



Appendix 9.3

Technical Photography,
3D Modelling and Verified Visualisations

Fair Oaks Renewable Energy Park

Ruddington

July 2022

H:B:A Environment

engena

RIDGE
CLEAN
ENERGY

Landscape
Institute
Registered
Practice

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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 also been working closely with Bath City Council on proposed development in the UNESCO World Heritage City of Bath. 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 November 2021 HBA Environment contacted MSE to request Technical Photography, GNSS/RTK Surveying, 3D Modelling and Visualisation support for the proposed Fair Oaks Renewable Energy Park, near Ruddington.

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 9 viewpoints were identified providing views of the site and visited on 17 & 23 November 2021 and 17 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 both landscape and portrait 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.



Single Frame 50mm photograph is insufficient to capture the wide spread of a solar farm in the view. Instead a panorama is created by stitching multiple 50mm images together:



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, 180 or 270 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 in Appendix 9.3.1.

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 DWG and PDFs supplied by Ridge Clean Energy together with LIDAR 2m DTM data. The model was geo-referenced and placed in the correct geographic coordinate system (OSGB36) using ground heights to correspond with 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 V-Ray 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 3D Model Photo-Overlay View



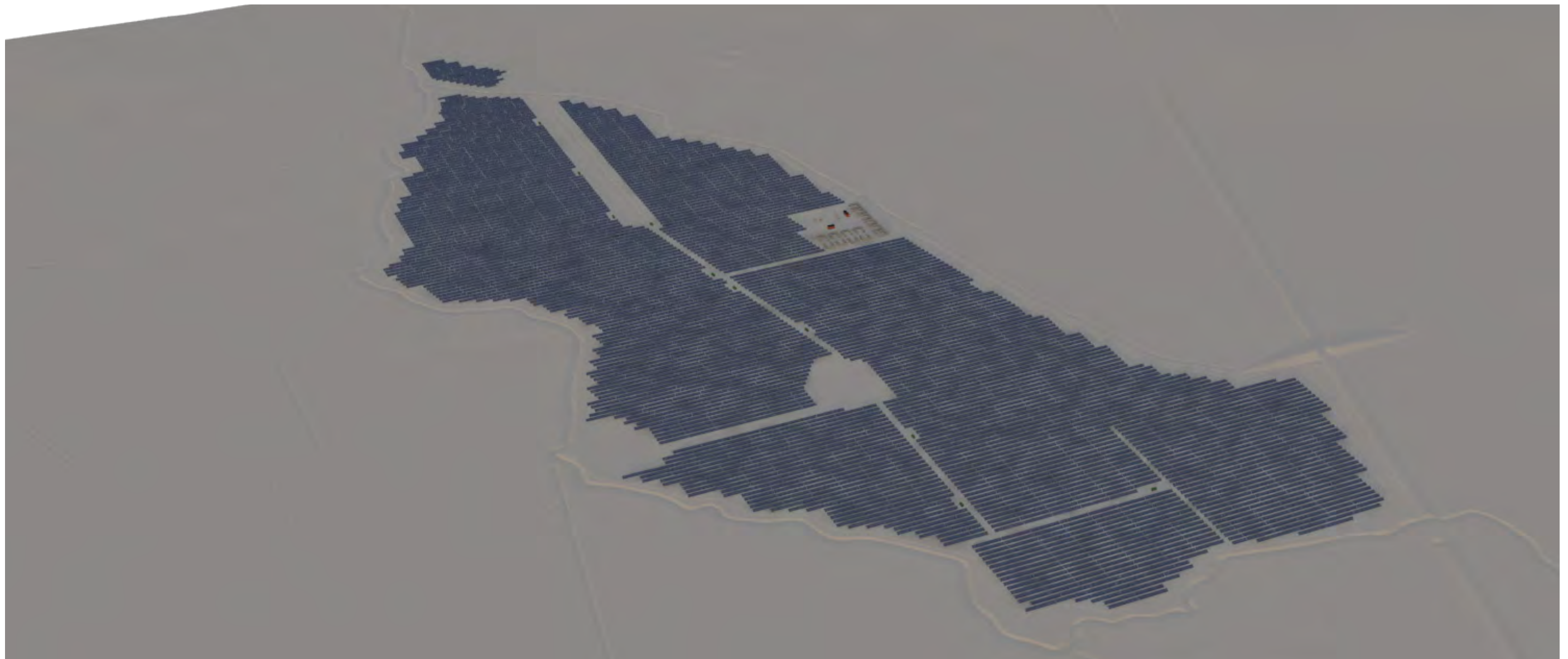
4. Photomontage



The topography of the site has been generated from a site topographical survey supplied by Engena. The surrounding landform has been created using 2m LIDAR DTM data, with triangulated surfaces generated using Rhinoterrain.

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

Proposed Fair Oaks Layout Model on the LIDAR DTM



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 geometry to give a cylindrical panoramic image. To undertake this accurately the use of a levelled tripod and panoramic tripod head set up to avoid foreground parallax is necessary.

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

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

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 system adds a 3 dimensional effect with shadow, to understand the form and materials of the proposed solar panels, fencing and ancillary development.

Viewing Printed Images

The visualisations have been prepared to be printed at A1 wide by A4 high (841mm x 297mm), to fully show the limits of the proposed solar farm development within its local landscape context.

Calculation of Visibility (ZTVs)

GIS viewshed software has been used to calculate visibility of the proposed development. A landform model has been constructed using Environment Agency 2m LIDAR Digital Terrain Model (DTM) data. 200 target points have been set at points along the panels at a height of 3m. An observer's eye height of 1.6m has been used.

A second calculation has been made of the substation, using the same landform data and eye height. The results illustrate maximum theoretical visibility, and do not include the screening effects of buildings or vegetation.

Summary

This work has been undertaken in accordance with the Landscape Institute 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 (photo-realistic).

The photography has been undertaken in a 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 in Rhino 3D. An additional check on the vertical scaling has been undertaken using RESOFT Windfarm. The resultant visualisations are highly accurate,

The sheets are set up to be printed at the true monocular viewing distance of 50cm. So the images will appear true to scale when viewed on site with one eye.

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.

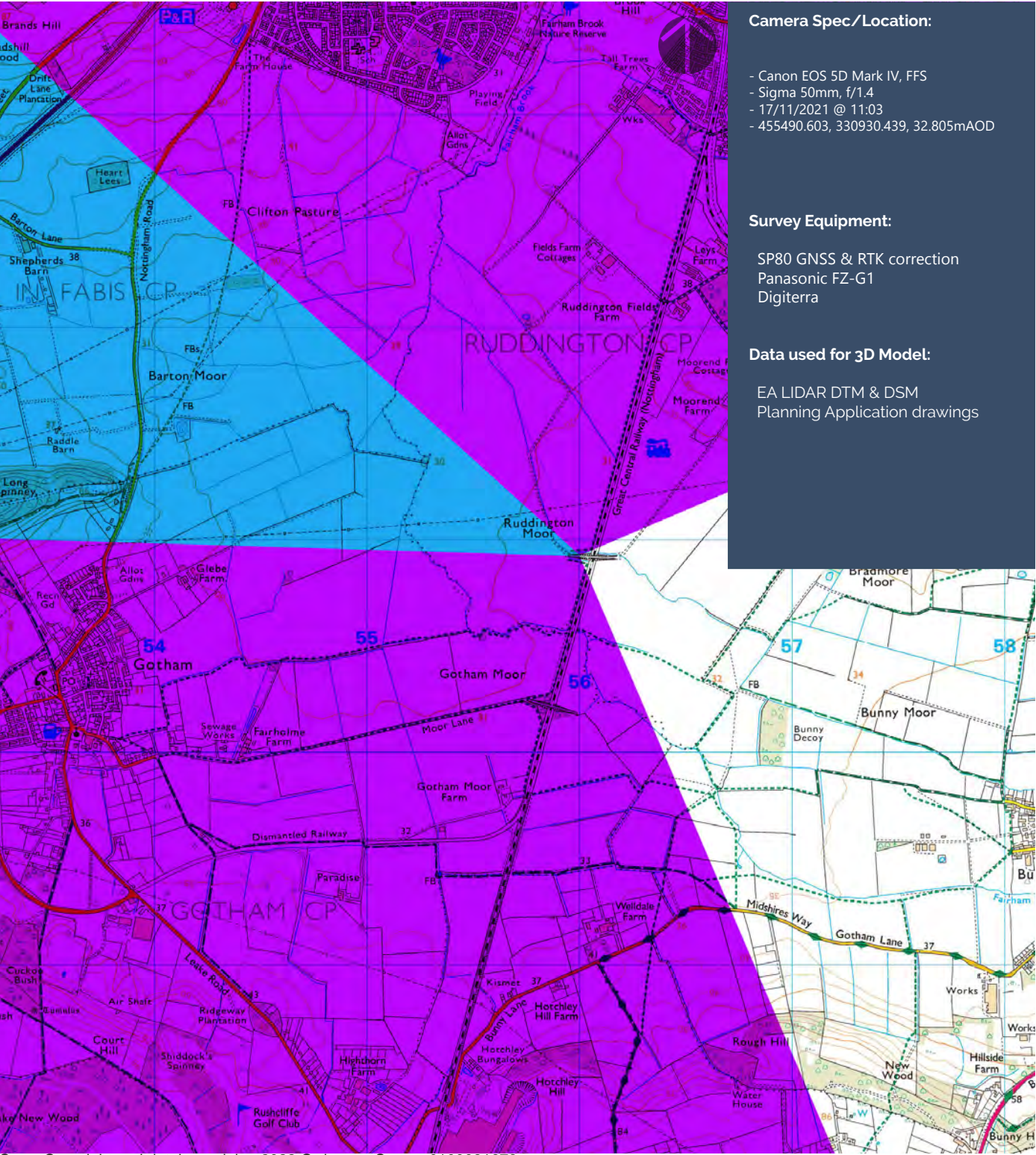
The visibility calculations use highly detailed LIDAR DTM data and helpful in understanding maximum theoretical visibility, without visual buffers.



