

Report



Glasgow Prestwick Airport - VHF Communications Safeguarding Assessments

Dalfad Wind Farm

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Executive Summary

Glasgow Prestwick Airport ("the Airport") is responsible for the technical safeguarding of their Communications Navigation and Surveillance (CNS) systems in accordance with the Civil Aviation Authority (CAA) Publications (CAP).

SLR Consulting Limited ("the Client"), has commissioned Sagentia Aviation to conduct Technical Safeguarding Assessments ("the Assessments") to determine potential impacts of Dalfad Wind Farm ("the Development") upon the Airport's In-Scope CNS systems.

Purpose

This report details the approach and presents the results of the Assessments commissioned and identifies any potential impacts to the Airport's In-Scope CNS systems.

Sagentia Aviation undertook the following specific technical assessments. Each are detailed in respective sections of this document, with summary conclusions and recommendations provided below:

- CNS Coverage Assessment
- CAP 670 Carrier Interference (C/I) Ratio Predication Assessment

CNS Coverage Assessment

- Overview

CNS Coverage Assessment (Intervisibility) uses composite optical line of site software modelling to create coverage maps highlighting potential shadow regions impacting the In-Scope CNS systems coverage which are caused by physical obstruction from the Wind Turbine Generators (WTGs) of the Development.

- Conclusions

The results indicate that the development could cause areas of shadowing at altitudes of 1,500 ft ASL and above, assessed against the In-Scope CNS systems.

The WTGs have been modelled in a realistic profile orientated towards the average prevailing wind direction of 225°, this reduces the width of the 'blocking face' presented to the respective VHF CNS and would subsequently reduce the impacted azimuth widths of any affected areas for each WTG.

- Recommendations

The Airport should consider the nature of the indicated degradation being intermittent and changeable. The WTGs have been modelled in a realistic profile orientated towards the average prevailing wind direction however this may change at any point in time.

Sagentia Aviation recommends the Airport review the results of this assessment against the Air Traffic Services (ATS) they provide, specifically considering that shadow regions are very negligible in azimuth width and of which only 8% of the VHF Comms shadow areas will be affected at any one point in time.

CAP 670 C/I Ratio Predication Assessment

- Overview

C/I refers to the phenomenon where an unwanted Radio Frequency (RF) signal can cause degradation to a wanted RF signal in the same (or adjacent sub carrier) frequency band.

In the case of Wind Farms, WTGs can reflect the CNS RF signal such that it appears to have originated from an unwanted source. C/I ratio is the assessment of the level of that unwanted signal against the field strength of the wanted signal.

Where the modelling presents areas of C/I falling below the CAP 670 threshold, it is anticipated that the quality of radio communications will be lower than the optimal reading of 5 on the 'readability scale'.

C/I can also occur in areas where the signal strength of the wanted RF signal is weak or heavily attenuated through terrain etc and where other unwanted signals overwhelm the much weaker field strength of the wanted signal. In such areas where the original field strength is weak in the first place, it is likely that the CNS signal quality will be unreliable even without the presence of Wind Farms.

- Conclusions

The results indicate that the Development could cause localised areas of C/I ratio falling below the CAP 670 Acceptance Criteria at 1,000ft AGL for both the TX and RX Comms sites. However, the regions affected are very small in size and localised to the Development.

- Recommendations

Sagentia Aviation recommends the Airport review the results of this assessment against the ATS they provide in the affected areas, specifically considering that C/I is localised to the Development and only present at low altitudes and that the impact to the ATS provided is likely to be negligible.

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1 Introduction

1.1 Introduction

Glasgow Prestwick Airport ("the Airport") is responsible for the technical safeguarding of their Communications Navigation and Surveillance (CNS) systems in accordance with the Civil Aviation Authority (CAA) Publications (CAP).

SLR Consulting Limited ("the Client"), has commissioned Sagentia Aviation to conduct Technical Safeguarding Assessments ("the Assessments") to determine potential impacts of Dalfad Wind Farm ("the Development") upon the Airport's In-Scope CNS systems.

1.2 Purpose

This report details the approach and presents the results of the Assessments commissioned and identifies any potential impacts to the Airport's In-Scope CNS systems.

1.3 Scope

1.3.1 The Development

For the purposes of this report and the scope of work undertaken in the Assessments contained within, the Development is defined as the Wind Turbine Generators (WTGs) of Dalfad Wind Farm Development.

Figure 1 below depicts the Development's location in relation to the Airport. The Development lies approximately 14.7 Nautical Miles (NM) from the Airport's Aerodrome Reference Point (ARP).

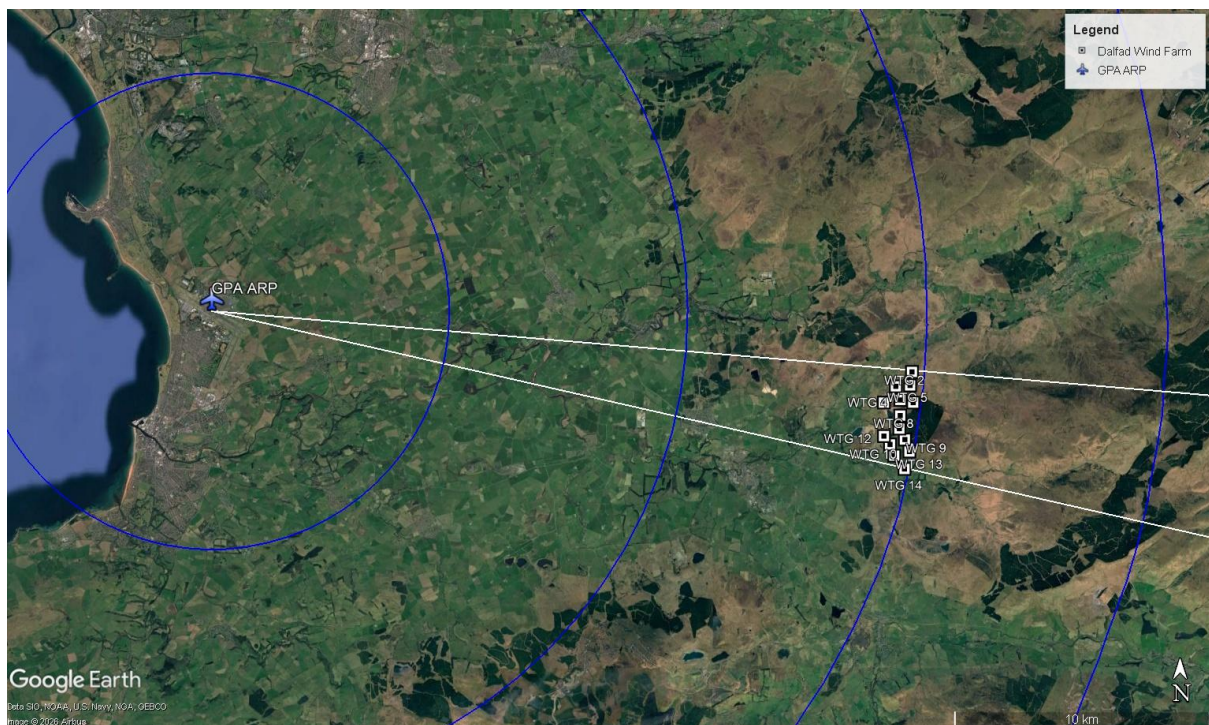


Figure 1 - The Development

The technical parameters including maximum turbine tip height Above Ground Level (AGL) used for the Development's WTGs are detailed in Table 1 below.

WTG	Eastings	Northings	Max Tip Height (m AGL)	Blade Length (m)	Blade Chord (m)	Hub Height (m AGL)	Tower Diameter (m)
WTG1	263439.731	623737.543	149.9	67.9	4.3	82	6.3
WTG2	263404.302	623263.880	200	81	4.3	119	6.3
WTG3	262783.916	623190.102	149.9	67.9	4.3	82	6.3
WTG4	262987.165	622730.977	200	81	4.3	119	6.3
WTG5	263446.438	622593.375	200	81	4.3	119	6.3
WTG6	262294.978	622772.913	149.9	67.9	4.3	82	6.3
WTG7	262917.231	622102.321	200	81	4.3	119	6.3
WTG8	262875.125	621606.938	200	81	4.3	119	6.3
WTG9	263075.219	621176.375	200	81	4.3	119	6.3
WTG10	263155.555	620706.913	200	81	4.3	119	6.3
WTG11	262499.407	621003.113	200	81	4.3	119	6.3
WTG12	262270.500	621337.000	200	81	4.3	119	6.3
WTG13	262638.966	620645.000	149.9	67.9	4.3	82	6.3
WTG14	263022.607	620036.250	149.9	67.9	4.3	82	6.3

Table 1 - Development WTG Parameters



Figure 2 - Development Layout

1.4 The Requirement

The Airport is responsible for the technical safeguarding of their CNS systems in accordance with the CAP 670 requirements. The Client has commissioned Sagentia Aviation to undertake the following Assessments to determine the level of impact caused by the presence of the proposed wind farm located within the Airport's Very High Frequency (VHF) Communications (Comms) Designated Operational Coverage (DOC):

- CNS Coverage Assessment (Intervisibility)
- CAP 670 Compliant VHF Carrier Interference (C/I) Ratio Assessment

Note: The CAP 670 GEN02.7 prescribes that every aeronautical radio station (CNS) requires a technical area to be safeguarded against the possibility that buildings or other structures erected within the safeguarded area cause interference to the signal radiated by that station. This is achieved by assessing a physical safeguarding frame (zone) which is sized and shaped for the respective CNS system. Sagentia Aviation has conducted a course appraisal in the production of the proposal for this report and concluded that the distance of the closest WTG of the Development is outside any prescribed physical safeguarding zone for the Airport's CNS and as such, Sagentia Aviation have not included a CAP 670 GEN02.7 physical safeguarding assessment within the scope of work undertaken in the Assessments.

1.5 The Assessments

Table 2 below details the Airport's CNS systems and the respective assessments that have been undertaken.

