA Process and Methodology**, the primary source of guidance for this chapter is the Landscape Institute with the Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3). The following sources (ordered by date) have also been referred to in the preparation of the methodology for the LVIA and production of visual representations:

   - Natural England (2014). An Approach to Landscape Character Assessment;
   - Scottish Natural Heritage (2017). Siting and Designing Wind Farms in the Landscape Version 3a;
   - Scottish Natural Heritage (2017). Visual Representation of Wind Farms Version 2.2;
   - Landscape Institute (2019). Visual Representation of Development Proposals: Landscape Institute Technical Guidance Note 06/19;
   - Christine Tudor Natural England (2019) An approach to landscape sensitivity assessment – to inform spatial planning and land management-Consultation Draft; and
   - Scottish Natural Heritage (July 2020). Landscape Sensitivity Assessment – Guidance for Scotland – Consultation Draft.

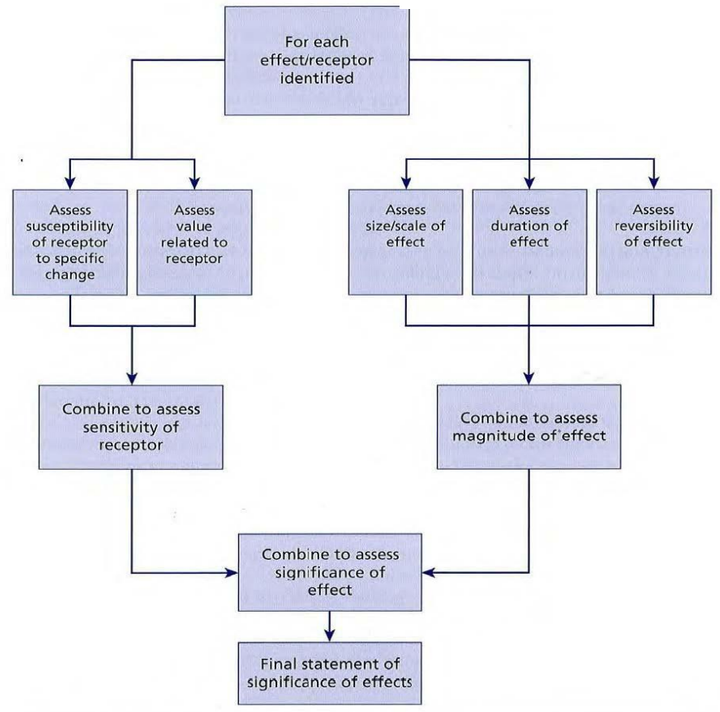
5.3 GLVIA3

4. The methodology is consistent with the approach and process set out in GLVIA3, as summarised in the following flow diagram taken from page 39 of GLVIA3.

5. In summary, the assessment involves the following key stages:

   - Establishment of the baseline conditions; the landscape character and visual context of the receiving environment and the sensitivity to change of these resources.
   - Contributions to the iterative process of design and mitigation based on understanding the nature, form and features of the Proposed Development in relation to the key landscape and visual sensitives.
   - An evaluation of the magnitude of change likely to result from the Proposed Development, both during construction and in operation on visual amenity and the landscape.
   - An evaluation of the cumulative magnitude of change likely to result from the Proposed Development in conjunction with other similar existing or future developments, both during construction and in operation on visual amenity and the landscape resource.
   - An assessment of the significance of landscape and visual effects considering the sensitivity of resources and the magnitude of change.
   - An assessment of the cumulative significance of landscape and visual effects considering the sensitivity of resources and the magnitude of change.

Flow diagram from GLVIA3 Page 39



6. The LVIA does not consider the effects of decommissioning of this particular Proposed Development on the basis that the application is for consent in perpetuity. Any changes in the future would be subject to the necessary assessment deemed appropriate at the time.

7. As stated in **Chapter 2: EIA Process and Methodology**, the assessment has taken into consideration how the current baseline conditions may change going forward to the point of construction, 2022-2023. Due to the limitations, necessary assumption and lack of evidence associated with the future baseline, a detailed consideration of the effects of the Proposed Development against the future baseline would generally not result in a robust assessment depending on the length of future prediction. However, the future baseline with relevance to LVIA is considered in descriptive terms highlighting where likely significant effects are likely to arise in relation to the future baseline as far as can be reasonably predicted for construction and consented wind farms in particular but other changes such as forestry works, implications of tree diseases changes to land use and settlement patterns for example.

8. For both the landscape and visual assessments, including cumulative assessment, the significance of effect is derived from the combination of the magnitude of change and the sensitivity of the landscape or visual receptor. Tables are used to guide the decision-making process for assessing sensitivity and magnitude and how these are considered together to reach an assessment of significance of effect. These tables are not to be used as a

prescriptive tool and in all cases guidelines to illustrate typical outcomes and it should be noted that professional judgement is always used in determining both the sensitivity of a receptor and the magnitude of change. There are situations where the conclusions regarding significance in this chapter differ from that suggested by the significance matrix which reflects the application of professional judgement.

5.4 Information and data sources

9. The first stage of the process is to collect data through a desktop study of the Site and the Study Area. This research identifies information such as landscape related planning designations, landscape character typology, other windfarms in the area, and views from key locations such as routes and settlements. Local studies including capacity studies and studies from other, nearby windfarms are also reviewed.

10. Geographical Information Systems (GIS), Resoft Windfarm software, and 3D software Autodesk Infraworks and Unity are used to explore the potential visibility of the Proposed Development. Zone(s) of Theoretical Visibility (ZTV), wirelines and the 3D model of the Proposed Development inform the identification of landscape and visual receptors that are likely to be pertinent to the assessment. The technical methodology for the production of ZTVs and visualisations is provided in section 5.10 of this methodology.

5.5 Study Area

11. The Study Area is defined based on guidance, consultation feedback, the emerging findings in the information and data analysis stage, particularly the findings from the ZTV(s). As set out in Guidance developed by SNH (Visual Representation of Windfarms Version 2.2, February 2017) the size of the Proposed Development determines an appropriate initial study area radius. This is tested and can be refined based on analysis of the ZTV, desk study and fieldwork.