M.A.Spence BA(Hons), MLD, CMLI, REIA, FRGS 17 July 2022
Principal, MSEnvironmental



Camera Location:



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Tripod:

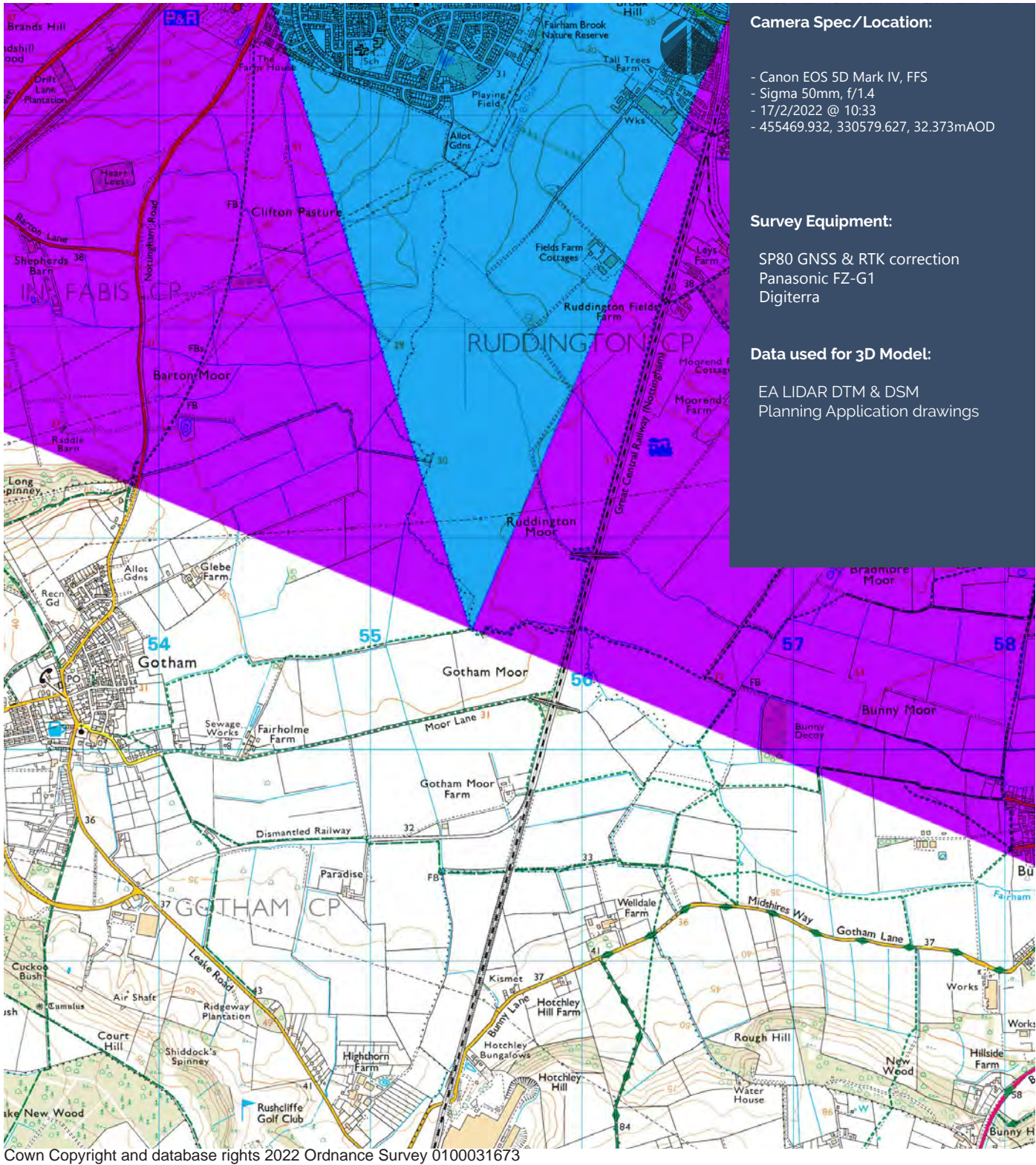


50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFOV)



Viewpoint 1 Single Frame 50mm image

Camera Location:



Tripod:



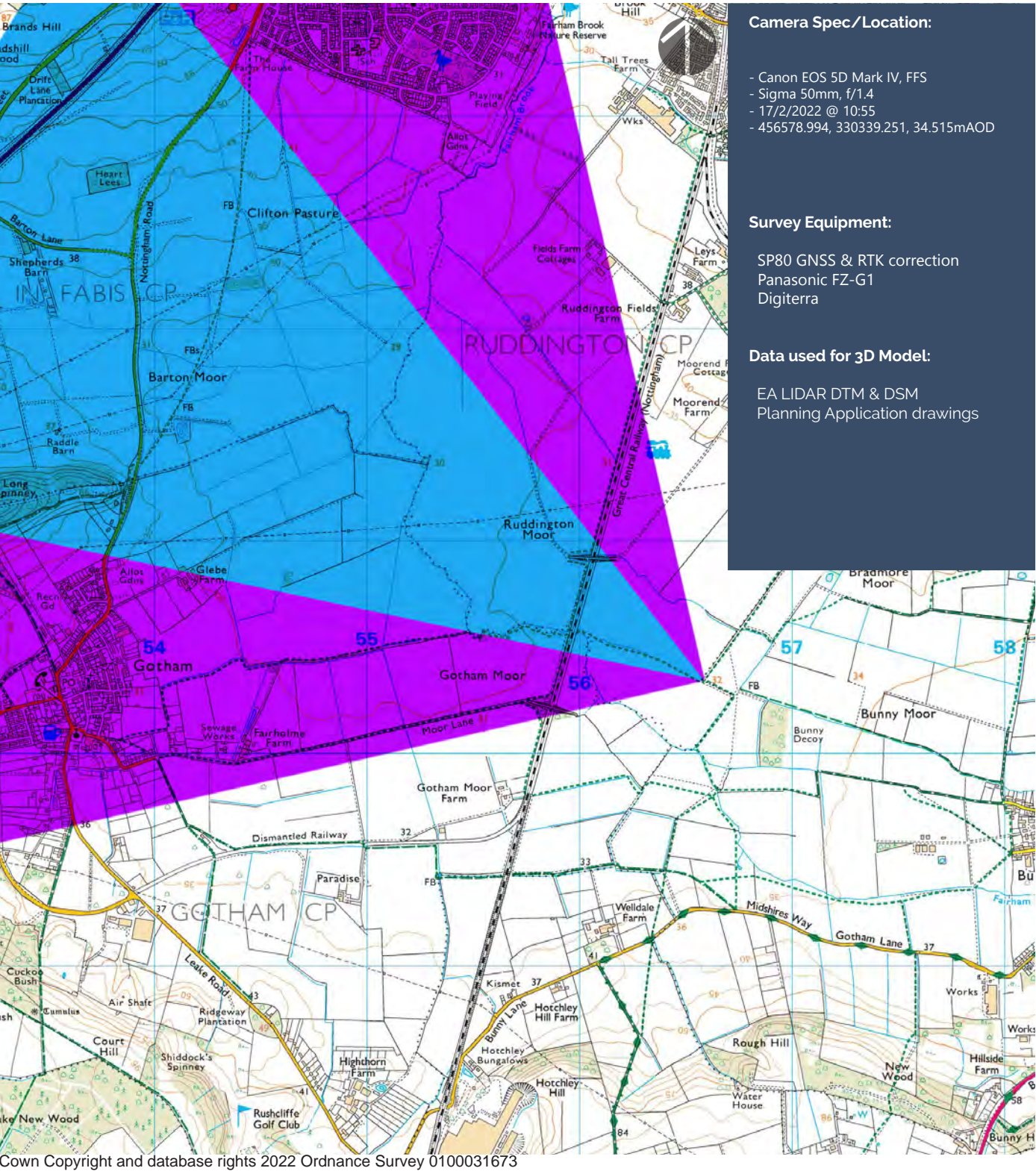
50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFOV)