In Scope CNS	Section 2 CNS Coverage Assessment (Intervisibility)	Section 3 CAP 670 Compliant VHF C/I Ratio Assessment
VHF Comms Transmitter (TX) Site	✓	✓
VHF Comms Receiver (RX) Site	✓	✓

Table 2 - In-Scope CNS Systems and Relevant Assessments

1.6 Abbreviations

Abbreviation	Meaning
'the Airport'	Glasgow Prestwick Airport
'the Assessments'	Technical Safeguarding Assessments
'the Client'	SLR Consulting Limited
'the Development'	Dalfad Wind Farm Development
AGL	Above Ground Level
AIP	Aeronautical Information Publication
ARP	Aerodrome Reference Point
ASL	Above Sea Level
ATS	Air Traffic Services
C/I	Carrier Interference
CAA	Civil Aviation Authority
CAP	CAA Publication
CNS	Communications Navigation and Surveillance
Comms	Communications
dB	decibel
DOC	Declared Operational Coverage
DTM	Digital Terrain Model
ft	Feet
HTZ Comms	ATDI HTZ Communications
m	Meters
NM	Nautical Mile
RCS	Radar Cross Section
RF	Radio Frequency
RX	Receiver
TX	Transmitter
VHF	Very High Frequency
WF	Wind Farm
WTG	Wind Turbine Generator

Table 3 - Abbreviations

2 Coverage Assessment (Intervisibility)

2.1 Introduction

This section presents the CNS Coverage Assessment (Intervisibility), using composite optical line of sight functions in ATDI HTZ Communications (HTZ Comms) to create coverage maps highlighting potential shadowing on the In-Scope CNS systems coverage caused by physical obstruction from the Development.

HTZ Comms is an industry standard RF network planning toolset with extensive RF Propagation analysis and modelling capabilities.

2.2 Overview

An Intervisibility calculation fundamentally ascertains whether a point in space can be directly seen from a source point, or whether the path to the point in space is blocked by an obstruction.

HTZ Comms incorporates extensive Digital Terrain Models (DTM) which feature not only terrain elevation at high resolution but also includes clutter layers (building and vegetation height).

2.3 Scope

The scope of the CNS Coverage Assessment (Intervisibility) undertaken, is against the following of the Airport's In-Scope CNS systems:

- VHF Comms TX Site
- VHF Comms RX Site

2.4 Methodology

The In-Scope CNS systems are modelled as a source point by using x, y, z as location and height (of the antenna) parameters.

Traditionally WTGs have been modelled in the worst-case profile, whereby a blocking plane is created that is not only the full width and height of a WTG, but which is always oriented perpendicular to the CNS. This approach whilst considered worst case does not represent a real world scenario as WTGs are oriented towards wind direction and will very rarely be oriented face on to the CNS in question, and secondly, WTGs do not present a full 'blocking plane'.

Sagentia Aviation has followed a methodology whereby each WTG is modelled facing an average wind direction (a parameter provided by the Developer). This results in a blocking plane with a reduced 'building footprint' relative to how the In-Scope CNS would see the WTGs being used in the modelling.

Figure 3 below shows a WTG in worst case (facing the CNS system) where the blade is represented by the thick red line, with associated building footprint represented by the red circle.

Figure 4 below shows a WTG in a more realistic scenario facing the average prevailing wind direction where the blade is represented by the thick yellow line, with associated building footprint represented by the yellow circle.

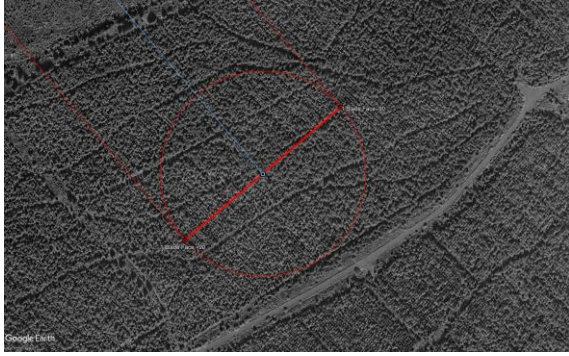


Figure 3 - Blade Worst Case Orientation

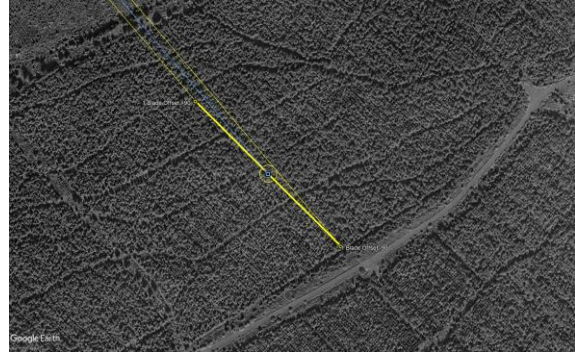


Figure 4 - Blade Offset Orientation

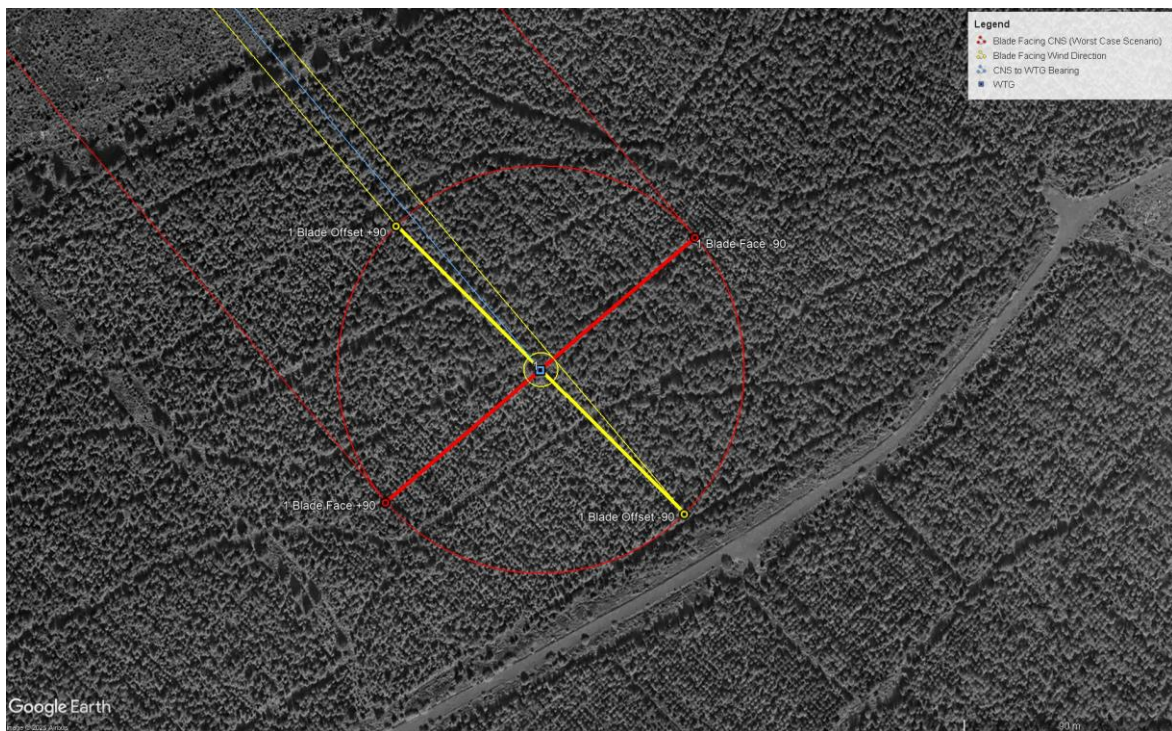


Figure 5 - Combined Orientations

As can be seen in the examples above, based on the wind direction used, the overall building footprint can be reduced in diameter, this will result in the potential shadow sectors being reduced in azimuth width relative to the CNS being considered as shown in Figure 6 below.

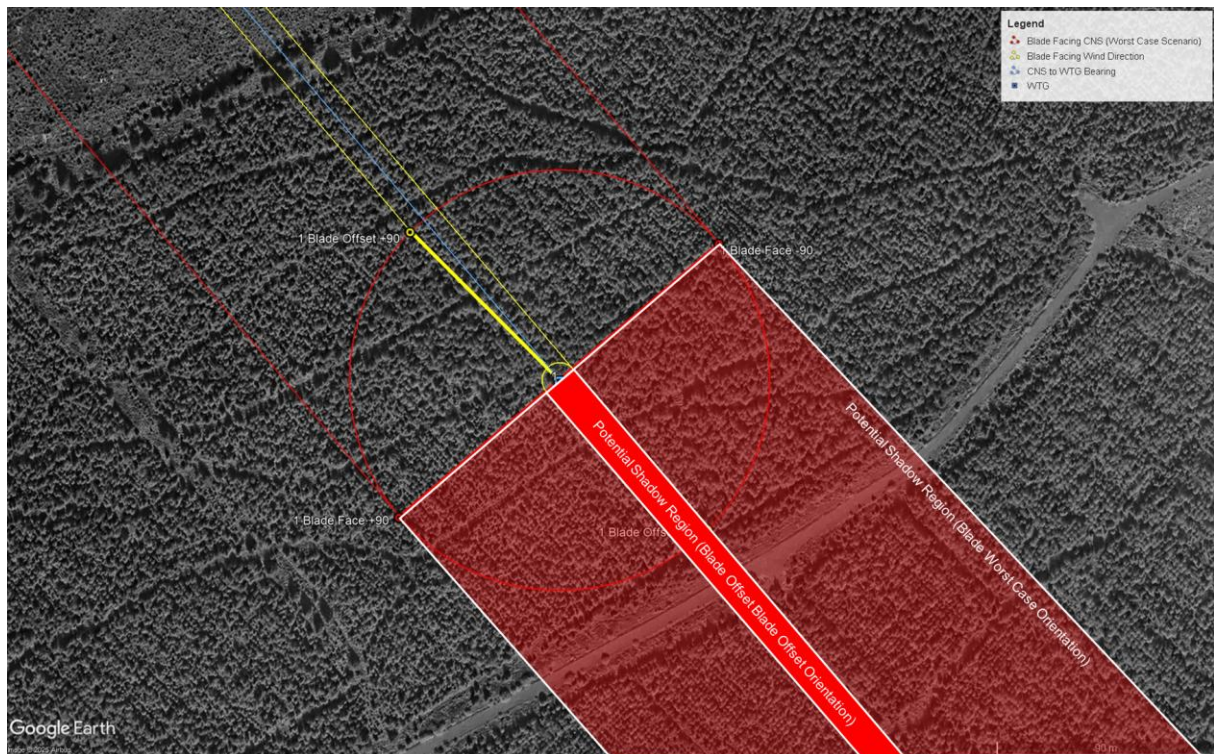


Figure 6 - Example Shadow Region Azimuth Width Reduction

Test points along an azimuth are tested at the same altitude path, either until the direct visibility is blocked by terrain, clutter, or the development or until the maximum test range as been reached. This process is repeated for every azimuth step from the Source Point with a full 360 intervisibility coverage chart being produced.

