Hill of Fare Wind Farm

Technical Appendix 6.2

ZTV and Visualisation Information

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1 ZTV and Visualisation Information

1.1 Introduction

1.1.1 This appendix provides background information in relation to the ZTVs (see Volume 2) and the suite of visualisations (see Volume 3) presented in the Environmental Impact Assessment Report (EIAR).

1.1.2 The following text explains how the visualisations have been prepared and presented; includes instructions for how the visualisations should be viewed and explains the limitations of the visualisation material.

1.1.3 The visualisations in this EIAR have been prepared in accordance with the published best practice, Visual Representation of Wind Farms, Version 2.2 (February 2017) Scottish Natural Heritage (SNH).

1.2 Production of Zone of Theoretical Visibility (ZTV) Maps

1.2.1 A Zone of Theoretical Visibility (ZTV) illustrates the extents from which a feature would theoretically be visible within a defined study area.

1.2.2 ZTVs are generated assuming a 'bare ground' terrain model. This means that the ZTVs presented within this LVIA have been generated from topographical data only and they do not take any account of vegetation or the built environment which may screen views of the development. It is, as such, a 'worst case' zone of visual influence and considerably over-emphasises the actual visibility of the proposed scheme. In reality trees, hedges and buildings may restrict views of the development from many of the areas rendered as within the ZTV.

1.2.3 A further assumption of the ZTV is that climatic visibility is 100 % (i.e. visibility is not impeded by moisture or pollution in the air). In reality, such atmospheric conditions are relatively rare in this part of the country. Mist, fog, rain and snow are all common weather occurrences, which would regularly restrict visibility of the development from some of the areas within the ZTV; this being an incrementally more significant factor with distance from the site. Atmospheric pollution is not as significant as it is in other parts of the country but is still present and would also restrict

actual visibility on some occasions, again more so with distance from the site.

1.2.4 The ZTVs were generated using GIS software. The programme used topographical height data (OS Terrain 50) to build a terrain model. The programme then renders the model using a square grid to illustrate whether the turbines would be visible in each 50 m x 50 m square on the grid for a specified distance in every direction from the site.

1.2.5 Digital ZTVs have been prepared to illustrate the theoretical visibility of the turbine for a radius of 35 km around the site. Two sets of ZTVs have been produced, the first shows visibility of the turbines at hub height and the second shows visibility of the turbines to blade tip when the blade is at its highest possible position. Enlargements of the ZTVs have also been produced.

1.2.6 Cumulative ZTVs have been produced to show locations where the ZTVs of two or more operational, consented or proposed wind turbine sites overlap (in certain cases a number of wind farms which are at the same stage in development have been grouped together). In the cumulative ZTVs one colour has been used to illustrate the theoretical visibility of the Proposed Development and a second colour to illustrate the visibility of a second site. Where the ZTVs of the two sites overlap a third colour has been used to illustrate this potential cumulative visual influence.

1.2.7 It should be noted that there are several limitations to the use of ZTVs. For a discussion of these limitations please refer to Visual Representation of Wind farms – Version 2.2 (NatureScot). In particular, it should be noted that the ZTV plans simply illustrate theoretical visibility and do not imply or assign any level of significance to those areas identified as being within the ZTV. The ZTVs are a tool to assist the Landscape Architect to identify where the site would potentially be visible from. The assessment of landscape and visual effects in this chapter does not rely solely on the accuracy of the ZTVs. The ZTVs have been ground proofed and professional judgement has been used to evaluate the significance of effects.

1.2.8 Further details about the production of the lit turbine ZTVs are included in **Technical Appendix 6.7**.

1.3 Viewpoint Photography

1.3.1 The following text explains how the baseline photography was taken for each viewpoint.

1.3.2 Baseline photographs of the existing view were taken using either a high quality Canon 5D Mark II digital camera with a Canon EF 50mm f/1.4 USM lens or a high quality Nikon D600 with a 50mm f/1.4 lens. In accordance with the SNH guidance (2017), both cameras have a full frame digital sensor.

1.3.3 Neutral density graduated filters were used as appropriate at some viewpoints to balance the exposure within some scenes – typically where there was a contrast between bright sky and darker landform. Other than this, no other filters were used during photography.

1.3.4 Photographs were captured in high resolution JPEG format.

1.3.5 At each viewpoint the camera was mounted on a levelled tripod at a height of approximately 1.5 m above ground level (providing an approximation of average adult eye level).

1.3.6 The camera was set up on a panoramic rotating head and photographs were taken at 20 degree increments of rotation from left to right.

1.3.7 In each case the camera focus was locked on the distant horizon (infinity). In doing so, the photographs are in each case focussed on the development site, whilst very close objects in the foreground may in some cases be out of focus. This approach is in line with best practice photography techniques. The exposure was set correctly for the centre of the development site and then locked off so that it remained constant as the camera was rotated through the panorama.

1.3.8 As far as possible, photographs were taken in good weather and clear visibility conditions. Wherever possible photographs were taken with the sun behind the camera although this was not possible for all viewpoints i.e. those that are broadly north of the site.

