# Appendix 17B

## Telecoms Impact Assessment

# Report

## *Ballinlee Wind Farm*

## *Telecommunications Impact Assessment*

**Document Number:**

**Author:** DMG

**Approved for Release:** Rev 6.0 KH **Date:** 09/09/25

**Document Filename:** *Ballinlee Wind Farm Telecommunications Impact Assessment*

# Executive Summary

Ai Bridges was commissioned to evaluate the possible impacts that the proposed wind farm development at Ballinlee, Co. Limerick could have on existing telecommunications operator networks. The scope of work included field and desktop surveys to determine telecommunications network infrastructure that could be impacted by the proposed development. Consultations with telecom operators were also undertaken to assist in identifying network infrastructure that could be impacted by the proposed wind farm.

Telecommunications mast-sites with network infrastructure that could potentially be impacted by the development were identified and a field survey of each of these sites was carried out. During the field surveys, radio antennas with bearings in the direction of the wind farm were recorded. The findings of the field surveys are provided in Appendix B of this report.

During the consultation process, nineteen telecom operators were contacted. At the time of writing this report, fourteen of these operators have responded to the consultation request. The responses received from each of the telecom operators can be found in Section 3 of this report.

Using the information obtained during the field survey assessments and consultation process a desktop impact analysis was carried out and all of the telecommunication operator networks were analysed using radio planning \ modelling software. Results from the impact analysis indicate that there are four radio links in the vicinity of the proposed wind farm development. These radio links are listed below in Table 1.

Results from network analysis (2D and 3D) indicate that the proposed turbines would not obstruct any of the radio links. However, it should be noted that the clearance distance between the blade-tip of T17 and the Fresnel Zone of the Eir radio link between Slievereagh and Tooreen is relatively small (i.e. clearance distance is less than 5 m).

To account for any potential impacts that may be reported during the operational phase of the proposed development, optional mitigation measure solutions should be considered for the Eir radio link between Slievereagh and Tooreen. Optional mitigation measures for the radio link have been provided in Section 6 of this report which are subject to further technical analysis and consultations with Eir.

| Telecom Operator | Link Description | Nearest Turbine | Fresnel Zone (F1) Clearance | Wind Farm Impacts / Observations |
|---|---|---|---|---|
| Eir | Limerick to Ballyhoura | T04 | 33.9 m | No impacts. |
| Eir | Slievereagh to Tooreen | T17 | 2.4 m | The clearance distance from T17 to the Fresnel Zone of this radio link is relatively small and Eir may request that mitigation measures are put in place.<br>Optional mitigation measures available to the developer are described in Section 6 of this report. |
| Vodafone | Tullovin to Bruff (18 GHz) | T01 | > 400 m | No impacts. |
| Vodafone | Tullovin to Bruff (15 GHz) | T01 | > 400 m | No impacts. |

**Table 1. Radio links in vicinity of proposed wind farm.**

# Sections



# Appendix

# Section 1 - Wind Farm Site Information

# 1. Introduction

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

## 1.1 Wind Farm Site Information

The wind farm development is located approximately 3km west of Bruff, Co Limerick. The coordinates of the turbines assessed in this report are provided in Appendix A. The dimensions of the turbines assessed in this report are provided in Table 2 below.

| Wind Farm | Number of Turbines | Turbine Hub Height | | Turbine Rotor Diameter |
|---|---|---|---|---|
| Ballinlee | 17 | T01 – T05 , T07 – T17 | 92 m | 136 m |
| | | T06 | 82 m | |

**Table 2. Wind Farm Turbine Details**

The location of the proposed Ballinlee wind farm development is shown below in Figure 1.


**Figure 1. Location of proposed wind farm.**

# Section 2 - Methodology

# 2. Introduction

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

## 2.1 Methodology

There are four primary stages in preparing and compiling a communication impact study:

- 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

Consultations are commenced with telecom operators who are requested to raise any concerns they have regarding the impact of the proposed wind farm on their networks. The consultation process is used to assist in identifying telecoms infrastructure that could be impacted by the proposed wind farm development.

### 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

A desktop survey is carried out to plot the wind turbines in a radio planning tool. The radio planning tool uses GIS and terrain mapping databases to enable accurate modelling. A selection of mast-site coordinates is then obtained and inputs from various operators \ service providers are 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 telecommunications sites in the vicinity relative to the proposed wind farm at Ballinlee. Figure 2 below shows the proposed wind turbines plotted in the radio planning tool.

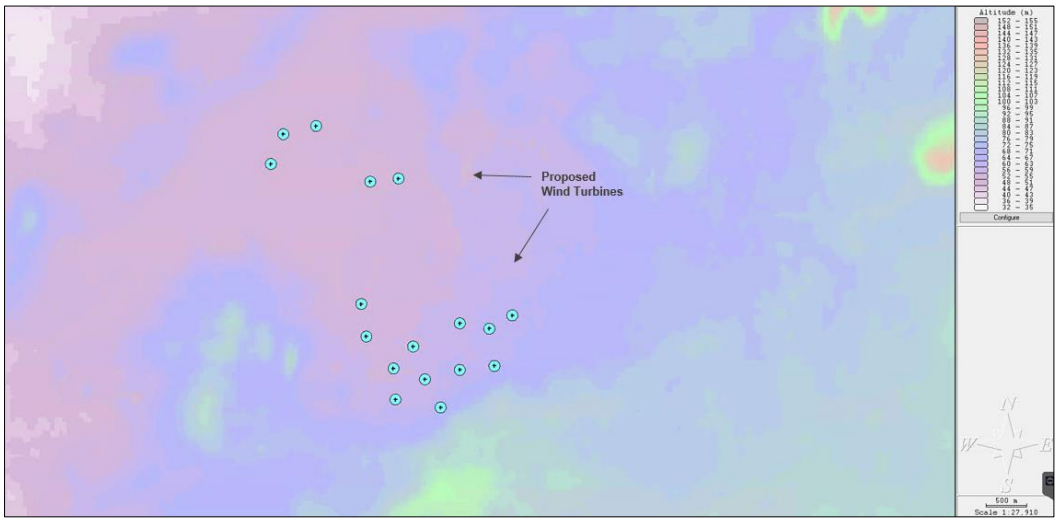


**Figure 2. Wind Turbines plotted in Radio Planning Software**

The findings from the consultations and field surveys are collated and the communications networks requiring further analysis are identified. Network modeling is used to assess the impact of the turbines on the communications networks. The results from the network modeling are used to determine if mitigation measures are required. Figure 3 below shows an example of a microwave radio link that crosses through the proposed wind farm site modelled in radio planning software.

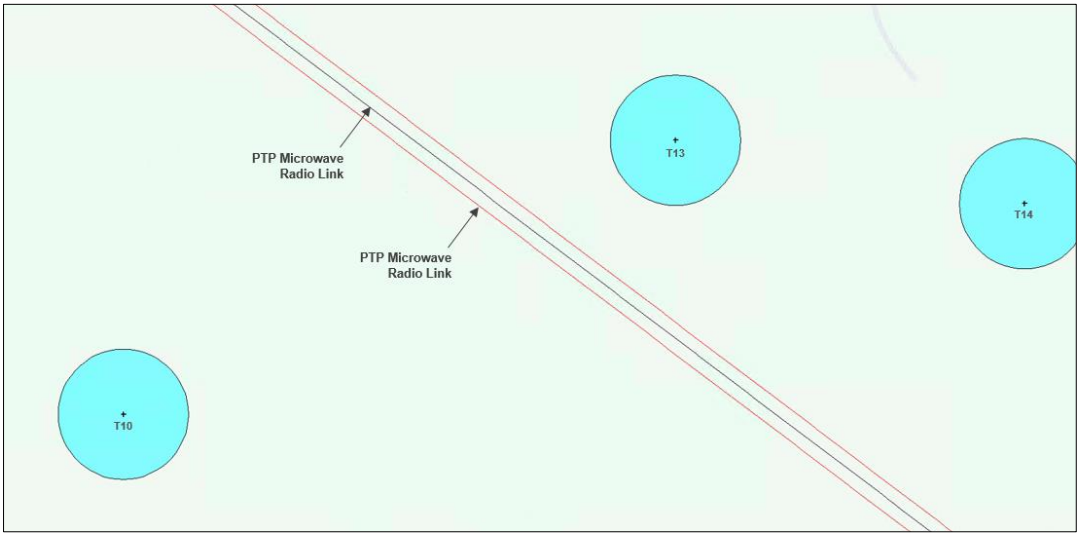


**Figure 3. Example of microwave radio link crossing through the wind farm site modelled in radio planning software.**

## Report Generation

The final stage of the communications impact study process is to collate the data and present the findings & analysis into a report for submission.

