



APPENDIX 14-3

***AI BRIDGES - COOLE WIND FARM
TELECOMMUNICATIONS
IMPACT STUDY***

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Report

Coole Wind Farm Telecommunications Impact Study

Document Number:

Author: David. McGrath.

Approved for Release: Rev 3.0 D McG **Date:** 11/02/21

Document Filename: *Coole Wind Farm Telecommunications Impact Study Report*

© copyright Ai Bridges Ltd. 2021

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

© copyright Ai Bridges Ltd. 2021
Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Executive Summary

Ai Bridges Ltd was commissioned to evaluate the possible effects that the proposed wind farm at Coole, Co Westmeath could have on the Three Ireland network following consultations between Three Ireland and the environmental consultant operating on behalf of Coole Wind Farm Ltd.

The consultations responses were reviewed and the microwave radio link technical information was identified. A survey was also conducted of all of the masts used by Three Ireland on their telecommunication network in the vicinity of the proposed Coole Wind Farm. The survey data was collated and indicated there were microwave radio dishes aligned on bearings in the direction of the proposed wind farm.

A software prediction analysis of the possible interference to the Three Ireland links was conducted and a 3D visualization was generated. The 3D visualization was used to illustrate the clearance/ interference conditions of the wind turbines on the Three Ireland links.

The analysis shows that only one of the links would be impacted and that there was a clearance condition on another of the links. The clearance was calculated to be 14.1m and it is unlikely to cause an issue. The impacted link is between the Multyfarnham Telecoms mast site to the Kilnaleck Telecoms mast-site and the interference condition is 67 m which is caused by T5 and this is the worst case scenario interference impact. There is also interference by T4 but to a lesser extent and a mitigation measure solution for the T5 impacts would resolve the T4 interference impact condition.

Further technical consultations were undertaken with Three Ireland to investigate suitable possible mitigation measure solutions to resolve the interference impacts of the T4 and T5 wind turbines. The 3 dimensional impact analysis on affected links was presented to Three Ireland. In a consultation response Three Ireland confirmed that the affected Multyfarnham to Kilnaleck link identified has been decommissioned and thus the proposed Coole Wind Farm would have no impacts on the Three Ireland network.

In December 2020, the EIAR consultants for the project were informed by another telecom operator – Ripplecom, that they also had a microwave radio link that could be impacted by the proposed wind farm. Ai Bridges were requested to conduct a detailed technical analysis on the Ripplecom telecommunications network. The analysis results indicated that the Ripplecom link would be impacted by wind turbine T15. The analysis findings were presented to Ripplecom and a mitigation measure was proposed. Ripplecom have accepted the mitigation measure proposal and have no further concerns regarding the proposed wind farm development.

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Sections

Section 1 - Wind Farm Site Information	4
Section 2 - Methodology.....	6
Section 3 - Telecom Operator Consultations	9
Section 4 - Field Surveys.....	25
Section 5 - Telecom Operator Links Analysis	29
Section 6 - Conclusions.....	35

Appendix

Appendix A – Coole Wind Farm Turbine Coordinates.....	38
---	----

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Section 1 - Wind Farm Site Information

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

1. Introduction

In this section a brief summary of the proposed wind farm site is provided. Details regarding the site’s geographic location and the proposed turbine dimensions are presented.

1.1 Wind Farm Site Information

The proposed wind farm development is located in County Westmeath, approximately 7km northwest of Castlepollard. The proposed tip height and rotor diameter of the turbines are shown below in Table 1. The co-ordinates of the turbines are listed in Appendix A.

Wind Farm	No. of Turbines	Turbine Tip Height (max)	Blade Length (max)
Coole	15	175m	77.5m

Table 1. Coole Wind Farm Turbine Details

The location of the proposed Coole Wind Farm development is shown below in Figure 1.



Figure 1. Location of proposed wind farm at Coole, Co, Westmeath.

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Section 2 - Methodology

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

2. Introduction

In this section a brief summary of the Telecommunications Impact Study Methodology is provided.

2.1 Methodology

The primary stages in preparing and compiling a telecommunications impact study are:

- Telecom Operator Consultations
- Field Surveys
- Desktop Survey Network Modelling and Analysis
- Report Generation

A summary of each of these stages is provided below:

Telecom Operator Consultations

An initial round of consultations with telecom operators were undertaken requesting them to raise any concerns they would have regarding the impact of the proposed wind farm on their networks. The consultation process was used to assist in identifying telecommunications infrastructure that could be impacted by the proposed wind farm development. Where the Telecoms Operators identify a potential impact on their network additional rounds of consultation may be required to inform the Desktop Analysis.

Field Surveys

Field surveys are undertaken and the co-ordinates of communication masts are recorded. During the field surveys of the communication sites, approximations of antenna size, bearing and height are made for the antennas installed on each of the masts surveyed.

Desktop Survey and Analysis

An initial desktop survey and analysis is carried out to plot the wind turbine network using a radio planning software tool. The radio planning tool uses GIS and terrain mapping databases to enable accurate modelling of the telecom operator radio links across all radio technologies. A selection of mast-site coordinates is then obtained within a study area in the vicinity of the proposed wind farm development. These co-ordinates are obtained from a database of national telecoms networks and also from information received from the various operators \ service providers during the consultation process. These are then converted from Irish National grid (Easting and Northing in meters) to degrees minutes seconds format and then imported into the radio planning tool. This provides a means of graphically showing the telecommunications sites in the vicinity, relative to the proposed wind farm. Where additional technical analysis was required additional cross-sectional analysis of the impacts were carried out and the findings of which are provided with the appendix sections of the report. In the event a severe interference impact requiring further analysis 3D software tools were employed to provide accurate visualisations for operators to finalise operator consultation outcomes.

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Figure 2 below shows the proposed Coole wind turbines plotted in the radio planning tool, along with telecommunication mast-sites in the surrounding areas. These mast-sites have been plotted relative to the proposed turbines.

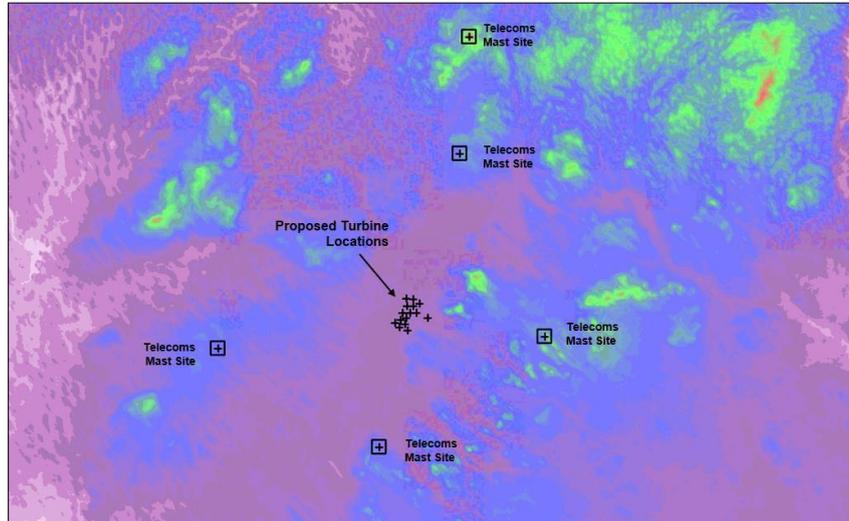


Figure 2. Proposed Coole Wind Turbines plotted in Radio Planning Software

The findings from the consultations are collated and the communications networks requiring further analysis are identified using the 3D network modelling features within the radio planning software. A network layout is then constructed within the software and this includes the construction of the wind turbines as 3D objects. The turbines are then imported into the network layout so that the impact of the turbines on the communications networks can be assessed. The results from the network modelling are used to determine if mitigation measures are required. Figure 3 below shows an example of a microwave radio link that passes near a wind turbine modelled in the radio planning software.