1.3.9 Inevitably with distance from the site, atmospheric moisture increasingly reduces the clarity of visibility and therefore photographs from the distant viewpoints typically depict the development site less clearly than the

nearby viewpoint photographs. This is an unavoidable limitation of viewpoint photography.

1.4 Stitching of Panoramas and Post-Photographic Processing

1.4.1 Each of the panoramic images presented is comprised of three single frame photographs stitched together in PTGui (for both cylindrical and planar projection images) and then cropped down to a particular horizontal and vertical field of view.

1.4.2 The panoramic baseline photographs which illustrate a 90 degree horizontal angle of view are stitched in cylindrical projection as per the SNH guidance (2017).

1.4.3 The photomontages which show a 53.5 degree horizontal field of view have been based on the same single frame panoramic photographs but have been stitched in planar projection in accordance with the SNH guidance (2017).

1.4.4 A limited amount of post photography processing of the image files has been undertaken to enhance the quality of the baseline photographs. As stated in the SNH guidance (2017):

1.4.5 “Photographic processing involves judgements - there is no process by which a ‘pure’ photograph can be produced without the application of human decision-making, from exposure timing to the specification of the camera, and whether this is applied manually or automatically.”

1.4.6 “In reality there is no way to avoid a photograph being enhanced as this is an integral part of photography and photomontage production.”

1.4.7 “Overall, there should be a minimum of post-processing image enhancement.”

1.4.8 The extent of image enhancement undertaken in the production of the photomontages has been limited to that which would conventionally occur in a darkroom to improve the clarity of an image and does not in each case change the essential character of the image. Overall, there has been minimal post-photography image enhancement and during the stitching process none of the photographs were distorted in terms of scaling (other

than that which is an inherent and unavoidable product of stitching photography in planar projection).

1.5 Wirelines

1.5.1 A wireline visualisation (sometimes also referred to as a wireframe visualisation) is a computer generated 3D outline of a particular structure (in this the proposed wind farm) placed on top of a 3D ground terrain model, which again is represented by a wireline. No rendering is given to any of the surfaces.

1.5.2 The wireline images of the Proposed Development (as well as any other cumulative turbines modelled) were generated utilising the actual dimensions of the proposed turbines and a model of the structures was placed in position over a ground terrain model generated from Ordnance Survey Landform Panorama height data.

1.5.3 The coordinates of the viewpoints were recorded using a Global Positioning System (GPS) in the field. Checks on these coordinates were made with reference to Google Earth. These coordinates were used to set up viewpoints in the model from which to view the turbines. The wirelines were generated using Resoft Windfarm.

1.5.4 The wireline images are generated on a bare ground model and therefore do not take account of any vegetation or the built environment between the viewpoint and the Proposed Development. As such, they represent a worst case view. Each of the wirelines was checked on site to ascertain whether there was any screening of the view caused by vegetation or buildings.

1.5.5 For each viewpoint a 90 degree cylindrical projection wireline is presented to scale beneath the baseline photograph to illustrate the view from each viewpoint. This wireline illustrates the Proposed Development with other operational and consented wind farms (including those under construction).

1.5.6 In addition, for each viewpoint an enlarged 53.5 degree planar projection wireline is presented on a second sheet to correspond in scale with the subsequent photomontage. Again this wireline illustrates the Proposed Development with other operational and consented wind farms (including those under construction).

1.5.7 For each of the viewpoints which is illustrated as a cumulative viewpoint, another wireline image has been produced (again in 53.5 degree planar projection) and this time shows other schemes in planning (i.e. as yet undetermined applications) as well as the Proposed Development and other operational and consented turbines.

1.5.8 The wireline images only illustrate the anticipated scale and position of the turbines in relation to the terrain. Whilst every effort has been made to ensure the accuracy of the images, it must be appreciated that no wireline image could ever claim to be 100 % accurate as there are a number of technical limitations to the model which are discussed further below.

1.5.9 It should be noted that wirelines are just a 'snap shot' of the view from a single fixed location and the wirelines presented in this EIAR represent only a small number of locations where the Proposed Development will be visible from. In reality views will change as receptors move through the landscape. Therefore, the wirelines are simply a tool to assist the Landscape Architect in their assessment of effects. The assessment of visual effects in this chapter does not rely solely on the accuracy of the wireline images. Professional judgement has been used to evaluate the significance of effects.

1.6 Photomontages

1.6.1 In simple terms, a photomontage is the superimposition of a rendered, photorealistic, computer generated model of a development (in this case the proposed wind farm) on to a baseline photograph to illustrate how it will appear in the surrounding landscape context.

1.6.2 A 3D wireline model was generated of the turbines as described above. Resoft Windfarm software was used to generate the 3D model of the turbines. The model of the structures was rendered and lighting was set appropriate to the date, time and orientation on which the photograph was taken.

1.6.3 A digital ground terrain model was generated in Resoft Windfarm and the Proposed Development was overlaid on top of it. Using world coordinates in the computer modelling programme the photographic viewpoints were replicated such that a view was set up looking at the turbines from exactly

the same location as where the baseline photograph was taken from. The view from the model was then superimposed over the original photograph and edited as necessary in Adobe Photoshop to give a final photomontage.