12. The Study Area defines the area in which significant effects are likely to occur. Where receptors are closer to the Site, it is expected that effects will be greater than those located at the outer edges of the Study Area which are likely to experience lower effects. The rationale for the Study Area is explained in section 5.4 of **Chapter 5: LVIA** and shown on **Figure 5.1: Blade Tip and Hub Height ZTV.**

5.6 Determining sensitivity

5.6.1 Landscape receptors

13. Landscape effects are defined as the changes in the character and quality of the landscape as a result of a development.

14. Direct and indirect landscape effects are defined in GVLIA 3. Direct effects *"result directly from the development itself"* (paragraph 3.22) whilst indirect or secondary effects result from the *"consequential change resulting from the development"* (paragraph 3.22). Indirect effects are often generated away from the site of the Proposed Development or as a result of a secondary association or complex pathway.

15. In order to understand the effects of the Proposed Development it is necessary to consider the following:

- Key landscape characteristics - this includes notable elements or combination elements which contribute to defining the character of an area; and
- Landscape fabric / elements - specific features and elements that make up the landscape such as the topography, vegetation and built form.

Aesthetic, perceptual / experiential qualities of landscapes are also be considered such as scale, enclosure, diversity, sense of wildness, remoteness, openness and tranquillity that give rise to landscape character and regional and local distinctiveness.

16. The sensitivity of the landscape receptors is arrived at by separately considering the landscape receptor value and the susceptibility of the landscape receptor to the change proposed. These are described below.

5.6.1.1 Landscape value

17. When determining landscape value, a range of factors are reviewed that fit on a sliding scale from high to negligible, as illustrated on **Table 5.1.1**. For example, a National Scenic Area with a strong sense of place in very good condition would be expected to fall within the higher end of the sliding scale. Reference is normally made to the relevant existing national and local studies to draw a list of the factors set out in this table. Where these don't exist, as set out in Box 5.1 on Page 84 of GLVIA3, a range of factors that can help in the identification of valued landscapes are reviewed. It should be noted that the importance of a landscape is often based on its designation or recognition through national or local consensus and because of its quality including cultural associations, scenic or aesthetic qualities. The absence of a landscape designation however should not preclude an area being defined as important. Such locations may be of local value informed by local cultural or natural heritage records, works of art or levels of use.

18.

Value	Recognition	Features	Quality/condition
High	Typically, a landscape or feature of international or national recognition: National Parks, National Scenic Areas, World Heritage Sites (where designated for landscape reasons), designed landscapes on the Historic Environment Scotland (HES) Register.	Typically, a strong sense of place with landscape / features worthy of conservation; no or few detracting features.	A very high-quality landscape / feature; attractive landscape / feature; exceptional / distinctive.
Medium	Regional recognition or undesignated, but locally valued landscape / features: Local Landscape Areas, Regional Scenic Areas, locally listed designed landscapes and Regional Parks.	Typically, contains distinguishing features worthy of conservation; evidence of some degradation and / or some detracting elements.	Ordinary to good quality landscape / feature with some potential for substitution; a reasonably attractive landscape / feature; fairly typical and commonplace.
Low	Typically, an undesignated landscape / feature.	Few landscape features worthy of conservation, evidence of degradation with many detracting features.	Ordinary landscape / feature with high potential for substitution; quality that is typically commonplace and unremarkable; limited variety or distinctiveness.
Negligible	Typically, an undesignated landscape / feature.	No landscape features worthy of conservation; evidence of degradation with many detracting features.	Low quality landscape / feature with very high potential for substitution; limited variety or distinctiveness; commonplace.

Table 5.1.1 Landscape value

5.6.1.2 Landscape susceptibility

19. When determining landscape susceptibility, a range of factors are considered on a sliding scale from high to negligible, as set out in **Table 5.1.2.** For example, a large scale scheme proposed within a small and intimate landscape would be expected to fall within the higher end of the sliding scale.

Susceptibility to proposed change	
High	Low ability to accommodate the specific proposed change; undue consequences for the maintenance of the baseline situation (receptor value) and / or achievement of relevant planning policies / strategies.
Medium	Moderate ability to accommodate the specific proposed change; some undue consequences for the maintenance of the baseline situation (receptor value) and / or achievement of relevant planning policies / strategies.
Low	High ability to accommodate the specific proposed change; little or no undue consequences for the maintenance of the baseline situation (receptor value) and / or achievement of relevant planning policies / strategies.
Negligible	Very high ability to accommodate the specific proposed change; no undue consequences for the maintenance of the baseline situation (receptor value) and/or achievement of relevant planning policies / strategies.

Table 5.1.1 Landscape susceptibility to proposed change

5.6.1.3 Landscape sensitivity

20. Susceptibility and value can be combined in different ways although it is generally accepted that a combination of high susceptibility and high value is likely to result in the highest sensitivity, whereas a low susceptibility and low value is likely to result in the lowest level of sensitivity. As noted in GLVIA3 there can be complex relationships between the value attributed to a landscape and its susceptibility to change, which can be particularly important when considering change in designated landscapes or those that are being considered for designated status.

21. However, whilst a valued landscape may serve to increase the overall sensitivity of the landscape receptor, a low value will not necessarily reduce overall sensitivity. Whilst it would be anticipated that landscape receptors considered highly susceptible to the proposed change would be considered to be of high sensitivity, this wouldn't be the case if there were reasons associated with the value that lead to a reduction in sensitivity. For example, where a designated area or area covered by policy may have a deterioration in recent condition and management regime.

22. The diagram presented as **Table 5.1.3** illustrates how value and susceptibility can be combined. When determining overall landscape sensitivity, it should be noted that the levels are indicative and fall on a sliding scale from high to negligible and professional judgement is always used to determine the overall level of sensitivity.