# Section 3 - Telecom Operator Consultations

# 3. Introduction

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

## 3.1 Telecom Operator Consultations

Consultations beginning in May 2025 were undertaken with telecom network operators to assist in identifying telecommunication infrastructure that could be impacted by proposed wind farm. The operators were requested to raise any concerns they may have regarding impacts to their networks due to the proposed wind farm development. Table 3 lists the telecom operators contacted and the issues raised by the operators. The responses received from each of the Telecom Operators are provided in Sections 3.1.1 to 3.1.19.

| ID | Operator | Response Received (Yes/No) | Issues raised by Operator \ Observations. |
|---|---|---|---|
| 1 | 2RN | Yes | No issues regarding transmission links; however, 2RN have requested that a protocol document be signed should the wind farm go ahead (regarding the TV broadcast service in the area). |
| 2 | AirNav Ireland | Yes | No issues. |
| 3 | Airwave | No | No response. |
| 4 | An Garda Síochána | No | No response. |
| 5 | BT Ireland | Yes | No issues. |
| 6 | CIE | Yes | CIE have stated that the wind farm would be located within the "*Coordination Zone*" of their GSM-R network (Mobile Network for Railways).<br>The nearest rail line to the proposed development is over 5 km away and at this distance there will be no impact to CIE's GSM-R network. |
| 7 | Coimisiún na Meán | Yes | No issues. |
| 8 | Dept. of Defence | No | No response. |
| 9 | Eir | Yes | Eir have raised a concern regarding two Licensed PTP microwave radio links. |
| 10 | Enet | Yes | No issues. |
| 11 | ESB Networks | Yes | No issues. |
| 12 | Imagine Broadband | Yes | No issues. |
| 13 | Limerick County Council | No | No response received. (No issues expected - Limerick Co Co have migrated all countywide communications to a terrestrial based network, thus there will be no radio communications issues due to the proposed wind farm. |
| 14 | Tetra Ireland (TI) | Yes | No issues. |
| 15 | Three Ireland | Yes | No issues. |
| 16 | Uisce Éireann | Yes | No issues. |
| 17 | Viatel | No | No response. |
| 18 | Virgin Media | Yes | No issues. |
| 19 | Vodafone | Yes | Vodafone have raised a concern regarding two Licensed PTP microwave radio links. |

**Table 3. Telecom Operators Consulted**

### 3.1.1 2RN Response to Consultations

2RN provided the following email response to consultations:

> *"We have no linking in the area that would be affected by the proposed windfarm.*
> *There is a risk of interference to Broadcast services from our Sites at Maghera and Mullaghanish so we would ask that a protocol be signed between 2rn and the developer should the site go ahead."*

### 3.1.2 AirNav Ireland Response to Consultations

AirNav provided the following email response to consultations:

> *"No issue for Airnav navaids."*

### 3.1.3 Airwave Response to Consultations

To date no response has been received.

### 3.1.4 An Garda Síochána Response to Consultations

To date no response has been received.

### 3.1.5 BT Ireland Response to Consultations

BT provided the following email response to consultations:

> *""BT no longer have a radio microwave network."*

### 3.1.6 CIE Response to Consultations

CIE provided the following email response to consultations:

> *"The proposed site lies within the GSM-R (Mobile Network for Railways) coordination zone. Please see below:*
>
> *From a study carried out by the ANFR (Agence Nationale des Frequences in France), the output calls for 2 main recommendations by defining 2 main zones as follows:*
>
> *1 - Exclusion zone: wind farm not less than 5 Km from antenna*
> *2 - Coordination zone : 5 Km <wind farm < 30 Km: this area, coordination between operators is required to fix any issue and impact on the signal propagation."*

### 3.1.7 Coimisiún na Meán Response to Consultations

Coimisiún na Meán provided the following email response to consultations:

> *"Coimisiún na Meán does not perform an in-depth analysis of the effect of wind turbines or electrical sub stations on FM networks. However, we are not aware of any issues from existing windfarms or electrical sub stations into existing FM networks. Also, the proposed sub station is not located close to any existing or planned FM transmission sites."*

### 3.1.8 Department of Defence Response to Consultations

To date no response has been received.

### 3.1.9 Eir Response to Consultations

Eir provided the following email response to consultations:

> *"[We have] two links are live crossing the Ballinlee Wind Farm study area, if you can apply adequate step back buffer area to each."*

| Band MHz\GHz | Link Length | Site A | | | | Site B | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Site Id | Lat | Long | Ant Height | Site id | Lat | Long | Ant Height |
| U6Ghz | | LMK | 52°39'39.90"N | 8°37'32.94"W | 30m | BHO | 52°18'21.61"N | 8°33'48.94"W | 35m |
| 11Ghz | | SVH | 52°22'41.68"N | 8°24'13.19"W | 35m | CRM | 52°31'11.25"N | 8°42'37.47"W | 12 m |

### 3.1.10 Enet Response to Consultations

Enet provided the following email response to consultations:

> *"This won't affect our current network:"*

### 3.1.11 ESB Networks Response to Consultations

ESB provided the following email response to consultations:

> *"I am writing to inform you that we have successfully assessed your windfarm proposal. We are pleased to advise that the proposed wind farm has been reviewed and cleared."*

### 3.1.12 Imagine Broadband Response to Consultations

Imagine Broadband provided the following email response to consultations:

> *"No Imagine MW links are affected by this development."*

### 3.1.13 Limerick County Council Response to Consultations

To date no response has been received.

### 3.1.14 Tetra Ireland (TI) Response to Consultations

Tetra Ireland provided the following email response to consultations:

> *"We anticipate no impact from the development in the area proposed, can you ensure the proposal is also reviewed by eir.*

### 3.1.15 Three Ireland Response to Consultations

Three Ireland provided the following email response to consultations:

> *"Developments in this area will have no impact on our transmission network."*


### 3.1.16 Uisce Éireann Response to Consultations

Uisce Éireann provided the following email response to consultations:

> *"I can confirm that Uisce Éireann have no communications links traversing the proposed development."*

### 3.1.17 Viatel Response to Consultations

To date no response has been received.

### 3.1.18 Virgin Media Response to Consultations

Virgin Media provided the following email response to consultations:

> *"Virgin Media Ireland DO NOT have any radio links in this area."*

### 3.1.19 Vodafone Ireland Response to Consultations

Vodafone provided the following email response to consultations:

> *"There are two parallel links (15GHz and 18GHz) passing through the top edge of the site boundary. A clearance of 30m from the first Fresnel zone is desired."*

| Link Name / ID | Band GHz | Link Length Km | Site A | | | Site B | | |
|---|---|---|---|---|---|---|---|---|
| | | | Northing (Irish Grid) | Easting (Irish Grid) | Ant Height m | Northing (Irish Grid) | Easting (Irish Grid) | Ant Height m |
| lk071-lk123_UG | 18 | 10.143 | 139114 | 153147 | 15 | 136323 | 162899 | 15 |
| LK071-LK123 GCN | 15 | 10.143 | 139114 | 153147 | 30 | 136323 | 162899 | 30 |

# Section 4 - Field Surveys

# 4. Introduction

To assess the accuracy of the network information (radio link co-ordinates, antenna heights etc.) provided by the telecom operators, field surveys of the relevant telecom-mast sites in the vicinity of the proposed wind farm were carried out.

During the field surveys, radio antennas with bearings in the direction of the wind farm were recorded. The telecom mast-sites surveyed (labelled Mast-Site A – Mast-Site F) are shown relative to the proposed wind farm site in Figure 4 below. The findings from the field surveys of the mast-sites are presented in Appendix B of this report.


**Figure 4. Telecom Mast-Sites Surveyed.**

# Section 5 - Desktop Survey Analysis

# 5. Introduction

Based on the findings of the consultation process, there are two Telecom Operators with networks in the vicinity of the proposed wind farm that require a detailed technical analysis:

- Eir Network
- Vodafone Network

Sections 5.1 to 5.2 below outline the desktop survey analysis findings* for each of the Telecom Operator networks listed above.

## 5.1 Eir Network Analysis

The Eir Network in the vicinity of Ballinlee consists of two Point-to-Point (PTP) microwave radio links. The radio links are listed below in Table 4 and a Plan View of the Eir radio network is shown in Figure 5.

| Link ID | Description |
|---|---|
| Eir_L1 | PTP microwave radio link from Limerick City to Ballyhoura. |
| Eir_L2 | PTP microwave radio link from Slievereagh to Tooreen, Croom. |

**Table 4. Eir Radio Links requiring Analysis**


**Figure 5. Plan View of the Eir Radio Network**

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

Figure 6 below shows a close-up plan view (2D) of the Eir microwave radio links relative to the proposed wind turbines. The 2D plan view indicates that both Eir links (Eir_L1 and Eir_L2) could potentially be impacted by the proposed turbine layout.