All assessments will be conducted to a range equal to the respective In-Scope CNS system's DOC as published in the UK Aeronautical Information Publication (AIP).

Figure 7 below depicts this process for a single azimuth step on a defined azimuth/ altitude path.

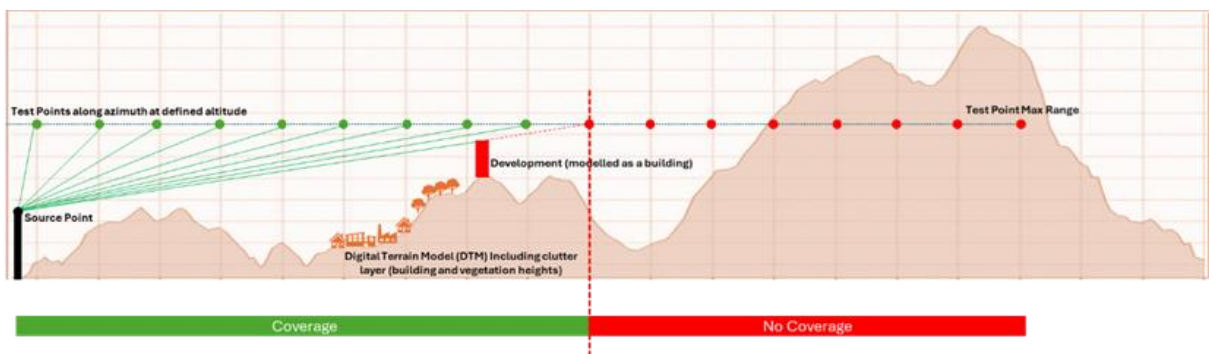


Figure 7 - Intervisibility Coverage Assessment along Azimuth/Altitude Path

Intervisibility coverage maps are produced for the In-Scope CNS for the following three use cases:

- Baseline Intervisibility Coverage
- Development Intervisibility Coverage
- Composite Intervisibility Coverage

2.4.1 Baseline Intervisibility Coverage Map

Baseline intervisibility coverage map without the Development. This displays the modelled coverage of the combined In-Scope CNS without any WTGs modelled. Figure 8 below depicts an example of a Baseline Intervisibility Coverage Map.

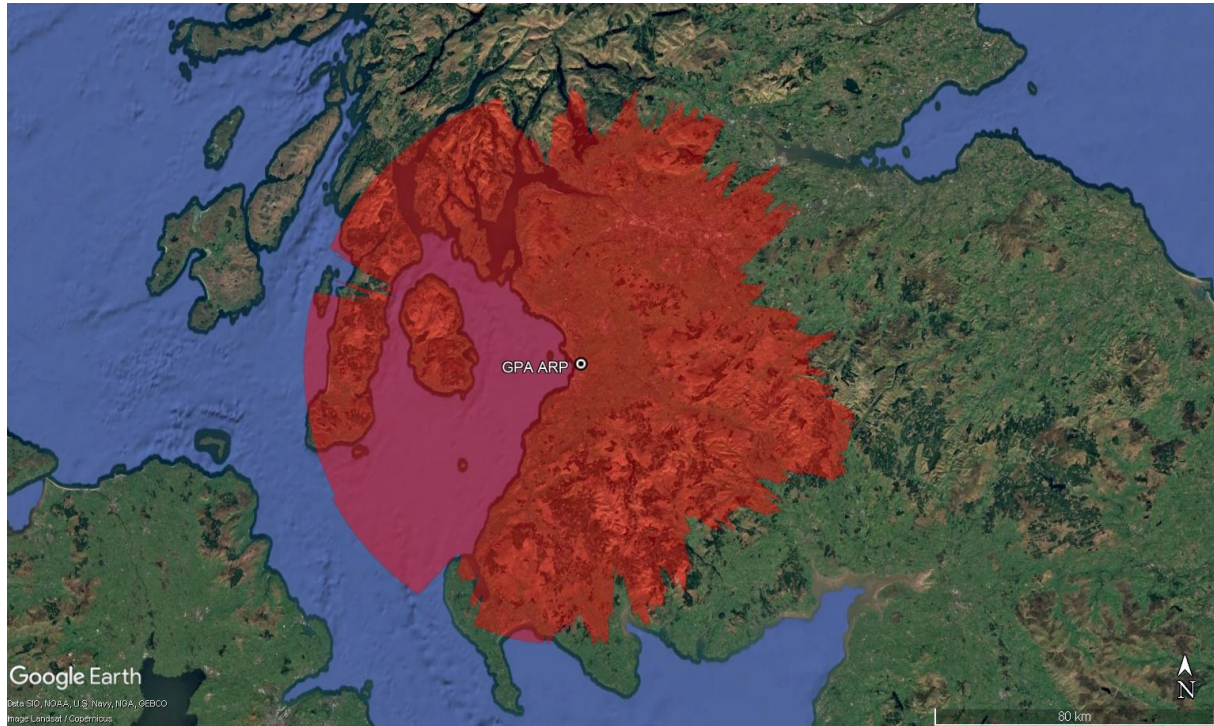


Figure 8 - Example Baseline Intervisibility Coverage Map

2.4.2 Development Intervisibility Coverage Map

An Intervisibility Coverage map with the WTGs of the Development modelled as buildings with respective footprint which equates to the maximum tip height of the WTGs in question offset to face the prevailing wind direction. This displays the coverage of the combined CNS with potential loss of coverage from the WTGs blocking the RF signal. Figure 9 below depicts an example of a Development Intervisibility Coverage Map.

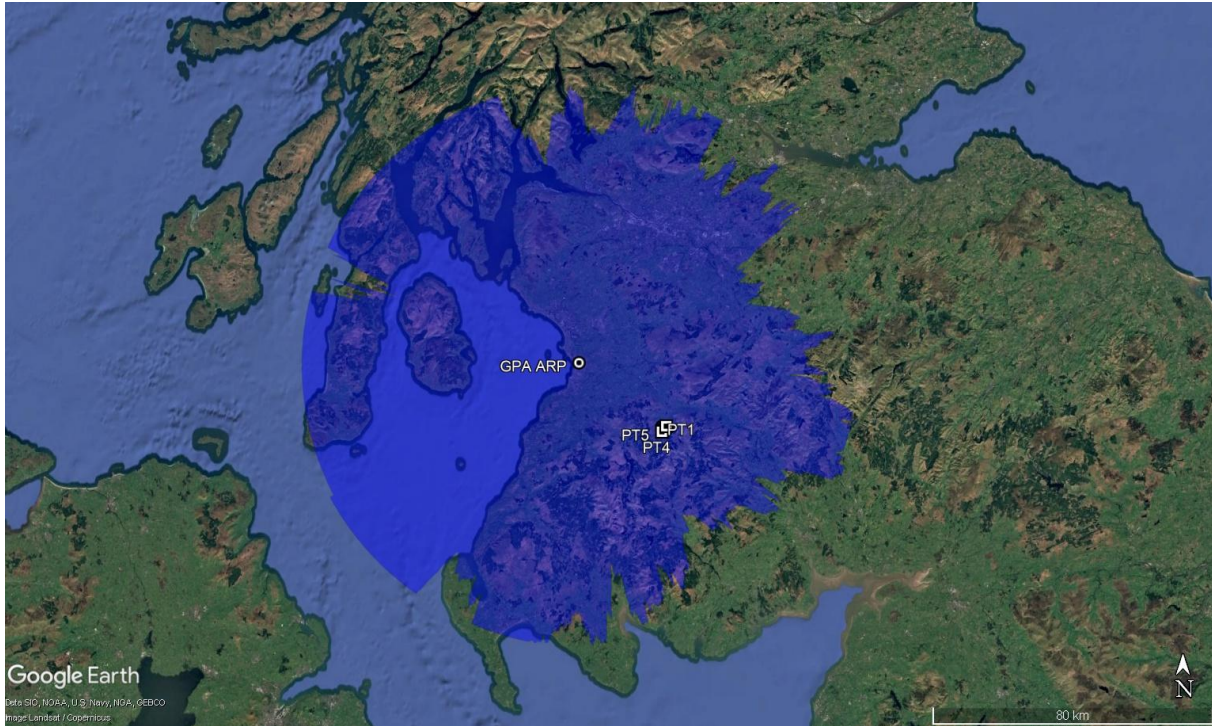


Figure 9 - Example Development Intervisibility Coverage Map

2.4.3 Composite Intervisibility Coverage Map

A composite Intervisibility Coverage map is presented which clearly depicts potential shadow regions behind the WTGs as shown on Figure 10 below as the red 'spokes' behind the WTGs.