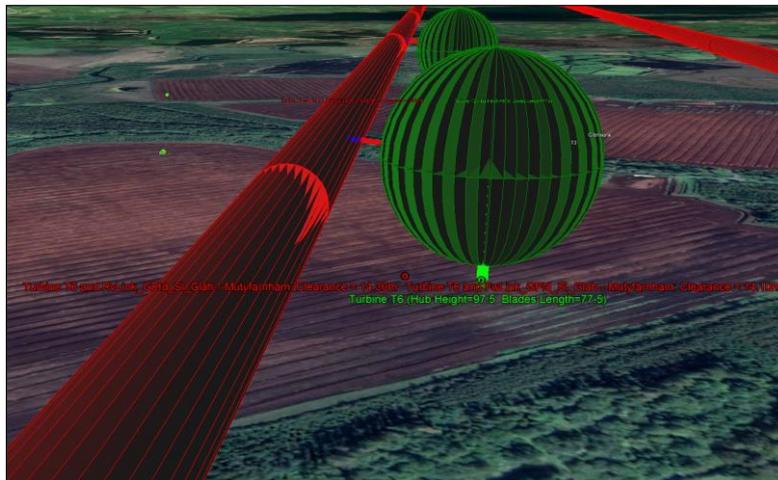


Figure 3. Example of microwave radio link crossing near a wind turbine modelled in radio planning software.

Report Generation

When the impact analysis is completed the results are collated and a 3D visualisation is created for inclusion in an Impact Assessment Report. The report would include all consultations, Desktop Survey and Analysis as well as proposed mitigation measures to remediate potential wind farm interference impacts. Mitigation Measure costs where agreed with the Telecoms Operators would also be included as part of the report.

© copyright Ai Bridges Ltd. 2021

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Section 3 - Telecom Operator Consultations

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

3. Introduction

In this section the consultation process undertaken with telecom operators is described. The response received from the operator(s) is also provided.

3.1 Telecom Operator Consultations

In December 2016, consultations with telecom operators began regarding a 13 turbine wind farm development at Coole. During these consultations Three Ireland indicated that they had three microwave radio transmission links in the vicinity of the proposed development.

Following further consultations with Three Ireland the wind farm turbine layout was amended to avoid the radio transmission links and the 13 wind turbine development was subsequently granted Planning Permission in 2019.

In 2021, Coole Wind Farm Ltd. aim to submit a new planning application for 15 Wind Turbines with tip heights up to 175m and rotor diameters up to 155m. 13 of the proposed Turbines will be in the same location as the permitted 13 Turbines. In accordance with planning regulations for the Environmental Impact Assessment (EIA) process, Telecom Operator consultations were commenced. During these consultations Three Ireland indicated that they have a new transmission link (Multyfarnham to Kilnaleck) in the vicinity of the proposed wind farm which could potentially be impacted. Three Ireland stated that this link was planned/installed in the 4th Quarter of 2016.

To assist in assessing the possible impact of the proposed wind farm on the Three Ireland network, Coole Wind Farm Ltd. appointed AiBridges Ltd to consult with Three Ireland and to propose possible mitigation measures where appropriate.

It should be noted that network analysis carried out by Ai Bridges Ltd indicated that a radio transmission link between Mulyfarnham and Kilnaleck would be impacted by turbines T5 and T6 (see Section 5.1.2).

In a further consultation response from Three Ireland they confirmed that the said link had been decommissioned and that there was no longer an impact from the proposed wind farm.

In December 2020, the EIAR consultants, were informed by another telecom operator – Ripplecom, that they also had a microwave radio link that could be impacted by the proposed wind farm. AiBridges carried out a detailed 3D modelling analysis of the telecommunications network. This analysis confirmed that wind turbine T15 would cause an impact to the Ripplecom radio link. Ai Bridges presented the network analysis findings to Ripplecom along with mitigation measure solution proposals. Following an extensive consultations process Ripplecom accepted the mitigation measure proposal and have no further concerns regarding the proposed wind farm development.

The consultations with Three Ireland are presented in Section 3.1.1 and the consultations with Ripplecom are presented in Section 3.1.2

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

3.1.1 Three Ireland Consultations

The initial consultation response received from Three Ireland in January 2017 is shown in Section 3.1.1.1. The most recent consultations from 2020 are provided in Section 3.1.1.2

3.1.1.1 2017 Consultations with Three Ireland

The consultation responses received from Three Ireland in 2017 are provided below.

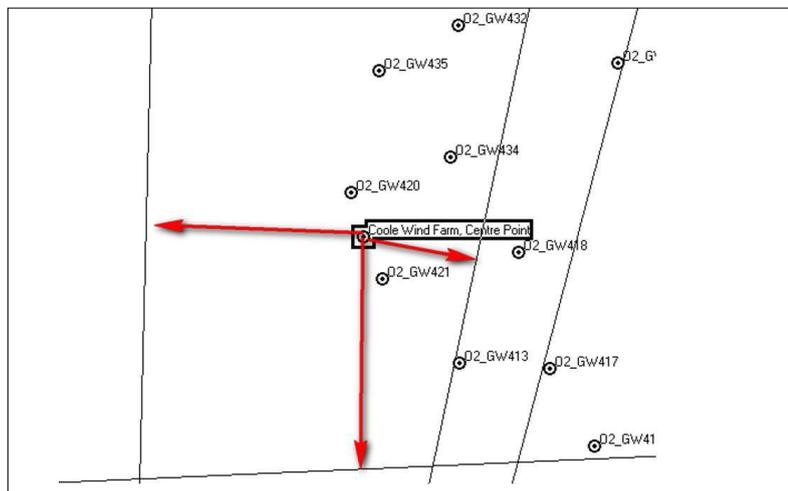
04/01/2017 – Three Ireland Response to Consultations

I've reviewed this proposed development based on the coordinates provided for the centre point and the potential impact this could have on the Three Network (including the legacy O2 network).

Our closest link is a H3G 6GHz between Vodafone Multyfarnham (238613,264058) and Slieve Glah (246271,300648). It's approx.. 670m to the East of the centre point.

Our closest link to the south is 1.377km away, a H3G 6GHz link from Camlisk More, Edgeworthstown (224267,272748) and Vodafone Ballany, Oldcastle (253180,274030).

Our closest link to the west is 1.284km away, a H3G 15GHz link from Vodafone Multyfarnham (238613,264058) to Finnea ESB (239088, 282913).



I hope this helps in determining where to place the turbines in this development. Do please let me know the specific coordinates for each turbine once they've been decided and we can analyse any potential impact more thoroughly.