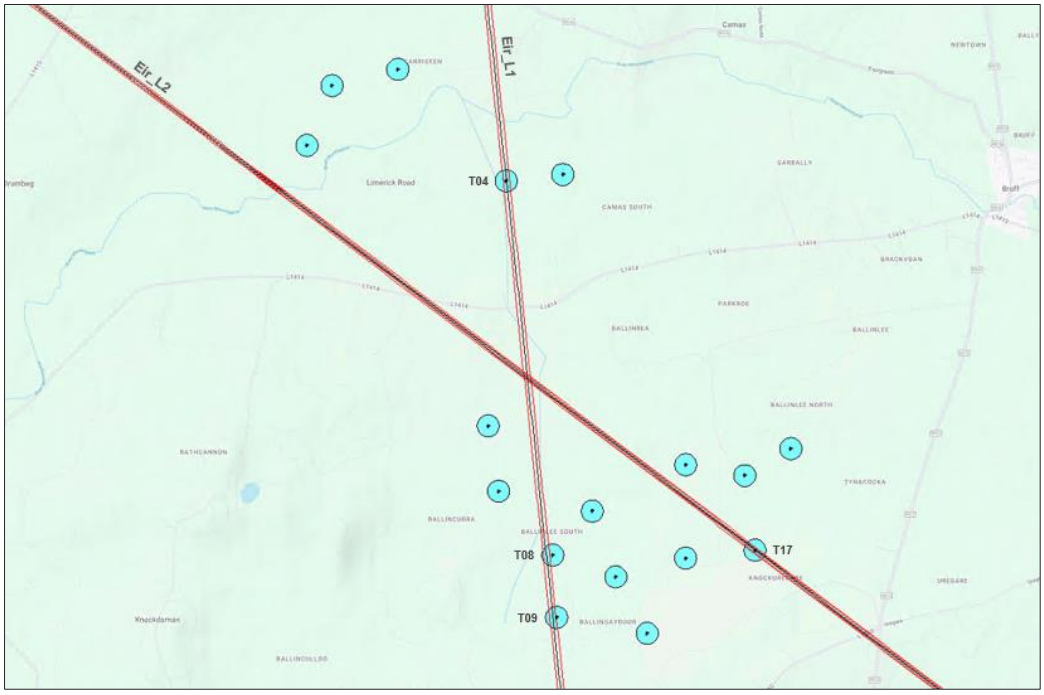


**Figure 6. Eir Network – Close-up Plan View.**

To further assess the potential impacts, the radio links were modelled in 3D and the Clearance Distances between the Fresnel Zones and the blade-tip of the nearest turbines have been calculated. 3D views of Eir_L1 and Eir_L2 are shown in Figures 7 and 8 respectively.

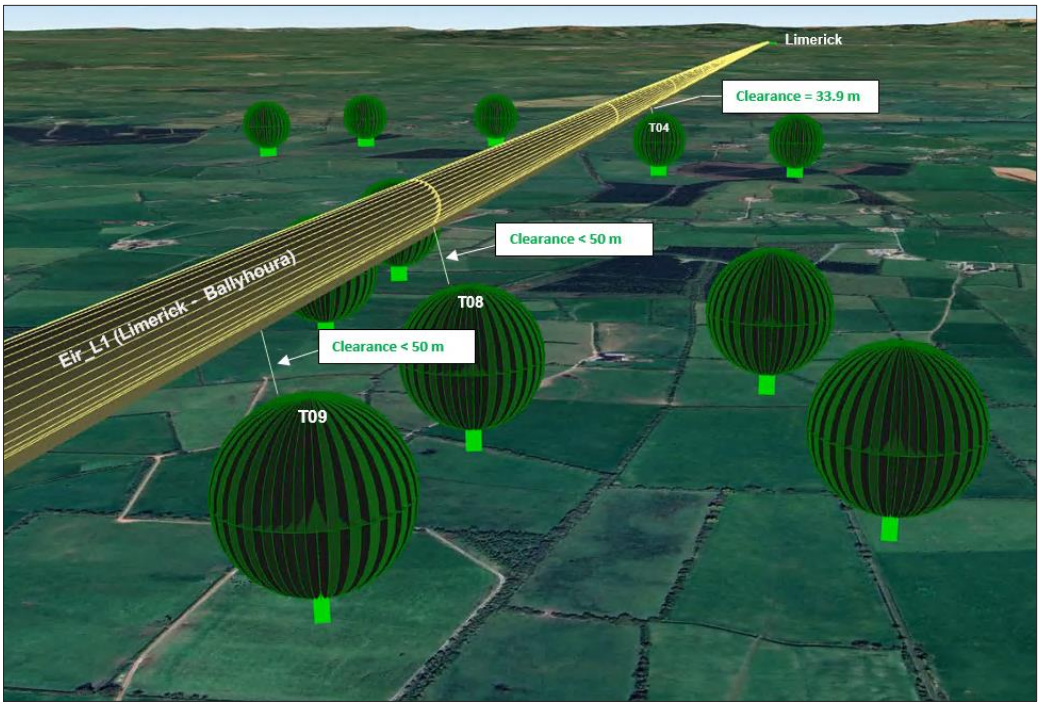


**Figure 7. Eir_L1 (Limerick City to Ballyhoura) – 3D View.**

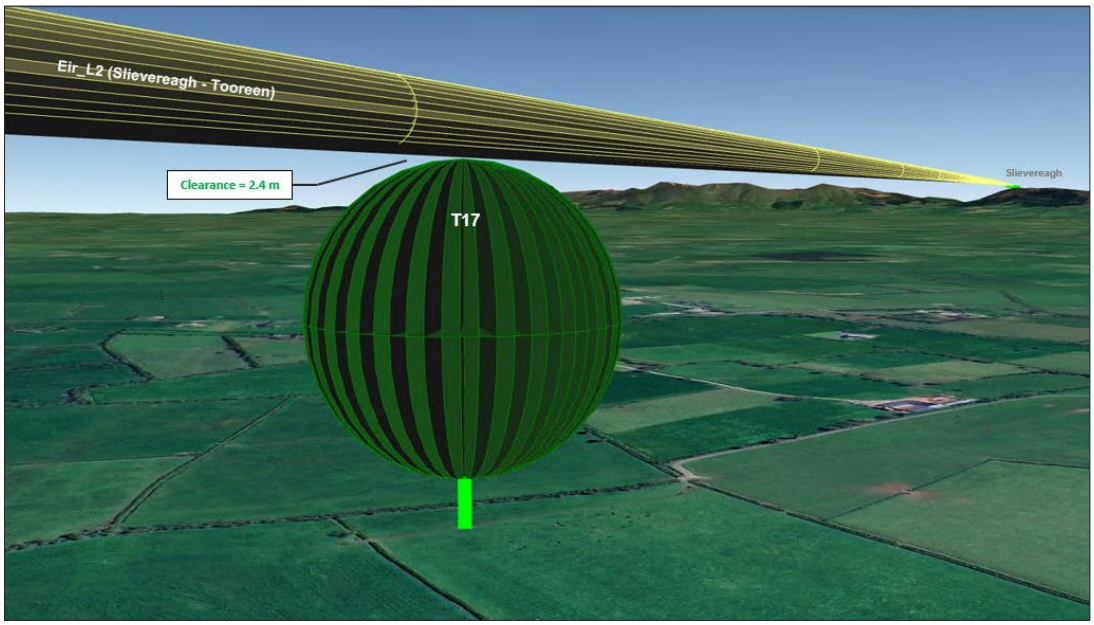


**Figure 8. Eir_L2 (Slievereagh to Tooreen) – 3D View.**

The results of the 3D analysis indicate that Eir_L1 would not be impacted by the proposed turbine layout, as the radio link over-shoots the turbines and there is a clearance distance of over 30 m from the Fresnel Zone of the radio link to the nearest turbine (T04).

Eir_L2 would also overshoot the proposed turbines; however, the clearance distance to the nearest turbine (T17) has been calculated to be just 2.4 m. As this clearance distance is relatively small, it is highly likely that Eir will request that a further set-back clearance be observed to offset the risk of potential interference. This would require mitigation measure solutions, which are documented in Section 6.0 of this impact assessment report.