Viewpoint 2 Single Frame 50mm image

Point of Perspective

Camera Location:



Tripod:

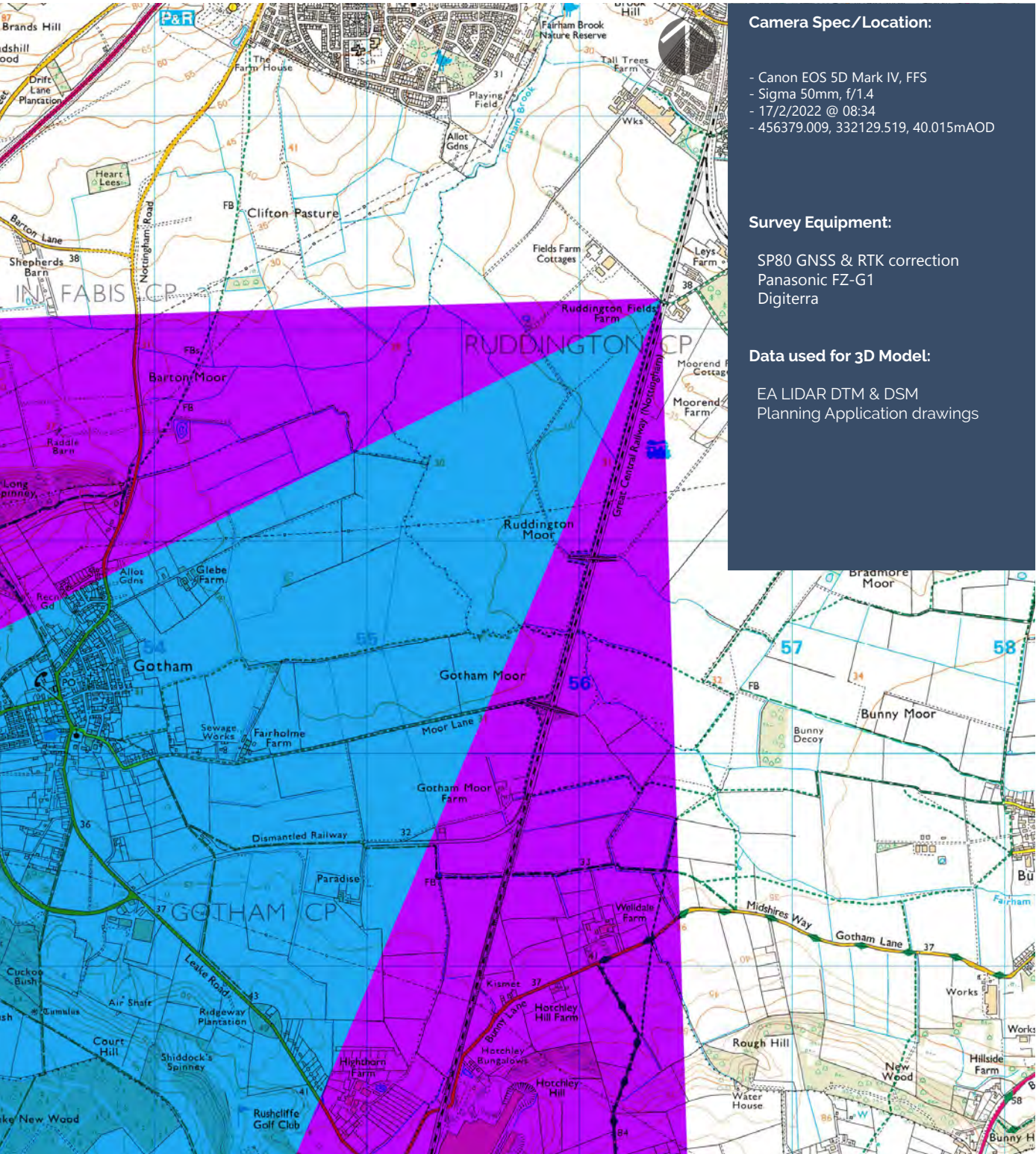


50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFOV)



Viewpoint 3 Single Frame 50mm image

Camera Location:



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Tripod:

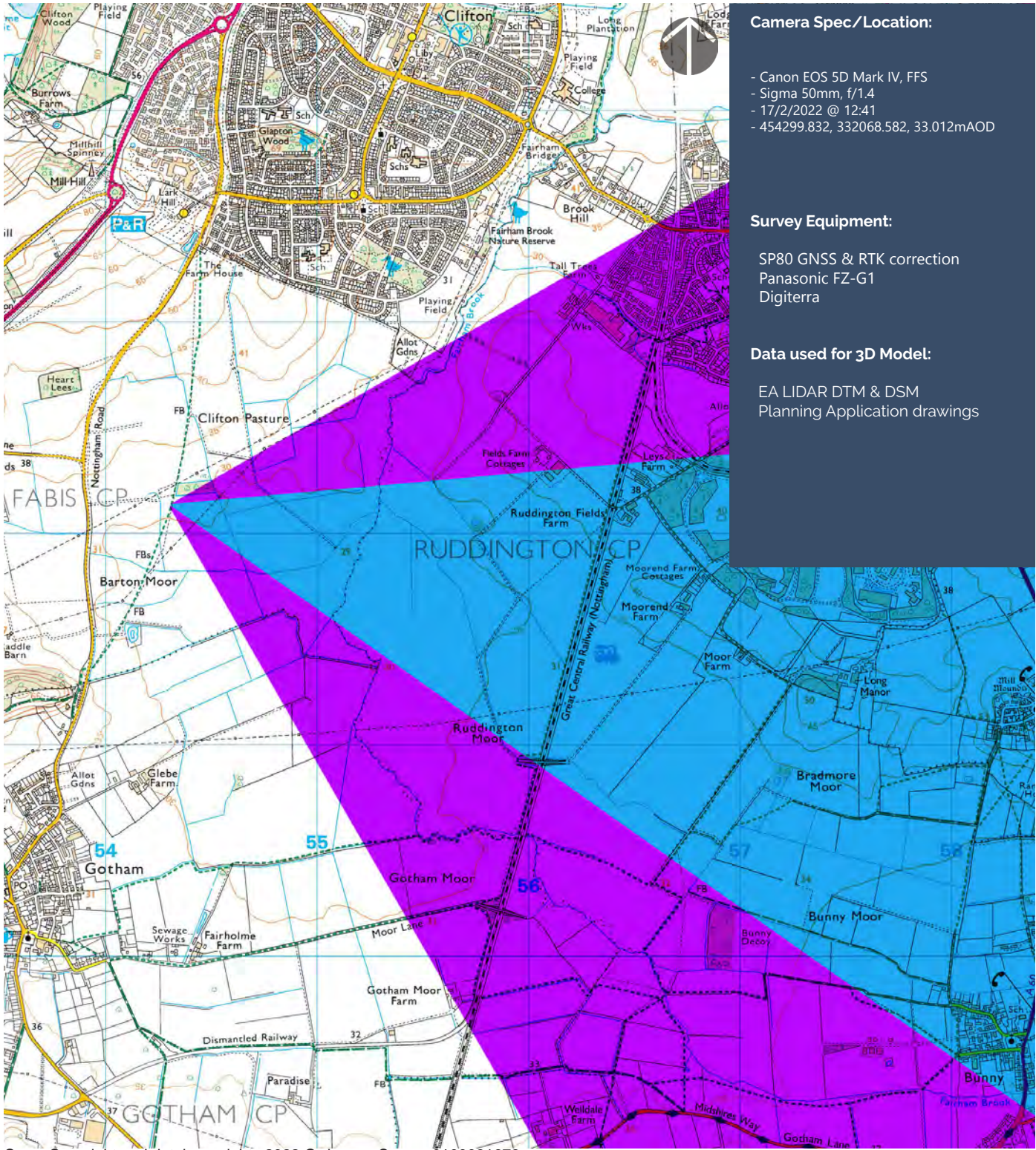


50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFOV)