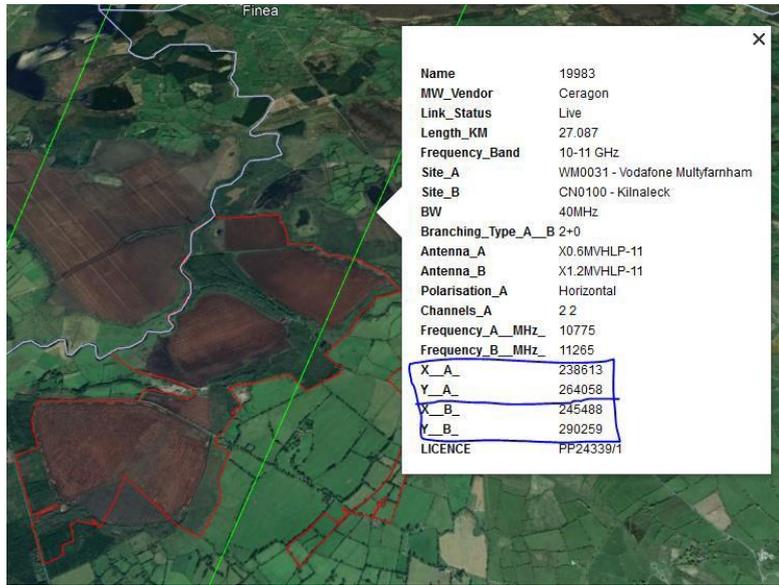
3.1.1.2 2020 Consultations with Three Ireland

The consultations with Three Ireland which were carried out in 2020 are provided below.

13/08/2020 – Three Ireland Response to Consultations

Please see below details for the current 3Ireland microwave link traversing and potentially being affected by the proposed windfarm. The coordinates are IG;

 Total Broadband Solutions	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21



If you could supply the turbine location coordinates in IG I can add to our planning tool and see if there is clearance for the link.

13/08/2020 – Three Ireland Response

This link was planned/installed in 4th Quarter of 2016.

31/08/2020 – Ai Bridges Letter of Consultation

Q: CEWF-EMI/AB/KH

31th August 2020,

RE: Coole Wind Farm Development,

Hello Allister,

Statkraft Ireland Ltd has engaged Ai Bridges Limited to prepare a detailed Technical Assessment for the potential impacts on the Three Ireland Network by a proposed 15-turbine Wind Farm Development at Coole in County Westmeath. This wind farm development had been previously permitted for 13-wind turbines.

We have been requested to follow up on their correspondence to-date with Three Ireland which re-commenced on the 11th August 2020 by their Environmental Consultants who are completing their EIA Assessments as part of the planning application.

It is our understanding that consultations regarding this wind farm first commenced with Three Ireland (Hutch/O2) in Dec 2015 when Three Ireland links in the vicinity of the wind farm were identified in consultations with Gerry Callan as follows

*“Our closest link is a H3G 6GHz between Vodafone Multyfarnham (238613,264058) and Slieve Glah (246271,300648). It’s approx.. 670m to the East of the centre point.
Our closest link to the south is 1.377km away, a H3G 6GHz link from Camlisk More, Edgeworthstown (224267,272748) and Vodafone Ballany, Oldcastle (253180,274030).
Our closest link to the west is 1.284km away, a H3G 15GHz link from Vodafone Multyfarnham (238613,264058) to Finnea ESB (239088, 282913).”*

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

In 2017, after the developer was made aware of these links by Three Ireland during the consultation process, the wind farm turbine layout was amended, in order to avoid impacting the link from Multyfarnham to Slieve Glah, and submitted as part of the planning application that received a Grant of Planning for the permitted 13-turbine wind farm.

We will be conducting a 3-dimensional radio planning analysis of the impacts that have been identified by Three Ireland during the recent consultation process. We would be grateful if you could

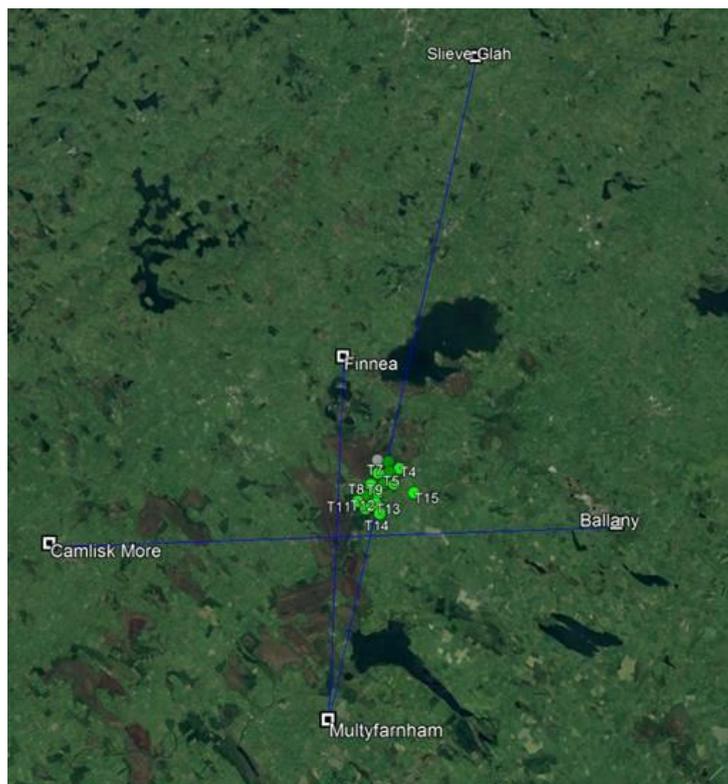
- confirm that there is only one link that is potentially impacted by the proposed wind farm development i.e. the link between Multyfarnham and Slieve Glah is the only link you have concerns about.
- confirm exact microwave radio link antenna co-ordinates (A-End and B-End) of the Link(s) and frequency of operation.
- confirm microwave radio link antenna heights and sizes.

If you have any queries regarding this project, please contact our offices at:

Ai Bridges Ltd.,
UNIT 9, BLOCK B,
Quin Rd. Business Park,
Ennis, Co. Clare,
Ireland.

Tel : [+353 65 6848768](tel:+353656848768)
FAX : [+353 65 6848769](tel:+353656848769)
Web : www.aibridges.ie

Encl.
Coole Wind Farm Development – Three Ireland Links



	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Yours sincerely,

Kevin Hayes
For and on behalf of **Ai Bridges Limited**

09/09/2020 – AiBridges Ltd Response

Hello Alistair

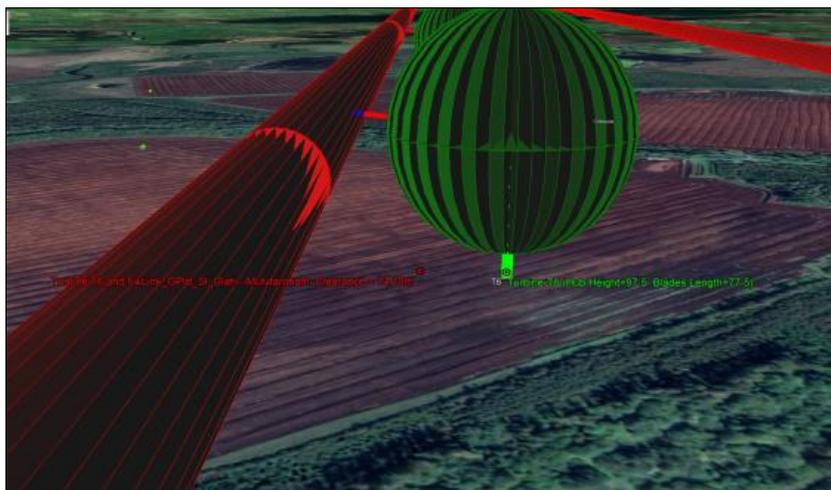
I am just following up on our recent consultation in relation to Coole Wind Farm.