Level of landscape sensitivity diagram

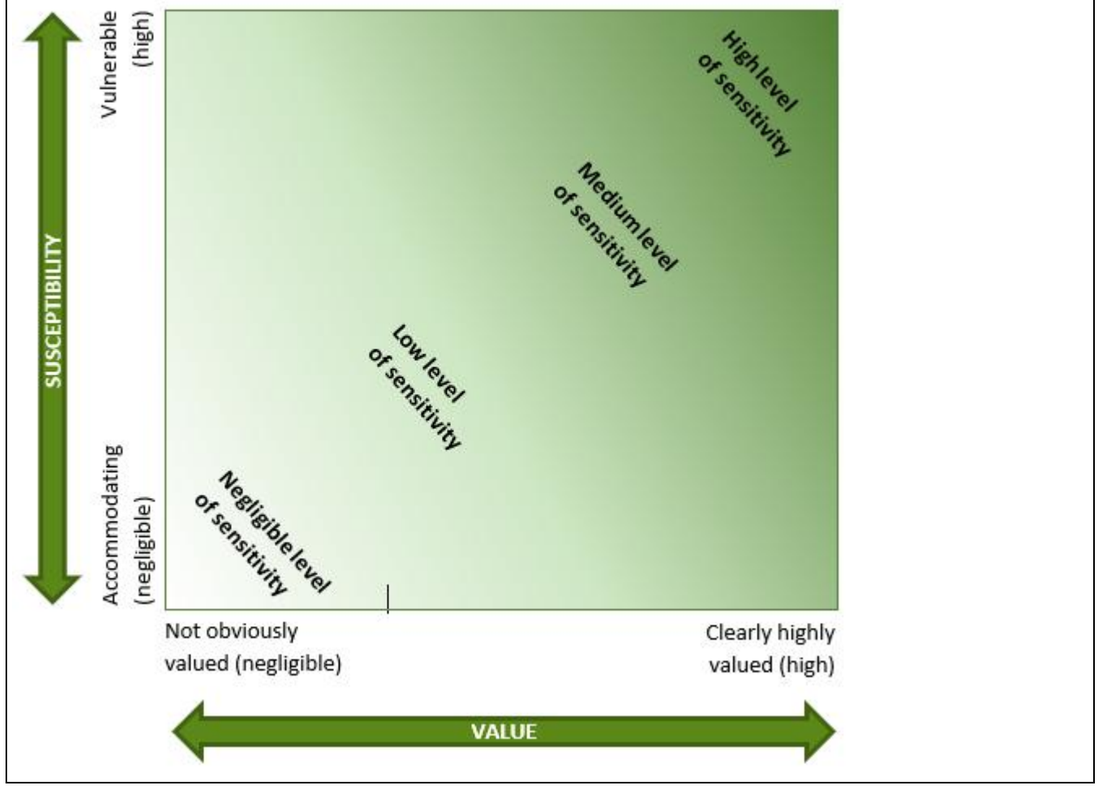


Table 5.1.2 Level of landscape sensitivity diagram

5.6.2 Visual receptors

23. Visual effects relate to changes in available views of the landscape and the effect of those changes on people, including:

- the immediate impact of the Proposed Development on the content and character of views (e.g. through intrusion or obstruction and / or the change or loss of existing elements in the view); and
- the broader impact considering the overall change on visual amenity enjoyed by receptors in the area.

24. GLVIA3 advises that it is helpful to consider (but not restricted to) the following:

- nature of the view (open, panoramic, framed, enclosed);
- proportion of the Proposed Development visible (full, most, part or none);
- distance of the viewpoint from the Proposed Development and whether it would be the focus of the view or only a small element;
- whether the view is stationary, transient or sequential; and
- the nature of the changes to the view.

25. Additionally, the seasonal effects of vegetation are considered, in particular the varying degree of screening and filtering of views.

26. The sensitivity of a visual receptor reflects their susceptibility to change and any values which may be associated with the specific view. The sensitivity of the visual receptors is arrived at by separately considering the visual receptor value and the susceptibility of the visual receptor to the change proposed.

5.6.2.1 Visual value

27. Certain views are highly valued for either their cultural or historical associations, which can increase the sensitivity of the viewer, as set out in **Table 5.1.4**.

Value	Recognition	Indicators of value
High	Recognised views from nationally or internationally important landscape or heritage resources may be identified in planning policies or statutory documents.	High value / celebrated view; referred to in national or international guide books, tourist guides etc.; literary and art references; presence of interpretive facilities (e.g. visitor centre).
Medium	Recognised views from local or regionally important landscape or heritage resource may be identified in local planning policies or supplementary planning documents.	Moderately valued view; referred to in local or regional guide books, tourist maps etc.; local literary and art references; presence of some interpretive facilities (e.g. parking places or sign boards)
Low	Locally recognised views, usually informal.	Valued view but no formal references, may include informal footpaths that indicate well used routes by locals. Likely to be common where views are typical of the location with little distinctiveness, lacking in attractors or detractors.
Negligible	Little to no recognition	Not known locally for its views, places that lack evidence of people actively seeking use and therefore any associated views.

Table 5.1.3 Visual value

5.6.2.2 Visual susceptibility

28. When determining visual susceptibility, a range of factors are considered that fit on a sliding scale from high to negligible, as set out in **Table 5.1.5**. For example, a view experienced by a resident of a property in close proximity and overlooking the Site would be expected to fall within the higher end of the sliding scale.

Susceptibility to proposed change	
High	· Residents at home; · Walkers on long distance trails and mountain access routes, · Users of footpaths where the attractive nature of the countryside is a significant factor in the enjoyment of the walk, · Cyclists on national and local cycle routes designed to provide an attractive experience; · Road users on recognised tourist routes; · Visitors to landscape and heritage resources and other attractions where views of the surroundings are an important contributor to appreciation, experience and/or enjoyment.
Medium	· General road users; · Passengers on rail lines where the trains run at low or moderate speeds; · Users of public open space and footpaths where the nature of the surroundings is not a significant factor in the enjoyment of the activity; · Visitors to landscape and heritage resources and other attractions where views of the surroundings are a minor contributor to appreciation, experience and/or enjoyment.
Low	· People at their place of work or shopping; · Users of high speed roads and passengers in trains running at high speed. · People engaged in recreational activities where the view of the surroundings is secondary to the enjoyment of the activity (such as playing or spectating at outdoor sports facilities) · Users of public open space and footpaths where the nature of the surroundings is irrelevant to the enjoyment of the activity
Negligible	· Users of indoor facilities where the view is irrelevant to their activity

Table 5.1.4 Visual susceptibility

5.6.2.3 Visual sensitivity

29. As with landscape, susceptibility and value can be combined in different ways to form a judgement about the visual sensitivity of a given receptor. It is generally accepted that a combination of high susceptibility and high value is likely to result in the highest sensitivity, whereas a low susceptibility and low value is likely to result in the lowest level of sensitivity.