Viewpoint 4 Single Frame 50mm image

Camera Location:



Tripod:

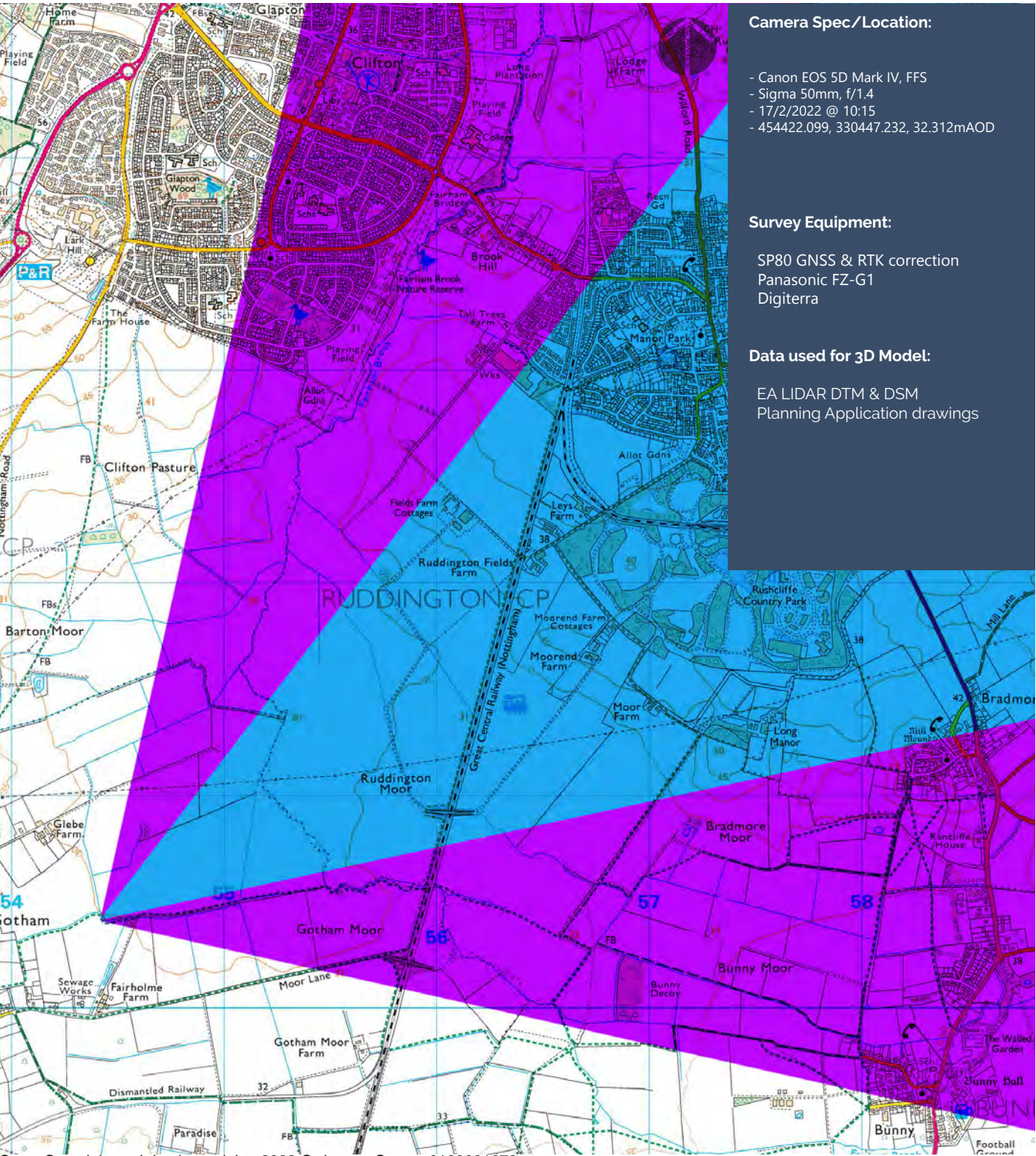


50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFOV)



Viewpoint 5 Single Frame 50mm image

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 17/2/2022 @ 10:15
- 454422.099, 330447.232, 32.312mAOD

Survey Equipment:

- SP80 GNSS & RTK correction
- Panasonic FZ-G1
- Digiterra

Data used for 3D Model:

- EA LIDAR DTM & DSM
- Planning Application drawings

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Tripod:

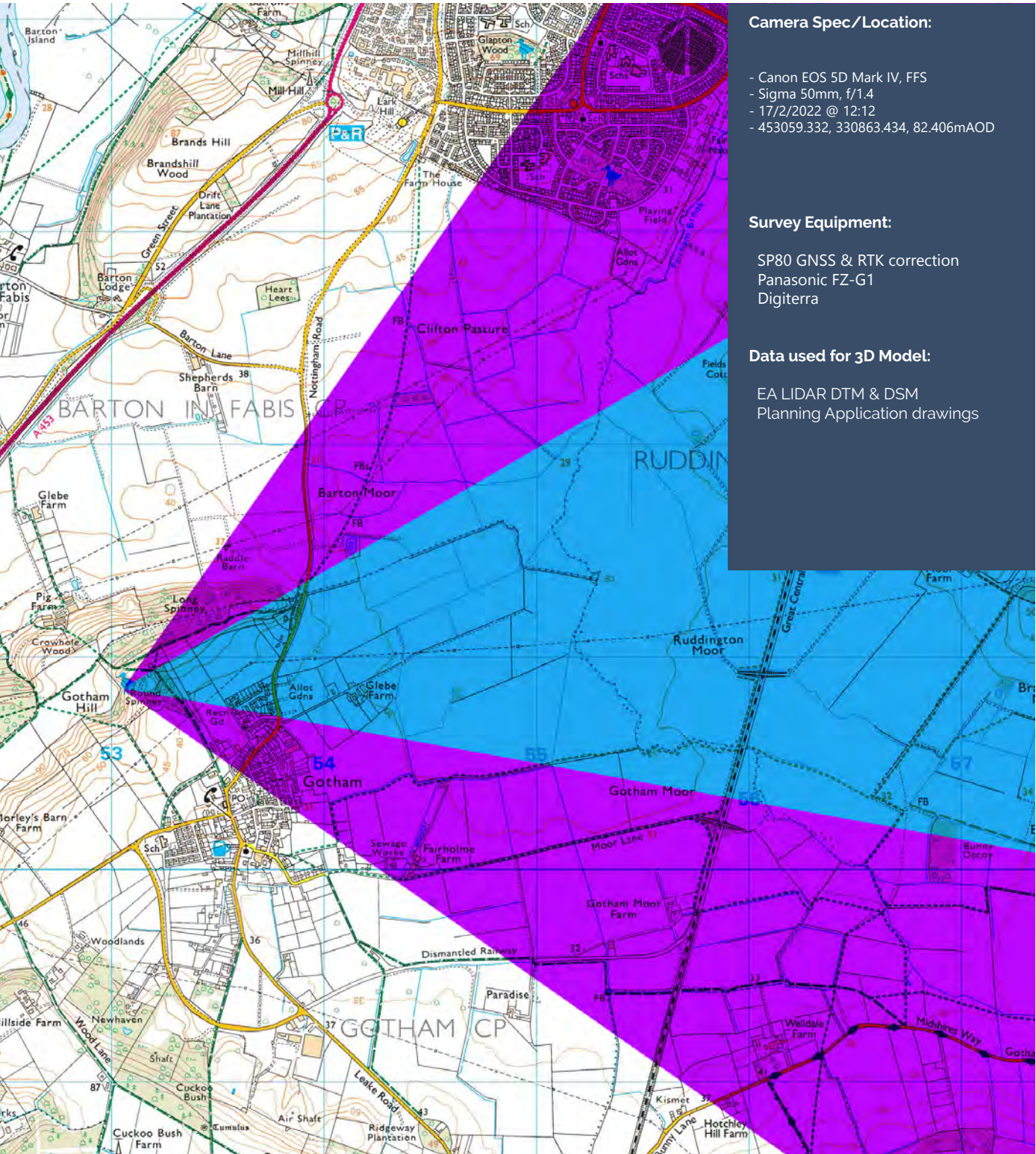


50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFOV)