Please find the attached 3 dimensional link analysis that we have conducted which shows that there is no interference on the Multyfarnham to Slieve Glah link operated by Three Ireland links . We have also carried our further analysis on the Multyfarnham to Kilnaleck link and there is likely to be an impact

Would you be available for a brief call later this week to discuss the typical mitigation measures that we have adopted with other mobile operators where we have identified cases of wind turbine interference

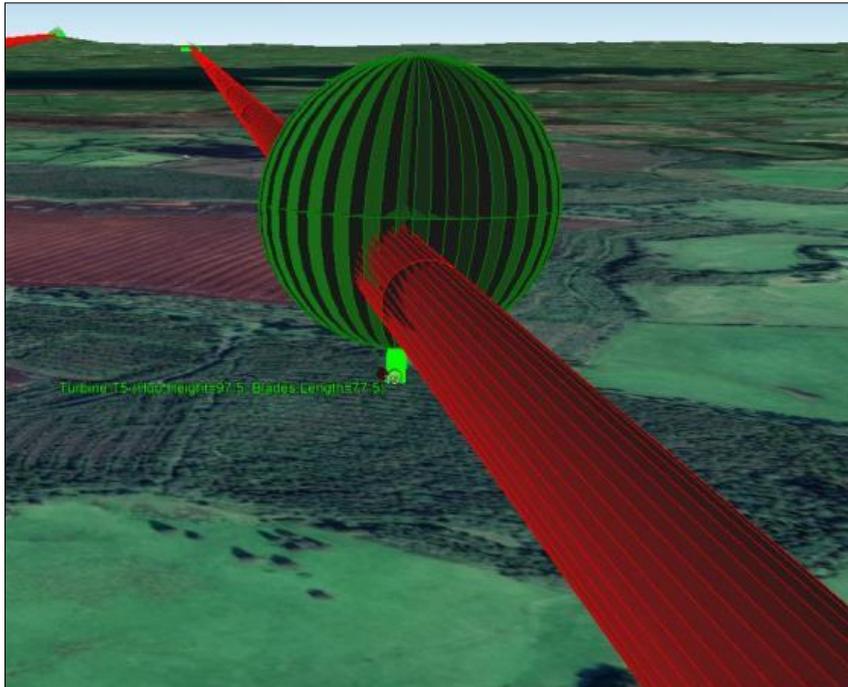
- Installation of a relay radio link around the interfering wind turbine
- Provision of a radio microwave service from an alternative mast site on the Three Network
- Provision of a fibre terrestrial the affected masts on the Three Network i.e. a terrestrial fibre based mitigation measure

Multyfarnham – Slieve Glah – No Interference Impacts



Multyfarnham – Kilnaleck – Interference Impacts

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21



09/09/2020 – Three Ireland Response

Hi Kevin,

Thank you for contacting me regards the potential impact on the link from Multyfarnham to Kilnaleck – this link is now decommissioned and 3Ireland have no other links traversing the Windfarm area.

09/09/2020 – AiBridges Ltd Response

Hello Alistair,

Thank you for this update. We will include your response as part of the planning submission

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

3.1.2 Ripplecom Consultations

The consultations with Ripplecom which were carried between December 2020 and February 2021 are provided below.

21/12/2020 – Ripplecom Response to Consultations

This development may impact a link to a customer in Granard.

Customer

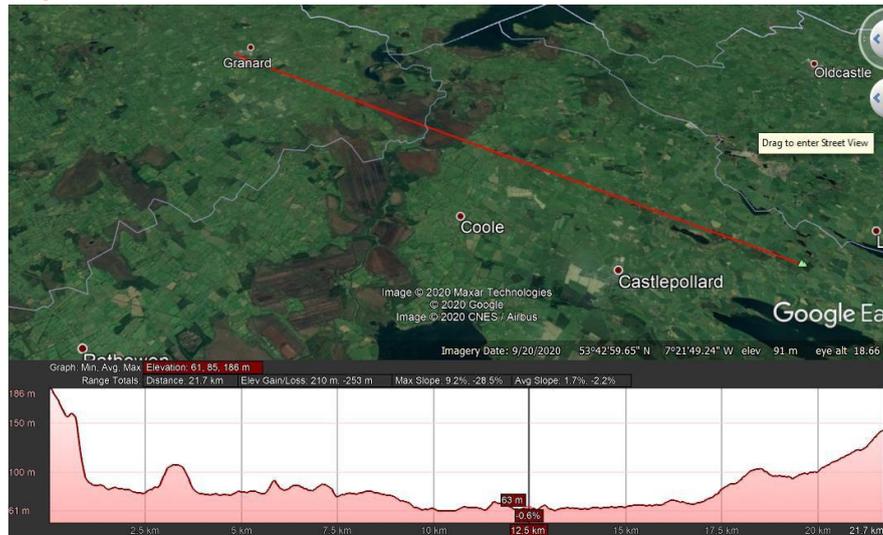
GPS: 53.7780720° , -7.5007500°

Height: 6m

High Site

GPS: 53.683378, -7.212596

Height: 5m



Regards,

Adrian Carroll | Network Operations Manager

T: 061 571156 | M: 086 8372264

E: adrian.carroll@ripplecom.net | W: ripplecom.net

Houston Hall, Raheen Business Park, Limerick, V94 PKF1

12/01/2021 – AiBridges Ltd Response

Hello Andrew,

We have been requested to carry out a detailed technical assessment on the possible impacts on your 17 GHz Radio Link to Granard, due to Coole Wind Farm.

So we can model the link as accurately as possible, could you provide the following information:

1. Co-ordinates of A-End and B-End
2. Antenna Heights
3. Tx and Rx Frequency
4. Dish Size
5. Transmit Power

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Please note, we are aware that the following co-ordinates have previously been provided for the radio link.

However, from our initial assessment there does not appear to be any telecoms equipment located at the High-Site GPS co-ordinates that were provided.

We would appreciate it if you could re-check the co-ordinates for this link.

Customer

GPS: 53.7780720° , -7.5007500°

Height: 6m

High Site

GPS: 53.683378, -7.212596

Height: 5m



14/01/2020 – Ripplecom Response

Yeah. I'm unsure of the site co-ordinates. I think they are wrong in our management platform. We will have to send some one to site to confirm. I will update you once we have this info.

14/01/2021 – AiBridges Ltd Response

Thank you for the update.

We are conducting field surveys on Telecoms Operator Sites this week and we will be completing our 3D interference prediction analysis this week so we would appreciate if you could forward the information

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

14/01/2021 – AiBridges Ltd Response

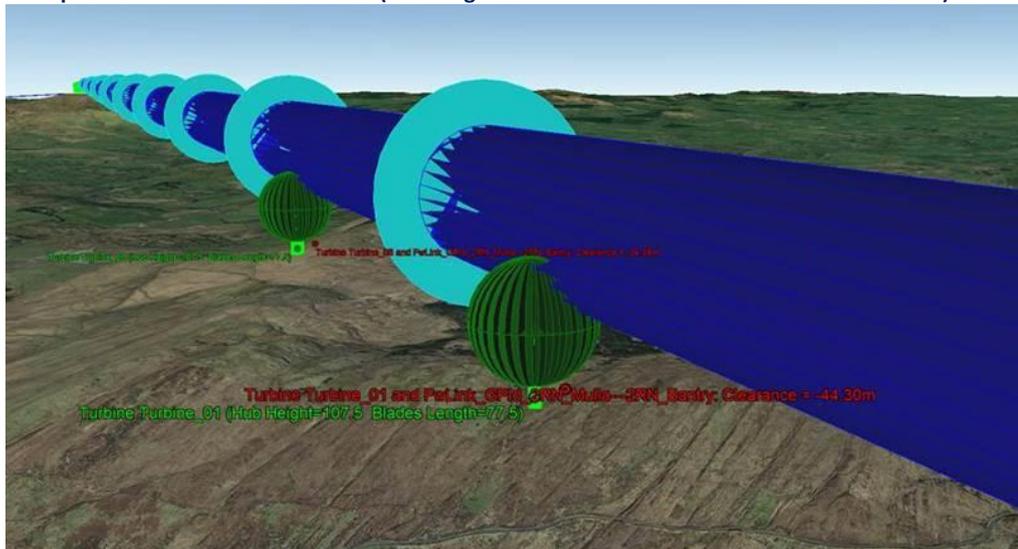
Hello Andrew,

Just to confirm that using a more accurate GIS Database there does appear to be a structure close to the co-ordinates that you have provided.

