Document Reference	Appendix No.	Title
4.01.7d	7.4	Technical Photography 3D Modelling & Verified Visualisations Part 1

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Appendix 1

Technical Photography, 3D Modelling and Verified Visualisations

Oaklands Solar Farm
Vale of Glamorgan

July 2022

Sirius Planning

Landscape Institute Registered Practice

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Contents

Introduction

Mike Spence BA (Hons), MLD, CMLI, REIA, FRGS is a one of the UK's leading independent exponents of technical photography, verified photomontages and visualisations. Since 2013 Mike has been a technical advisor to the Landscape Institute on 'photography and photomontage in landscape and visual impact assessment', and has been undertaking this work for over 25 years. He is one of the main authors of the Landscape Institute's TGN 06/19 and provided technical support to Scottish Natural Heritage on their windfarm visualisation guidance. His background as a Chartered Landscape Architect, Registered EIA Practitioner and Fellow of the Royal Geographic Society working on strategic infrastructure projects has meant that the accuracy of the visualisation work is paramount, and technical photography, together with extensive surveying experience and detailed 3D modelling using real world co-ordinates ensures that the visualisations produced follow a clear and transparent methodology to ensure they are as accurate as possible.

Recent projects include the UNESCO World Heritage Sites at Kew Royal Botanic Gardens, Fountains Abbey for The National Trust, and Derwent Valley Mills for Amber Valley Borough Council. Mike has halso been working closely with Bath City Council on proposed development in the UNESCO World Heritage City of Bath. He has been carrying out solar farm visualisations since 2014, and has worked on over 60 large scale projects, including NSIPs. Mike's work and objective technical checks have been used at numerous Public Inquiries and Planning Hearings, on behalf of both local authorities and developers.

In January 2022 Sirius contacted MSE to request Technical Photography, GNSS/RTK Surveying, 3D Modelling and Visualisation support for the proposed Oaklands Solar Farm.

Verified Photography and 3D Modelling

The photographs were taken with a full frame camera (Canon EOS 5D Mark III) and 50mm lens combination consistent with Landscape Institute's TGN 06/19, GLVIA3 and the emerging understanding of the requirement for technical photography for visualisation work. As part of the work 17 viewpoints were identified providing views of the site and visited on 25 February 2022. The weather was good with clear visibility.

Technical Photography

The camera was mounted on a Manfrotto 303 SPH panoramic tripod head, levelled using a Manfrotto Leveller, supported on a Manfrotto Tripod. The tripod head was levelled using a spirit level, to avoid pitch and roll. The camera was set with the centre of the lens 1.60m above ground level. Photographs were taken in Manual mode with an aperture of f/8 or f/11 and a fixed focal length throughout. The panoramic tripod head was set with increments to give approximately 50% overlap between frames. Photographs were taken in landscape format. From each photograph location a full 360 degree field of view was taken centred around a nodal point. The nodal point was set to avoid any problems of foreground parallax. A Sigma 50mm f/1.4 lens was used for all viewpoint photographs.

50mm lens full 360 degree panorama

Extracted 90 degree portion

For each 360 degree panorama the images were cylindrically corrected and stitched together. This allowed an accurate 90 degree cylindrical view to be extracted from the full panorama, to illustrate the wider 'landscape setting' of the development.

Technical information for the camera locations is provided for each viewpoint.

Surveying

The position of each camera location was surveyed using Spectra Precision GNSS equipment with Real Time Kinematic Correction (RTK) which achieves an accuracy down to 1cm in eastings, northings and height (metres Above Ordnance Datum). The equipment included Spectra Precision SP80 GNSS smart antennae with Panasonic Toughpad data recorder. Points were saved using Digiterra software. A photograph of the camera location was taken.

3D Modelling

MSEnvironmental constructed a geo-referenced 3D model using Rhino 3D from a 3D model supplied by Sirius Planning together with EA LIDAR 2m DTM data. The model was geo-referenced and placed in the correct geographic coordinate system (OSGB36) using ground heights to correspond wth the survey and site layout.

Camera locations surveyed on site were added to the geo-referenced 3D model. LIDAR DSM data and target points were taken from the existing features in the view and built into the 3D model. This allowed the horizontal and vertical alignment of the photograph and 3D model to be checked, cross-referenced and verified. Cylindrical renders generated using VRay for Rhino were exported from the 3D modelling software and used to overlay the single frame planar images. Target points from both the photograph and the model view were aligned to ensure a precise fit between the two images. The results are presented as a sequence of visualisations as follows:

1.Existing View

2.3D Model View

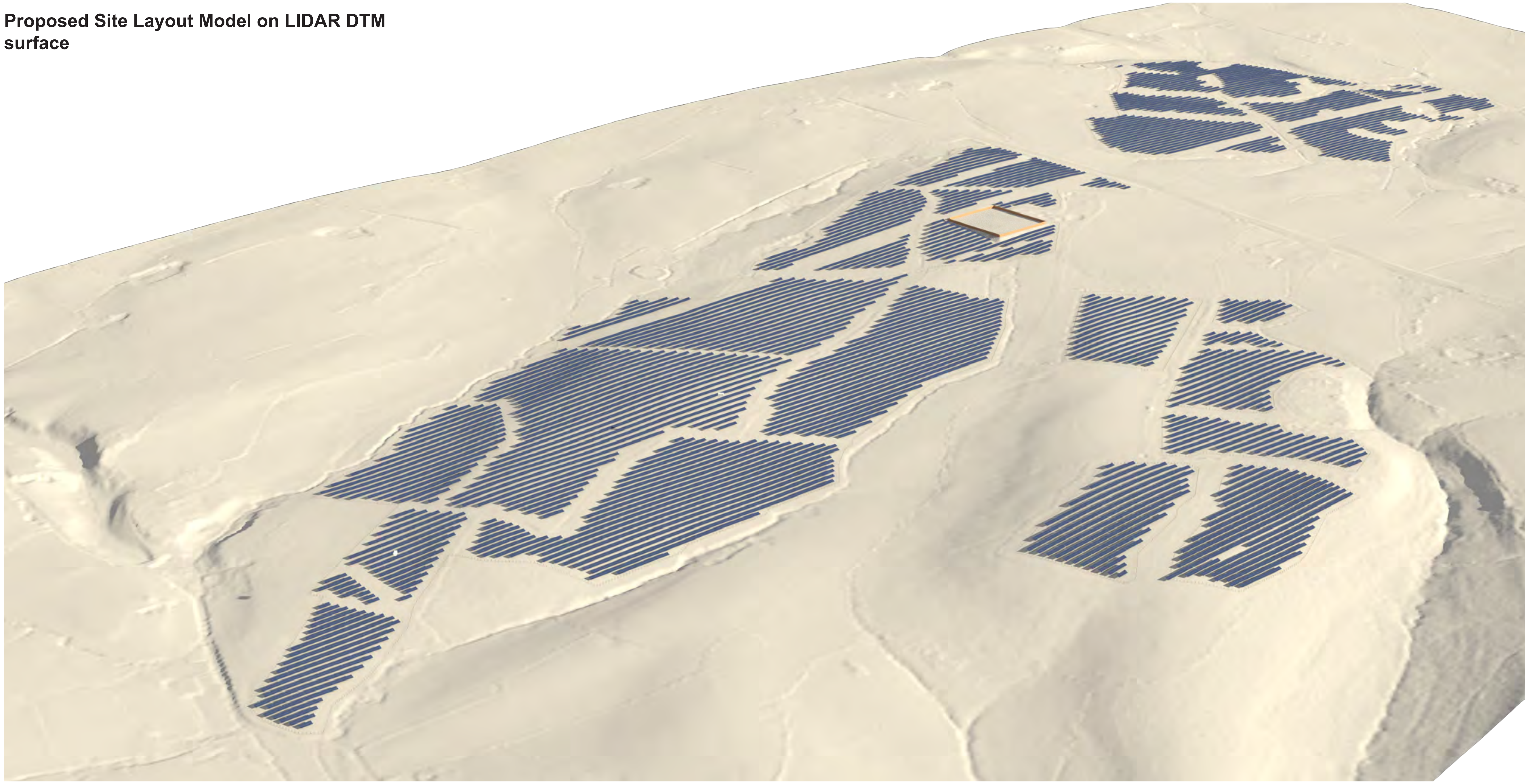
3. Composite View

4. Photomontage

The topography of the site and surrounding landform has been created using a combination of 2m LIDAR data, downloaded from the DEFRA Opensource datasets with triangulated surfaces generated using Rhinoterrain.

The 3D Model was completely built in Rhino 3D and geo-referenced by MSE. It is fully geo-referenced and positioned to correspond with the site layout and elevations supplied in the planning application drawings:

Proposed Site Layout Model on LIDAR DTM surface



Planar vs Cylindrical Projection

All photographs are taken as a series of single frame planar images. A planar image is a single frame image which has a single point of perspective lying centrally in the image. The limitation of single frame images is that they have a limited horizontal field of view. To allow a wider field of view we stitch the individual planar images using software, such as PTGUI which automatically corrects the geometrically to give a cylindrical panoramic image. To undertake this accurately the use of a levelled tripod and panoramic tripod head set up to avoid forground parallax is necessary.

A full 360 degree panorama is taken with overlapping images. These images are stitched together and cylndrically projected, as if the panorama was being located in the inner face of a cylinder.