Viewpoint 6 Single Frame 50mm image

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 17/2/2022 @ 12:12
- 453059.332, 330863.434, 82.406mAOD

Survey Equipment:

- SP80 GNSS & RTK correction
- Panasonic FZ-G1
- Digiterra

Data used for 3D Model:

- EA LIDAR DTM & DSM
- Planning Application drawings

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Tripod:

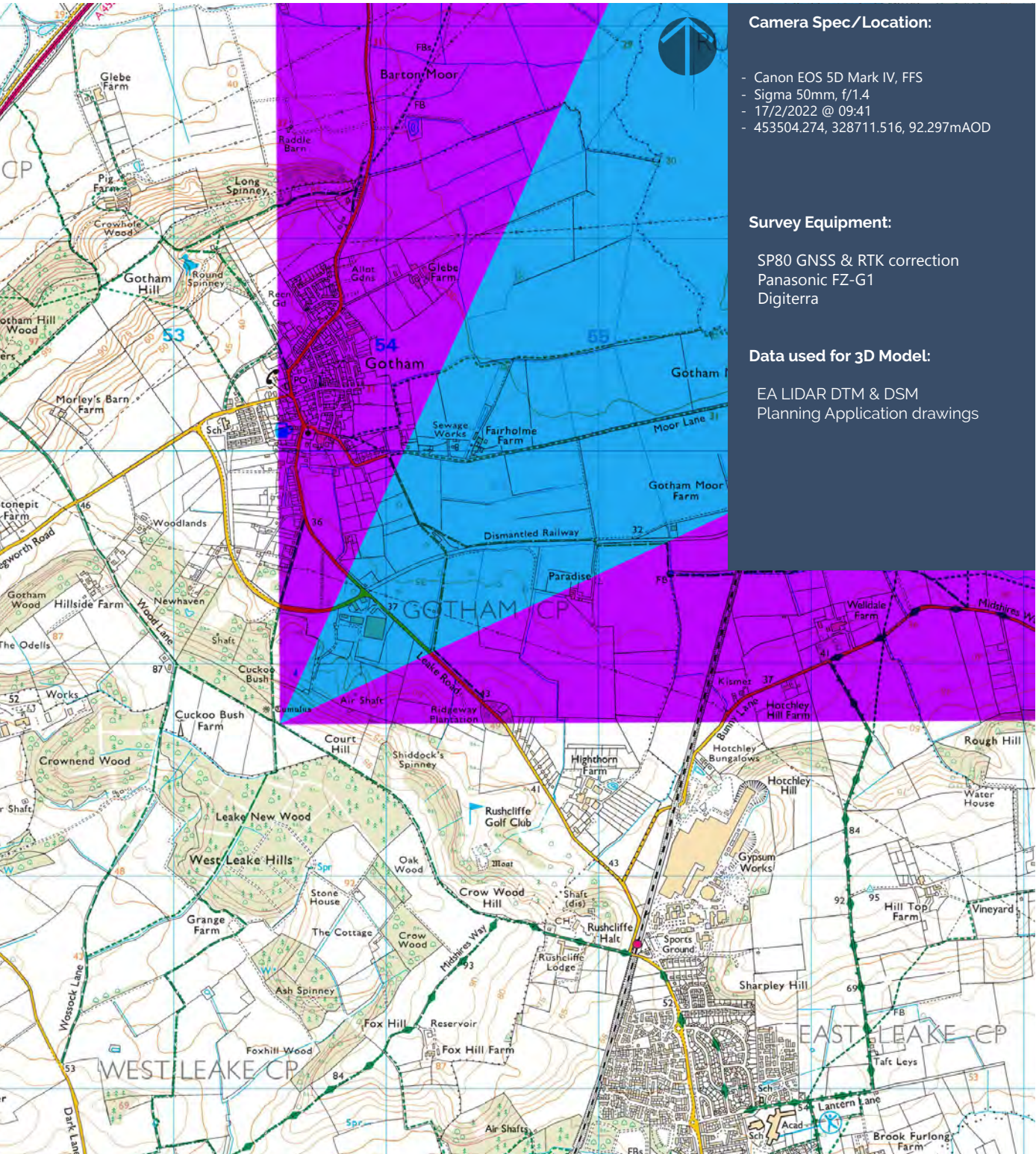


50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFOV)



Viewpoint 7 Single Frame 50mm image

Camera Location:



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Tripod:

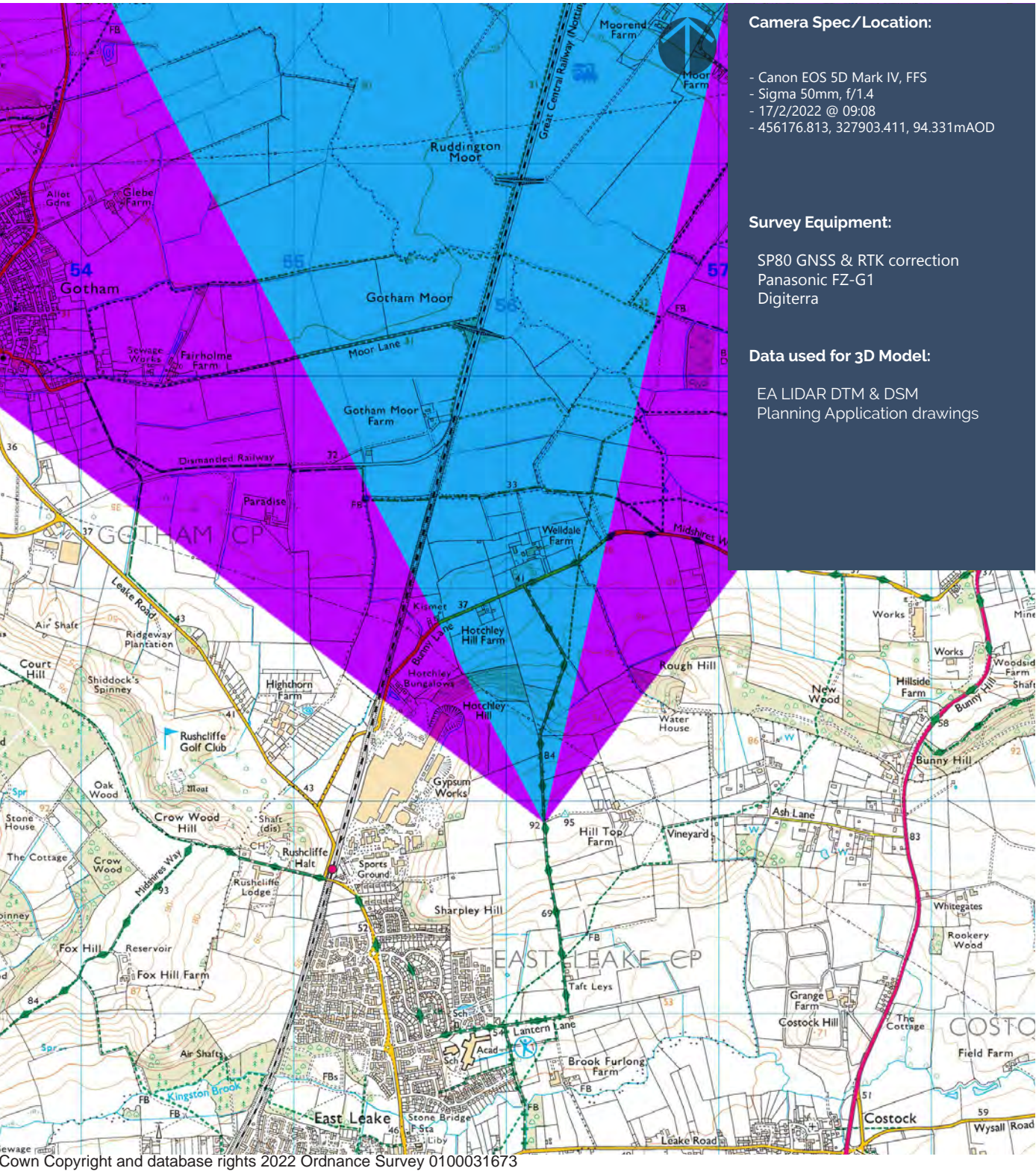


50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFOV)