Would you be able to confirm if this is a Telecoms Mast Structure or a Monopole \ Timber Pole structure used as a relay site. As you can see in the example below the height of the dish (Above Mean Sea Level) will be critical in our analysis as a lower dish location would mean we may have ore clearance. This is only an example for reference purposes and is for another operator on another un-related site



Example : 3D Interference Prediction (showing 1st Fresnel Zone and the 0.6 1ST Fresnel Zone)



14/01/2020 – Ripplecom Response

Yes that would be it, it's the only structure on that hill, it's a small lattice mast. See pic below.

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21



21/01/2021 – AiBridges Ltd Response

Hello Andrew

I am following up from our call earlier this afternoon.

As discussed we have completed our desktop survey and analysis of the potential interference impacts of the Coole Wind Farm development on the 17GHz link operated by Ripplecom. We have also conducted field surveys as we have been commissioned by the Wind Farm developer to propose a mitigation proposal to remediate the potential wind farm impacts on the Ripplecom 17GHz link.

Radio Link Re-location Mitigation Measure Proposal :

As shown below we have proposed mitigation measure solutions that will provide clearance based on a relocation of the dish at the High Site end of the link. The re-location distance required is 67m. This proposed mitigation would also require a re-location at the customer end of the link in Granard, also shown below

© copyright Ai Bridges Ltd. 2021
 Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

The proposed mitigation solution would require that a new lattice structure be erected at the Ripplecom High Site and only the impacted link dish would have to be re-located to the new structure. The existing antenna at the customer premises buildings would have to be re-located to the corner of the building

When using the revised location for the new lattice structure and using the corner of the end user premises building , there would a clearance of 4m from the 0.6 Fresnel of the link and thus avoid interference impacts on the link. We have agreed this clearance with other mobile operators \ broadcast operators and it is used as an accepted industry standard for interference modelling. This model is based on Huygens Kirchoff interference modelling techniques.

The wind farm developer is agreeable to covering the costs of the remediation works and we will be recommending associated costs tomorrow which we can send to you for review.

Fibre Broadband Mitigation Measure Proposal :

The wind farm developer has also raised the possibility of a fibre broadband solution as a possible mitigation measure. Our research shows that there service availability in Granard and that Ripplecom (and the Viatel Group) would have access to wholesale agreements to fibre broadband services. In the event of planning permission the wind farm would only likely become operational by mid-2023 and that by then fibre broadband would become more widespread and offer a faster and more reliable service than that offered by the current 17GHz delivery mechanism. Our engineers have also conducted an analysis on the bandwidth delivery capacities of 17GHz links based on the allowable technical parameters of this spectrum and fibre broadband delivery would provide better delivery capacities in comparison.

I will follow up with mitigation costs proposals tomorrow and I would be grateful if you could review and revert with your comments.

Thank you or your assistance on this.

High Site – Impacted Dish :



	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

High Site Existing Dish Location & Re-location Position :



Ripplecom Existing & Proposed Monopole Location and Coordinates :

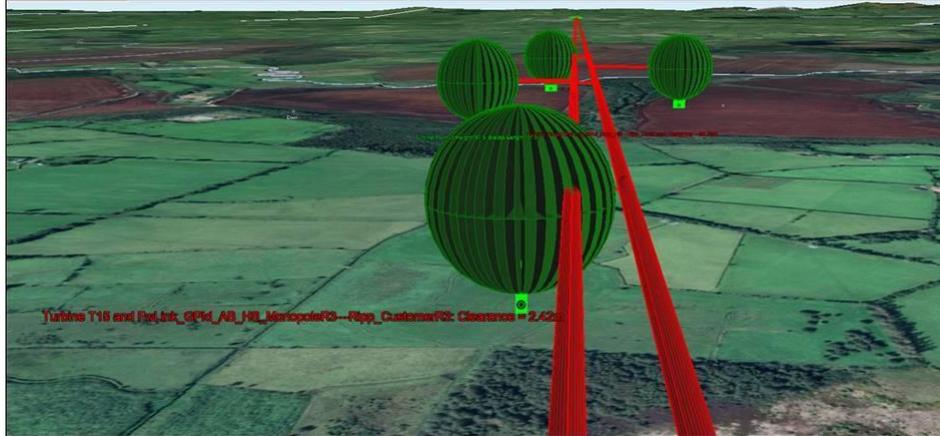


End-user Site Location : Proposed Mitigation to re-locate dish on the end user buildings, Granard



	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Link Clearance Condition 4m (based on 0.6 Fresnel)



22/01/2021 – AiBridges Ltd Response

Hello Andrew,

As discussed please find attached our proposed Mitigation Measure Costs for the proposal to install an additional 17GHz radio link in parallel to your existing link to your customer site.

I would be grateful if you could review and confirm that this mitigation measure proposal would be acceptable

If you have any queries please do not hesitate to contact me

Mitigation Measure Cost Proposal :

Materials Supply € [redacted] ex VAT
 17GHz Radio Equipment Supply
 POP Site Telecommunications Mast Structure
 POP Site Cabinet \ RF Cabling Upgrade
 End User Steelwork \ Cabling

Professional Services € [redacted] ex VAT
 Engineering Design \ Planning Services
 Telecommunications Mast Structure Installation
 Logistics \ Transport
 End User Site Installtion

Best Regards,
 Kevin Hayes,

27/01/2021 – AiBridges Ltd Response

Hello Adrian

I am just following up from the email below that I sent below. I would be grateful if you could confirm if you have had a chance to review these mitigation measure costs for the Radio Link Re-location Mitigation Measure Proposal

Also as discussed would you be able to give an indication if you have considered the proposal to deliver service to the customer via a fibre broadband wholesale delivery.

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Our client is looking to finalise their planning application this week if possible and we would like to finalise an agreement on a mitigation measure with yourselves

I look forward to hearing from you.

Mitigation Measure Cost Proposal :

Materials Supply € [redacted] ex VAT
 17GHz Radio Equipment Supply
 POP Site Telecommunications Mast Structure
 POP Site Cabinet \ RF Cabling Upgrade
 End User Steelwork \ Cabling

Professional Services € [redacted] ex VAT
 Engineering Design \ Planning Services
 Telecommunications Mast Structure Installation
 Logistics \ Transport
 End User Site Installtion

Best Regards,
 Kevin Hayes,

27/01/2021 – AiBridges Ltd Response

Hello Aidan,

Thank you for taking my call earlier.

As discussed we are proposing the following in relation to the mitigation measures based on a Radio Link Re-location Mitigation Measure.

