

Moray Offshore Renewables Ltd

KEY

- Turbine Layout Scenario 4c:
- Telford 7MW Turbines (204m)
 - Stevenson 7MW Turbines (204m)
 - MacColl 7MW Turbines (204m)
 - Eastern Development Area
 - 10km Distance Radii
 - 50km Study Area Boundary
 - ▽ Viewpoint Location
 - A9

Blade Tip ZTV (204m)

No. of Visible Turbines

- 0
- 1 - 50
- 51 - 100
- 101 - 150
- 151 - 200
- 201 - 216

Horizontal Scale: 1:120,000 A3 Chart
 0 2,500 5,000 Meters

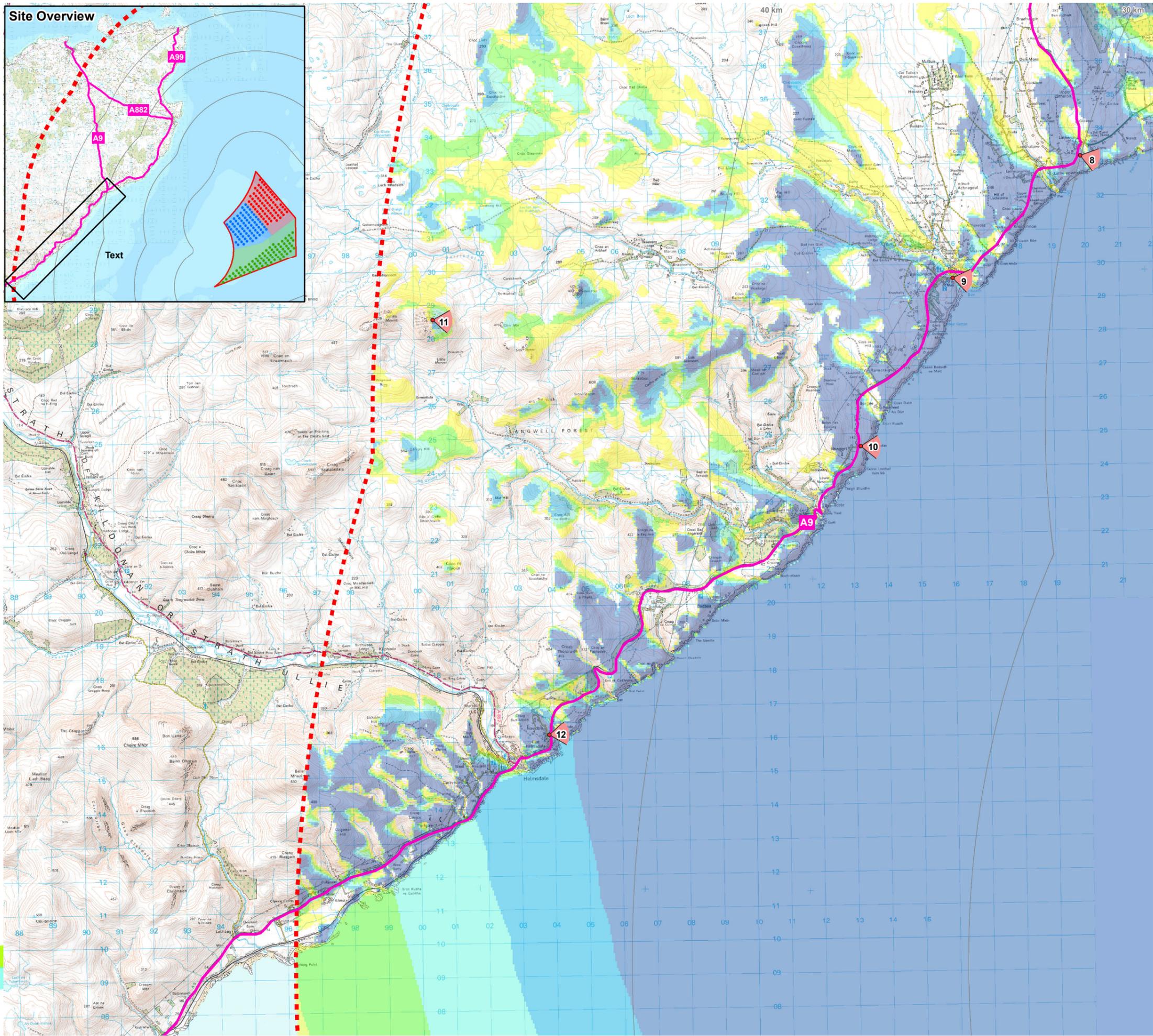
Geodetic Parameters: WGS84 UTM Zone 30N

Produced: LA
 Reviewed: SM
 Approved: SM

Date: 09/07/2012 Revision: B
 REF: 8460001-PPW0201-OPE-MAP-041

Figure 8.4-12b
Visual Receptors with ZTV
A9: Thurso to Latheron

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 - Stevenson Development Area
 - MacColl Development Area
 - Eastern Development Area
 - 10km Distance Radii
 - 50km Study Area Boundary
 - ▲ Viewpoint Location
 - A9