Table 5 below provides a brief summary of the network analysis for the Eir network in the vicinity of the proposed wind farm.

| Link ID | Link Description | Nearest Turbine(s) | Fresnel Zone (F1) Clearance / Interference | Observations |
|---|---|---|---|---|
| Eir_L1 | Limerick City to Ballyhoura | T04 | 33.9 m | No Impacts. |
| | | T08 | Clearance > 50 m | |
| | | T09 | Clearance > 50 m | |
| Eir_L2 | Slievereagh to Tooreen | T17 | 2.4 m | No Impacts. |

**Table 5. Eir Network – Analysis Summary**

*Note: Although the 3D modelling analysis indicates that the radio link between Slievereagh and Tooreen will not be impacted, it is recommended that should the wind farm receive planning permission, additional telecom operator consultations would be undertaken regarding this radio link, due to the proximity of T17 (less than 15 m). An optional mitigation measure solution has been provided (in Section 6 of this report) to account for any potential impacts that may be reported during the operational phase of the proposed development.*

## 5.2 Vodafone Network Analysis

The Vodafone network in the vicinity of the proposed wind farm consists of two Point-to-Point (PTP) microwave radio links. The radio links are listed in Table 6 below and a plan view of the Vodafone network is shown in Figure 9.

| Link ID | Operator | Link Description |
| --- | --- | --- |
| VF_L1 | Vodafone | PTP microwave radio link from Tullovin to Bruff (18 GHz Link) |
| VF_L2 | Vodafone | PTP microwave radio link from Tullovin to Bruff (15 GHz Link) |

**Table 6. Vodafone Radio Links requiring Analysis**

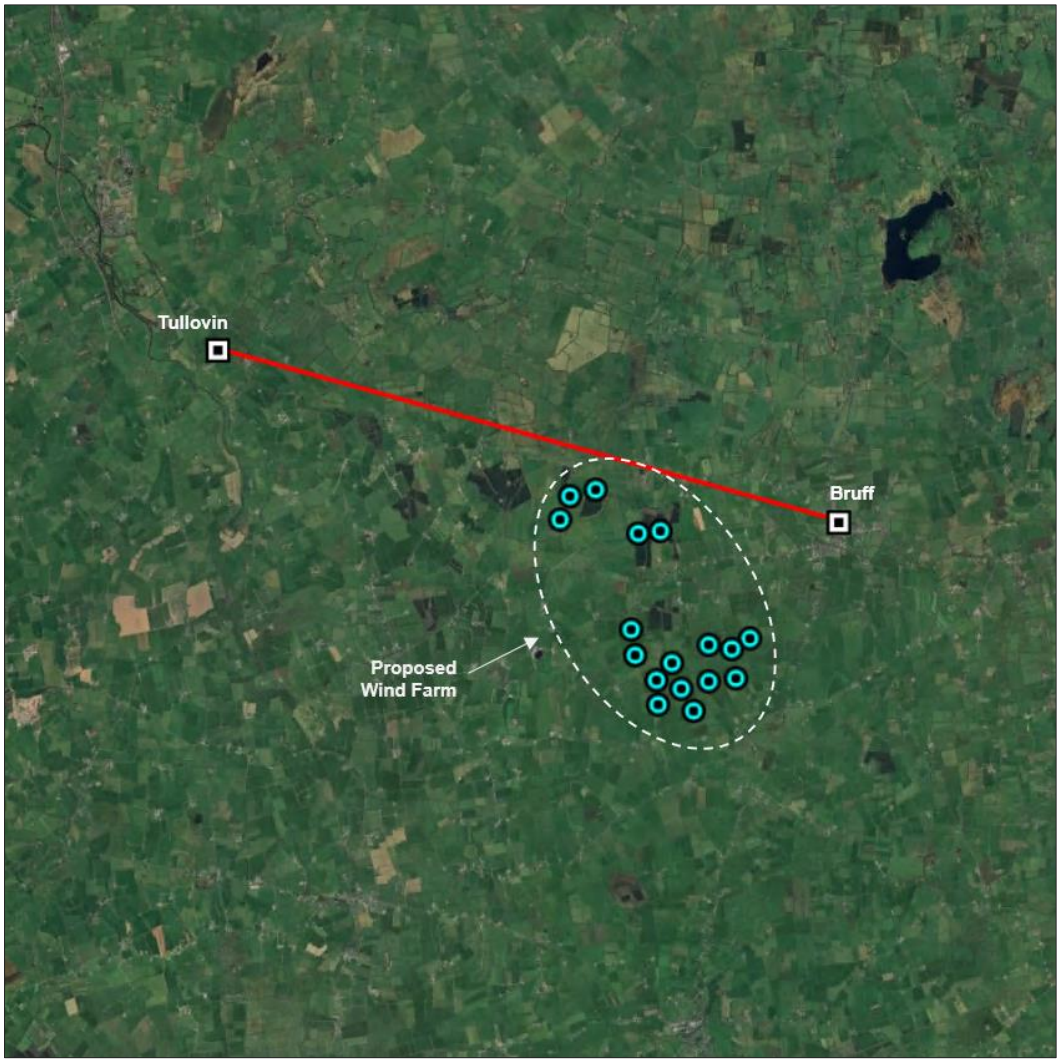


**Figure 9. Vodafone Radio Network – Plan View**

Figure 10 below shows a close-up plan view of the Vodafone radio links relative to the proposed wind turbines. The plan view shows that the nearest of the proposed turbines to the Vodafone links is T01.

Desktop analysis indicates that there would be a Clearance Distance of 449 m between the blade-tip of T01 and the Fresnel Zone (F1) of the radio links between Tullovin and Bruff. At this distance there would be no impact on the radio link due to the proposed turbine.

Table 7 below provides a brief summary of the network analysis for the Vodafone network in the vicinity of the proposed wind farm.

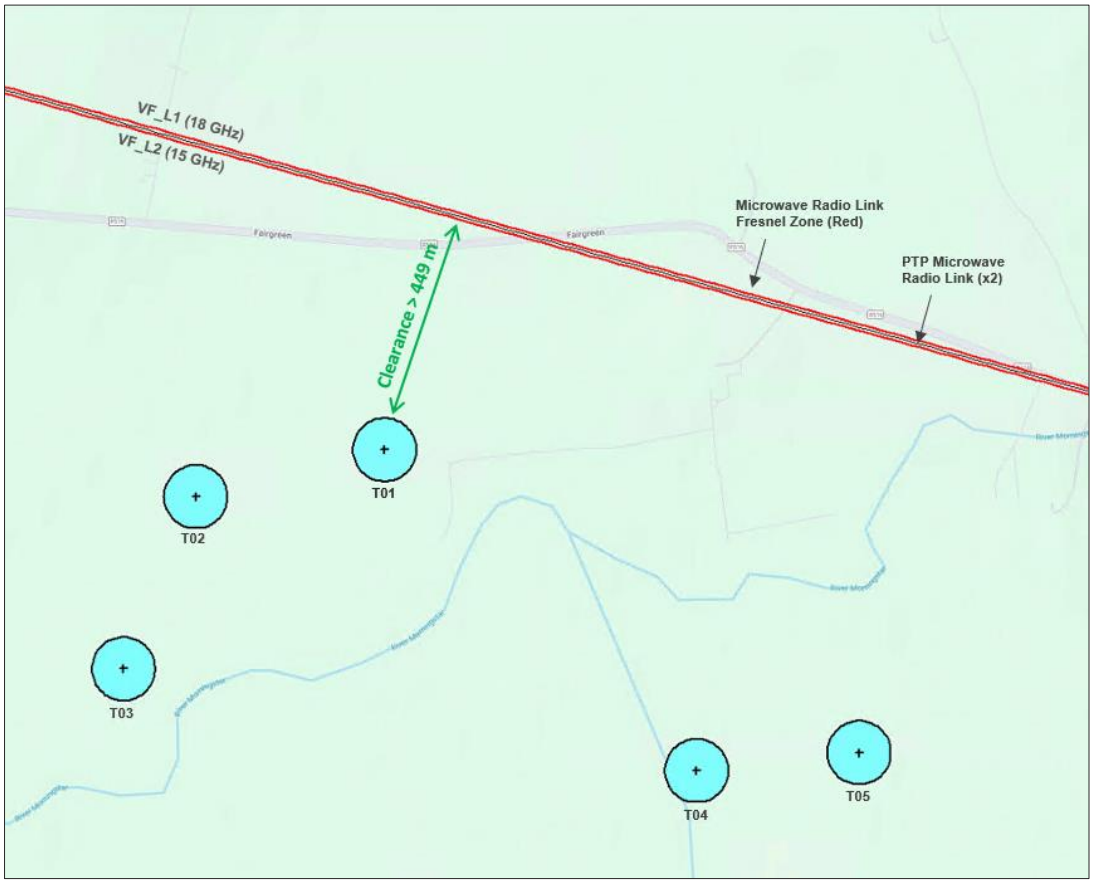


**Figure 10. Vodafone Link 1 and Link 2 (Tullovin to Bruff) – Close-up Plan View.**

| Link ID | Link Description | Nearest Turbine | Fresnel Zone (F1) Clearance / Interference | Observations |
|---|---|---|---|---|
| VF_L1 | Tullovin to Bruff (18 GHz) | T01 | Clearance > 400 m | No Impacts. |
| VF_L2 | Tullovin to Bruff (15 GHz) | T01 | Clearance > 400 m | No Impacts. |

**Table 7. Vodafone Ireland Network – Analysis Summary**

# Section 6 - Mitigation Measures

# 6. Mitigation Measures

Section 6.1 that follows, describes the mitigation measures available to the wind farm developer to offset any potential impacts due to the proposed turbine layout on the Eir radio link between Slievereagh and Tooreen.