1. Ripplecom would be compensated by the wind farm developer for the mitigation measure. works on the basis of advance payment\Pro-Forma Invoice teams, noting vouched expenditure not required . (i.e. Proposed mitigation measure costs of € [redacted] equipment and installation
2. Ripplecom would receive a 6-month advance notification in advance of turbine construction allowing a window of 6 months to put a new radio link in place.

We would be grateful if you could give an indication of acceptance of this mitigation measure by the close of business tomorrow as the wind farm developer has a deadline for their planning application of Monday 1st February. The wind farm developer is required to demonstrate that they have agreed in principle a form of mitigation to the satisfaction of any potentially impacted telecommunications operators.

Best Regards,
 Kevin Hayes,

28/01/2020 – Ripplecom Response

That sounds fine, if is there an agreement that needs to be signed or paperwork to be filled in please send it on.

Regards,
 Adrian Carroll | Network Operations Manager

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

28/01/2021 – AiBridges Ltd Response

Hello Aidan,

All we would need is an email response from you confirming acceptance of the proposed mitigation measure and would then include this response as part of the Telecoms Operator Consultations section within the Wind Farm Planning Application

Best Regards,
Kevin Hayes,

29/01/2020 – Ripplecom Response

Hi Kevin,

Ripplecom accept the proposed mitigation measure outlined in your earlier email.

Regards,
Adrian Carroll

 <i>Total Broadband Solutions</i>	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Section 4 - Field Surveys

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

4. Introduction

To assist in identifying the Three Ireland telecoms equipment that could potentially be impacted by the proposed turbines, field surveys of the following telecom masts were carried out: Multyfarnham, Slieve Glah and Kilnaleck. Section 4.1 to Section 4.3 that follow outline the findings from the field surveys.

4.1 Mast A (Multyfarnham, Co Westmeath)

Telecommunications Mast A is located in the townland of Multyfarnham, Co Westmeath, and is located 10km south of the proposed farm. The survey of this mast found that there are a number of licensed PTP microwave radio links operating from this structure.

On the mast there are 2 PTP microwave dish antennas with approximate bearings in the direction of the wind farm. A summary of the field survey findings are shown in Table 2 below.



Figure 4. Telecoms Mast at Multyfarnham

Mast ID	Microwave radio links observed with a bearing in direction of Coole WF*
Mast A	2

Table 2. Field Survey Summary – Mast A

* Approximate bearing recorded from ground level during field survey.

© copyright Ai Bridges Ltd. 2021
 Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

4.2 Mast B (Slieve Glah, Co Cavan)

Telecommunications Mast B is located in the mast-site at Slieve Glah Mountain, Co Cavan, and is located 23km north of the proposed wind farm. The survey of this mast found that there are a number of licensed PTP microwave radio links operating from this structure.

On the mast there are 2 PTP microwave dish antennas with approximate bearings in the direction of the wind farm. A summary of the field survey findings are shown in Table 3 below.



Figure 5. Telecoms Mast at Slieve Glah

Mast ID	Microwave radio links observed with a bearing in direction of Coole WF*
Mast B	2

Table 3. Field Survey Summary – Mast B

* Approximate bearing recorded from ground level during field survey.

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

4.3 Mast C (Kilnaleck, Co Cavan)

Telecommunications Mast C is located in the townland of Kilnaleck, Co Cavan, and is located 13km north of the proposed farm. The survey of this mast found that there are a number of licensed PTP microwave radio links operating from this structure.

On the mast there is one PTP microwave dish antenna with an approximate bearing in the direction of the wind farm. A summary of the field survey findings are shown in Table 4 below.



Figure 6. Telecoms Mast at Kilnaleck

Mast ID	Microwave radio links observed with a bearing in direction of Coole WF
Mast C	1

Table 4. Field Survey Summary – Mast C

**Approximate bearing recorded from ground level during field survey.*

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Section 5 - Telecom Operator Link Analysis

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

5. Introduction

Based on the findings obtained during field surveys and the telecom operator consultation process, an analysis of relevant telecom links operating in the vicinity of the proposed wind farm was carried out. The analysis is presented in Section 5.1 below.

5.1 Licensed Transmission Networks

Table 5 below lists the licensed radio links that required a desktop analysis. The results of the desktop analysis* for these links is provided in Sections 5.1.1 and 5.1.2 that follow.

Link ID	Operator	Link Description
1	Three Ireland	PTP Radio link between the Multyfarnham and Slieve Glah
2	Three Ireland	PTP Radio link between the Multyfarnham and Kilnaleck

Table 5. Licensed Radio Links requiring Analysis

Note: The 3D modelling analysis which was conducted for the Ripplecom radio link has been included in the consultations which were sent to Ripplecom can be found in Section 3.1.2 of this report.

* The Desktop Survey Analysis findings are subject to accuracy of the information (GPS co-ordinates, turbine dimensions, etc.) provided to Ai Bridges Ltd.

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

5.1.1 Link 1 Analysis (Multyfarnham to Slieve Glah – Three Ireland)

Figure 7 below shows Link 1 between Multyfarnham and Slieve Glah.

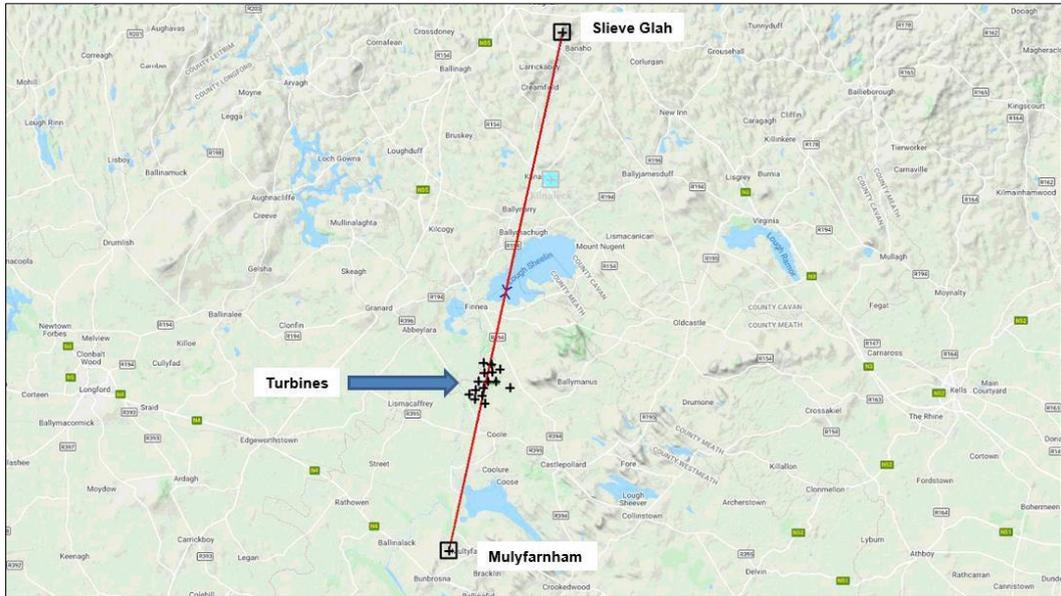


Figure 7. Link 1 (Multyfarnham to Slieve Glah)

Desktop survey analysis indicates that this radio link would pass between four turbines T2, T6, T9 and T13. The nearest turbine to the link would be T6. Figure 8 shows a close-up plan view of the radio link passing through the proposed wind farm.