Blade Tip ZTV (204m)

No. of Visible Turbines

- 0
- 1 - 50
- 51 - 100
- 101 - 150
- 151 - 200
- 201 - 216

Horizontal Scale: 1:110,000 A3 Chart
 0 2,500 5,000 Meters

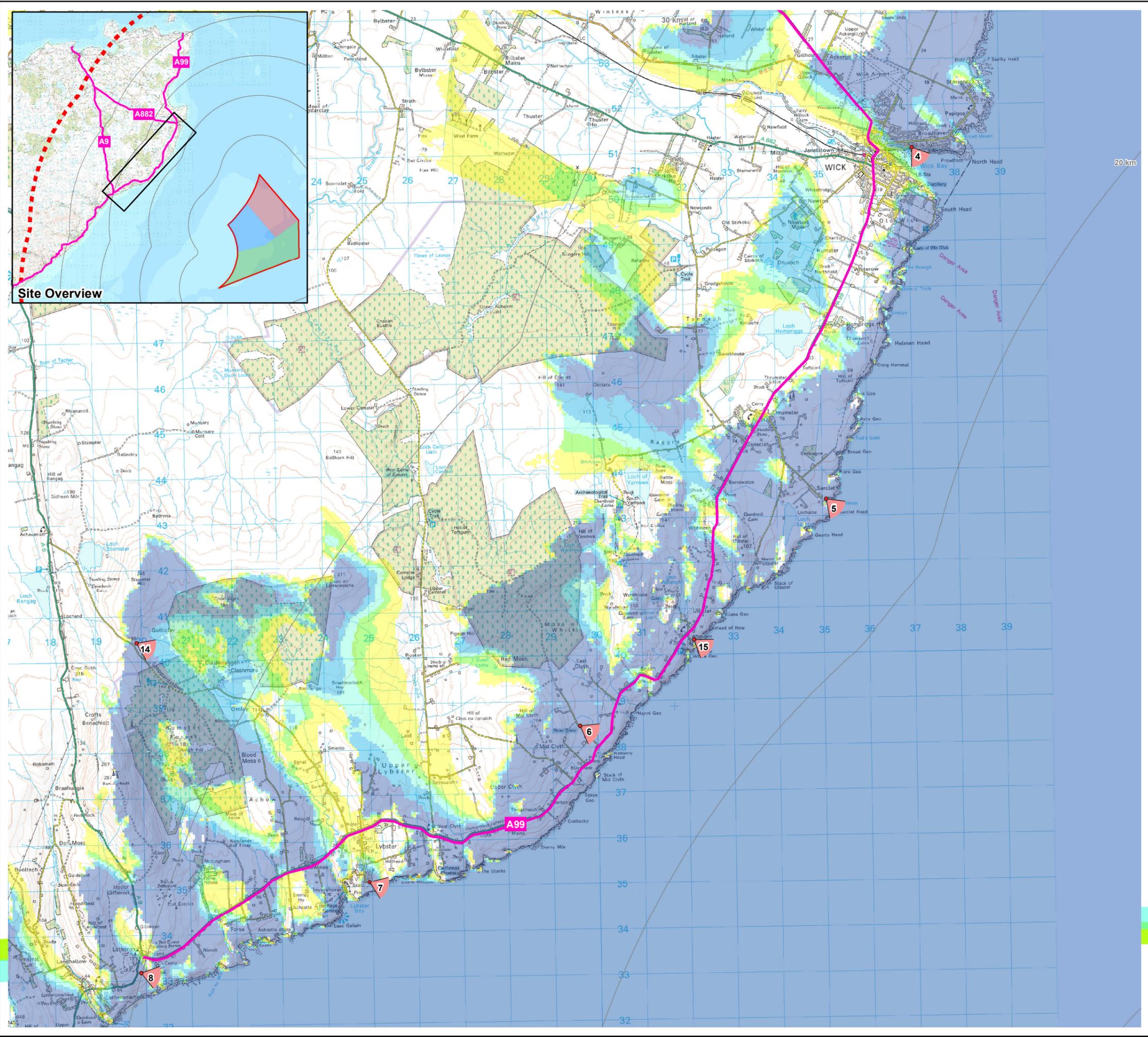
Geodetic Parameters: WGS84 UTM Zone 30N

Produced: LA
 Reviewed: SM
 Approved: SM

Date: 09/07/2012 Revision: B
 REF: 8460001-PPW0201-OPE-MAP-042

Figure 8.4-12c
Visual Receptors with ZTV
A9: Brora to Latheron

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KEY

- Turbine Layout Scenario 4c:
- Telford 7MW Turbines (204m)
 - Stevenson 7MW Turbines (204m)
 - MacColl 7MW Turbines (204m)
 - Eastern Development Area
 - 10km Distance Radii
 - 50km Study Area Boundary
 - Viewpoint Location
 - A99