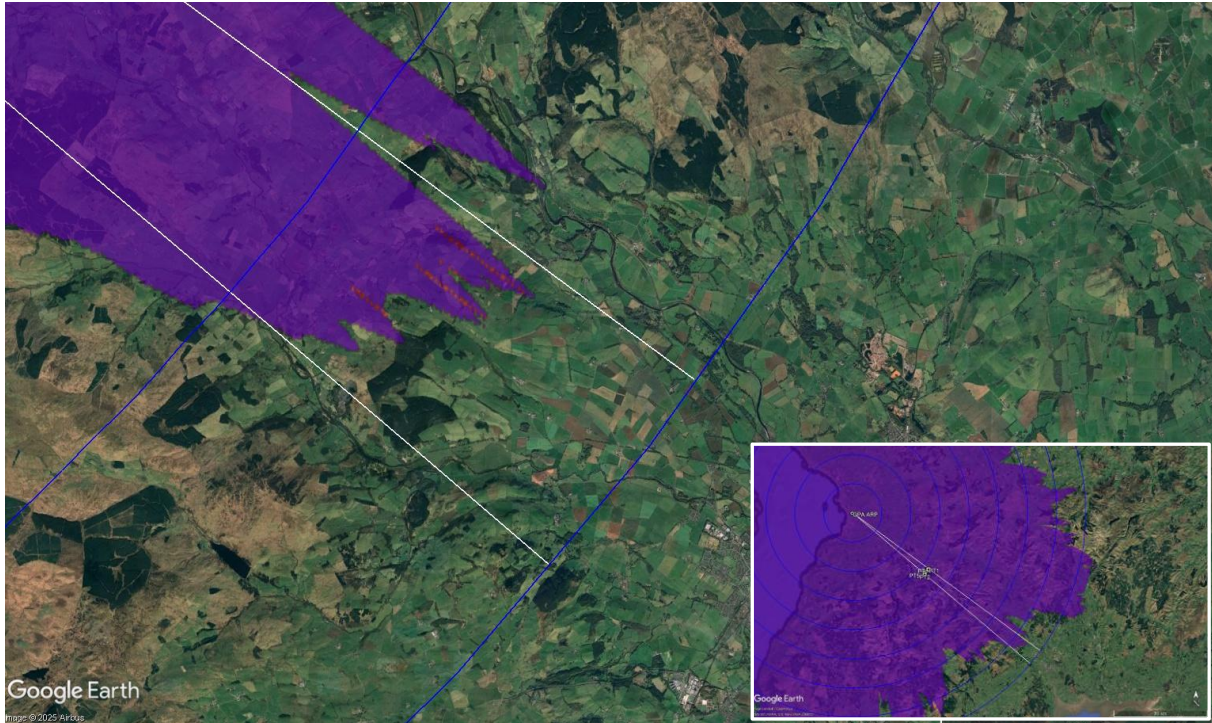


Figure 10 - Example Composite Intervisibility Coverage Map

To assess potential impacts at key altitudes, combined Intervisibility coverage maps for the In-Scope CNS and each use-case stated above were produced at the following heights:

- 500 feet (ft) Above Sea Level (ASL)

- 1,000ft ASL
- 1,500ft ASL
- 2,000ft ASL
- 3,000ft ASL
- 4,000ft ASL
- 5,000ft ASL

2.4.4 Impact Ratio

Additionally, an impact ratio is calculated, based on the area of the resultant blocking plane against the area of the oriented WTG's blades and tower structure combined.

This affords the Airport to not only knowing where potential shadow regions could occur, but also the percentage area of how much of that shadow region could be impacted at any one point in time.

The individual WTG impact ratios relative to the CNS Site are calculated and then averaged for the combined VHF coverage, based on the area of the total blocking plane oriented to the wind direction against the total structure area which is the sum of the area of the WTG's blades and the area of the static tower structure. Figure 11 below depicts how the Blocking Area and Total Structure areas are calculated.

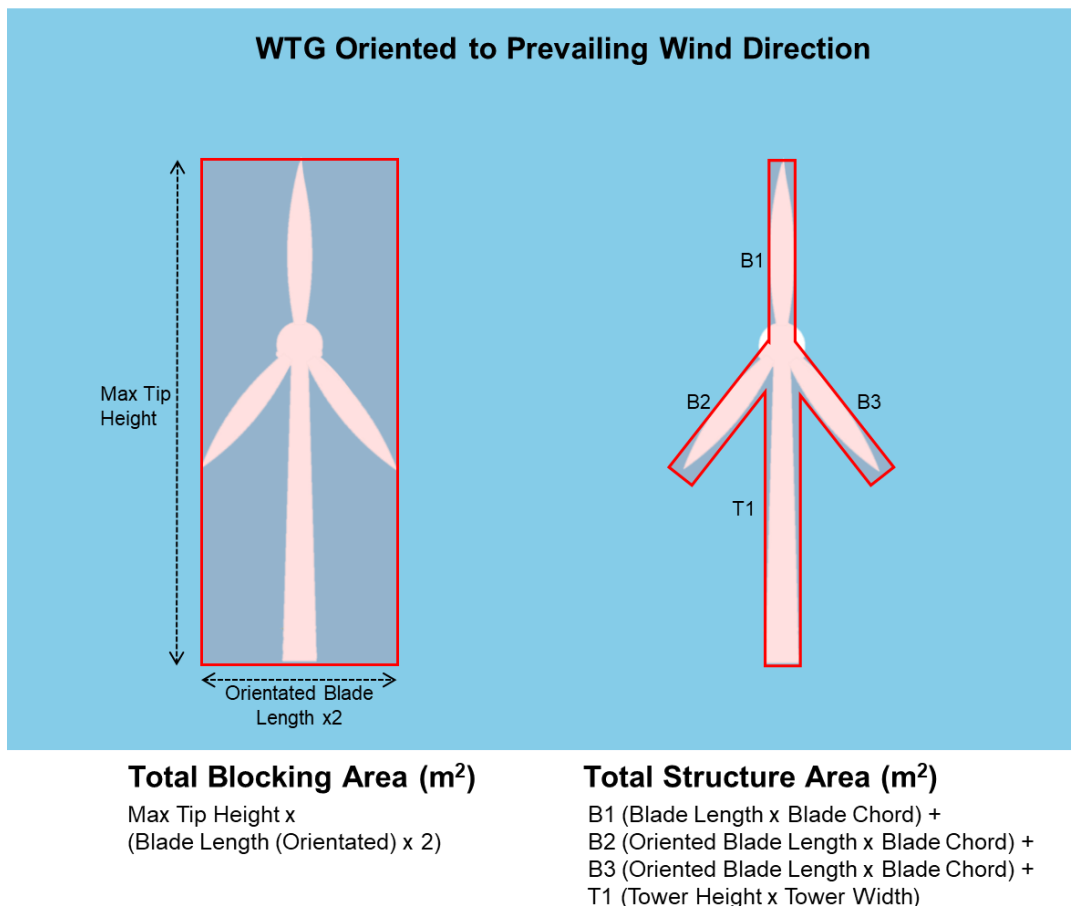


Figure 11 - Impact Ratio Calculation

The average impact ratio for all WTGs is calculated to give an indication of how much of the shadow regions displayed (red shadow regions) for each altitude could be impacted at any one point in time.

2.5 Results

2.5.1 Impact Ratios

2.5.1.1 VHF Comms TX Site

Table 4 below shows the calculated impacted ratios for each of the WTGs oriented to the prevailing wind in respect to the VHF Comms TX Site.

WTG	Total Structure Area (m ²)	Total Blocking Area (m ²)	Impact Ratio
WTG1	1186	13167	9%
WTG2	1538	20456	8%
WTG3	1176	12826	9%
WTG4	1526	19918	8%
WTG5	1525	19879	8%
WTG6	1165	12436	9%
WTG7	1514	19368	8%
WTG8	1504	18901	8%
WTG9	1497	18542	8%
WTG10	1488	18146	8%
WTG11	1491	18272	8%
WTG12	1497	18539	8%
WTG13	1132	11263	10%
WTG14	1124	11006	10%
Average Impact Ratio			8%

Table 4 - TX Site WTG Impact Ratios

2.5.1.2 VHF Comms RX Site

Table 5 below shows the calculated impacted ratios for each of the WTGs oriented to the prevailing wind in respect to the VHF Comms RX Site.

WTG	Total Structure Area (m ²)	Total Blocking Area (m ²)	Impact Ratio
WTG1	1196	13512	9%
WTG2	1549	20983	7%
WTG3	1186	13163	9%
WTG4	1537	20425	8%
WTG5	1536	20374	8%
WTG6	1175	12757	9%
WTG7	1525	19845	8%
WTG8	1514	19352	8%
WTG9	1506	18969	8%
WTG10	1497	18547	8%
WTG11	1500	18692	8%
WTG12	1506	18979	8%

WTG	Total Structure Area (m ²)	Total Blocking Area (m ²)	Impact Ratio
WTG13	1139	11511	10%
WTG14	1131	11235	10%
Average Impact Ratio			8%

Table 5 - RX Site WTG Impact Ratios

2.5.1.3 VHF Comms Combined Impact Ratio

The Combined Impact Ratio is calculated as the average Impact Ratio from the VHF Comms TX Site (8%) and the VHF Comms RX Site (8%) and equals **8%**.

2.5.2 VHF Comms Coverage Impact Summary

Composite Intervisibility Coverage maps (Appendix A) have been produced and assessed; each presents the combined VHF Comms for the In-Scope CNS.

Potential shadowing on the VHF Comms coverage caused by physical obstruction from the Development oriented to the prevailing wind direction is presented in Table 6 below:

Altitude	Overall Wind Farm Sector	Impacted Range Window Depth (circa NM)	Average Impact Ratio	Appendix A Reference
500ft ASL	Nil	Nil	Nil	Figure 12
1,000ft ASL	Nil	Nil	Nil	Figure 13
1,500ft ASL	94.63° to 102.53°	14.64 NM to 18.54 NM	8%	Figure 14
2,000ft ASL	94.63° to 102.53°	19.60 NM to 23.96 NM	8%	Figure 15
3,000ft ASL	94.63° to 102.53°	28.06 NM to 33.77 NM	8%	Figure 16
4,000ft ASL	94.63° to 102.53°	35.81 NM to 42.51 NM	8%	Figure 17
5,000ft ASL	94.63° to 102.53°	42.00 NM to 42.50 NM ¹	8%	Figure 18

Table 6 - VHF Comms Coverage Impact Summary

2.6 Conclusions

The results indicate that the development could cause areas of shadowing at altitudes of 1,500 ft ASL and above, assessed for VHF Comms.

The predicted shadow regions are always directly behind the individual WTGs. In all instances the depth of the potential shadow regions increases slightly with altitude.

The WTGs have been modelled in a realistic profile orientated towards the average prevailing wind direction of 225°, this reduces the width of the 'blocking face' presented to the respective VHF CNS and would subsequently reduce the impacted azimuth widths of any affected areas for each WTG.