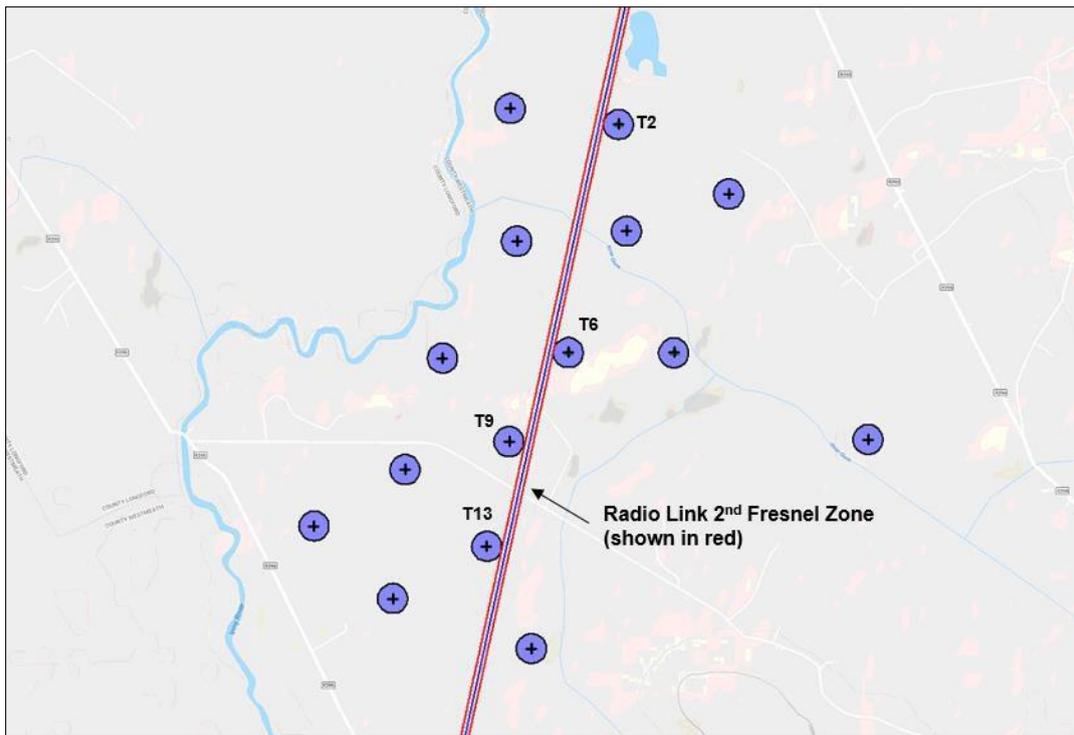


Figure 8. Link 1 - Closeup Plan View (Multyfarnham to Slieve Glah)

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Further analysis using 3-dimensional software modelling shows that there is a small clearance of 14.1m between the between the blade-tip of T6 and the 2nd Fresnel of the radio link (Figure 9).

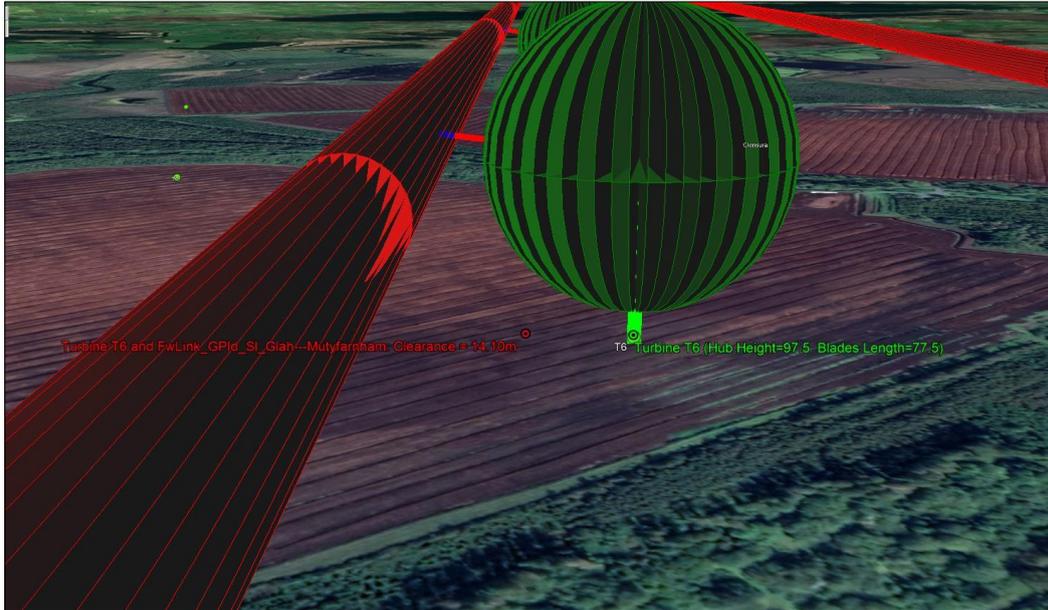


Figure 9. Link 1 3-Dimensional Analysis (Multyfarnham to Slieve Glah)

Table 6 below provides a brief summary of the desktop survey analysis* of Link 1.

Operator	Three Ireland
Link Description	Licensed PTP radio link from Multyfarnham to Slieve Glah
Clearance Condition	14.10m
Wind Farm Impacts	Unlikely to be impacted by wind turbines
Mitigation Measures	Mitigation Measures are unlikely to be required.

Table 6. Link 1 – Analysis Summary

* The Desktop Survey Analysis findings are subject to accuracy of the information (GPS co-ordinates, turbine dimensions, etc.) provided to Ai Bridges. 11GHz Radio Link Assumed

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

5.1.2 Link 2 Analysis (Multyfarnham to Kilnaleck – Three Ireland)

Figure 10 below shows Link 2 between Multyfarnham to Kilnaleck.



Figure 10. Link 2 (Multyfarnham to Kilnaleck)

Desktop survey analysis indicates that the radio link would pass through two turbines: T4 and T5. The nearest turbine to the radio link centreline is T5. Figure 11 shows a close-up plan view of the radio link passing through the wind farm.

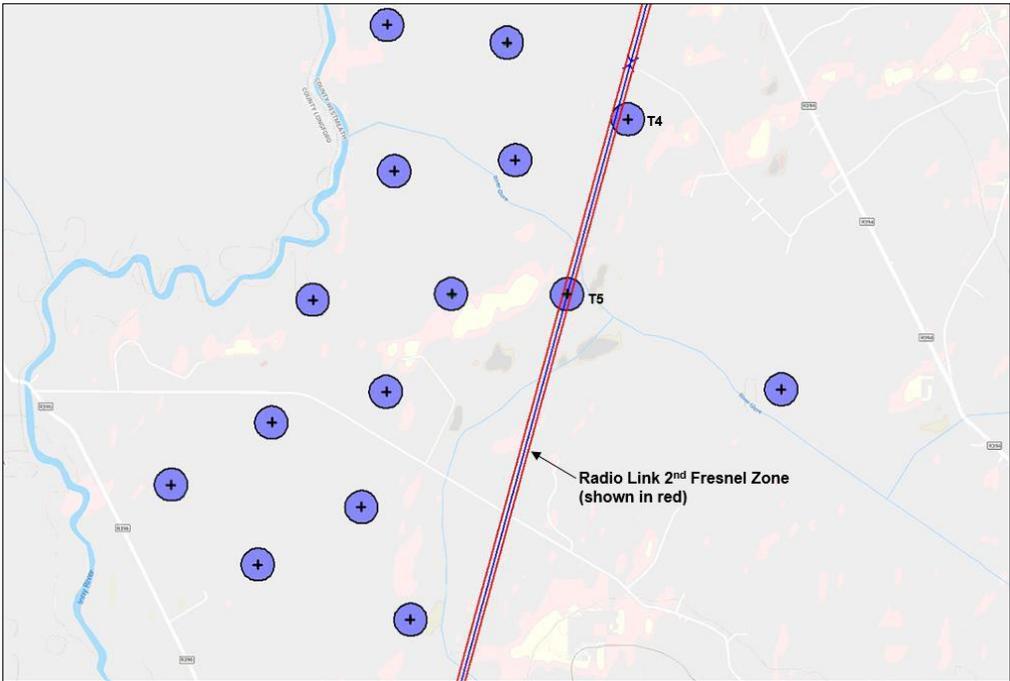


Figure 11. Link 2 - Closeup Plan View (Multyfarnham to Kilnaleck)