Viewpoint 8 Single Frame 50mm image

Camera Location:



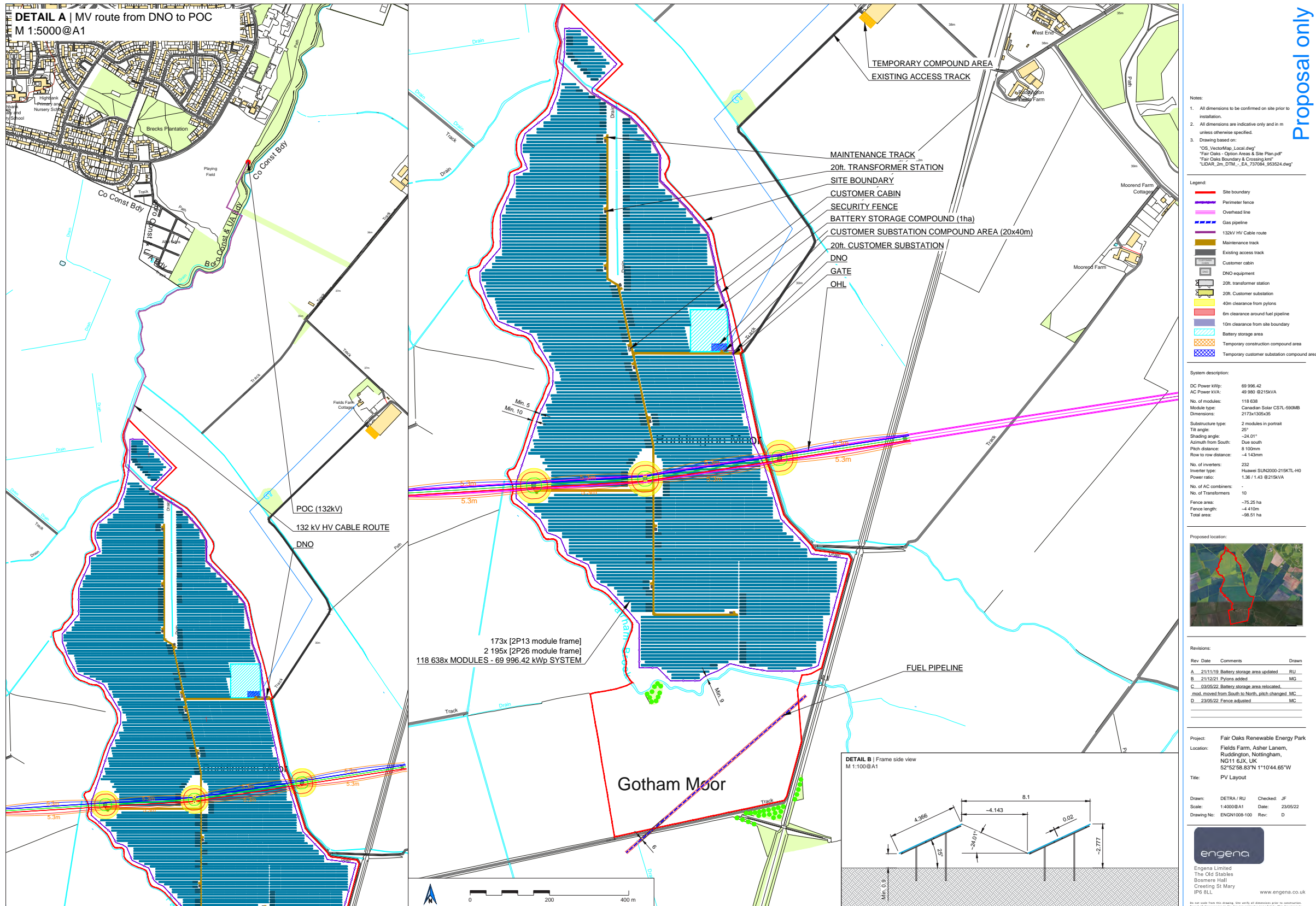
Tripod:



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



Viewpoint 9 Single Frame 50mm image



Proposal only



Spectra Precision SP80 GNSS Receiver



The Most Connected GNSS Receiver



SP80

SP80 GNSS Receiver

The Spectra Precision SP80 is a next generation GNSS receiver that combines decades of GNSS RTK technology with revolutionary new GNSS processing. Featuring the new 240-channel “6G” chipset, the SP80 system is optimized for tracking and processing signals from all GNSS constellations.

In addition, SP80 is the most connected GNSS receiver in the industry. It is the first to offer a unique combination of integrated 3.5G cellular, Wi-Fi and UHF communications with SMS, email and anti-theft features.

These powerful capabilities, packaged in an ultra-rugged and cable-free housing with unlimited operation time (hot-swappable batteries), make SP80 an extremely versatile turnkey solution.

Key Features

- New 240-channel 6G ASIC
- Z-Blade GNSS-centric
- 3.5G cellular modem
- Internal TRx UHF radio
- Built-in WiFi communication
- SMS and e-mail alerts
- Anti-theft protection
- Hot-swappable batteries



Patented inside-the-rod mounted UHF antenna design



Unique 6G GNSS-centric Technology

Exclusive Z-Blade processing technology running on a next-generation Spectra Precision 240-channel 6G ASIC fully utilizes all 6 GNSS systems: GPS, GLONASS, BeiDou, Galileo, QZSS and SBAS. The unique GNSS-centric capability optimally combines GNSS signals without dependency on any specific GNSS system; this allows SP80 to operate in GPS-only, GLONASS-only or BeiDou-only mode if needed. In addition, SP80 supports the recently approved RTCM 3.2 Multiple Signal Messages (MSM), a standardized definition for broadcasting all GNSS signals from space, regardless of their constellation. This protects the surveyor's investment well into the future by providing superior performance and improved productivity as new signals become available.

SMS and Email Messaging

SP80 has a unique combination of communication technologies including an integrated 3.5G GSM/UMTS modem, Bluetooth and Wi-Fi connectivity, and optional internal UHF transmit radio. The cellular modem may be used for SMS (text message) and e-mail alerts as well as regular Internet or VRS connectivity. Likewise, SP80 can use all available RTK correction sources and connect to the Internet from the field using WiFi hotspots, where available. The internal UHF transmit/receive radio allows for quick and easy setup as a local base station. This saves time and increases the surveyor's efficiency.



Anti-Theft Protection

A unique anti-theft technology secures SP80 when installed as a field base station in remote or public places and can detect if the product is disturbed, moved or stolen. This technology allows the surveyor to lock the device to a specific location and make it unusable if the device is moved elsewhere. In this case, SP80 will generate an audio alert and show an alert message on its display. Furthermore, an SMS or e-mail will be sent to the surveyor's mobile phone or computer and provides the receiver's current coordinates allowing tracking of its position and facilitating recovery of the receiver. SP80's anti-theft technology provides surveyors with remote security and peace of mind.

The Most Powerful Tool for Reliable Field Use

The SP80's rugged housing, created by Spectra Precision's engineering design lab in Germany, incorporates a host of practical innovations. Dual hot-swappable batteries can be easily exchanged in the field as a one hand operation for an interruption-free working day, ensuring surveyors remain productive until the job is done. The impact-resistant glass-fiber reinforced casing, designed to withstand 2m pole drops and waterproof to IP67, ensures that SP80 can handle the toughest outdoor conditions. The patented UHF antenna, set inside the rugged carbon fiber rod, extends the range of RTK radio performance at the same time as armoring protection. The sunlight-readable display offers instant access to key information like the number of satellites, RTK status, battery charge and available memory. These powerful design features combine to make SP80 the most capable, most reliable GNSS receiver, backed by a comprehensive standard 2 year warranty.



The Spectra Precision Experience

With the most advanced and rugged field data collectors from Spectra Precision, surveyors get maximum productivity and reliability every day. Spectra Precision Survey Pro or FAST Survey software is specifically tailored for the SP80 GNSS receiver providing easy-to-use, yet powerful GNSS workflows, letting the surveyor concentrate on getting the job done. Spectra Precision Survey Office Software provides a complete office suite for post-processing GNSS data and adjusting survey data, as well as exporting the processed results directly back to the field or to engineering design software packages. Combined with Spectra Precision field and office software, SP80 is a very powerful and complete solution.