The 3D model renders are rendered out in cylindrical projection to allow the precise image re-mapping to match the cylindrical photograph panorama.

3D Modelling software

The work has largely been undertaken using Rhino 3D. All 3D modelling has been undertaken in metres and geo-referenced to align with OSGB36. RESOFT Windfarm was also used which is a 3D modelling package which we use to check on vertical alignment of the 3D model. This is also set up to OSGB36. RESOFT Windfarm has been used to generate the geometric grid from LiDAR DTM data present in all 3D model visualisations.

VRay for Rhino has been used for rendering. The use of a sunlight sytem adds a 3 dimensional effect with shadow, to understand the form and materials of the proposed building.

Viewing Printed Images

The visualisations have been prepared to be printed on a series of A1 wide by A4 high (841mm x 297mm)sheets. The images are cylindrial projection and should be held in an arc and viewed with one eye closed at a distance of approximately 50cm.

Summary

This work has been undertaken in accordance with the the Landscape Instute TGN 06/19 and the developing understanding of visualisation work. The accuracy of camera locations and 3D modelling conforms with Type 4 (the highest level of accuracy). The 3D modelling has been produced to AVR3.

The photography has been undertaken in an extremely robust manner, using professional full frame sensor DSLR and 50mm lens with panoramic head and tripod. The camera position has been surveyed using highly accurate GNSS equipment, giving high levels of accuracy of camera location. The 3D model has been built and geo-referenced in Rhino 3D. An additional check on the vertical scaling has been undertaken using RESOFT Windfarm. The resultant visualisations are highly accurate

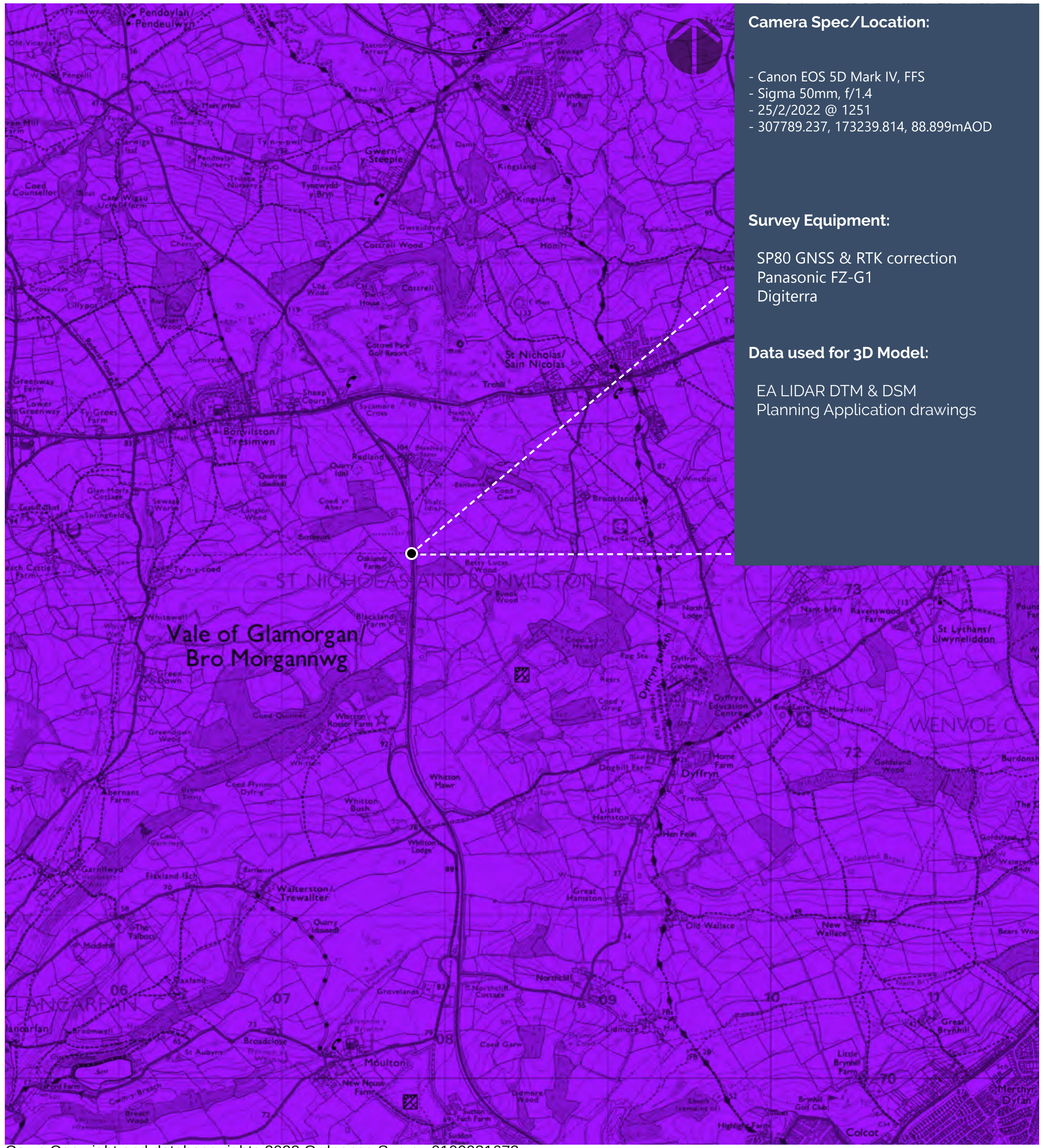
The photography, surveying and 3D modelling have followed a transparent methodology, and the resultant visualisations are considered robust and fit for purpose to illustrate the positioning, and scale and massing of the proposed scheme in its local context.