30. However, whilst a valued view may serve to increase the overall sensitivity of the visual receptor, a low value will not necessarily reduce overall sensitivity. Whilst it would be anticipated that visual receptors considered highly susceptible to the proposed change would be considered to be of high sensitivity, this wouldn't be the case if there were reasons associated with the value of the view that lead to a reduction in sensitivity. For example, a resident at home would generally have a high sensitivity to the proposed change, but if the view they currently experience is of a low value degraded and industrial landscape it can be expected that their susceptibility to a proposed change of a similar industrial nature would be reduced.

31. Similarly, receptors considered of low or medium susceptibility are usually in the same category of sensitivity, unless there are reasons associated with the value of the view that lead to an increase in sensitivity, which is shown in **Table 5.1.5**. For example, where a road user on a defined tourist route would have a higher susceptibility to the proposed change than if travelling on a busy main road.

32. The diagram in **Table 5.1.6** illustrates typical characteristics of the different levels of sensitivity taking into account the value and susceptibility as described above. When determining overall visual sensitivity, it should be noted that the levels are indicative and fall on a sliding scale from high to negligible and professional judgement is always used to determine the overall level of sensitivity.

Level of visual sensitivity diagram

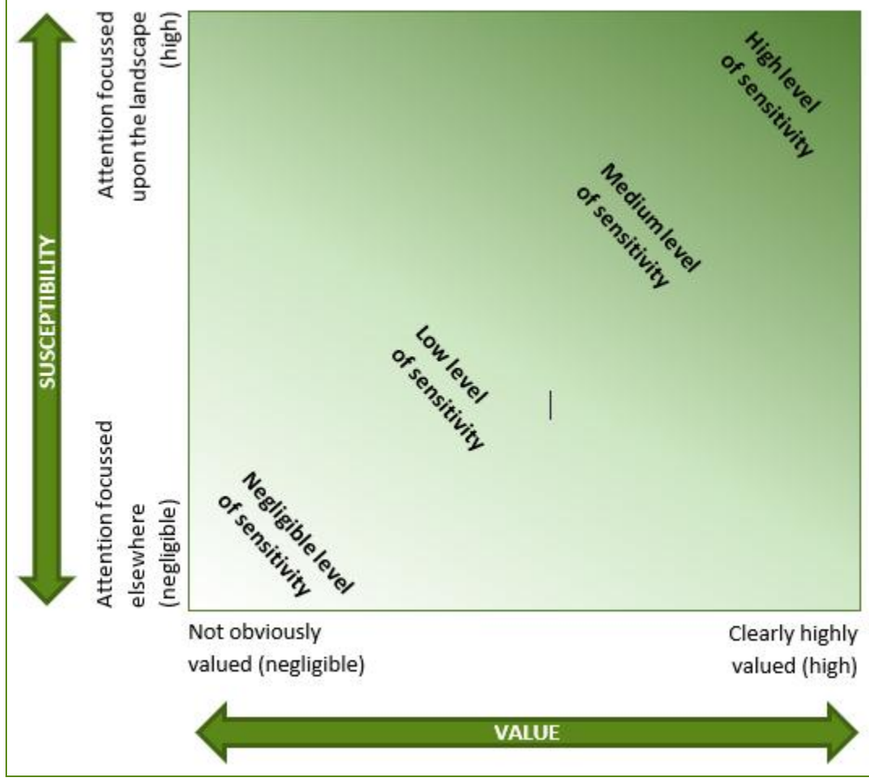


Table 5.1.6 Visual Sensitivity

5.7 Assessing magnitude of change

33. The magnitude of landscape and visual change depends upon a combination of factors including:

- the size, scale and nature of change in relation to the context;
- the geographical extent of the area influenced; and
- its duration and reversibility.

5.7.1 Size/Scale of change

34. The size / scale of change to the landscape and to visual receptors that would arise because of the Proposed Development will take account of the following factors and as set out in **Table 5.1.7**.

Landscape:

- the extent of loss or alteration to key existing landscape characteristics and landscape fabric / elements and for designated areas – special qualities and / or purpose of designation;
- the proportion of total extent represented and the contribution this element makes to the landscape;
- the scale of the receiving landscape and whether it can absorb the Proposed Development;
- the distance of the landscape receptor from the Proposed Development; and
- the landscape context within which the Proposed Development is located.

35. In terms of visual effects, the magnitude of effects needs to be considered against:

- the scale of change in the view (addition or loss of features) and changes to its composition and depth of view;
- the degree of contrast or integration of new features or characteristics into the landscape considering form, scale, mass, height, colour and texture; and
- the nature of the view of the Proposed Development, the time over which it will be experienced and changes in the experience from for instance full, partial, glimpsed to screened.

Size/scale of change	
High	Occupies a wide proportion of the view or would obstruct a significant portion of the view. The Proposed Development would become the dominant feature. Considerable change to the majority / many existing landscape elements and/or landscape character; fundamental changes to the surroundings and baseline to a large extent; very noticeable.
Medium	Occupies much of the view but would not fundamentally change its characteristics. Changes would be immediately visible but not a key feature of the view. Some change to existing landscape elements and /or landscape character; discernible changes to the surroundings of a receptor, such that its baseline is partly altered; readily noticeable.
Low	Occupies a small portion of the view and would only slightly alter the view's composition. Small change to existing landscape elements and/or landscape character; slight, but detectable impacts that do not alter the baseline of the receptor materially; not readily noticeable
Negligible	Occupies little or no portion of the view and would not result in a change to the view's composition. Little or limited /no change in existing landscape elements and/or landscape character, barely distinguishable change from baseline conditions; not noticeable.

Table 5.1.7 Scale of Change

5.7.2 Geographical extent

36. The geographical extent over which the landscape effects would be experienced and the geographical extent of the Proposed Development in relation to visual receptors is also considered (Table 5-8). This is distinct from the size and scale of effect.

37. The extent of landscape effects will vary depending on the nature of the Proposed Development and not all the following scales may be relevant:

- at the site level, within the development site itself;
- at the level of the immediate setting of the site;
- at the scale of the landscape type of character area within which the Proposed Development lies; and
- on a larger scale, influencing several landscape types or character areas.