## 6.1 Mitigation Measure Solutions – Eir Network

To offset any potential impacts due to T17 on the Eir radio link from Slievereagh to Tooreen the following mitigation solutions are available:

i) Re-locate the antenna at Tooreen to the new telecoms mast which has been installed at the site.

ii) Route the Eir Service into Tooreen from an Alternative Feeder Site.

These mitigation measures are described in more detail in Sections 6.1.1 and Section 6.1.2 that follow.

### 6.1.1 Re-locate the antenna at Tooreen to the new telecoms mast which has been installed at the site.

An option to mitigate for any potential impacts on the radio link between Slievereagh and Tooreen would be to relocate the radio antenna at Tooreen from the existing 12m telegraph pole to the new 24 m high lattice telecoms mast which has been recently installed site, as shown in the figure below.

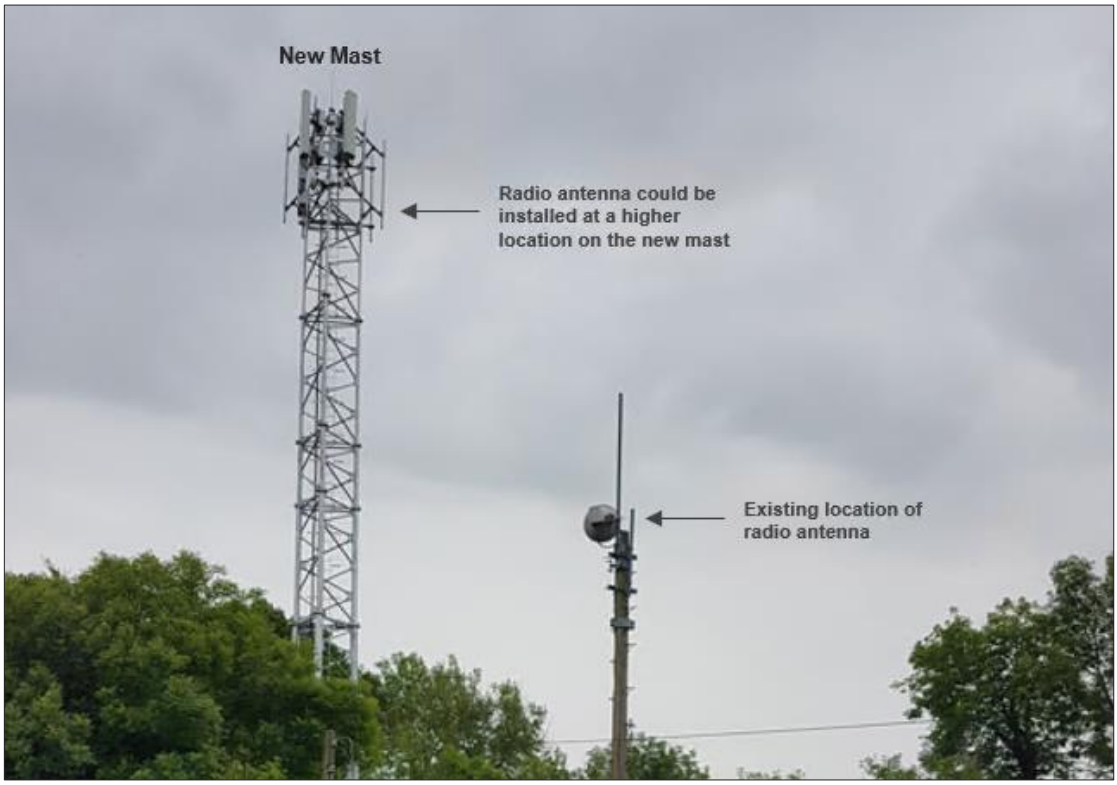


**Figure 11. New Telecoms Mast at Tooreen**

3D analysis indicates that the increase in antenna height at the Tooreen end of the radio link, would result in a clearance distance of 8.6 m between the blade-tip of T17 and the Fresnel Zone of the radio link.

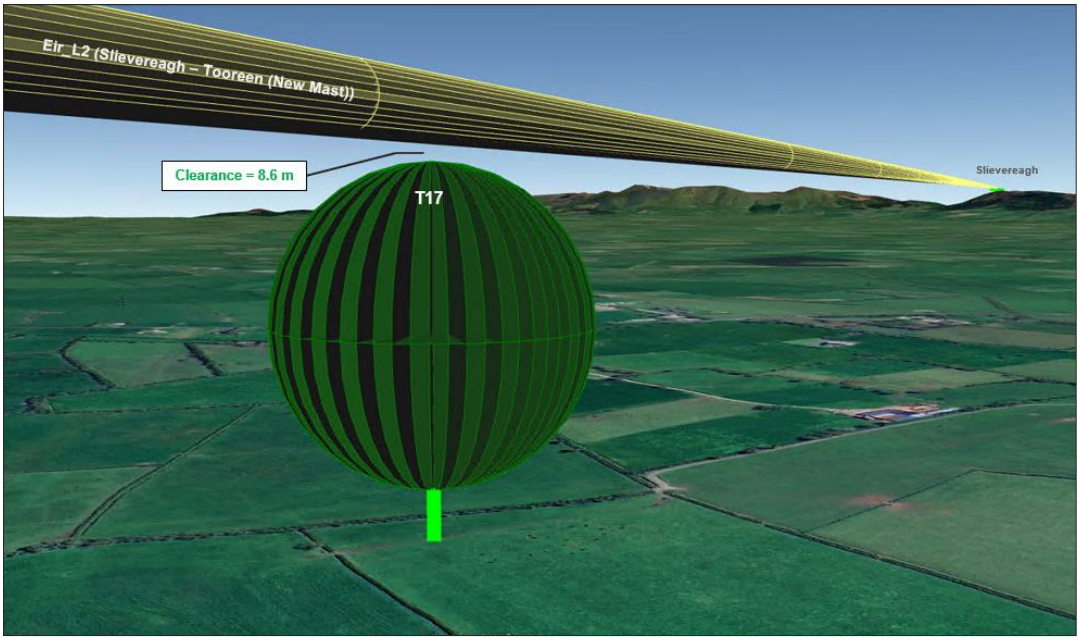


**Figure 12. 3D View of Eir radio link – Tooreen Antenna on New Mast**

### 6.1.2 Route the Eir Service into Tooreen from an Alternative Feeder Site.

An alternative option to mitigate for any potential impacts on the radio link between Slievereagh and Tooreen would be to use an alternative Eir POP site to provide a service into Tooreen. Figure 13 below illustrates how Eir's existing POP site at Ballyhoura could be used as a Feeder Site for Tooreen.

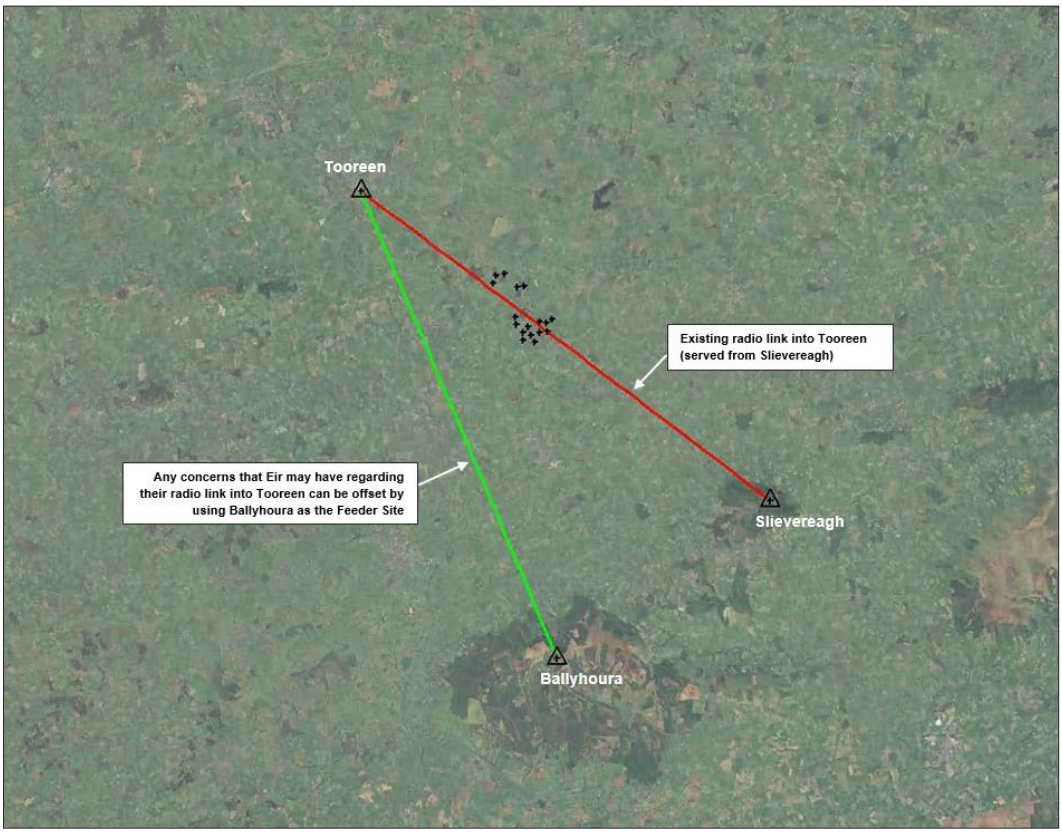


**Figure 13. Example of how an alternative feeder-site could be used to mitigate against an obstructing turbine.**

To determine if Ballyhoura could be used as a viable POP site for Tooreen, a radio link path profile was generated. A radio link budget was also carried out to determine if the proposed link would meet the Radio Link Availability Criteria required by ComReg for radio licensing.