Mike Spence

M.A.Spence BA(Hons), MLD, CMLI, REIA, FRGS 16 July 2022
Principal, MSEnvironmental

Viewpoint 2

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 25/2/2022 @ 1251
- 307789.237, 173239.814, 88.899mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

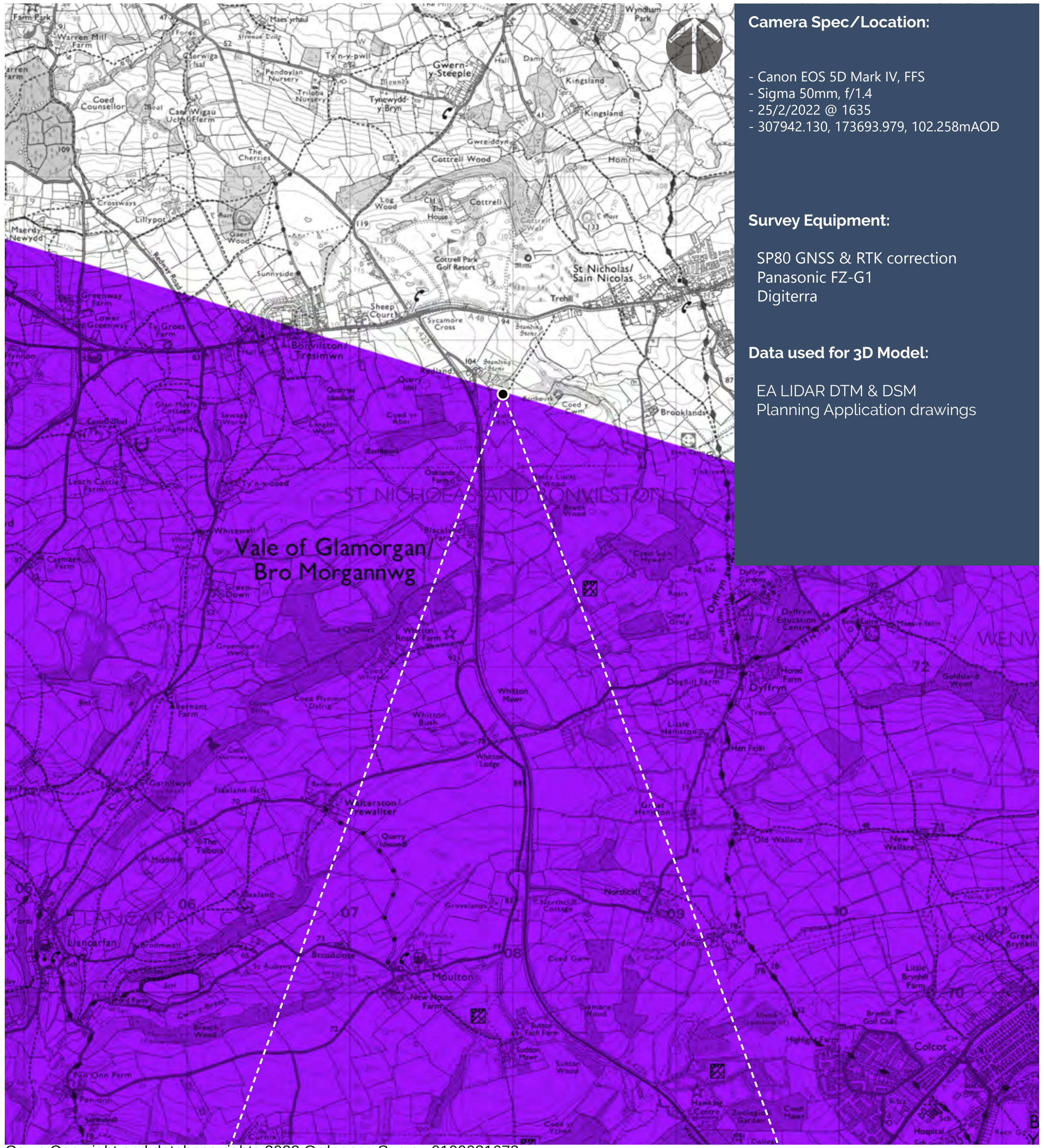
Point of Perspective

Point of Perspective

50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFoV)