TOUGHPAD FZ-G1

Panasonic recommends Windows.

| | | | |
|--|--|--|--|
| SOFTWARE | <ul style="list-style-type: none">Windows 10 Pro 64 bitPanasonic Utilities (including Dashboard), Recovery Partition | | |
| DURABILITY | <ul style="list-style-type: none">MIL-STD-810G certified (4' drop, shock, vibration, rain, dust, sand, altitude, freeze/thaw, high/low temperature, temperature shock, humidity, explosive atmosphere)IP65 certified sealed all-weather designOptional class I division 2, groups ABCD certified modelSolid state drive heaterMagnesium alloy chassis encased with ABS and elastomer corner guardsOptional hand strap or rotating hand strapPort coversRaised bezel for LCD impact protectionPre-installed replaceable screen film for LCD protection | | |
| CPU | <ul style="list-style-type: none">Intel® Core™ i5-6300U vPro™ Processor~ 2.4 GHz up to 3.0 GHz with Intel® Turbo Boost Technology~ Intel Smart Cache 3MB | | |
| STORAGE & MEMORY | <ul style="list-style-type: none">8GB DDR3L SDRAM^{1,5}256GB solid state drive (SSD) with heater^{4,5}Optional 512GB~ up to 64GB additional storage with optional microSDXC card slot | | |
| DISPLAY | <ul style="list-style-type: none">10.1" WUXGA 1920 x 1200 with LED backlighting10-point capacitive multi touch + Waterproof Digitizer pen daylight-readable screen~ 2-800 nitIPS display with direct bonding~ Anti-reflective and anti-glare screen treatments~ Ambient light sensor, digital compass, gyro and acceleration sensors~ Automatic screen rotation~ Intel® HD Graphics 520 (Built-in CPU) video controller~ Concealed mode (configurable) | | |
| AUDIO | <ul style="list-style-type: none">Integrated microphoneRealtek high-definition audioIntegrated speakerOn-screen and button volume and mute controls | | |
| KEYBOARD & INPUT | <ul style="list-style-type: none">10-point gloved multi touch + digitizer screen~ Supports bare-hand touch and gestures and electronic waterproof stylus pen~ Supports glove mode and wet-touch mode~ 7 tablet buttons (2 user-definable)~ Integrated stylus holder~ On-screen QWERTY keyboard | | |
| CAMERAS | <ul style="list-style-type: none">720p webcam with mic8MP rear camera with autofocus and LED light | | |
| EXPANSION | <ul style="list-style-type: none">Optional MicroSDXC3 | | |
| INTERFACE | <table><tr><td><ul style="list-style-type: none">Docking connectorHDMIHeadphones/speakerOptional Serial Dongle⁷USB 3.0 (x 1)²Optional second USB 2.0³Optional 10/100/1000 Ethernet³</td><td><ul style="list-style-type: none">24-pin Type AMini-jack stereoD-sub 9-pin4-pin4-pinRJ-45</td></tr></table> | <ul style="list-style-type: none">Docking connectorHDMIHeadphones/speakerOptional Serial Dongle⁷USB 3.0 (x 1)²Optional second USB 2.0³Optional 10/100/1000 Ethernet³ | <ul style="list-style-type: none">24-pin Type AMini-jack stereoD-sub 9-pin4-pin4-pinRJ-45 |
| <ul style="list-style-type: none">Docking connectorHDMIHeadphones/speakerOptional Serial Dongle⁷USB 3.0 (x 1)²Optional second USB 2.0³Optional 10/100/1000 Ethernet³ | <ul style="list-style-type: none">24-pin Type AMini-jack stereoD-sub 9-pin4-pin4-pinRJ-45 | | |
| WIRELESS | <ul style="list-style-type: none">Optional integrated 4G LTE multi carrier mobile broadband with satellite GPSOptional GPS (u-blox NEO M8N)³Intel® Dual Band Wireless-AC 8260 (IEEE802.11 a/b/g/n/ac)Bluetooth v4.1, Classic mode/Low Energy mode, Class 1 (Windows 10 pro 64-bit)Security<ul style="list-style-type: none">~ Authentication: LEAP, WPA, 802.1x, EAP-TLS, EAP-FAST, PEAP~ Encryption: CKIP, TKIP, 128-bit and 64-bit WEP, Hardware AESDual high-gain antenna pass-through | | |
| POWER SUPPLY | <ul style="list-style-type: none">Li-Ion battery pack:<ul style="list-style-type: none">~ Standard battery: Li-ion 11.1 V, 4200 mAh (typ.), 4080 mAh (min.)~ Optional long life battery⁷: Li-ion 10.8V, 9300mAh(1yp.), 8700mAh (min.)Battery operation¹:<ul style="list-style-type: none">~ Standard battery: 14 hours~ Optional long life battery⁷: 28 hoursBattery charging time¹:<ul style="list-style-type: none">~ Standard battery: 2.5 hours off, 3 hours on~ Optional long life battery⁷: 3 hours off, 4 hours onOptional bridge battery⁷ (1 minute swap time) | | |
| POWER MANAGEMENT | <ul style="list-style-type: none">Suspend/Resume Function, Hibernation, Standby | | |
| SECURITY FEATURES | <ul style="list-style-type: none">Password Security: Supervisor, User, Hard Disk LockKensington cable lock slotTrusted platform module (TPM) security chip v2.0¹⁰Computrace® theft protection agent in BIOS⁸Optional Insertable SmartCard reader^{2,7}Optional Contactless SmartCard/HF RFID reader²~ ISO 15693 and 14443 A/B compliant | | |

| | | | |
|--|---|--|---|
| WARRANTY | <ul style="list-style-type: none">3-year limited warranty, parts and labor | | |
| DIMENSIONS & WEIGHT ¹ | <ul style="list-style-type: none">10.6" (L) x 7.4" (W) x 0.8" (H)2.4 lbs. (standard battery)3.0 lbs. (optional long life battery)⁷ | | |
| INTEGRATED OPTIONS ¹⁰ | <ul style="list-style-type: none">4G LTE multi carrier mobile broadband with satellite GPSChoice of 10/20 barcode reader (EA11 or EA21), GPS, Serial Dongle, Ethernet, MicroSDXC or second USB 2.0 port³Choice of bridge battery, magstripe reader, insertable SmartCard reader, insertable SmartCard reader with bridge battery, contactless SmartCard/RFID HF reader or UHF 900MHz RFID reader (EPC Gen 2)¹² | | |
| ACCESSORIES ¹⁰ | <table><tr><td><ul style="list-style-type: none">AC Adapter (3-prong)Standard Battery PackLong Life Battery Pack⁷Long Life Battery Bundle (includes rotating hand strap and corner guard set)Single Battery Charger BundleLIND 3-Bay Battery ChargerLIND Car Adapter 120WLIND Car/AC Adapter 90W (with USB port)LIND Car Adapter 90W MIL-STDTall Corner Guard SetRotating Hand Strap and Tall Corner Guard Set BundleToughMate G1 Always-On Case (with hand strap)ToughMate G1 Professional PortfolioToughMate G1 "X" Hand StrapDesktop CradleVehicle Docks (no pass-through)~ Gamber-Johnson~ Havis with LIND power supplyVehicle Docks (dual pass-through)~ Gamber-Johnson~ Havis with LIND power supplyCradlepoint Router~ Verizon~ AT&TReplacement Digitizer Pen WaterproofTether10.1" LCD Protective Film</td><td><ul style="list-style-type: none">CF-AA6413CMFZ-VZSU84ZUFZ-VZSU88UFZ-BNDL61LL1ST1CG4FZ-BNDL61BATCHR9FZ-LND3BAG1CF-LNDDC120CF-LNDACDC90CF-LNDMLDC90FZ-WCGG111FZ-BNDL61ST1CG4TBCG1AGNL-PTBCG1PFLIO-BLK-PTBCG1XSTP-PFZ-VEBG11AU7160-0486-00-PCF-H-PAN-702-P7160-0486-02-PCF-H-PAN-702-2-PCP-IBR1100LPE-VZCP-IBR1100LPE-ATFZ-VNPG11U-SFZ-VNTG11UFZ-VFPG11U</td></tr></table> | <ul style="list-style-type: none">AC Adapter (3-prong)Standard Battery PackLong Life Battery Pack⁷Long Life Battery Bundle (includes rotating hand strap and corner guard set)Single Battery Charger BundleLIND 3-Bay Battery ChargerLIND Car Adapter 120WLIND Car/AC Adapter 90W (with USB port)LIND Car Adapter 90W MIL-STDTall Corner Guard SetRotating Hand Strap and Tall Corner Guard Set BundleToughMate G1 Always-On Case (with hand strap)ToughMate G1 Professional PortfolioToughMate G1 "X" Hand StrapDesktop CradleVehicle Docks (no pass-through)~ Gamber-Johnson~ Havis with LIND power supplyVehicle Docks (dual pass-through)~ Gamber-Johnson~ Havis with LIND power supplyCradlepoint Router~ Verizon~ AT&TReplacement Digitizer Pen WaterproofTether10.1" LCD Protective Film | <ul style="list-style-type: none">CF-AA6413CMFZ-VZSU84ZUFZ-VZSU88UFZ-BNDL61LL1ST1CG4FZ-BNDL61BATCHR9FZ-LND3BAG1CF-LNDDC120CF-LNDACDC90CF-LNDMLDC90FZ-WCGG111FZ-BNDL61ST1CG4TBCG1AGNL-PTBCG1PFLIO-BLK-PTBCG1XSTP-PFZ-VEBG11AU7160-0486-00-PCF-H-PAN-702-P7160-0486-02-PCF-H-PAN-702-2-PCP-IBR1100LPE-VZCP-IBR1100LPE-ATFZ-VNPG11U-SFZ-VNTG11UFZ-VFPG11U |
| <ul style="list-style-type: none">AC Adapter (3-prong)Standard Battery PackLong Life Battery Pack⁷Long Life Battery Bundle (includes rotating hand strap and corner guard set)Single Battery Charger BundleLIND 3-Bay Battery ChargerLIND Car Adapter 120WLIND Car/AC Adapter 90W (with USB port)LIND Car Adapter 90W MIL-STDTall Corner Guard SetRotating Hand Strap and Tall Corner Guard Set BundleToughMate G1 Always-On Case (with hand strap)ToughMate G1 Professional PortfolioToughMate G1 "X" Hand StrapDesktop CradleVehicle Docks (no pass-through)~ Gamber-Johnson~ Havis with LIND power supplyVehicle Docks (dual pass-through)~ Gamber-Johnson~ Havis with LIND power supplyCradlepoint Router~ Verizon~ AT&TReplacement Digitizer Pen WaterproofTether10.1" LCD Protective Film | <ul style="list-style-type: none">CF-AA6413CMFZ-VZSU84ZUFZ-VZSU88UFZ-BNDL61LL1ST1CG4FZ-BNDL61BATCHR9FZ-LND3BAG1CF-LNDDC120CF-LNDACDC90CF-LNDMLDC90FZ-WCGG111FZ-BNDL61ST1CG4TBCG1AGNL-PTBCG1PFLIO-BLK-PTBCG1XSTP-PFZ-VEBG11AU7160-0486-00-PCF-H-PAN-702-P7160-0486-02-PCF-H-PAN-702-2-PCP-IBR1100LPE-VZCP-IBR1100LPE-ATFZ-VNPG11U-SFZ-VNTG11UFZ-VFPG11U | | |