The Radio Link Path Profile and Radio Link Budget are based on the following ITU-R Recommendations:

- ITU-R P.525-2
- ITU-R P.526-11
- ITU-R P.676-8

The Radio Path Profile is shown below in Section 6.1.2.1. The Radio Link Budget can be found in Appendix C.

### 6.1.2.1 Path Profile – Ballyhoura to Tooreen

The radio link path profile shows clear Line-of-Sight (LOS) and the link budget results would pass the radio availability criteria required by ComReg.

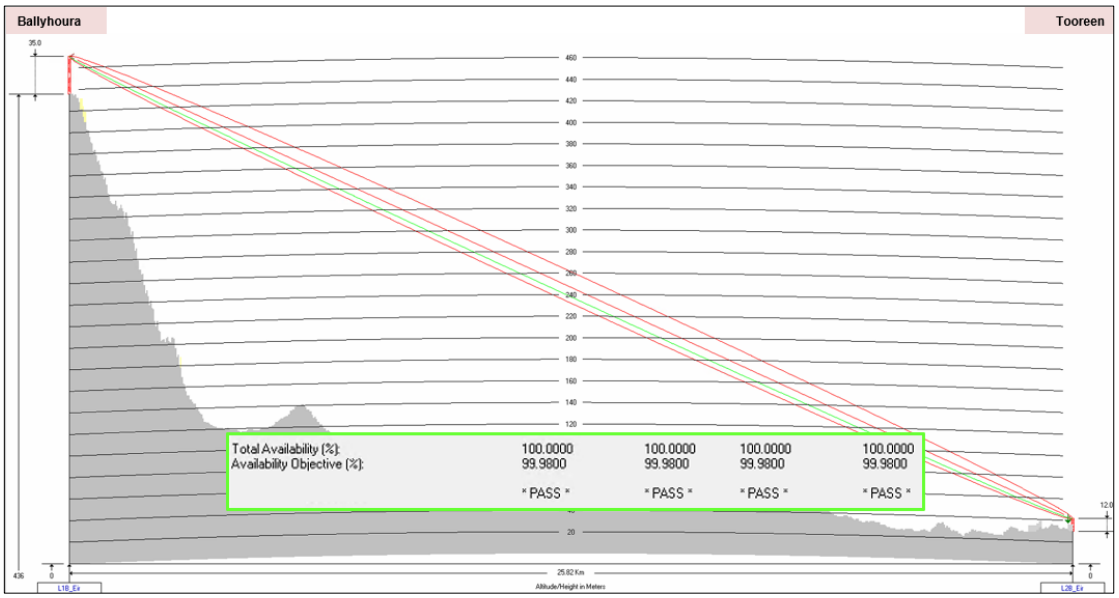


**Figure 14. Path Profile – Ballyhoura to Tooreen**

# Section 7 - Conclusions

# 7. Conclusions

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

- Results from the telecom operator consultations and desktop survey analysis indicate that there are four radio links that cross over/near the proposed development. These radio links are listed below in Table 8.
- Network analysis indicates that none of the radio links would be impacted by the proposed turbine layout.

| Telecom Operator | Link ID | Link Description | Nearest Turbine | Fresnel Zone Clearance | Impact of Wind Farm / Observations |
|---|---|---|---|---|---|
| Eir | Eir_L1 | Limerick City to Ballyhoura | T04 | 33.9 m | No impacts. |
| | Eir_L2 | Croom | T17 | 2.4 m | The clearance distance from T17 to the Fresnel Zone of this radio link is relatively small and Eir may request that mitigation measures are put in place.<br>Optional mitigation measures available to the developer are described in Section 6 of this report. |
| Vodafone | VF_L1 | Tullovin to Bruff (18 GHz Link). | T01 | | No impacts. |
| | VF_L2 | Tullovin to Bruff (15 GHz Link). | T01 | | No impacts. |

**Table 8. Radio Links in vicinity of proposed wind farm.**

- Although the 3D modelling analysis indicates that the Eir radio link between Slievereagh and Tooreen will not be impacted, the clearance distance between the blade-tip of T17and the Fresnel Zone (F1) of the radio link is just 2.4 m. To account for any potential impacts that may be reported during the operational phase of the proposed development, optional mitigation measure solutions should be considered.
- The optional mitigation measure solutions available to the developer to offset any potential impact to the Eir radio link between Slievereagh and Tooreen are described in Section 6. However, the appropriate mitigation measure for this link is subject to further technical analysis and consultations with Eir.
- Figure 15 below has been provided to illustrate each of the telecommunication links that cross though/near the proposed wind farm development.

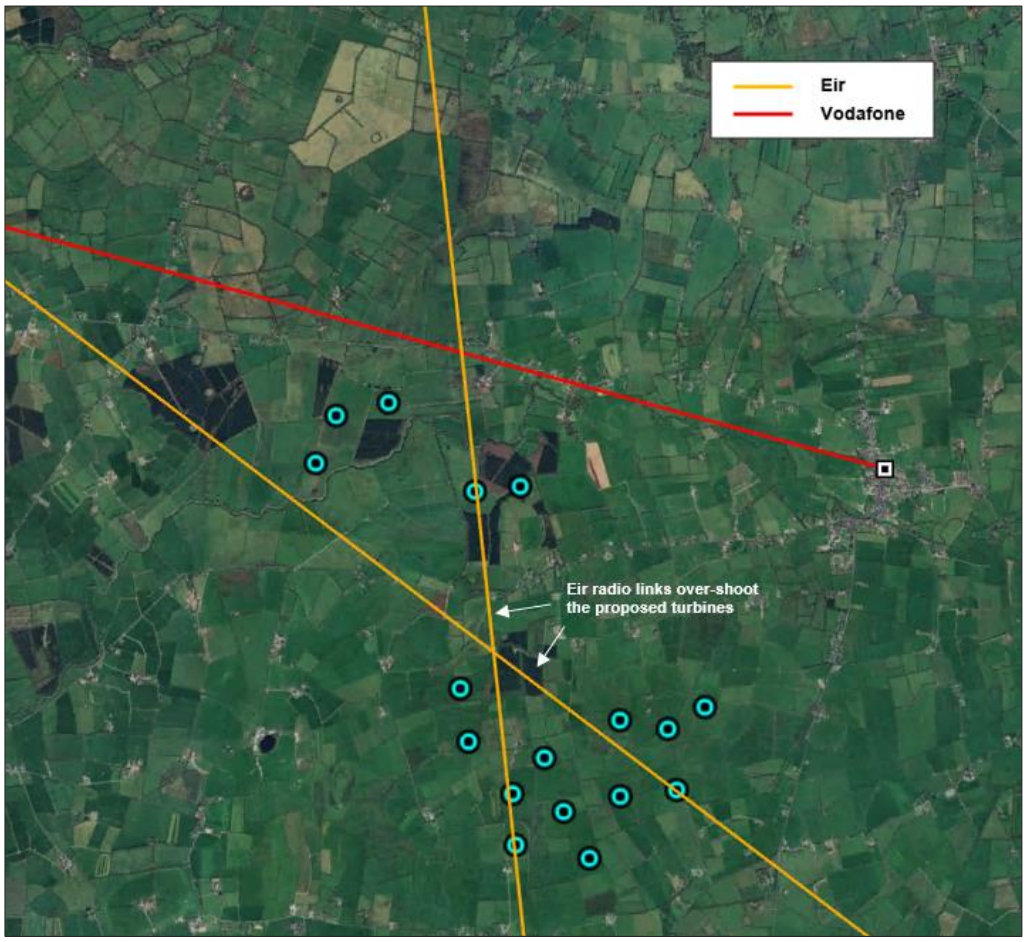


**Figure 15. Plan View of Radio links that cross though/near the proposed wind farm development.**

# APPENDIX A – Wind Farm Turbine Coordinates

# Appendix A –Wind Farm Turbine Co-ordinates

The coordinates of the turbines assessed in this report are provided below in Table 9.

| Turbine ID | Co-ordinates (ITM) | |
| --- | --- | --- |
| | Eastings | Northings |
| T01 | 559035 | 636918 |
| T02 | 558629 | 636821 |
| T03 | 558471 | 636454 |
| T04 | 559699 | 636226 |
| T05 | 560048 | 636262 |
| T06 | 559575 | 634719 |
| T07 | 559635 | 634317 |
| T08 | 559967 | 633921 |
| T09 | 559988 | 633538 |
| T10 | 560213 | 634189 |
| T11 | 560355 | 633784 |
| T12 | 560540 | 633452 |
| T13 | 560792 | 634470 |
| T14 | 561156 | 634401 |
| T15 | 561442 | 634564 |
| T16 | 560787 | 633896 |
| T17 | 561214 | 633948 |

**Table 9. Wind Turbine Co-ordinates**

# APPENDIX B – Field Survey Findings

# Appendix B – Field Survey Findings

The telecom mast-sites surveyed for this Telecoms Impact Study are shown relative to the proposed wind farm site in Figure 14 below.