Only 8% of the VHF Comms shadow areas visible on the combined Composite Intervisibility Coverage maps presented in Appendix A would have degraded coverage at any one point in time.

¹ Note that the assessment range limit was set to 42.5 NM.

Additionally, the Airport should recognise that RF waves do not propagate only in direct 'straight lines', and that the impact is likely to be more distinct shadowing areas of degraded coverage directly behind the individual wind turbines rather than swathes of blank coverage.

2.7 Recommendations

The Airport should consider the nature of the indicated degradation being intermittent and changeable. The WTGs have been modelled in a realistic profile orientated towards the average prevailing wind direction of 225° however this may change at any point in time.

Sagentia Aviation recommends the Airport review the results of this assessment against the Air Traffic Services (ATS) they provide, specifically considering that shadow regions are very negligible in azimuth width and of which only 8% of the VHF Comms shadow areas will be affected at any one point in time.

3 CAP 670 Compliant VHF C/I Ratio Assessment

3.1 Introduction

This section presents the CAP 670 C/I Ratio Prediction Assessment, using the Network Interference functions in HTZ Comms to create C/I sum maps following the methodology prescribed in the CAP 670 GEN 02².

3.2 Overview

C/I refers to the phenomenon where an unwanted RF signal can cause degradation to a wanted RF signal in the same (or adjacent sub carrier) frequency band.

In the case of Wind Farms, WTGs can reflect the CNS RF signal such that it appears to have originated from an unwanted source. C/I ratio is the assessment of the level of that unwanted signal against the field strength of the wanted signal.

C/I can also occur in areas where the signal strength of the wanted RF signal is weak or heavily attenuated through terrain etc. and where other unwanted signals overwhelm the much weaker field strength of the wanted signal. In such areas where the original field strength is weak in the first place, it is likely that the CNS signal quality will be unreliable even without the presence of Wind Farms.

3.3 Scope

The scope of the CAP 670 Compliant VHF C/I Ratio Assessments undertaken, is against the following of the Airport's In-Scope CNS systems:

- VHF Comms TX Site
- VHF Comms RX Site

3.4 Methodology

C/I ratio maps are produced for In-Scope CNS at each altitude being assessed following the CAP 670 methodology, which considers interference from terrain and interference generated from the Development. C/I below the CAP 670 threshold of 14 decibels (dB) is presented in the volume of interest.

3.5 Results

A summary of the results of the CAP 670 C/I Ratio predication assessment is presented in Table 7 below:

Altitude	CNS	CI Present below <14dB Threshold ³	Appendix B Reference
1,000ft AGL	TX	Yes	Figure 19
1,000ft AGL	RX	Yes	Figure 24
2,000ft AGL	TX	No	Figure 21
2,000ft AGL	RX	No	Figure 26

² Part B, Section 4: Appendix A to GEN 02: Methodology for the Prediction of Wind Turbine Interference Impact on Aeronautical Radio Station Infrastructure.

³ 'YES' indicates C/I that has been generated by the Development.

Altitude	CNS	CI Present below <14dB Threshold ³	Appendix B Reference
3,000ft AGL	TX	No	Figure 22
3,000ft AGL	RX	No	Figure 27
5,000ft ASL	TX	No	Figure 23
5,000ft ASL	RX	No	Figure 28

Table 7 - CAP 670 C/I Ratio Prediction Summary

3.6 Conclusions

C/I Ratio is the comparison of the strength of one RF signal against another, in this case between the strength of the In-Scope CNS and the signal strength modelled for the Development (the turbine related interference).

3.6.1 VHF Comms TX Site

The results indicate that for altitudes from 2,000ft AGL to 5,000ft ASL no C/I ratio below the CAP 670 criteria of <14dB is present.

The results also indicate that for the altitude of 1,000ft AGL, C/I ratio below the CAP 670 criteria of <14dB is present. However, on examining the field strength pattern at 1,000ft AGL, (see Figure 20 - VHF Comms TX Site 1,000ft AGL Field Strength Pattern, as an example for the VHF Comms TX Site), it can clearly be seen that the underlying terrain profiles significantly influence the results presented. As such it is concluded that the Development is not a significantly contributing factor of potential poor coverage in the volume of interest.

The following is a summary of the full C/I Ratio results for the VHF Comms TX Site:

- 1,000ft AGL
C/I is predicted as a result of the Development
- 2,000ft AGL
No C/I is predicted as a result of the Development
- 3,000ft AGL
No C/I is predicted as a result of the Development
- 5,000ft ASL
No C/I is predicted as a result of the Development

3.6.2 VHF Comms RX Site

The results indicate that for altitudes from 2,000ft AGL to 5,000ft ASL no C/I ratio below the CAP 670 criteria of <14dB is present.

The results also indicate that for the altitude of 1,000ft AGL, C/I ratio below the CAP 670 criteria of <14dB is present. However, on examining the field strength pattern at 1,000ft AGL, (see Figure 25, as an example for the VHF Comms RX Site), it can clearly be seen that the underlying terrain profiles significantly influence the results presented. As such it is concluded that the Development is not a significantly contributing factor of potential poor coverage in the volume of interest.

The following is a summary of the full C/I Ratio results for the VHF Comms RX Site:

- 1,000ft AGL
C/I is predicted as a result of the Development
- 2,000ft AGL
No C/I is predicted as a result of the Development

- 3,000ft AGL
No C/I is predicted as a result of the Development
- 5,000ft ASL
No C/I is predicted as a result of the Development

3.7 Recommendations

The CAP 670 threshold value of <14dB has been determined from laboratory-based susceptibility testing of a wide range of ground based and airborne radio receiver types. It includes a modest safety margin to allow for signal fading, effects of weather, multipath reflection etc., which will all potentially degrade the C/I ratio further.

Areas where C/I ratio <14dB is depicted indicate that audio quality of radio communications as perceived by either Air Traffic Controller or Pilot may be impaired.

The results indicate that the Development could cause localised areas of C/I ratio falling below the CAP 670 Acceptance Criteria at 1,000ft AGL for both the TX and RX comms sites. However, the regions affected are small in size and localised to the Development.

Sagentia Aviation recommends the Airport review the results of this assessment against the ATS they provide in the affected areas, specifically considering that C/I is localised to the Development and only present at low altitudes and that the impact to the ATS provided is likely to be negligible.

Appendix A CNS Intervisibility Coverage Maps

A.1 Introduction

In conducting the Intervisibility Coverage Assessment, many technical artifacts are generated. Map images are produced for three different use cases at every altitude being assessed for each CNS being considered.

To improve readability of this document, only the key Composite Intervisibility Coverage Maps have been included for reference in this Appendix.

The Baseline Intervisibility Coverage Maps and Development Intervisibility Coverage Maps are available for audit/ inspection by the Airport.

A.2 Contents

The contents of this Appendix are as follows:

- A.3 VHF Comms Composite Intervisibility Coverage Maps

Note: [Images are displayed from the next page onwards]