38. In terms of visual effects, the geographical extent of the Proposed Development will vary based on the location of the visual receptor and consideration will be given to:

- the angle of the view in relation to the main activity of the receptor and the main focus of the view;
- the distance of the visual receptor from the Proposed Development; and
- the extent of the area over which the changes would be visible.

39. For visual receptors moving through the landscape (e.g. road and rail users) the length of the journey during which they would see the development is reflected in the judgement of the geographical extent of effects.

Geographical extent of change	
High	The assessment location is representative of similar effects over an extensive geographic area. E.g. the change would influence multiple landscape types or character areas. The change would affect a large number of receptors and would have high influence on the perception of the landscape or view. e assessment location is clearly representative of similar effects over an extensive geographic area. E.g. the change would influence several landscape types or character areas. The change would affect a large number of receptors and would have widespread influence on the perception of the landscape or view.
Medium	The assessment location is representative of similar effects over a moderate geographic area. E.g. the change would influence the landscape types or character areas within which the proposal lies. The change would affect a moderate number of receptors and would have moderate influence on the perception of the landscape or view.
Low	The assessment location represents a small geographic area. E.g. the change would influence the immediate setting of the site. The development would be perceived locally, with a minor effect on wider landscape character or views.
Negligible	The assessment location clearly represents a small geographic area. E.g. the change would influence the site level within the development site itself. The development would be perceived only locally, with a limited effect on wider landscape character or views.

Table 5.1.8 Geographical extent of change

5.7.3 Duration and reversibility

40. Duration and reversibility are particularly important when considering the different stages of the project. As stated in GLVIA3 (paragraph 5.51) *"duration can usually be simply judged on a scale such as short term, medium term or long term"* and is defined in **Table 5.1.9**.

41. Reversibility (paragraph 5.52 of GLVIA 3) *"is a judgement about the prospects and the practicality of a particular effect being reversed in, for example a generation."* Some forms of development are considered permanent such as housing developments, whilst others such as solar farms can be considered temporary or reversible since they have a limited operational life and can be removed and land reinstated. In the case of wind turbines, they can be reversible on the basis that the turbines and associated infrastructure can be removed, and effects largely reversed following decommissioning, but reference should be made to the proposed lifespan of the planning submission. If there are no proposals to limit the lifetime of the Proposed Development (in perpetuity consent) the assessment will consider that the Proposed Development would be permanent and long term.

42. The effects during construction of the windfarm development are usually assessed as temporary and short term but will vary depending on the site and planning construction programme.

Duration of change	
High	Long term / 10 years +
Medium	Medium term / 2 to 10 years
Low	Short term / 1-2 years
Negligible	Brief term / <1 year

Table 5.1.9 Duration of change

5.7.4 Magnitude of Change

43. Like with sensitivity, combining these together requires careful consideration and professional judgement. As such, the assessment will separately consider each aspect to form the judgement of overall magnitude. **Tables 5.1.7 to 5.1.9** have demonstrated these individual judgements. The following **Table 5.1.10** illustrates how these are combined through a two-step process. First by considering size and scale together with the geographical extent in step one. The result of this gives us a preliminary magnitude of change result.

Magnitude of change diagram: step 1

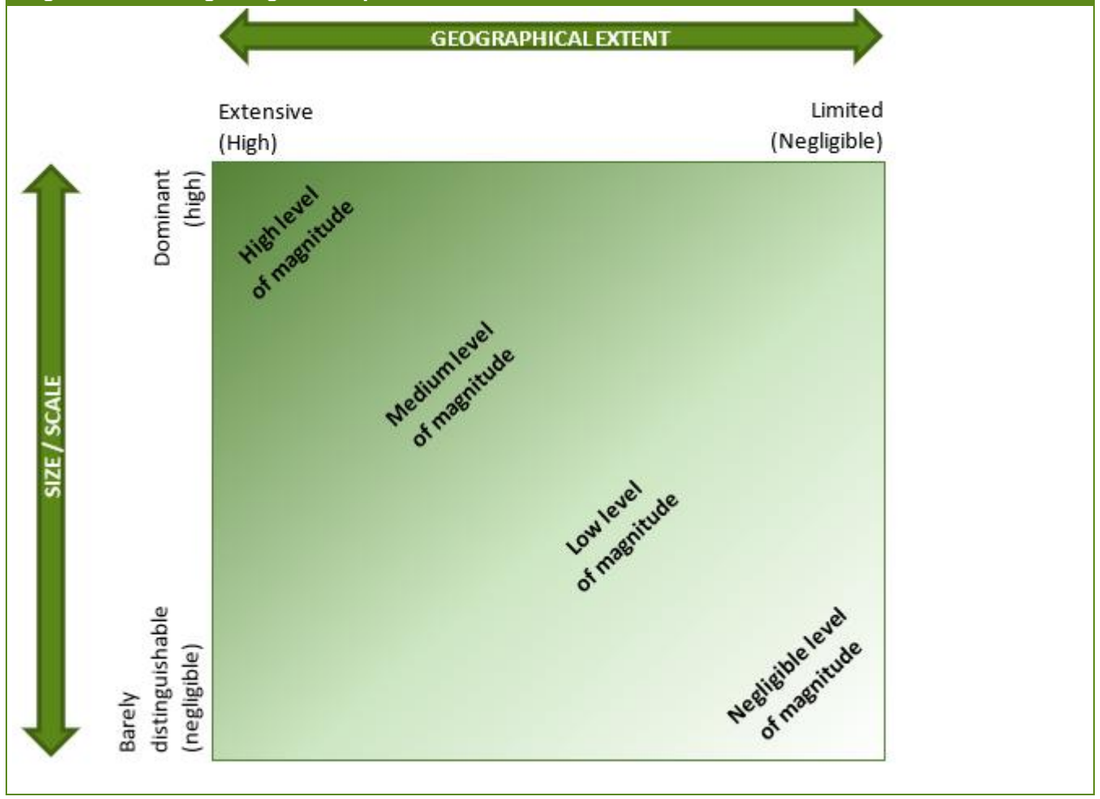


Table 5.1.10 Magnitude of change diagram: step 1

44. As illustrated below in the diagram presented as **Table 5.1.11**, for step two, the preliminary result from step 1 is then considered alongside the duration and reversibility which can either increase or decrease the rating accordingly. For example, a high magnitude of change could be reduced if this is only going to be experienced over a short period of time. This is typical of construction activities where they are both short term and of a temporary nature.