**Figure 16. Telecom Mast-Sites shown relative to proposed Wind Farm**

The findings from the field surveys of each of the mast-sites are presented below.

## Mast-Site A (Limerick City)

Telecommunications Mast-Site A is located in Limerick City and is approximately 20 km north of the proposed wind farm. A photo of the mast structure at this location is shown in the figure below. The Telecom Operators who have radio links operating from this mast-site in the direction of the wind farm are listed in Table 10.

**Figure 17. Mast A**

| Mast ID | Telecom operators with radio links in direction of proposed wind farm |
| --- | --- |
| Mast A | Eir |

**Table 10. Field Survey Summary – Mast-Site A**

## Mast-Site B (Tooreen, Croom)

Telecommunications Mast-Site B is located in Tooreen, Croom and is approximately 8 km northwest of the proposed wind farm. A photo of the mast structure at this location is shown in the figure below. The Telecom Operators who have radio links operating from this mast-site in the direction of the wind farm are listed in Table 11.

**Figure 18. Mast B**

| Mast ID | Telecom operators with radio links in direction of proposed wind farm |
| --- | --- |
| Mast B | Eir |

**Table 11. Field Survey Summary – Mast-Site B**

## Mast-Site C (Tullovin)

Telecommunications Mast-Site C is located in the townland of Tullovin and is approximately 6km southeast of the proposed wind farm. Access into the mast-site was not possible on the day of survey; however, a roadside view of the telecoms mast structure at this site is shown in the figure below. The Telecom Operators who have radio links operating from this mast-site in the direction of the proposed wind farm are listed in Table 12.


**Figure 19. Mast C**

| Mast ID | Telecom operators with radio links in direction of proposed wind farm |
| --- | --- |
| Mast C | Vodafone |

**Table 12. Field Survey Summary – Mast-Site C**

## Mast-Site D (Bruff)

Telecommunications Mast-Site D is located at the rear of the Garda Station in the town of Bruff, Co Limerick and is approximately 3km east of the proposed wind farm. There is one mast-structure at this site. A photo of the mast at this location is shown in the figure below. The Telecom Operators who have radio links operating from this mast-site in the direction of the wind farm are listed in Table 13.

**Figure 20. Mast D**

| Mast ID | Telecom operators with radio links in direction of proposed wind farm |
| --- | --- |
| Mast D | Vodafone |

**Table 13. Field Survey Summary – Mast-Site D**

## Mast-Site E (Slievereagh)

Telecommunications Mast-Site E is located on Slievereagh Mountain and is approximately 14km southeast of the proposed wind farm. A photo of the mast at this location is shown in the figure below. The Telecom Operators who have radio links operating from this mast-site in the direction of the wind farm are listed in Table 14.

**Figure 21. Mast E**

| Mast ID | Telecom operators with radio links in direction of proposed wind farm |
| --- | --- |
| Mast E | Eir |

**Table 14. Field Survey Summary – Mast-Site E**

## Mast-Site F (Ballyhoura)

Telecommunications Mast-Site F is located on Ballyhoura Mountain and is approximately 16km south of the proposed wind farm. A photo of the mast structure at this location is shown in the figure below. The Telecom Operators who have radio links operating from this mast-site in the direction of the wind farm are listed in Table 15.

**Figure 22. Mast F**

| Mast ID | Telecom operators with radio links in direction of proposed wind farm |
| --- | --- |
| Mast F | Eir |

**Table 15. Field Survey Summary – Mast-Site F**

# APPENDIX C – Radio Link Budget Reports

# Appendix C – Radio Link Budget Reports

## C.1 Radio Link Budget Report (Ballyhoura – Tooreen)

**Link Budget Report**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Site Name: | L1B_Eir (Ballyhoura) | | L2B_Eir (Tooreen) | | | | |
| Type: | Cell | Cell | | | | | |
| Latitude: | 52°18'21.6"N | | 52°31'11.2"N | | | | |
| Longitude: | 8°33'48.9"W | | 8°42'37.4"W | | | | |
| Altitude (m): | 436.0 | | 30.0 | | | | |
| UserData1: | User Data | | | | | | |
| Datum: | World Geodetic System 1984 (WGS 84) | | | | | | |
| | Forward Link | | Reverse Link | | | | |
| Transmission Site: | L1B_Eir | | L2B_Eir | | | | |
| Reception Site: | L2B_Eir | | L1B_Eir | | | | |
| Radio Type: | NetRadio0001 | | NetRadio0001 | | | | |
| Modulation Scheme: | 4-QAM | | 4-QAM | | | | |
| Bandwidth (MHz): | 2 | | 2 | | | | |
| Roll-Off Factor: | 0.2 | | 0.2 | | | | |
| Coding Gain (dB): | 0 | | 0 | | | | |
| System Gains (dB): | 0 | | 0 | | | | |
| Channel Overhead (%): | 20 | | 20 | | | | |
| FEC Overhead (%): | 0 | | 0 | | | | |
| Reference Temperature (°K): | 290 | | 290 | | | | |
| Receiver Noise Figure (dB): | 5 | | 5 | | | | |
| Maximum Data Rate (Mbps): | 2.667 | | 2.667 | | | | |
| Maximum Bit Rate (Mbps): | 3.333 | | 3.333 | | | | |
| Required Bit Error Rate: | BER 10-3 | BER 10-6 | BER 10-3 | BER 10-6 | | | |
| Service Threshold (dBm): | -91 | -90 | -91 | -90 | | | |
| Carrier to Noise Ratio (dB): | 14.965 | 15.965 | 14.965 | 15.965 | | | |
| Cross Polarization Improvement Factor (dB): | | | 20 | 20 | 20 | 20 | |
| Rx Equalization Sig Norm Parameter (Kn,M): | | | 0.1 | 0.1 | 0.1 | 0.1 | |
| Rx Equalization Sig Norm Parameter (Kn,NM): | | | 0.1 | 0.1 | 0.1 | 0.1 | |
| UserData1: | User Data | | User Data | | | | |
| Center Frequency (MHz): | 11000 | | 11000 | | | | |
| Channel Bandwidth (MHz): | 28 | | 28 | | | | |
| Transmission Power (dBm): | 30 | | 30 | | | | |
| Transmission Gains (dB): | 0 | | 0 | | | | |
| Transmission System Loss (dB): | | 0 | | 0 | | | |
| Transmission Line Loss (dB/100 m): | | 4 | | 4 | | | |
| Transmission Line Length (m): | | 10 | | 10 | | | |
| Transmission Connection Loss (dB): | | 0.3 | | 0.3 | | | |
| Transmission Number of Connections: | | 2 | | 2 | | | |
| Transmission Additional Loss (dB): | | 0 | | 0 | | | |
| Transmission Losses (dB): | 1 | | 1 | | | | |
| Transmission Antenna: | HP2-11-NSMA | | HP2-11-NSMA | | | | |
| Transmission Antenna Size (m): | | 0.6 | | 0.6 | | | |
| Transmission Antenna Height (m): | | 35 | | 12 | | | |
| Transmission Antenna Gain (dBd): | | 32.36 | | 32.36 | | | |
| Transmission Antenna Gain (dBi): | | 34.5 | | 34.5 | | | |
| Transmission Power EIRP (dBm): | | 63.5 | | 63.5 | | | |
| Reception Gains (dB): | 0 | | 0 | | | | |
| Reception System Loss (dB): | 0 | | 0 | | | | |
| Reception Line Loss (dB/100 m): | | 4 | | 4 | | | |
| Reception Line Length (m): | 10 | | 10 | | | | |
| Reception Connection Loss (dB): | | 0.3 | | 0.3 | | | |
| Reception Number of Connections: | | 2 | | 2 | | | |
| Reception Additional Loss (dB): | | 0 | | 0 | | | |
| Reception Losses (dB): | 1 | | 1 | | | | |