A.3 VHF Comms Composite Intervisibility Coverage Maps

A.3.1 500ft ASL

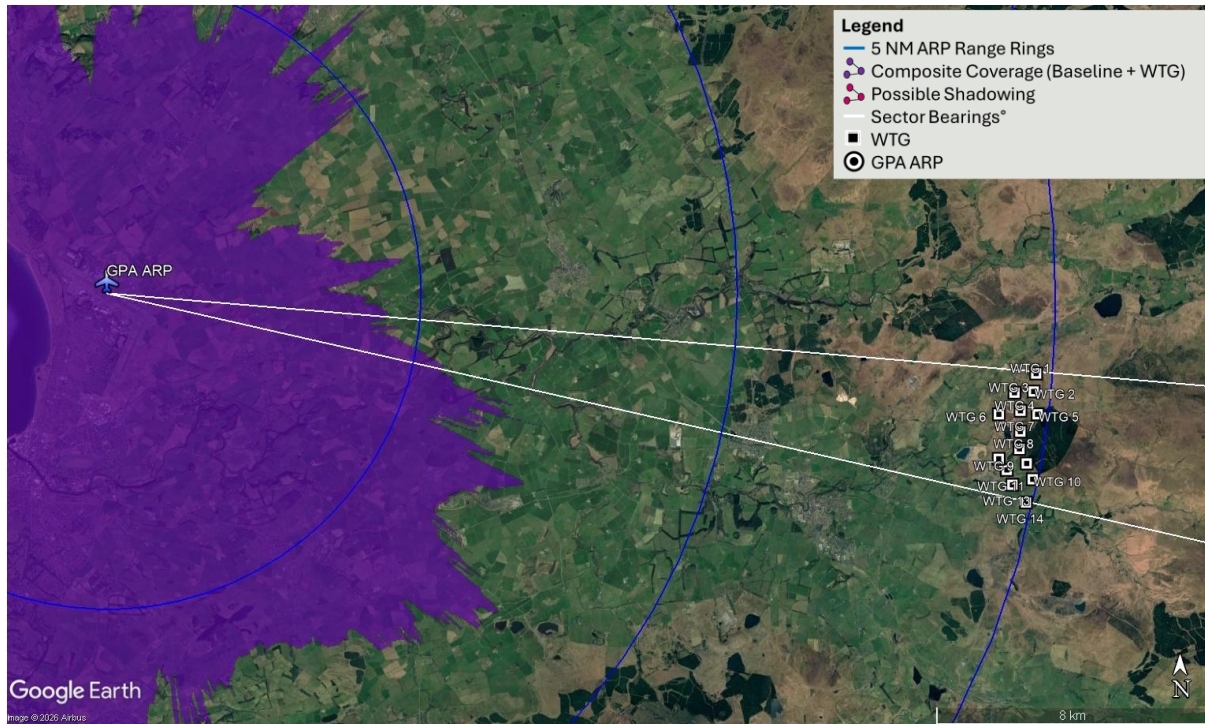


Figure 12 - VHF Comms 500ft ASL Composite Intervisibility Coverage Map

A.3.2 1,000ft ASL

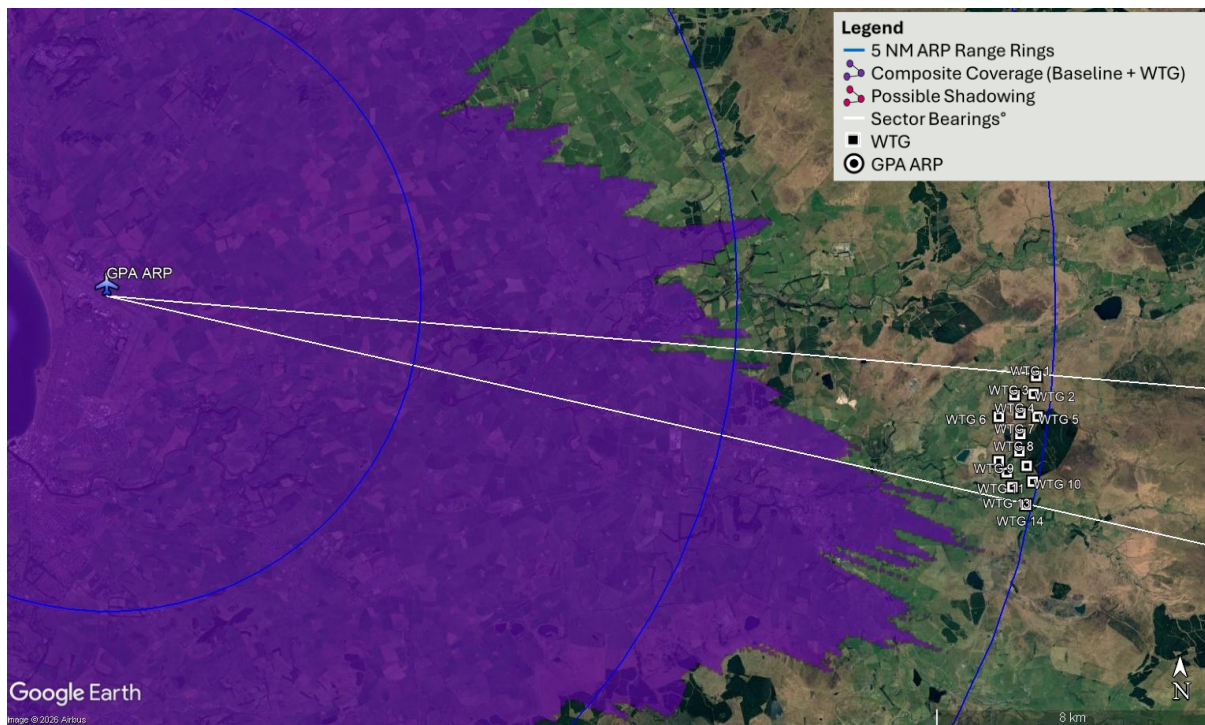
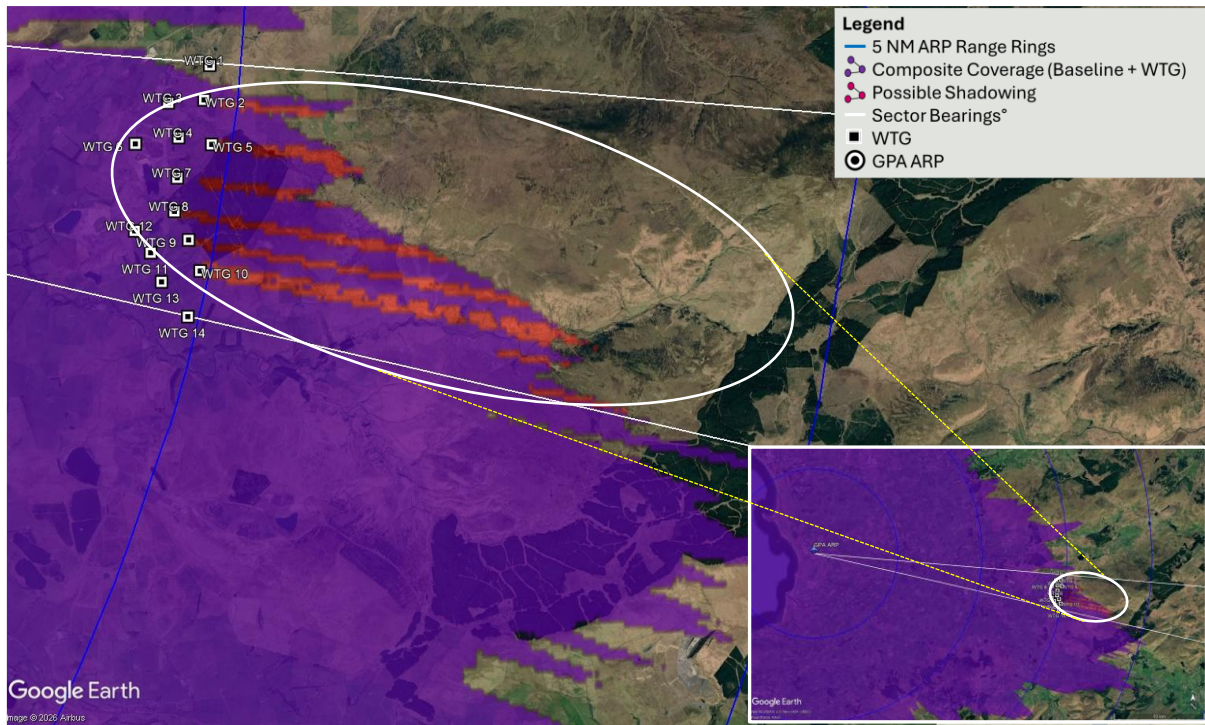