1.6.4 The photomontages illustrate the Proposed Development set in the current view (i.e. in the context of just operational wind farms where visible). In addition, cumulative photomontages have been produced for certain viewpoints as identified in the LVIA. The cumulative photomontages show the Proposed Development with all other operational, consented and submitted wind farms.

1.6.5 Whilst every effort has been made to ensure the accuracy of the photomontages, it must be appreciated that no photomontage could ever claim to be 100 % accurate as there are a number of technical limitations in the model relating to the accuracy of information available from Ordnance Survey and from the GPS. In particular, it should be recognised that baseline photographs on which photomontages are based can, at best, only ever be a 'flattened' 2D representation of what the eye sees in 3D on site. A photograph will never capture as much detail as the eye would see in the field, it therefore follows that a photomontage can never truly capture the sense of perspective and detail which would be possible in reality. In some of the photomontages, the visibility of the turbines has been slightly digitally enhanced to ensure that they are visible when printed out. Taking account of the inherent technical limitations in producing and presenting photomontages, the photomontages have been produced according to best practice.

1.6.6 The photomontages are simply a tool to assist the Landscape Architect in his/her assessment of effects. The assessment of visual effects in this assessment does not rely solely on the accuracy of the photomontages. Professional judgement has been used to evaluate the significance of effects. Each of the photomontages should be viewed flat and at comfortable arm's length.

1.7 Presentation of Visualisation Sheets

1.7.1 The following visualisation sheets are presented in the EIAR:

Sheet A: Baseline Photograph and Cumulative Wireline of the Proposed Development

1.7.2 This sheet provides a cumulative wireline image of the Proposed Development directly beneath the corresponding baseline view as replicated from Sheet 1. Both images present a 90 degree horizontal field of view and a 14.2 degree vertical field of view. This sheet presents the information required of the 'Baseline Panorama and Wireline' as set out in Annex C of the SNH guidance (2017). Both of the images on this sheet are presented in cylindrical projection and the principal viewing distance (the distance at which one should view the image to obtain a geometrically accurate impression) is 500 mm when the image is curved through the same radius.

1.7.3 For the purposes of clarification, the cumulative wireline on this sheet illustrates the Proposed Development and other operational, consented wind farms/turbines and any schemes in planning.

Sheet B: Wireline of the Proposed Development

1.7.4 This sheet provides an enlarged and cropped wireline image of the Proposed Development. The image illustrates a 53.5 degree horizontal field of view and an 18 degree vertical field of view. Whilst it is essentially an enlargement of the wireframe presented in Sheet 1, this wireframe is presented in planar projection. As such the image should be viewed on a flat surface. The principal viewing distance (the distance at which one should view the image to obtain a geometrically accurate impression) is 812.5 mm. This sheet presents the information required of the 'Wireline' as set out in Annex C of the SNH guidance (2017).

1.7.5 For the purposes of clarification, the wireline on this sheet illustrates the Proposed Development only.

Sheet C: Photomontage of the Proposed Development

1.7.6 This sheet provides an enlarged and cropped photomontage of the Proposed Development. The image illustrates a 53.5 degree horizontal field of view and an 18 degree vertical field of view. It is presented in planar projection, and as such the image should be viewed on a flat surface. The principal viewing distance (the distance at which one should view the image to obtain a geometrically accurate impression) is 812.5 mm. This sheet presents the information required of the 'A1 Panorama' as set out in Annex C of the SNH guidance (2017).

1.7.7 For the purposes of clarification this sheet illustrates only the Proposed Development in conjunction with existing operational wind farms. It does not show consented but as yet unbuilt turbines or any schemes that are in planning.

Limitations of the Visualisations

1.7.8 Annex A of 'Visual Representation of Wind Farms', Version 2.2 (SNH, February 2017) sets out a summary of the key limitations of visualisations and recommends that these are set out for each wind farm application. The following text is therefore reproduced from Annex A of the aforementioned SNH guidance (2017):

1.7.9 "Visualisations of wind farms have a number of limitations which you should be aware of when using them to form a judgement on a wind farm proposal. These include:

- A visualisation can never show exactly what the wind farm will look like in reality due to factors such as: different lighting, weather and seasonal conditions which vary through time and the resolution of the image;
- The images provided give a reasonable impression of the scale of the turbines and the distance to the turbines, but can never be 100% accurate;
- A static image cannot convey turbine movement, or flicker or reflection from the sun on the turbine blades as they move;
- The viewpoints illustrated are representative of views in the area, but cannot represent visibility at all locations;
- To form the best impression of the impacts of the wind farm proposal these images are best viewed at the viewpoint location shown;
- The images must be printed at the right size to be viewed properly (260mm by 820mm);
- You should hold the images flat at a comfortable arm's length. If viewing these images on a wall or board at an exhibition, you should stand at arm's length from the image presented to gain the best impression.
- It is preferable to view printed images rather than view images on screen. If you do view images on screen you should do so using a normal PC screen with the image enlarged to the full screen height to

give a realistic impression. Do not use a tablet or other device with a smaller screen to view the visualisations described in this guidance."