Magnitude of change diagram: step 2

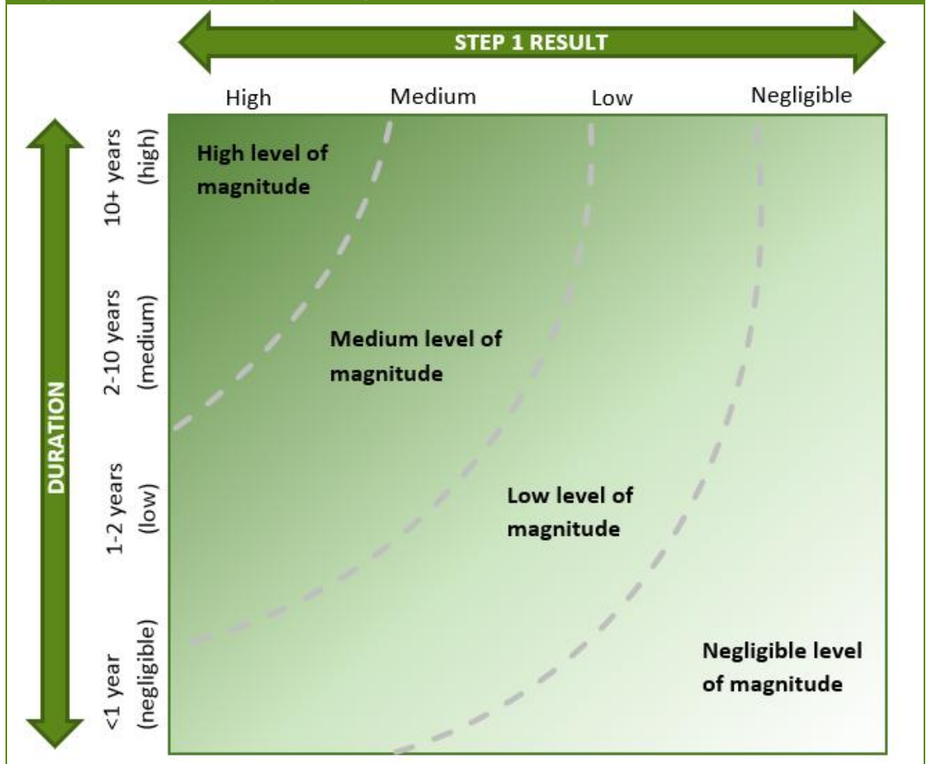


Table 5.1.11 Magnitude of change diagram: step 2

5.8 Level of effect and significance

45. Professional judgement is used to combine sensitivity and magnitude to gauge the level of effect and determine whether it is significant or not with a clear rationale for the overall judgement.

46. **Table 5.1.12** provides general guidance on the inter-relationship between magnitude of change and sensitivity of receptor. However, this matrix is used as a framework and guide for consistency, not as a prescriptive formula: the level of effect (and thus significance) will vary depending on the circumstances, the type and scale of development proposed, the baseline context and other factors as set out in the previous sections. **Table 5.1.3 and 5.1.14,** below, gives typical descriptors of the levels of landscape and visual effects.

47.

Significance matrix					
		Magnitude			
		High	**Medium**	**Low**	**Negligible**
Sensitivity	**High**	Major	Major to Moderate	Moderate	Minor to Negligible
	Medium	Major to Moderate	Moderate	Moderate to Minor	Negligible
	Low	Moderate	Moderate to Minor	Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Table 5.1.12 Significance matrix

48. As set out in chapter 2, using professional judgement and with reference to the Guidelines for Environmental Impact Assessment (IEMA 2004), the assessments within this chapter consider effects of moderate and greater level of effect to be significant (grey boxes in **Table 5.1.12**), while those less than moderate to be non-significant.

5.8.1 Landscape level of effect

49. **Table 5.1.13** below presents the sliding scale for landscape effects.

Landscape level of effect	
Major	The Proposed Development would result in major changes to landscape character and these would be considered significant.
Moderate	The Proposed DevelopmentProposed Development would result in moderate changes to landscape character and these would be considered significant.
Minor	The Proposed Development would result in minor changes and these would be considered non-significant.
Negligible	The Proposed DevelopmentProposed Development would result in negligible changes to landscape character and these would be considered non-significant.

Table 5.1.13 Landscape level of effect

5.8.2 Visual level of effect

50. **Table 5.1.14** below presents the sliding scale for visual effects.

Visual level of effect	
Major	The Proposed Development would result in major changes to visual receptors and these would be considered significant.
Moderate	The Proposed Development would result in moderate changes to visual receptors and these would be considered significant.
Minor	The Proposed Development would result in minor changes to visual receptors and these would be considered non-significant.
Negligible	The Proposed Development would result in negligible changes to visual receptors and these would be considered non-significant.

Table 5.1.14 Visual level of effect

5.8.3 Nature of effect

51. Effects can be either beneficial or adverse and, in some cases, neutral (neither beneficial nor adverse).

52. The nature of effect of wind turbines on landscape character and visual amenity is very subjective, with a broad spectrum of opinion on the appearance of wind turbines in the landscape. Some people see turbines as sculptural features positively addressing the effects of climate change, whilst others regard them as alien and an industrialisation of the countryside.

53. The aim of the LVIA is to provide an objective assessment of the relationship between the Proposed Development and the landscape in which it would be located and seen. As part of this it is also important to consider the nature of the proposed change in the context of the key characteristics of the landscape. As large engineered structures being added to the landscape, it is unlikely that a beneficial nature of effect would be found, but neutral effects could occur where it is considered the Proposed Development does not change the defining characteristics of the landscape.

54. For the purposes of this LVIA, and to ensure this LVIA assesses the worst-case scenario, the nature of all effects will be considered as adverse, unless otherwise identified.

55. Other aspects of the Proposed Development may have opportunities for beneficial landscape and visual effects, for example, where improvements are made to access and public rights of way or mitigation planting relating to the windfarm infrastructure increasing biodiversity.

5.9 Assessment of cumulative effects

5.9.1 Approach

56. SNH's guidance 'Assessing the Cumulative Impact of Onshore Wind Energy Developments (SNH, 2012) provides the basis for the cumulative assessment methodology, in addition to GLVIA3.