**Blade Tip ZTV (204m)
No. of Visible Turbines**

- 0
- 1 - 50
- 51 - 100
- 101 - 150
- 151 - 200
- 201 - 216

Horizontal Scale: 1:80,000 A3 Chart
 0 1,750 3,500 Meters

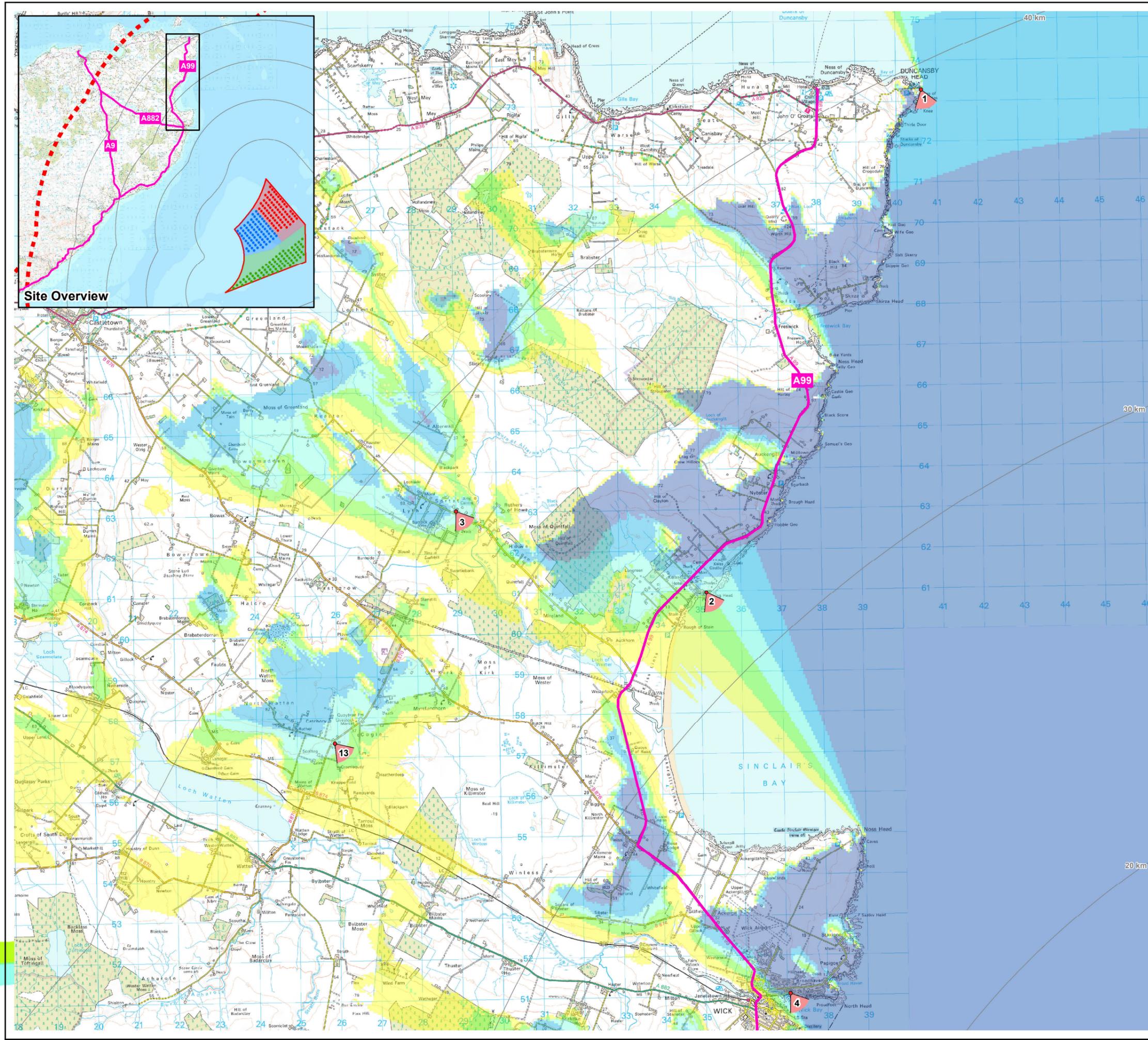
Geodetic Parameters: WGS84 UTM Zone 30N

Produced: LA
 Reviewed: SM
 Approved: SM

Date: 09/07/2012 Revision: B
 REF: 8460001-PPW0201-OPE-MAP-043

**Figure 8.4-12d
 Visual Receptors with ZTV
 A99: Latheron to Wick**

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Site Overview



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- KEY**
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 - Telford Development Area
 - Stevenson Development Area
 - MacColl Development Area
 - Eastern Development Area
 - 10km Distance Radii
 - 50km Study Area Boundary
 - Viewpoint Location
 - A99