Figure 13 - VHF Comms 1,000ft ASL Composite Intervisibility Coverage Map

A.3.3 1,500ft ASL



A.3.5 3,000ft ASL

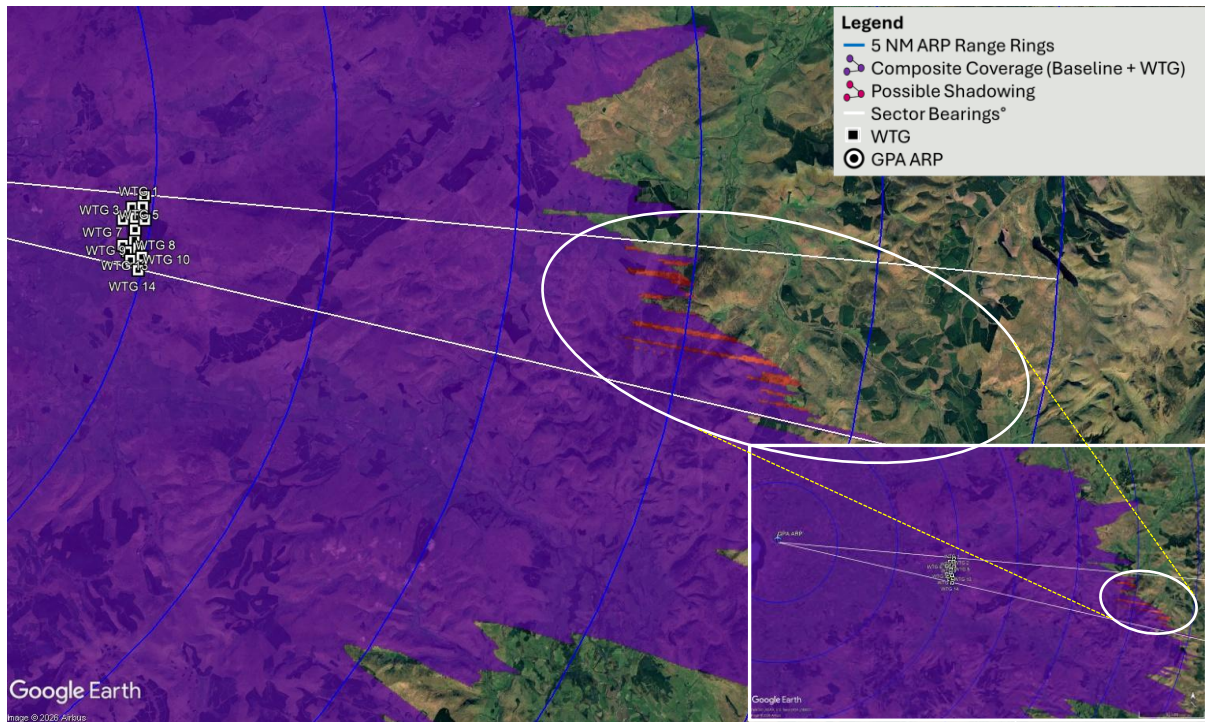


Figure 16 - VHF Comms 3,000ft ASL Composite Intervisibility Coverage Map

A.3.6 4,000ft ASL

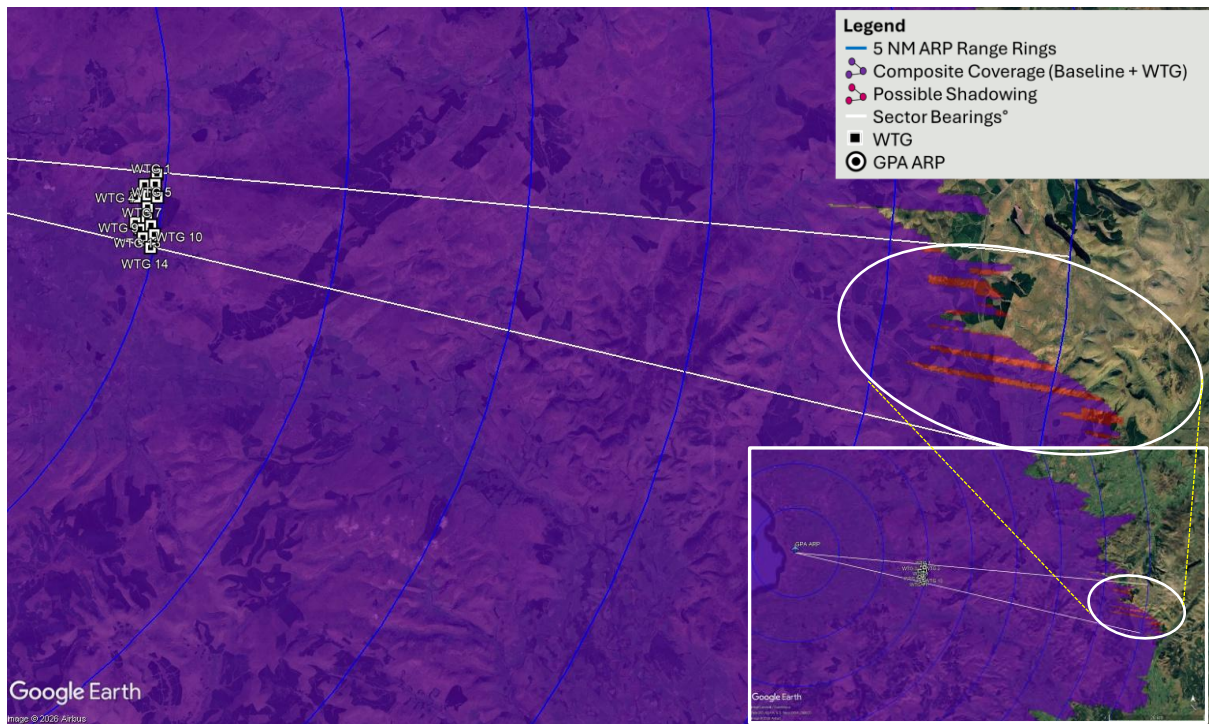


Figure 17 - VHF Comms 4,000ft ASL Composite Intervisibility Coverage Map

A.3.7 5,000ft ASL



Figure 18 - VHF Comms 5,000ft ASL Composite Intervisibility Coverage Map

Appendix B CAP 670 C/I Ratio Maps

B.1 Introduction

In conducting the CAP 670 C/I Ratio Prediction Assessment for the Development, many technical artifacts are generated. Map images are produced for Post Development at every altitude being assessed for each CNS system being considered. For ease of readability of the main report, these images are contained within this Appendix.

B.2 Contents

The contents of this Appendix are as follows:

- B.3 VHF Comms TX Site - CAP 670 C/I Ratio Maps
- B.4 VHF Comms RX Site - CAP 670 C/I Ratio Maps

Note: [Images are displayed from the next page onwards]