Viewpoint 2 Single Frame 50mm image

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 25/2/2022 @ 1635
- 307942.130, 173693.979, 102.258mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

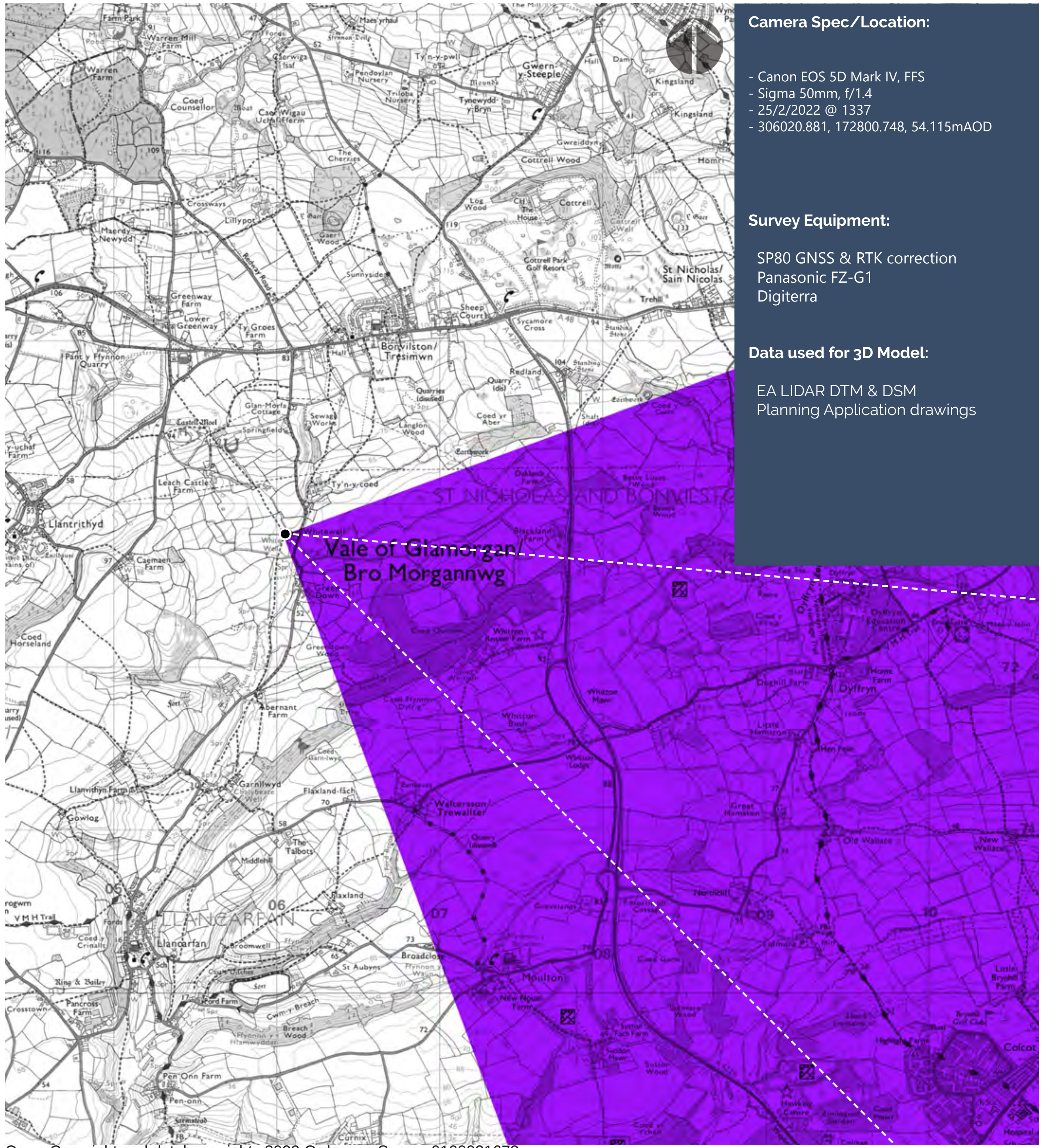
50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFoV)

Point of Perspective

Viewpoint 3 Single Frame 50mm image

Viewpoint 4

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 25/2/2022 @ 1337
- 306020.881, 172800.748, 54.115mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