- Blade Tip ZTV (204m)**
- No. of Visible Turbines**
- 0
 - 1 - 50
 - 51 - 100
 - 101 - 150
 - 151 - 200
 - 201 - 216

Horizontal Scale: 1:90,000 A3 Chart
 0 1,750 3,500 Meters

Geodetic Parameters: WGS84 UTM Zone 30N

Produced: LA
 Reviewed: SM
 Approved: SM

Date: 09/07/2012 Revision: B
 REF: 8460001-PPW0201-OPE-MAP-044

Figure 8.4-12e
Visual Receptors with ZTV
A99: Wick to John O' Groats

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methodology

Software Packages Used:-

- Resoft Windfarm v.4.2.1.7
- Adobe Photoshop CS5.5 & Adobe Indesign CS5.5
- PTGUI v9.1.3 Pro
- ESRI ArcGIS v10
- AutoCAD Map 3D 2011
- Autodesk 3Ds Max 2013

Photographic Details:

- Photographers
Gray Caledonian Photography:- Sanais House • Croy • Inverness • IV2 5PN • Tel: 07771 776 577
- Camera Information
Canon EOS 5D Mark II Digital SLR camera with a fixed 50mm lens.
Camera set to RAW image format.
Nodal Ninja panoramic head with Adjuste Leveller.
Nodal Ninja panoramic head set to 20 degrees
Tripod.
Height to the centre of the camera lens above ground: 1.5m

Terrain Data Used:-

- Ordnance Survey 10-metre Landform Profile Digital Terrain Model Data. (DTM) along the coastal edge.
- Ordnance Survey 50-metre Landform Panorama Digital Terrain Model Data. (DTM) inland.
- (Note:- Ordnance Survey 5-metre Contour data is not available in this location.)

Turbine Model Information:-

Turbine dimensions are in accordance with those stated in the Environmental Statement:

- 7MW, Hub height @ LAT:- 118m , Blade Rotor Diameter :- 172m (Max Tip Height @ LAT - 204m)
- 3.6MW, Hub height @ LAT:- 97m , Blade Rotor Diameter :- 130m (Max Tip Height @ LAT - 162m)
- 5MW, Hub height @ LAT:- 99.5m , Blade Rotor Diameter :- 116m (Max Tip Height @ LAT - 167m)

Modelling Methodology:-

The viewpoint assessment comprises 24 viewpoints, the locations of which have been agreed with The Highland Council.

The viewpoint assessment is illustrated by a range of tools including photographs and photomontages. The photographs used to produce the photomontages have been taken in RAW format using a Canon EOS 5D Mark II Digital SLR camera with a fixed 50mm lens. This camera has a full-frame (35 mm negative size) CMOS sensor, therefore with a fixed 50mm lens, it provides a focal length that is commonly regarded as best practice, based on the 'Guidelines for the Assessment of Landscape and Visual Effects: Second Edition' and current best practice. The camera is mounted and levelled on a Nodal Ninja panoramic head at 1.5 metres above ground to the centre of the lens. The photographs are taken in landscape format at 20 degree intervals giving a 50% overlap between frames. These are all individually cylindrically projected and then digitally joined to create a fully cylindrically projected panorama using PTGUI software. The individual images are not cropped in any way during the process.

Tonal alterations are also made using Adobe Photoshop software to create an even range of exposure across the photographs so that the individual photographs are not apparent. This process of cylindrical projection avoids the wide-angle effect that would result should these frames be arranged in a perspective projection, whereby the image is not faceted to allow for the cylindrical nature of the full 360-degree view but appears essentially as a flat plane. For this reason the most representative image of the appearance of the Development is obtained by curving the images or by viewing all parts of the panoramic images at a constant distance in order to maintain the correct viewing distance for all parts of the view.

The majority of the viewpoint photographs were taken in clear visibility with blue skies and scattered cloud, however some of the photographs show a higher level of cloud cover.

Wireline representations that illustrate the Development model, set within a computer-generated image of the landform are used in the assessment to predict the theoretical appearance of the turbines. These are produced and generated with Resoft Windfarm software using Ordnance Survey 10 metre Landform Profile DTM data.

The viewpoints are based on theoretical visibility from 1.5 metres above ground level. There are limitations in these theoretical productions, and these should be borne in mind in the consideration and use of the wireline Images. Firstly, the wireline illustrates the 'bare ground' situation, not taking into account the screening effects of vegetation, buildings, or other local features that may prevent or reduce visibility. Secondly, the wireline is based on a terrain data with 10 metre contour intervals, so there may therefore be local, small-scale landform that is not reflected in the wireline but may alter the real visibility of the Development, either by screening theoretical visibility or revealing parts of the Development that are not theoretically visible. Where descriptions within the assessment identify the numbers of turbines visible this refers to the theoretical illustrations generated and therefore the reality may differ to a degree from these impressions.