B.3 VHF Comms TX Site - CAP 670 C/I Ratio Maps

B.3.1 1,000ft AGL

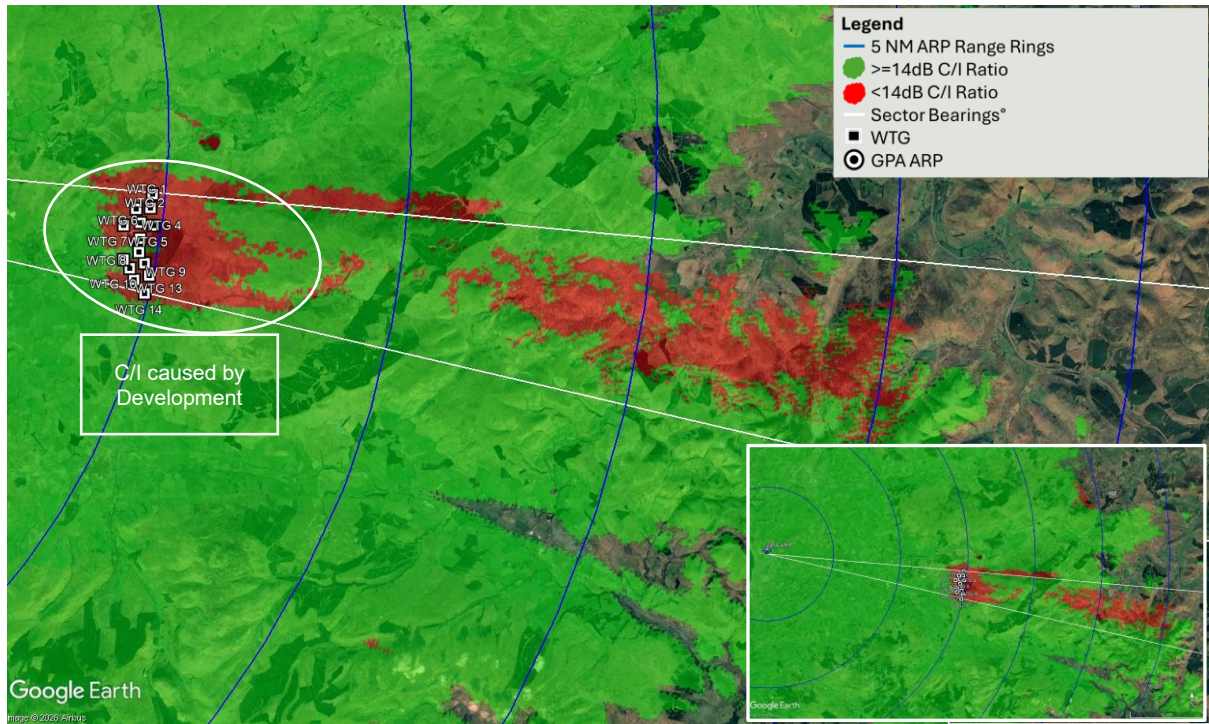


Figure 19 - VHF Comms TX Site 1,000ft AGL Post Development C/I Map

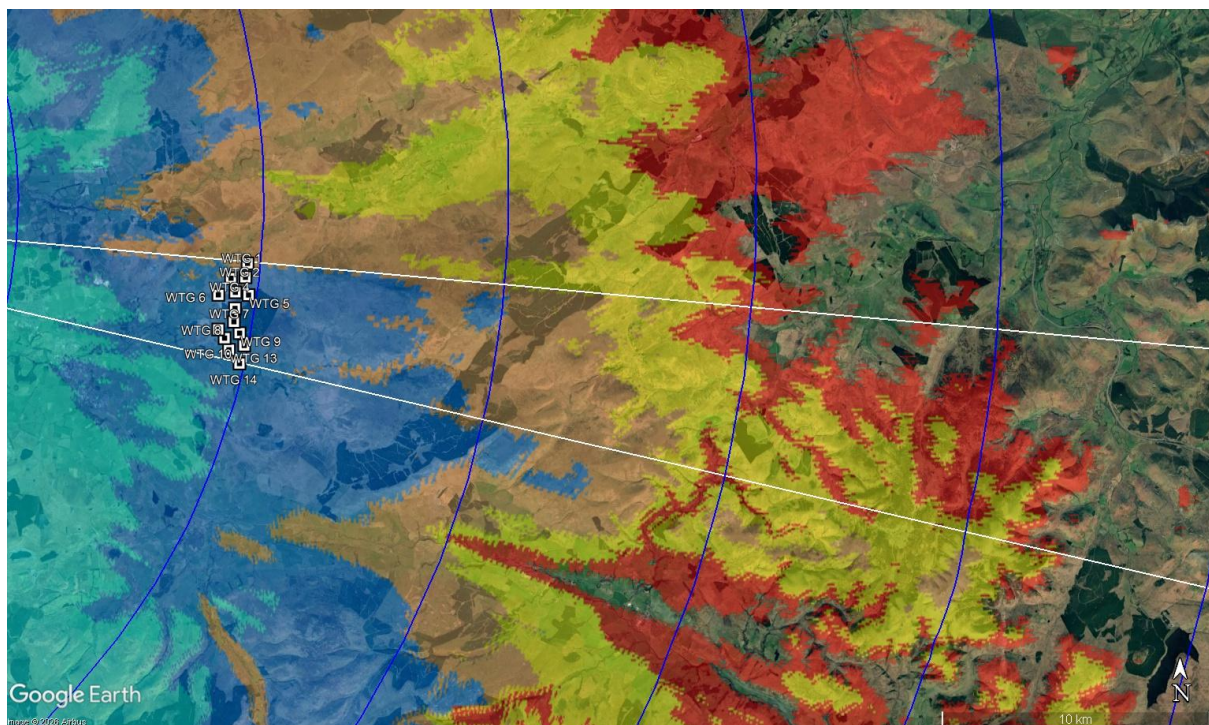


Figure 20 - VHF Comms TX Site 1,000ft AGL Field Strength Pattern

B.3.2 2,000ft AGL

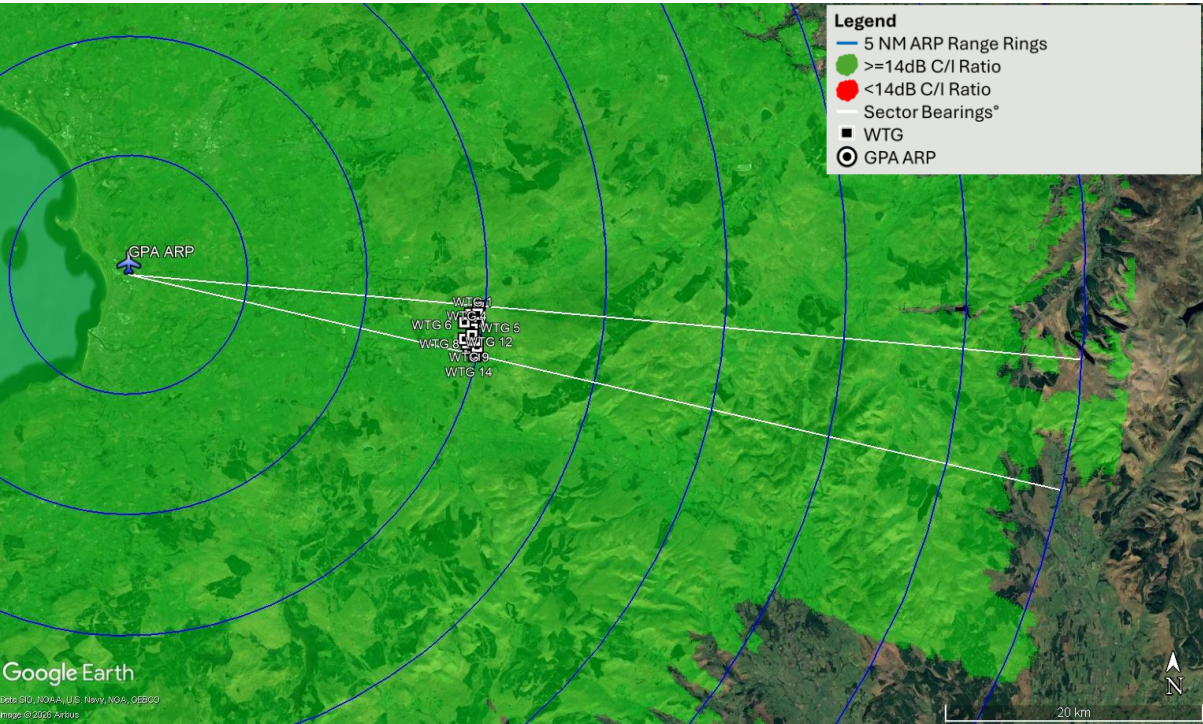


Figure 21 - VHF Comms TX Site 2,000ft AGL Post Development C/I Map

B.3.3 3,000ft AGL



Figure 22 - VHF Comms TX Site 3,000ft AGL Post Development C/I Map

B.3.4 5,000ft ASL



Figure 23 - VHF Comms TX Site 5,000ft ASL Post Development C/I Map

B.4 VHF Comms RX Site - CAP 670 C/I Ratio Maps

B.4.1 1,000ft AGL

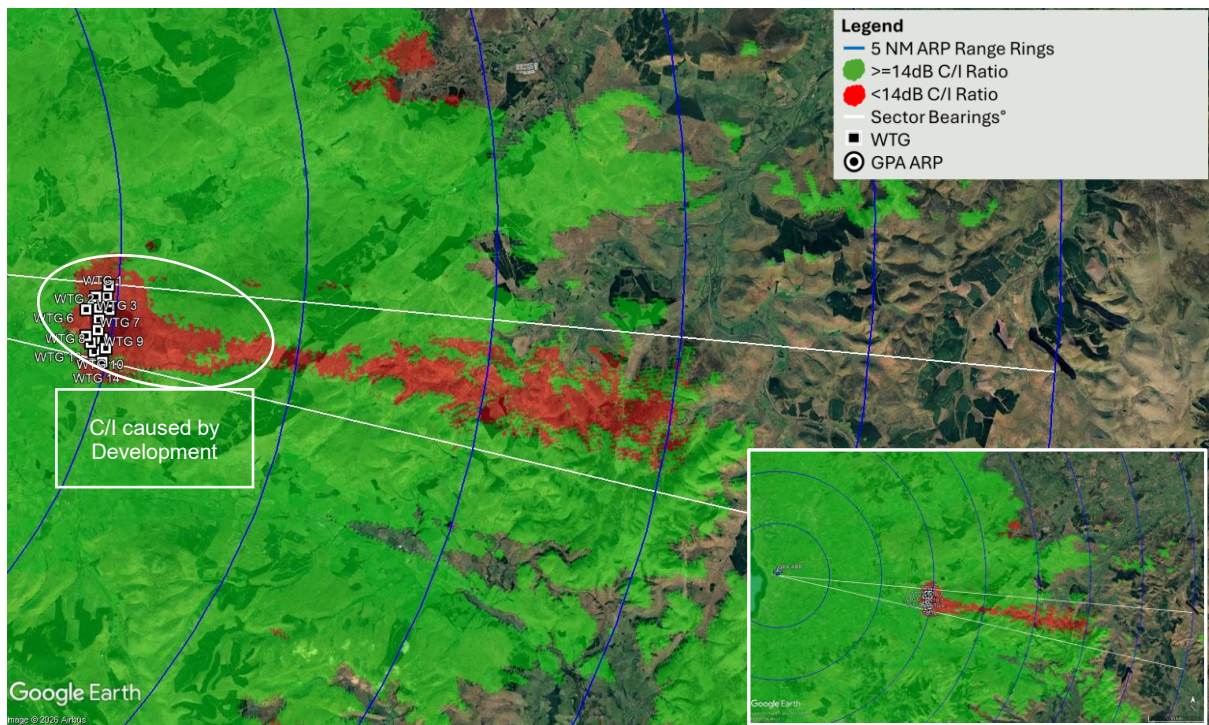
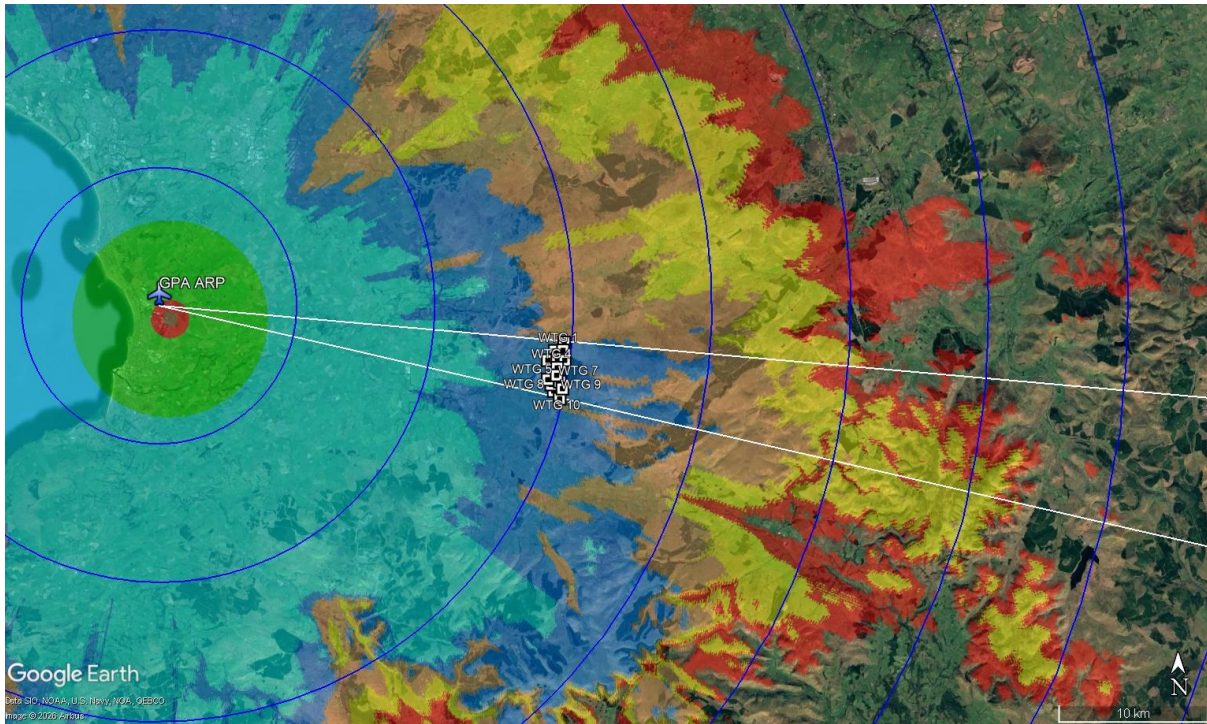


Figure 24 - VHF Comms RX Site 1,000ft AGL Post Development C/I Map



B.4.2 2,000ft AGL



B.4.3 3,000ft AGL

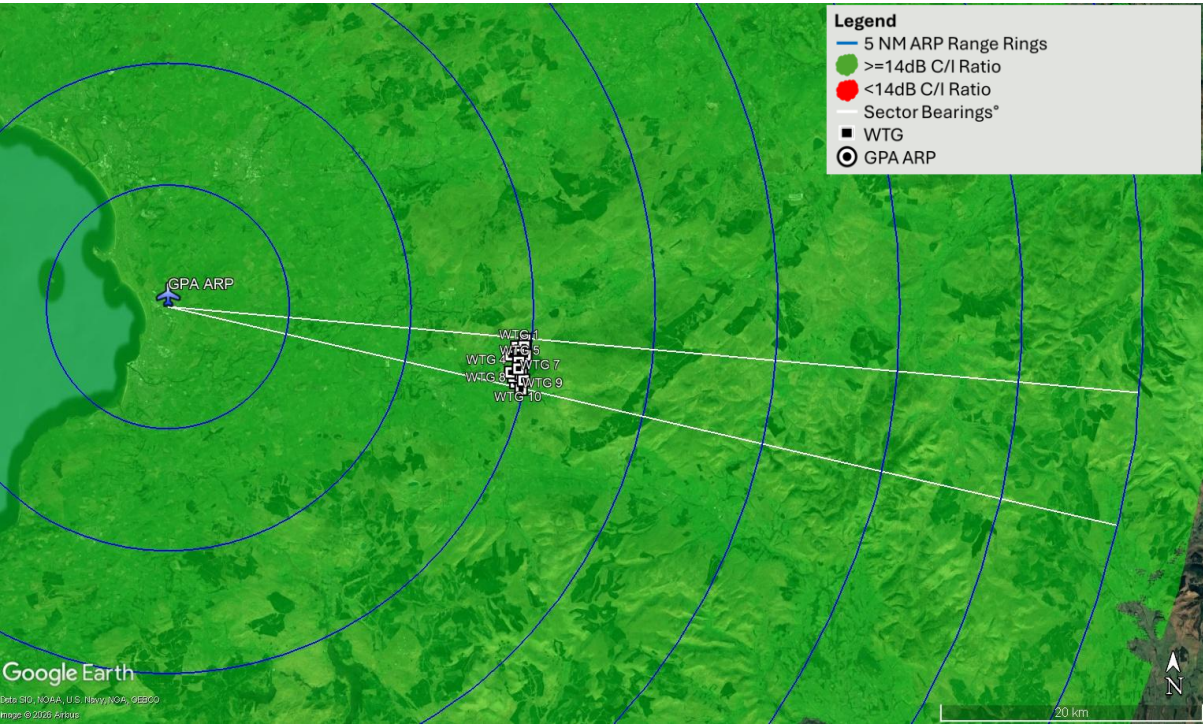


Figure 27 - VHF Comms RX Site 3,000ft AGL Post Development C/I Map

B.4.4 5,000ft ASL



Figure 28 - VHF Comms RX Site 5,000ft ASL Post Development C/I Map

About Sagentia Aviation

Osprey Consulting Services Ltd (t/a Sagentia Aviation) specialises in delivering innovative technical and engineering consultancy services in civil and military aviation environments. It serves government agencies, regulatory authorities, equipment providers, and airport and spaceport operators to enable change and solve critical aviation challenges.

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About Sagentia

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