© copyright Ai Bridges Ltd. 2021
 Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Further analysis using 3-dimensional software modelling shows that the operation of the link would be impacted by the turbines. Figure 12 below illustrates that turbine T5 would impede the radio link path. Therefore, it is probable that the operation of the link would be impacted by the proposed wind farm development.

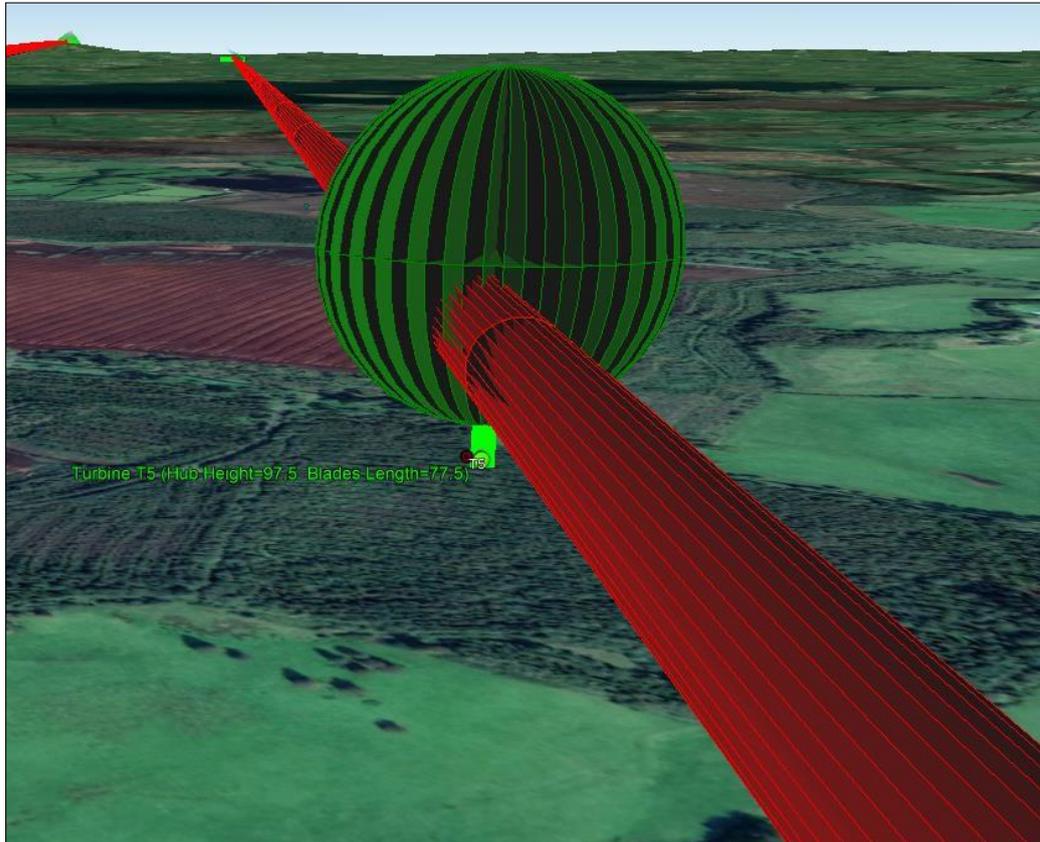


Figure 12. Link 2 3-Dimensional Analysis (Multyfarnham to Kilnaleck)

Table 7 below provides a brief summary of the desktop survey analysis of Link 2.

Operator	Three Ireland
Link Description	Licensed PTP radio link from Multyfarnham to Kilnaleck
Clearance Condition	-67m (Interference)
Wind Farm Impacts	Highly likely to be impacted by wind turbine(s)
Mitigation Measures	Mitigation Measures are likely to be required. Additional consultations with Three Ireland would be required to determine a suitable mitigation solution.

Table 7. Link 2 – Analysis Summary

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Section 6 - Conclusions

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

6. Conclusions

From the findings made in this report the following conclusions have been made:

- During consultations carried out in 2017, Three Ireland raised concerns regarding their radio transmission link between Multyfarnham and Slieve Glah. To accommodate Three Ireland's concerns Coole Wind Farm Ltd. amended the turbine layout of the 13 turbine development. That planning application has since been granted.
- In 2021, Coole Wind Farm Ltd. aim to submit a new planning application for 15 Wind Turbines with tip heights of up to 175m and rotor diameters up to 155m. 13 of the proposed Turbines will be in the same location as the permitted 13 turbines. In accordance with planning regulations for the Environmental Impact Assessment (EIA) process, Telecom Operator consultations were commenced. During these consultations Three Ireland indicated that they have a new transmission link (Mulyfarnham to Kilnaleck) in the vicinity of the proposed wind farm which could potentially be impacted. Three Ireland stated that this link was planned/installed in the 4th Quarter of 2016.
- A telecom link analysis carried out by Ai Bridges Ltd indicates that the proposed 15 turbine wind farm would not impact a radio transmission link between Multyfarnham and Slieve Glah.
- A telecom link analysis carried out by Ai Bridges Ltd indicates that the proposed 15 turbine wind farm would cause a likely impact to the radio transmission link between Multyfarnham and Kilnaleck.
- Following a further consultation response from Three Ireland they indicated that the impacted link has been decommissioned thus the Coole Wind Farm would have no impact on the Three Ireland network.
- In December 2020, the EIAR consultants, were informed by Ripplecom, a wireless internet service provider (WISP), that they also had a microwave radio link that could be impacted by the proposed wind farm. Ai Bridges were requested to conduct a detailed technical analysis on the Ripplecom link. The analysis results indicated that the Ripplecom link would be impacted by wind turbine T15. The analysis findings were presented to Ripplecom along with mitigation measure solutions. Ripplecom have accepted the mitigation measure proposal and have no further concerns regarding the proposed wind farm development.

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

APPENDICES

	Procedure: 001	Rev: 3.0
Title: Coole WF Telecommunications Impact Study	Approved: DM	Date: 11/02/21

Appendix A – Coole Wind Farm Turbine Co-ordinates

The turbine co-ordinates for the Coole wind farm studied in this report are listed below in Table A-1.

Turbine ID	X	Y
1	640852	777346
2	641419	777267
3	641463	776708
4	641994	776908
5	641716	776074
6	641168	776069
7	640893	776651
8	640511	776034
9	640862	775599
10	640322	775448
11	639849	775149
12	640263	774772
13	640750	775050
14	640986	774517
15	642772	775661

Table A-1 Proposed Coole Wind Farm Turbine Co-ordinates