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Modelling Methodology

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Photomontages have been produced for a number of the views, again using Resoft Windfarm software, to provide a more realistic image of how the Development might look. In all views the photomontages include the turbines.

Photographs, wirelines and, where relevant, photomontages, are shown with a 72 degree field of view, which accords with SNH and Landscape Institute guidance.

When reproduced at a size of 395mm x 144mm as is the case in this assessment, the 72-degree panoramic photographs, wirelines and photomontages should be viewed with one eye from a distance of around 314 mm in order to gain as accurate an impression as possible of the real effect on the views.

The calculation for the viewing distance is as follows: $d = (180 \times w) \div \pi A$

d is the correct viewing distance in mm,

w is the width of the image in mm,

A is the horizontal field of view in degrees

π has its usual geometrical meaning.

Additionally, single frame photomontages have been included. The photographs used for these are taken at the standard focal length of 50mm and conform to the 39.6 degree horizontal field of view (HFOV) x 27 degree vertical field of view (VFOV) of the Development. The photographs are centred on the centre point of the Rochdale Envelope.

The 39.6 degree HFOV single frame photomontages, when reproduced at a size of 360mm x 240mm, as is the case in this assessment, should be viewed with both eyes from an approximate distance of 500mm in order to gain as accurate an impression as possible of the real effect on the views. This viewing distance is based on Highland Council Visualisation Standards for Wind Energy Developments (January 2010) which states that 'when viewed with both eyes, the viewing distance shall be approximately the diagonal of the page, regardless of focal length'.

A set of single frame photomontages with a 75mm focal length are also included. These images are extracted from the 50mm master photomontage and conform to a 27-degree HFOV x 18 degree VFOV of the Development. When reproduced at a size of 360mm x 240mm, as is the case in this assessment, these should be viewed from an approximate distance of 500mm in order to gain as accurate an impression as possible of the real effect on the views. This viewing distance is based on Highland Council Visualisation Standards for Wind Energy Developments (January 2010) which states that 'when viewed with both eyes, the viewing distance shall be approximately the diagonal of the page, regardless of focal length.'

In the wirelines, the turbines are shown with the central turbines facing the viewer directly, with the full rotor diameter visible at its tallest extent. In the photomontages, the wind turbine rotors are shown with a random appearance with the blades facing the viewer.

Night time views have been included to illustrate the possible effect of lighting of the proposed turbines and the Offshore Substation Platforms (OSPs). Lighting has been simulated using 3Ds Max Software by selecting photometric lights with a lighting intensity of 2000 candela. Lights with a red filter and 2000 candela simulation have been placed on the nacelle of the perimeter turbines of each wind farm site - Telford, Stevenson and MacColl, with additional lights located in the middle of each wind farm site. Lights with a yellow filter and 2000 candela simulation have been placed at each corner of the Offshore Substation Platforms (OSPs). In the photomontages, the wind turbine rotors are shown with a random appearance with the blades facing a south west direction.

The photographs and other graphic material such as wirelines and photomontages used in this assessment are for illustrative purposes only and, whilst useful tools in the assessment, are not considered to be completely representative of what will be apparent to the human eye.

The assessments are carried out from observations in the field and therefore may include elements that are not visible in the photographs.