Please consult your reseller or Panasonic representative before purchasing.

Caution: Do not expose bare skin to this product when handling this unit in extreme hot or cold environments.

¹ Approximate time. Battery operation and recharge times will vary based on many factors, including screen brightness, applications, features, power management, battery conditioning and other customer preferences. Battery testing results from MobileMark 2007.

² Bridge battery, magstripe reader, insertable SmartCard reader, insertable SmartCard reader with bridge battery, contactless SmartCard reader and UHF RFID reader are mutually exclusive. Please note, USB 3.0 port cannot be accessed when the unit is equipped with the magstripe reader, but optional USB 2.0 port can be accessed.

³ GPS, Serial Dongle, Ethernet, MicroSDXC and second USB port are mutually exclusive options.

⁴ 1GB = 1,000,000,000 bytes.

⁵ Total usable memory will be less depending upon actual system configuration.

⁶ The size of the VRAM cannot be set by the user and varies by operating system as well as the size of the RAM. Windows 7 max, VRAM is 1555MB.

⁷ Magstripe reader, insertable SmartCard reader, insertable SmartCard reader with bridge battery and UHF RFID reader include tall corner guards and rotating hand strap. Bridge battery (without SmartCard reader) includes medium corner guards and rotating hand strap.

⁸ Requires software and activation to enable theft protection.

⁹ Length measurements do not include protrusions. Weight varies with options and digitizer pen.

¹⁰ Accessories and Integrated Options may vary depending on your configuration. Visit the Panasonic website for more accessories and details.

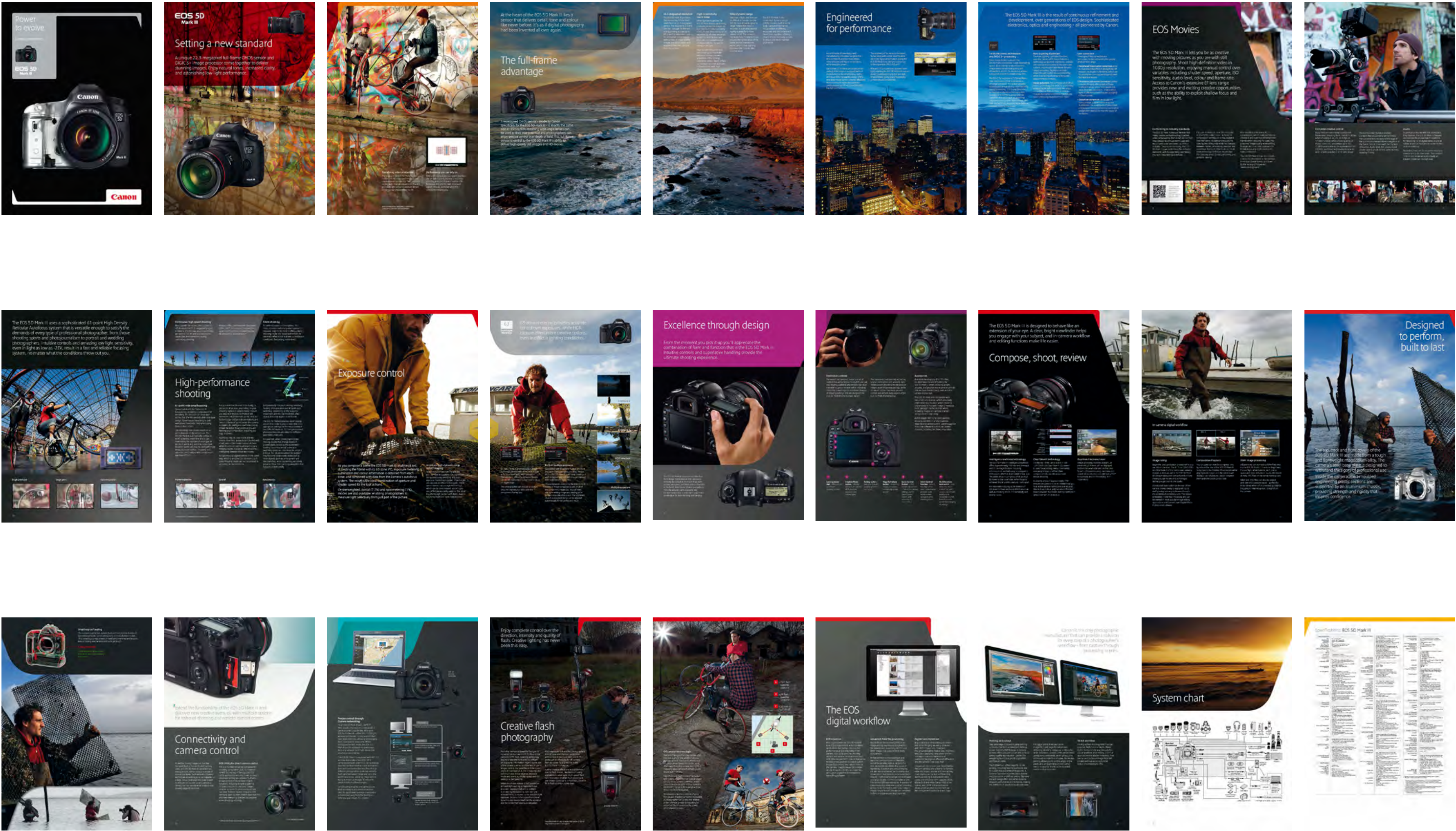
¹¹ Hazardous location certifications may not apply to all configurations. Consult your Panasonic representative for availability.

¹² TPM 1.2 available upon request - please contact your reseller or Panasonic representative.



1.800.662.3537
panasonic.com/toughpad/G1

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APPENDIX 9.3.5: CAMERA EQUIPMENT (SIGMA 50mm f/1.4)