| | | | | |
|---|---|---|---|---|
| Reception Antenna: | HP2-11-NSMA | | HP2-11-NSMA | |
| Reception Antenna Size (m): | 0.6 | | 0.6 | |
| Reception Antenna Height (m): | | 12 | | 35 |
| Reception Antenna Gain (dBd): | | 32.36 | | 32.36 |
| Reception Antenna Gain (dBi): | | 34.5 | | 34.5 |
| | | | | |
| Link Polarization: | Vertical | Vertical | | |
| Cross Polarization Factor (dB): | | 26.667 | | 26.667 |
| | | | | |
| Link Distance (m): | 25824.436 | | 25824.436 | |
| Azimuth - True (°): | 337.33 | 157.214 | | |
| Azimuth - Magnetic (°): | 339.702 | | 159.679 | |
| Transmission Inclination (°): | 0.952 | | -0.952 | |
| Reception Inclination (°): | 0.952 | | -0.952 | |
| | | | | |
| ITU Recommendation: | ITU-R P.525-2 | | | |
| Free Space Distance (m): | 25827.998 | | | 25827.998 |
| Center Frequency (MHz): | 11000 | | 11000 | |
| Free Space Loss (dB): | 141.51 | | 141.51 | |
| | | | | |
| Max Fresnel Radius (m): | 13.269 | | 13.269 | |
| Max 2nd Fresnel Radius (m): | 18.766 | | 18.766 | |
| | | | | |
| Earth Radius Factor (K): | 4/3 | | | |
| Effective Radius (m): | 8502056.000 | | | |
| | | | | |
| ITU Recommendation: | ITU-R P.526-11 | | | |
| Diffraction Model: | Cascade Knife Edge | | | |
| Diffraction: | No LOS Diffraction | | No LOS Diffraction | |
| Diffraction Loss (dB): | 0 | | 0 | |
| | | | | |
| Clearance Target (%): | 60 | | | |
| Minimum Clearance (m): | 5.701 | | 5.701 | |
| Minimum Clearance Point (m): | | 25707.05 | | 25707.05 |
| | | | | |
| Terrain Reflection Dispersion (°): | | 0.5 | | |
| Reflection Area 1 (m): | 385.69 | | 385.69 | |
| Reflection Area 2 (m): | 721.072 | | 721.072 | |
| Reflection Area 3 (m): | 888.763 | | 888.763 | |
| Reflection Area 4 (m): | 1593.066 | | 1593.066 | |
| Reflection Area 5 (m): | 1827.8 - 1861.4 | | | 1827.8 - 1861.4 |
| Reflection Area 6 (m): | 2062.601 | | 2062.601 | |
| Reflection Area 7 (m): | 2263.83 | | 2263.83 | |
| Reflection Area 8 (m): | 3035.21 | | 3035.21 | |
| Reflection Area 9 (m): | 6120.7 - 6187.8 | | | 6120.7 - 6187.8 |
| Reflection Area 10 (m): | 6288.417 | | 6288.417 | |
| Reflection Area 11 (m): | 6422.6 - 6489.6 | | | 6422.6 - 6489.6 |
| Reflection Area 12 (m): | 6556.7 - 6623.8 | | | 6556.7 - 6623.8 |
| Reflection Area 13 (m): | 6690.9 - 6825 | | | 6690.9 - 6825 |
| Reflection Area 14 (m): | 6892.1 - 6925.6 | | | 6892.1 - 6925.6 |
| Reflection Area 15 (m): | 7093.3 - 7193.9 | | | 7093.3 - 7193.9 |
| Reflection Area 16 (m): | 7328.1 - 7395.2 | | | 7328.1 - 7395.2 |
| | | | | |
| ITU Recommendation: | ITU-R P.676-8 | | | |
| Atmospheric Pressure (hPa): | 1013 | | 1013 | |
| Standard Temperature (°C): | 15 | | 15 | |
| Water Vapor Density (g/m³): | 7.5 | | 7.5 | |
| Atmospheric Gases Loss (dB): | | 0.426 | | 0.426 |
| | | | | |
| Total Path Loss (dB): | 141.936 | | 141.936 | |
| | | | | |
| Reception Signal Level (dBm): | | -44.936 | | -44.936 |
| | | | | |
| | BER 10-3 | BER 10-6 | BER 10-3 | BER 10-6 |
| Service Threshold (dBm): | -91 | -90 | -91 | -90 |
| Link Gross Margin (dB): | 46.064 | 45.064 | 46.064 | 45.064 |
| | | | | |
| ITU Recommendation: | ITU-R F.1703-0 / ITU-T G.827 | | | |
| Objective ITU Quality Grade: | Short Haul SDH Networks | | | |
| Unavailability Objective (%): | 2.00E-02 | | | |
| Availability Objective (%): | 99.9800 | | | |

ITU Recommendation: ITU-R F.1668-1 / ITU-T G.826
Error Performance Objective BBER (%): 1.60E-05 1.60E-05
Error Performance Objective BBER (s/Month): 0.42 0.42

| | SESR | ESR | SESR | ESR |
|---|---|---|---|---|
| Error Performance Objective (%): | 1.60E-04 | 3.20E-03 | 1.60E-04 | 3.20E-03 |
| Error Performance Objective (s/Month): | 4.205 | 84.096 | 4.205 | 84.096 |

ITU Recommendation: ITU-R F.1668-1 / ITU-T G.828
Error Performance Objective BBER (%): 4.00E-06 4.00E-06
Error Performance Objective BBER (s/Month): 0.105 0.105

| | SESR | ESR | SESR | ESR |
|---|---|---|---|---|
| Error Performance Objective (%): | 1.60E-04 | 8.00E-04 | 1.60E-04 | 8.00E-04 |
| Error Performance Objective (s/Month): | 4.205 | 21.024 | 4.205 | 21.024 |

Multipath Model: ITU-R P.530-15
Multipath Planning Type: Quick Planning
Multipath Time Frame: Average annual distribution
ITU Recommendation: ITU-R P.453-9
Point Refractivity Gradient (dN1): -76.7
Geoclimatic Factor: 4.05E-05 4.05E-05
Multipath Occurrence Factor (%): 1.49E-01 1.49E-01

Precipitation Model: ITU-R P.530-15
ITU Recommendation: ITU-R P.837-5 / ITU-R P.841-4
Precipitation Time Frame: Average annual distribution
Precipitation Rate @ 0.01% (mm/h): 22
ITU Recommendation: ITU-R P.838-3
Specific Attenuation (dB/km): 0.627685 0.627685
Rainfall Attenuation (dB): 9.924 9.924

| | BER 10-3 | BER 10-6 | BER 10-3 | BER 10-6 |
|---|---|---|---|---|
| Fading Outage (%): | 4.02E-07 | 5.07E-07 | 4.02E-07 | 5.07E-07 |
| Selective Fading Outage (%): | 1.59E-08 | 1.59E-08 | 1.59E-08 | 1.59E-08 |
| Composite Fading Outage (%): | | 4.18E-07 | 5.23E-07 | 4.18E-07 | 5.23E-07 |

| | | | | |
|---|---|---|---|---|
| Fading Outage (s/Month): | 0.011 | 0.013 | 0.011 | 0.013 |
| Selective Fading Outage (s/Month): | 0 | 0 | 0 | 0 |
| Composite Fading Outage (s/Month): | 0.011 | 0.014 | 0.011 | 0.014 |

| | BER 10-3 | BER 10-6 | BER 10-3 | BER 10-6 |
|---|---|---|---|---|
| Unavailability due to Rain (%): | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Unavailability due to Rain (s/Year): | | 0 | 0 | 0 | 0 |

| | BER 10-3 | BER 10-6 | BER 10-3 | BER 10-6 |
|---|---|---|---|---|
| Unavailability due to Fading (%): | | 4.18E-07 | 5.23E-07 | 4.18E-07 | 5.23E-07 |
| Unavailability due to Rain (%): | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Total Unavailability (%): | 4.18E-07 | 5.23E-07 | 4.18E-07 | 5.23E-07 |
| Unavailability Objective (%): | 2.00E-02 | 2.00E-02 | 2.00E-02 | 2.00E-02 |

| | | | | |
|---|---|---|---|---|
| Unavailability due to Fading (s/Year): | 0.132 | 0.165 | 0.132 | 0.165 |
| Unavailability due to Rain (s/Year): | 0 | 0 | 0 | 0 |
| Total Unavailability (s/Year): | 0.132 | 0.165 | 0.132 | 0.165 |
| Unavailability Objective (s/Year): | 6307.2 | 6307.2 | 6307.2 | 6307.2 |

| | | | | |
|---|---|---|---|---|
| Total Availability (%): | 100.0000 | 100.0000 | 100.0000 | 100.0000 |
| Availability Objective (%): | 99.9800 | 99.9800 | 99.9800 | 99.9800 |

* PASS * * PASS * * PASS * * PASS *