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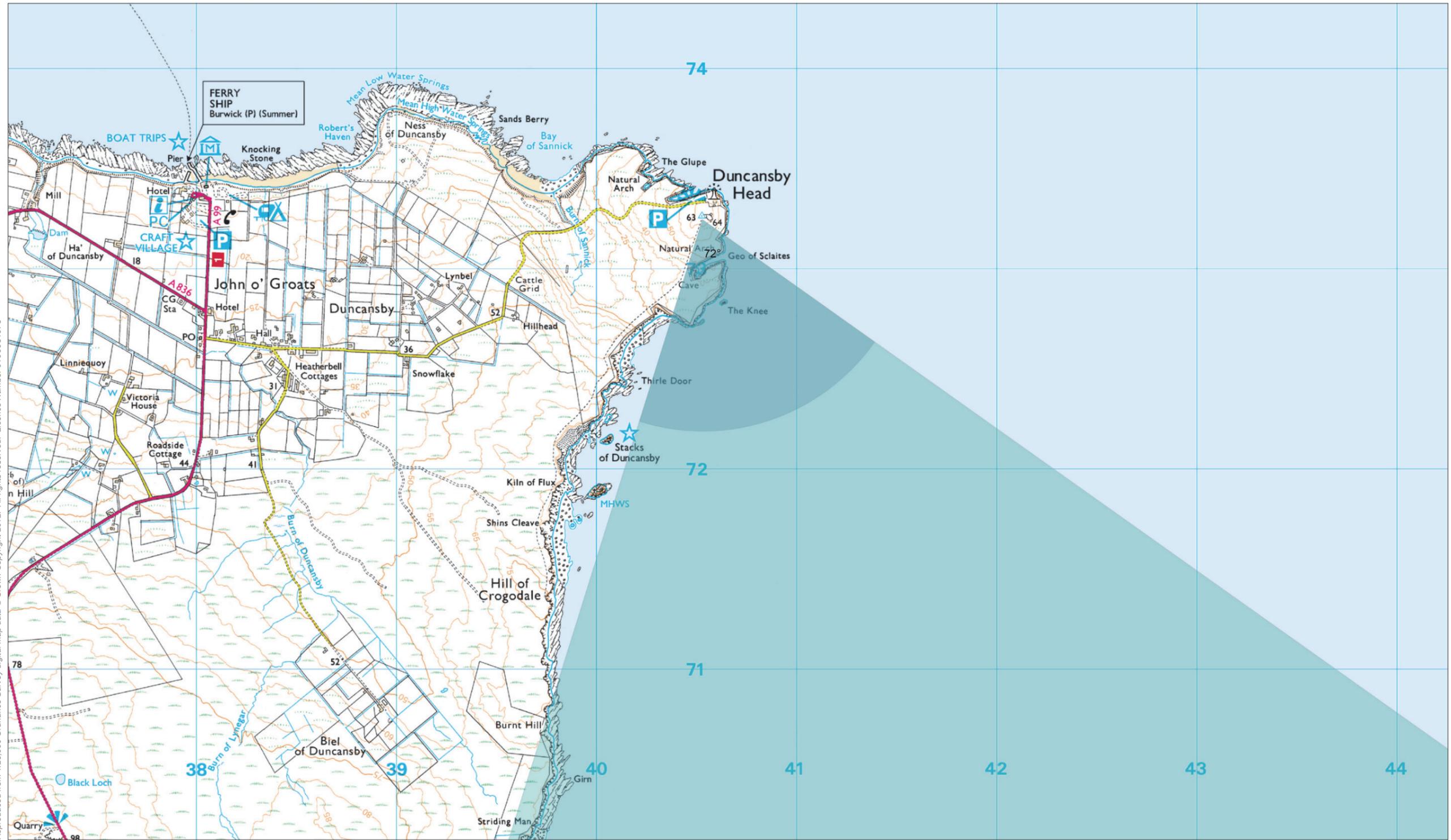
Date: 09/07/2012	Revision: B
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Modelling Methodology
Continued.

Moray Offshore
Renewables Ltd

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Viewpoint 1: Duncansby Head

OSGB Grid Reference: 340528 E 973247 N

Distance to nearest turbine: 41.75 km

AOD: c 62 m

View from trig point near car parking area, accessed from footpath to south of Lighthouse



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Scale in metres: 1: 20,000



Geodetic Parameters: WGS84 UTM Zone 30N

Produced: LT

Reviewed: SM

Approved: SM

Date: 09/07/2012

Revision: B

Ref: 8460001-PPW0201-OPE-MAP-046



Figure 8.4-13 (page 1 of 2)
Viewpoint 1: Duncansby Head
Location

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Existing view from Duncansby Head

Distance to nearest turbine: 41.75 km (Telford)

Camera: Canon EOS 5D Mark II

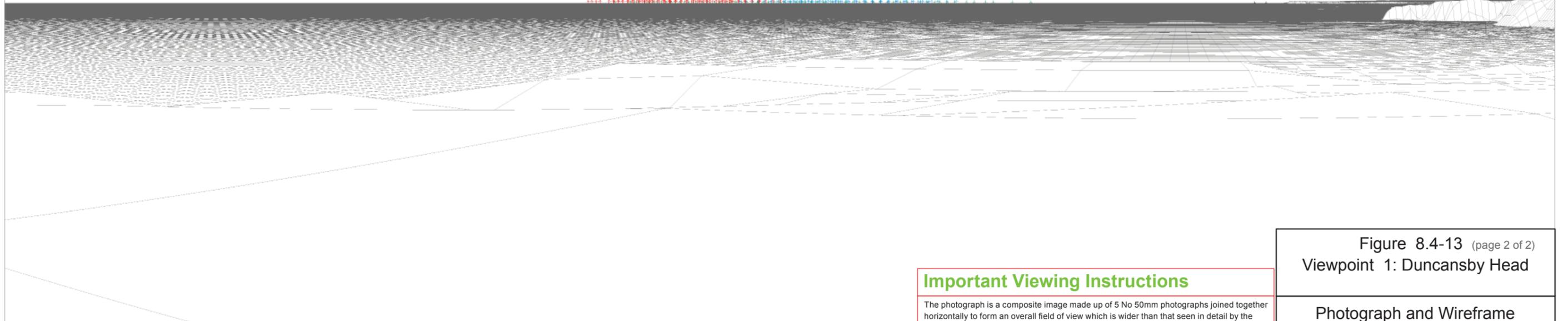
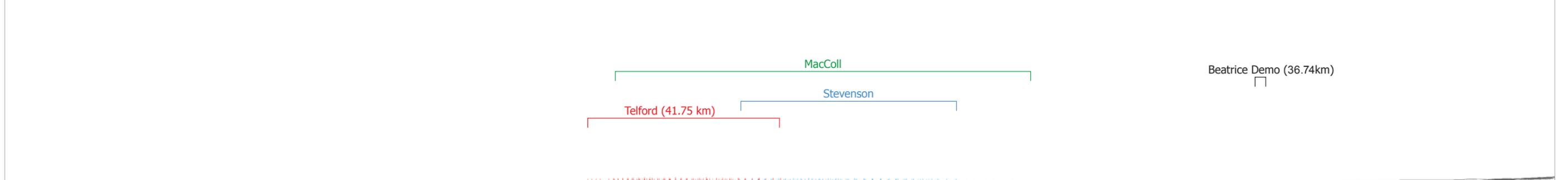
Focal Length: 50mm