57. The assessment of cumulative effects is essentially the same as for the assessment of the stand-alone landscape and visual effects, in that the level of landscape and visual effect is determined by assessing the combination of sensitivity of the landscape or visual receptor and the magnitude of change.

58. This section sets out the approach to the inclusion of sites, their status and how they will be assessed.

59. Windfarms status and assessment scenarios are defined as:

- **Operational** = operational windfarms. These are included as part of the baseline assessment on which the main LVIA assessment is undertaken;
- **Consented** = windfarms that have gained consent and not built, and those with consent and in-construction. These are included as part of the Future Baseline within the main LVIA assessment; or
- **Application** = windfarms at application stage, the subject of appeal, or those at scoping* stage (where necessary). These are considered within the Cumulative Assessment.

60. *Windfarms at scoping stage are unlikely to have any confirmed or detailed information on turbine locations, numbers or size and are difficult to include within an assessment. However, those scoping sites that lie in close proximity to the Proposed Development (within approximately 10km) and are considered to potentially have a substantial bearing on cumulative assessment may need to be considered if project timescales allow and sufficient information is available.

61. Projects which have been refused at appeal or withdrawn will not be included in the assessment.

62. Single turbines and turbines less than 50m in height are not considered in the assessment, unless in close proximity (within 5km) from the Proposed Development.

63. To simplify a potentially complex assessment the following approaches are used:

- The cumulative assessment considers scenarios within which developments of the same status may be "grouped", for instance two or more nearby cumulative windfarm proposals may be considered in one scenario if it is considered that the cumulative effects arising if one or more are developed are likely to be similar.
- Receptors judged to receive a Negligible magnitude of effect from the Proposed Development on its own are not considered for cumulative assessment on the basis that any significant effects arising would primarily be caused by the cumulative developments and unlikely to be contributed to by the Proposed Development.
- Only those receptors judged likely to experience effects from the cumulative development(s) being considered within a given scenario are included in the assessment.

5.9.2 Type of cumulative effect

64. Types of cumulative effect are defined as follows:

- Cumulative landscape effects: Where more than one type of development may have an effect on a landscape designation or particular area of landscape character. This may also include effects on the physical fabric of the landscape where one or more developments may affect landscape components.
- Cumulative visual effects: Where the cumulative or incremental visibility of similar types of development combined generate a cumulative visual effect.

65. These can be further defined as follows:

- Simultaneous or combined: where two or more developments may be viewed from a single fixed viewpoint simultaneously, within the viewer's field of view and without requiring them to turn their head.
- Successive or repetitive: where two or more developments may be viewed from a single viewpoint successively as the viewer turns their head or swivels through 360°.
- Sequential: where a number of developments may be viewed sequentially or repeatedly at increased frequency, from a range of locations when travelling along a route within the study area.

5.9.3 Cumulative Study Area

66. SNH's guidance (2012) identifies that an initial 60km radius search area should be considered for cumulative assessment of windfarms. Analysis of the Proposed Development's ZTV and the pattern of cumulative sites will be undertaken to refine the study area to ensure that all potential significant cumulative effects would be captured. SNH suggests that the detailed study area should be a c.35km radius but that it needs to respond to the pattern of windfarm development and their ZTVs.

67. Draft ZTVs will be produced for all the relevant existing, consented and proposed sites in the study area which will enable an understanding of the pattern of cumulative visibility and defining the detailed scope of the study. This resulting detailed study area will be agreed with consultees.

5.9.4 Obtaining cumulative data

68. Windfarm status, turbine locations, hub and blade heights from all the relevant windfarms within the study area will be obtained through either directly from the developer, desk-based searches of online developer's information, planning applications and publicly available databases.

5.9.5 Grouping sites

69. A final list of windfarms within the detailed study area will be grouped to reflect similar status, location, and where possible, the pattern of predicted visibility. To handle a large number of sites, a number of detailed ZTVs will be produced, each illustrating the cumulative visibility of separate groups in addition to the Proposed Development.

5.9.6 Identification of Key Viewpoints

70. All viewpoints identified for the LVIA will be considered for cumulative effects. Photographic panoramas and wirelines illustrating all the relevant cumulative sites will be produced accordingly, extending up to a 360-degree arc of view where necessary.

5.9.7 Magnitude of cumulative change

71. As set out in SNH 2012 guidance cumulative landscape and visual effects can be defined as *"the additional changes caused by a Proposed Development in conjunction with other similar developments".* The assessment does not consider the combined effect of the Proposed Development as part of a group of proposals due to the potential complexity of this approach and that it is not within the scope of this LVIA to undertake a detailed assessment of all other windfarms. As stated in GLVIA3 Para 7.18 *"A more comprehensive overview of the cumulative effects must rest with the competent authority".* However, it is acknowledged that in some cases it can be useful to understand the in combination cumulative context for sites that have a strong relationship or bearing on the proposed scheme. For example, where a cumulative site is in very close proximity to the proposed scheme to the extent where it may appear as a single windfarm. Where this is the case, it will be identified and presented in the main chapter.

72. The principle of magnitude of cumulative change thus makes it possible for the Proposed Development to have a major effect on a particular receptor, while having only a minor cumulative effect in conjunction with other existing developments.

73. The cumulative landscape and visual magnitude of change is determined with reference to the criteria set out above for the main assessment and the following considerations:

- the distance and direction to each visible or potentially visible windfarm;
- the number of visible or potentially visible windfarms;
- the distance between individual existing or proposed windfarms and the Proposed Development;
- the number and height of turbines at each existing or proposed windfarm;
- the horizontal extent of the view occupied by existing and/or proposed windfarms;
- the vertical scale comparison of existing/and or proposed windfarms; and
- duration of the change (such as potential for change such as repowering or decommissioning).

5.9.8 Significance of cumulative effects

74. Determination of the significance of cumulative landscape and visual effects is undertaken by employing professional judgement to combine and analyse the cumulative magnitude of change against the identified sensitivity to change. It should be noted that the cumulative assessment is the result of the addition of the Proposed Development to the identified cumulative baseline scenario.