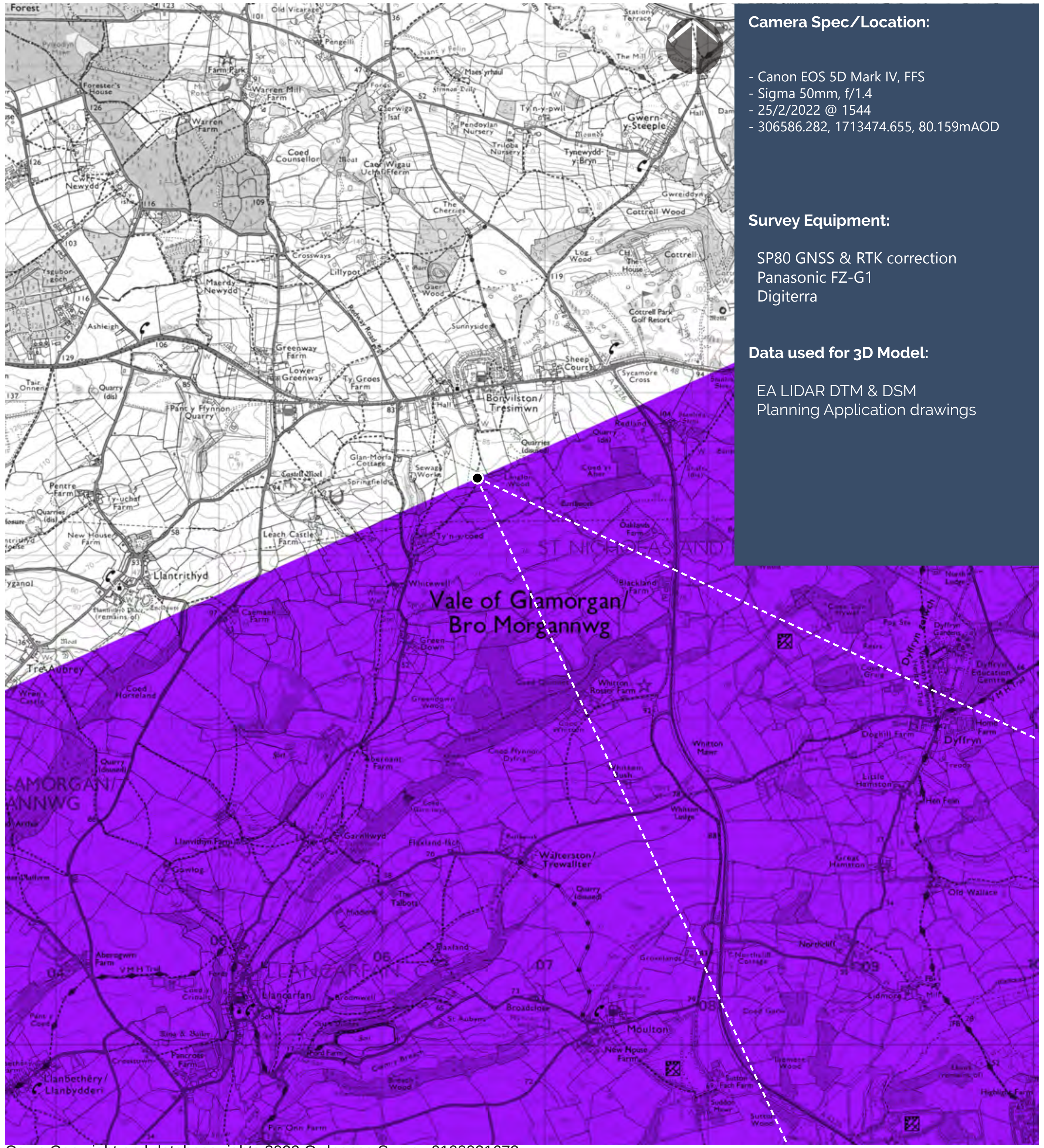
Point of Perspective

50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFoV)

Viewpoint 4 Single Frame 50mm image

Viewpoint 5

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 25/2/2022 @ 1544
- 306586.282, 1713474.655, 80.159mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