Horizontal Field of View: 72 degrees

Camera Height: 1.5m

Date: 02/09/11

Time: 12:20



Computer generated wireframe showing the proposed developments Telford (Red), Stevenson (Blue) and MacColl (Green) and other operational wind farm turbines in black

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Important Viewing Instructions

The photograph is a composite image made up of 5 No 50mm photographs joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye. For correct perspective viewing, these images must be viewed at an exact distance of 314 mm with one eye whilst curving the image in and exact arc of 72 degrees. This image should only be assessed in the real landscape from the same viewpoint.

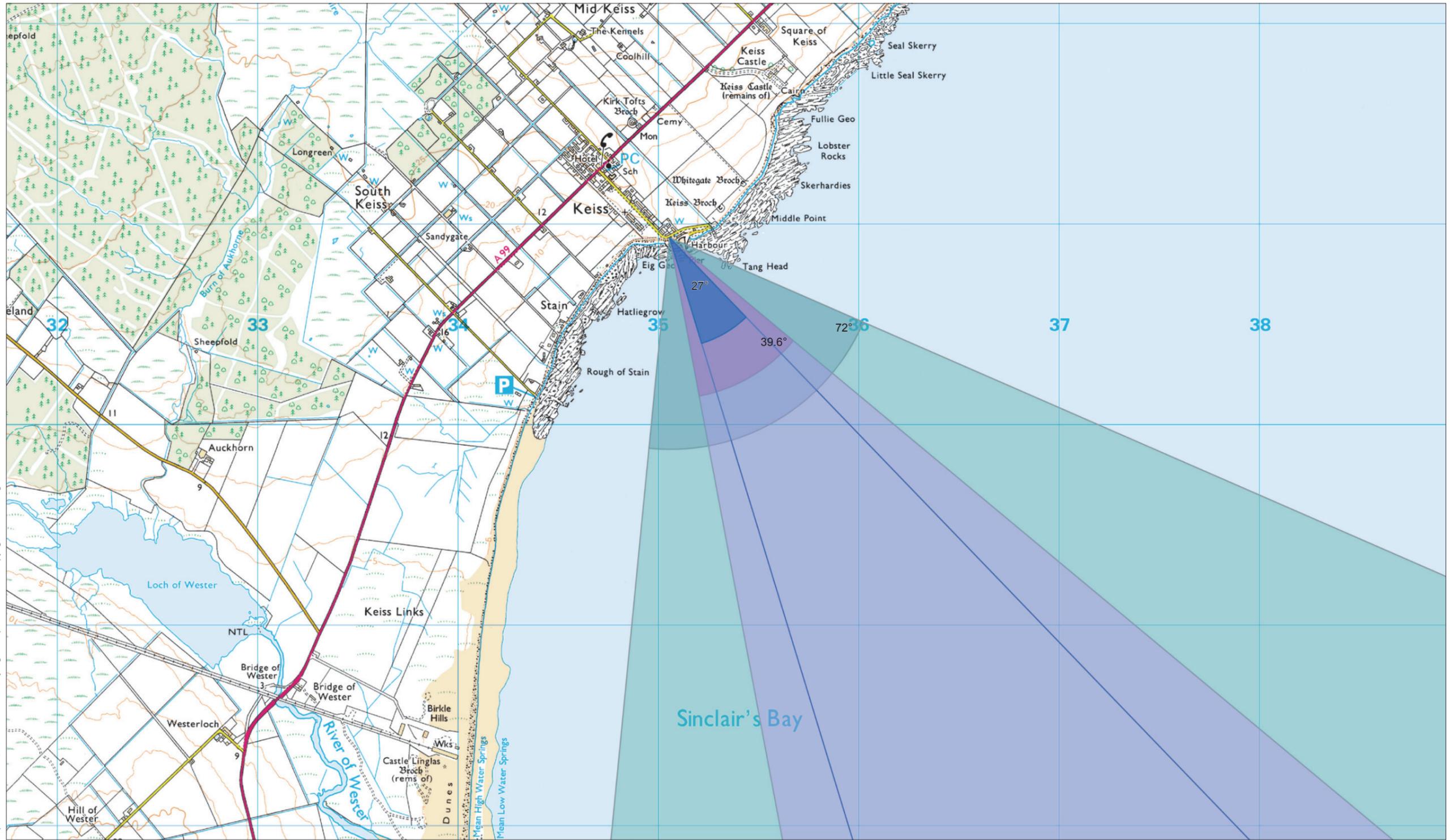
Figure 8.4-13 (page 2 of 2)
Viewpoint 1: Duncansby Head