5.10 Visual Representations

75. The methodology for undertaking ZTVs and preparing visual representations will be compliant with relevant sections of:

- 'Visual representation of Wind Farms', Version 2.2, Scottish Natural Heritage, 2017.
- 'Visual Representation of Development Proposals, Technical Guidance Note 06/19', Landscape Institute (LI), 2019.
- 'Guidelines for Landscape and Visual Impact Assessment' Third Edition, Landscape Institute and the Institute of Environmental Assessment, 2013 (GLVIA3).

76. The more recent LI Visualisation guidance is not windfarm specific but is broadly consistent with the SNH 2017 guidance. The LI guidance provides more detail on maintaining a proportionate approach to visualisations, providing advice on selecting visualisation types taking into account the intended purpose, anticipated users, planning stage, sensitivity of the context, and indicative overall level of effect. This is helpful in consideration of responding to stakeholder and public requests where it may not always be appropriate to produce the full suite of visualisations. The LI guidance is also useful to consider for aspects of the windfarm application that may not be directly covered by the SNH 2017 guidance such as substations, infrastructure and co-located technologies.

5.10.1 Zones of Theoretical Visibility

77. ZTVs are used to identify the theoretical visibility of a windfarm development. It is a computer-generated analysis which evaluates visibility using the height and extent of a Proposed Development against a digital terrain model.

78. ZTVs are produced using Geographic information System (GIS) software (ESRI ArcGIS). Turbine coordinates of the proposed windfarm (and also other windfarm sites for cumulative ZTVs) are input into GIS and the correct turbine hub and blade-tip height assigned. OS Terrain Data 5 is used for the digital terrain model which provides a suitable level of detail to produce the ZTV, in accordance with guidance. Observer height is set to 2m above ground level and the Earth's curvature and atmospheric refraction are taken into account.

79. The resulting ZTVs are set up in the GIS figure template associated with the project. Paired ZTVs for blade-tip/hub height or cumulative assessment are generated by adding them together in ArcGIS.

80. There are limitations with the preparation of ZTVs as follows:

- The ZTV illustrates the 'bare ground' situation and does not consider the screening effects of vegetation, buildings or other surface features.
- The ZTVs are based on theoretically visibility from 2m above ground level.
- The blade tip ZTV does not indicate the decrease in visibility that occurs with increased distance from the Proposed Development. The nature of what is visible from 3 km away would be markedly different from what is visible from 10 km away.
- There is a wide range of variation within the visibility shown on the ZTV, for example an area shown on the blade tip ZTV as having visibility of large numbers of turbines may gain views of the smallest extremity of blade tips, or of many full turbines. This can make a considerable difference in the effects of the Proposed Development on that area. The hub height ZTVs should be used in conjunction with the blade tip ZTV to provide an indication of the degree to which the turbines are visible.

These limitations mean that while the ZTVs are used as a starting point in the assessment to determine where the Proposed Development would be theoretically visible from, such information needs to be verified in the field to ensure that the assessment conclusions are accurate.

5.10.2 Viewpoint Photography

81. Photography for all the assessment viewpoints has been undertaken fully in accordance with the SNH 2017 visualisation guidance. The key aspects of the methodology include:

- a 50mm fixed lens on a SLR camera with a full frame sensor;
- tripod with a panoramic head;
- camera positioned at 1.5m height;
- 50% overlap on panoramic photographs to minimise distortion when stitching the photographs;
- portrait orientation photographs taken for viewpoints close to the Proposed Development to ensure full vertical extent of windfarm can be seen;
- 360-degree panorama taken (where the viewpoint allows); and
- grid reference recorded at each viewpoint location using handheld GPS.

5.10.3 Visualisations

82. The viewpoint assessment is illustrated by a range of visualisations including photographs, wirelines and photomontages informed by a 3D model. Visualisations of windfarms have a number of limitations when informing a judgement on a wind farm proposal, as set out in SNH (2017), page 24:

- *"Visualisations provide a tool for assessment that can be compared with an actual view in the field; they should never be considered as a substitute to visiting a viewpoint in the field*
- *Neither photographs nor visualisations can replicate a view as seen in reality by the human eye.*
- *Visualisations are only as accurate as the data used to construct them*
- *Visualisations can only represent the view from a single location at a particular time and in particular weather conditions*

- *Static visualisations cannot convey the effect of turbine blade movement"*

5.10.3.1 Photographic Panoramas

83. Photographs taken to SNH 2017 visualisation guidance are stitched together using PTGui software which provides an accurate planar or projection panorama as required. The resulting panorama is cropped to the required horizontal field of view and image size as required by SNH guidance.

5.10.3.2 3D Model

84. A 3D Model is created in ReSoft WindFarm software using OS Terrain5 data, the positions of the turbines at their designated co-ordinates, viewpoint locations at their GPS co-ordinates and any points that have been surveyed to assist with the accurate positioning of the turbines within the photomontage. The turbines modelled are based upon the dimensions and model required by the client.

85. An additional computer model is created within Autodesk Infraworks 360 from the same data used to create the ReSoft WindFarm model for modelling the site infrastructure (by others in the Project team) which informs the photomontages.

5.10.4 Wirelines

86. Using the 3D model in ReSoft WindFarm, the wireline views are generated using the GPS coordinates for the viewpoints. Appropriate colours and identification markers are created. The wirelines are set to the relevant horizontal field of view and exported for insertion into figure templates set up in Adobe InDesign to the correct image size as required by SNH guidance.

5.10.4.1 Photomontages

87. Following production of the wirelines using ReSoft Windfarm software, the photograph panoramas are imported into the Photomontage module of the software and aligned with the wireline using the associated viewpoint coordinates, view direction and pitch angle. Once the photograph is aligned with the wireline, the turbines are lit according to the weather conditions and the time of day/year, rendered to the image and exported.

88. The draft photomontage is then finalised using Adobe Photoshop where ground cover/forestry is edited as necessary to ensure the turbines appear as realistic as possible.

89. To photomontage the site infrastructure a 3D model of the development was created with Autodesk Infraworks 360. This includes the tracks, crane hardstanding, earthworks and other associated infrastructure which are modelled in and rendered accordingly. Raster outputs are then generated from each of the viewpoints where there is potential visibility of the infrastructure to be aligned and rendered into the panorama using Adobe Photoshop.

90. Once all the outputs have been prepared. they will be aligned, positioned and cropped to fit the relevant figure templates in Adobe InDesign, in accordance with SNH guidance.

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