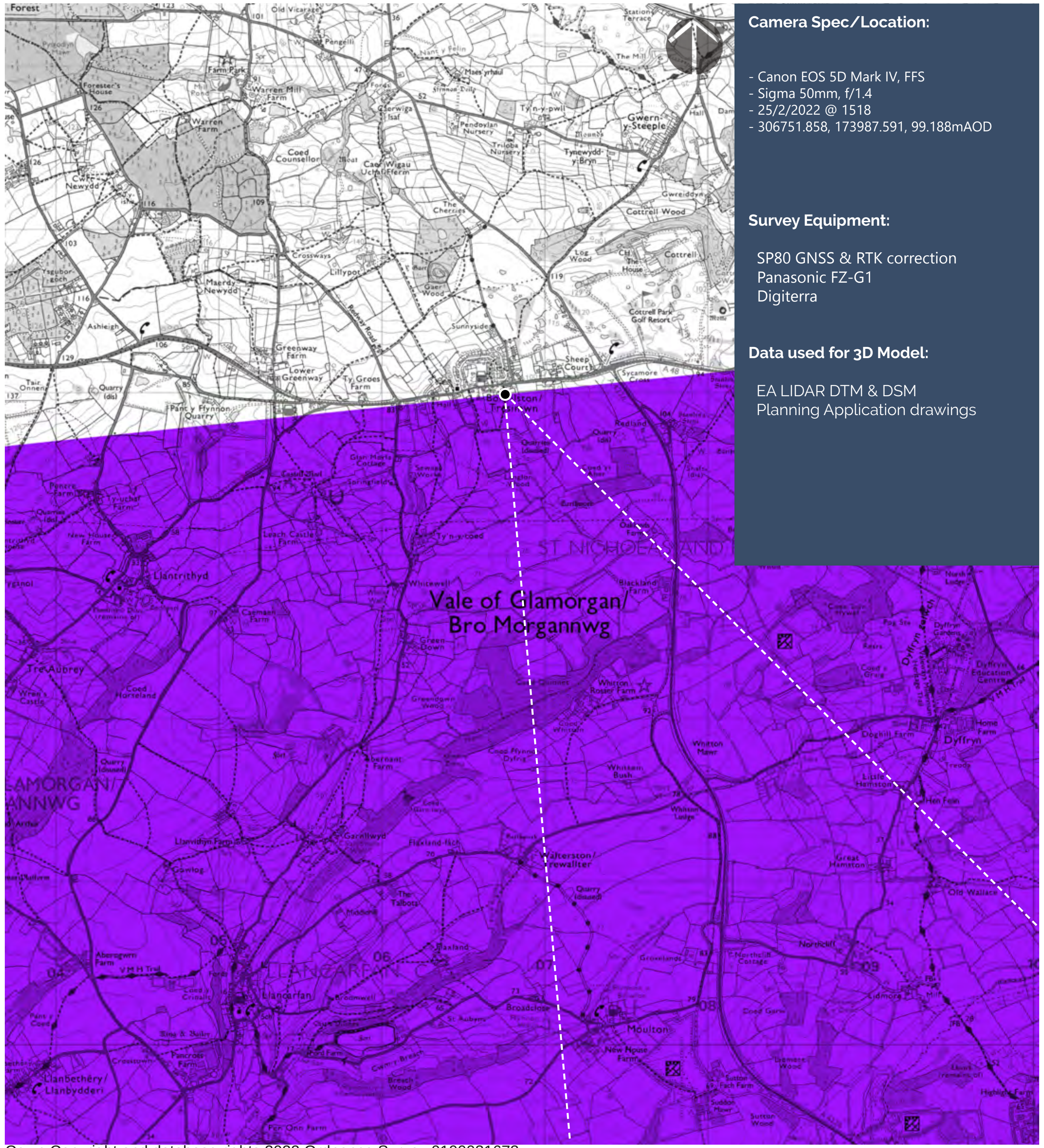
Point of Perspective

Point of Perspective

50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFoV)

Viewpoint 5 Single Frame 50mm image

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 25/2/2022 @ 1518
- 306751.858, 173987.591, 99.188mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