Photograph and Wireframe

Layout Scenario 4c

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Viewpoint 2: Keiss Pier

OSGB Grid Reference: 335055 E 960934 N

Distance to nearest turbine: 34.33 km

AOD: c 13 m

View from land above Keiss Harbour



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Scale in metres: 1: 20,000



Geodetic Parameters: WGS84 UTM Zone 30N

Produced: LT

Reviewed: SM

Approved: SM

Date: 09/07/2012

Revision: B

Ref: 8460001-PPW0201-OPE-MAP-047



Figure 8.4-14 (page 1 of 5)
Viewpoint 2: Keiss Pier
Location

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Renewables Ltd



Existing view from Keiss Pier

Distance to nearest turbine : 34.33 km (Telford)

Camera: Canon EOS 5D Mark II

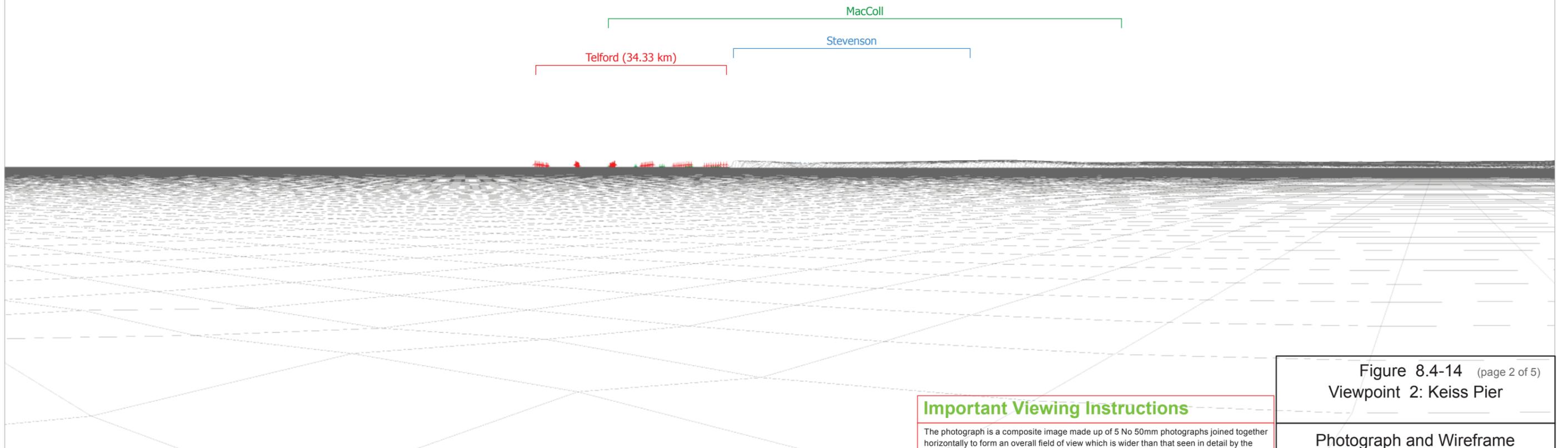
Focal Length: 50mm

Horizontal Field of View: 72 degrees

Camera Height: 1.5m

Date: 08/09/12

Time: 16:12



Computer generated wireframe showing the proposed developments Telford (Red), Stevenson (Blue) and MacColl (Green) and other operational wind farm turbines in black

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Important Viewing Instructions

The photograph is a composite image made up of 5 No 50mm photographs joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye. For correct perspective viewing, these images must be viewed at an exact distance of 314 mm with one eye whilst curving the image in and exact arc of 72 degrees. This image should only be assessed in the real landscape from the same viewpoint.

Figure 8.4-14 (page 2 of 5)
Viewpoint 2: Keiss Pier

Photograph and Wireframe

Layout Scenario 4c