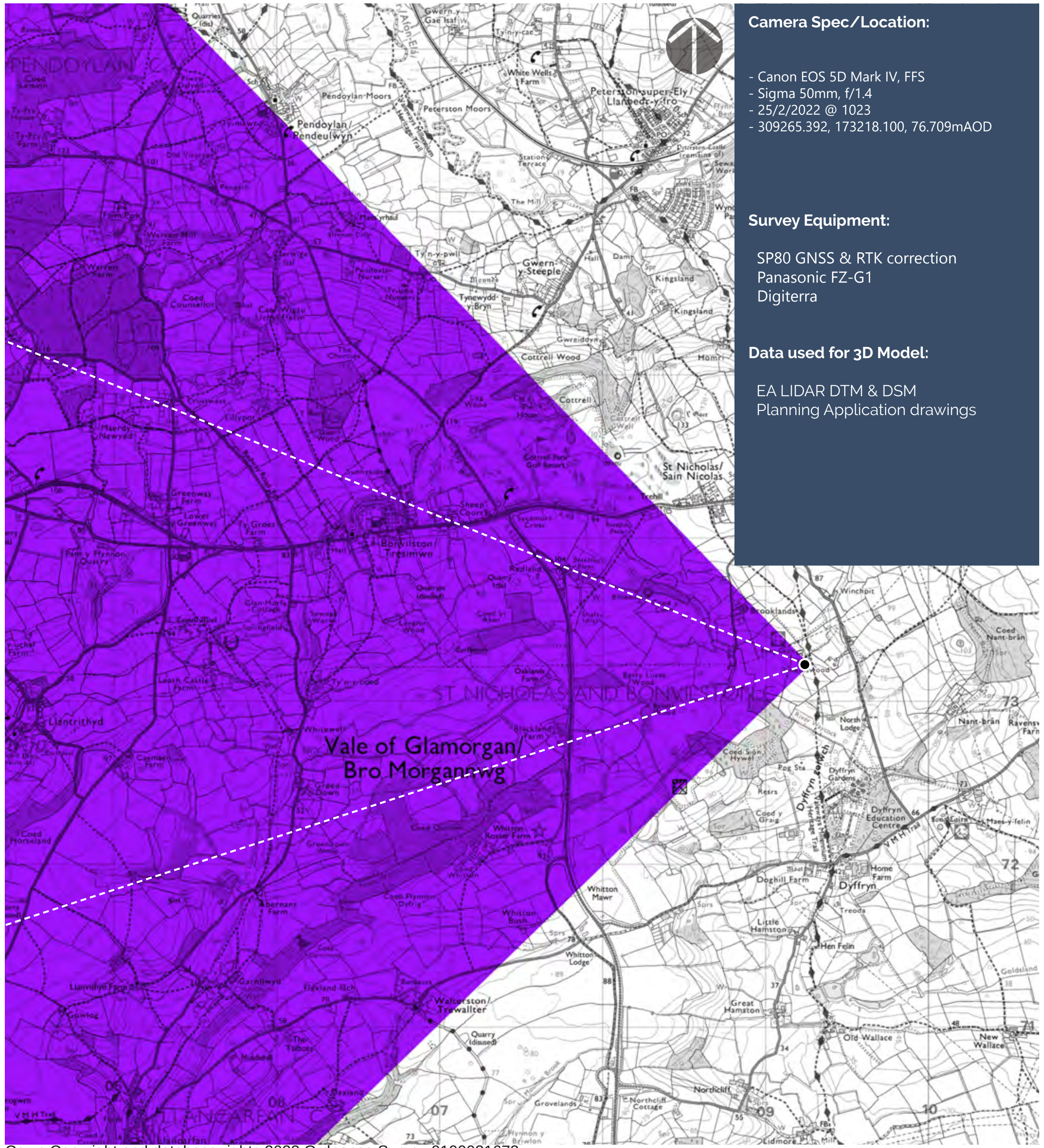
Point of Perspective

50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFoV)

Viewpoint 6 Single Frame 50mm image

Viewpoint 9

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 25/2/2022 @ 1023
- 309265.392, 173218.100, 76.709mAOD

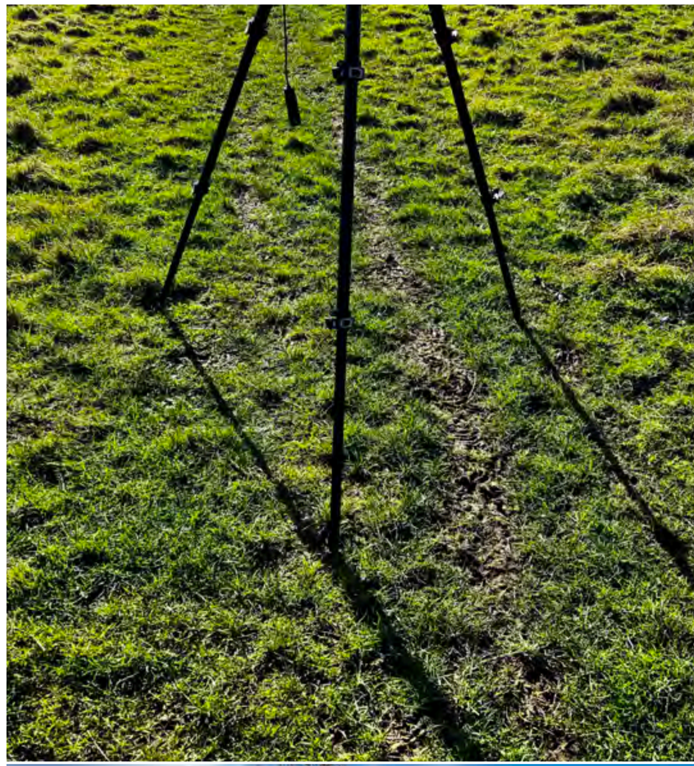
Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:



Point of Perspective

Point of Perspective

Point of Perspective

Point of Perspective

50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFoV)

Viewpoint 9 Single Frame 50mm image