

Telecommunications Impact Assessment

Mynydd Fforch Dwn Wind Farm

Savills (UK) Limited

May 2023

PLANNING SOLUTIONS FOR:

- Solar
- Telecoms
- Railways
- Defence
- Buildings
- Wind
- Airports
- Radar
- Mitigation

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ADMINISTRATION PAGE

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Issue	Date	Detail of Changes
1	October 2022	Initial issue
2	November 2022	Arqiva consultation update
3	May 2023	Removal of turbine T2 and two turbine dimensions reduced

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EXECUTIVE SUMMARY

Report Overview

Pager Power has been commissioned to investigate the potential impact of a proposed wind development, located approximately 1 km to the northeast of the village of Tonmawr, Neath Port Talbot, Wales, upon wireless communications infrastructure (point-to-point links) in the surrounding area.

The proposed wind development comprises seven wind turbines with various dimensions of which the largest turbine has a maximum tip height of 200 metres above ground level and a rotor diameter of 150 metres. Coordinate data and turbine dimensions are presented in Section 2.2.

Assessed Scenario

The following Telecommunications Impact Assessment was completed based on a maximum tip height of 220m above ground level for turbines T4 and T5. The maximum tip height for turbines T4 and T5 are now 200m above ground level. Furthermore, turbine T2 is no longer to be progressed. The changes are therefore of no consequence with respect to the conclusions of the following analysis.

Overall Results

British Telecom (BT), Mobile Broadcast Network Limited (MBNL), Virgin Media O2, and Vodafone have confirmed they have no objections to the proposed development based on the current turbine layout.

Atkins had passed on the request for link information onto Dwr Cymru (Welsh Water) who have subsequently confirmed that they have no objections to the proposed development based on the current turbine layout.

Following further analysis undertaken by the Joint Radio Company (JRC) an initial objection to the proposed development was removed. Therefore, the JRC have no objections to the proposed development based on the current turbine layout.

The applicant and Pager Power have had correspondence with Arqiva with respect to their communication infrastructure. The proposed development is predicted to affect one UHF communication link, which traverses the proposed development site. Following consultation, Arqiva undertook a preliminary desktop assessment and confirmed that there is a technically viable mitigation solution that does not involve turbine movement. Mitigation of the communications link will be agreed upon and implemented post-consent.

Mitigation

Due to an infringement of the exclusion zone, mitigation will be a requirement for Turbine 1. An agreement with Arqiva will be made to ensure that a suitable form of mitigation is implemented.

An overview of possible mitigation strategies has been provided for reference (see Section 5).

LIST OF CONTENTS

Administration Page	2
Executive Summary	3
Report Overview	3
Assessed Scenario	3
Overall Results	3
Mitigation	3
List of Contents	4
List of Figures	5
List of Tables	5
About Pager Power	6
1 Background	7
1.1 Introduction	7
2 Proposed Wind Development Details	8
2.1 Proposed Development Layout	8
2.2 Coordinate Data	9
3 Telecommunications Consultation Summary	10
3.1 Process	10
3.2 Consultation Overview	10
4 Technical Assessment	12
4.1 Methodology	12
4.2 Identified Telecommunication Links	13
4.3 Arqiva UHF Link 2D Exclusion Zone Chart	13
5 Mitigation	16
5.1 Microwave Link Mitigation	16
5.2 UHF Telemetry Links	17
6 Conclusions	18
6.1 Overall Results	18
6.2 Mitigation	18

LIST OF FIGURES

Figure 1 Proposed development layout	8
Figure 2 Exclusion zone calculation based on 0.6th Fresnel zone.....	13
Figure 3 Telecommunications link exclusion zone chart - Arqiva UHF Link Preseli to Croeserw.....	14
Figure 4 Preseli to Croeserw and T1 exclusion zone calculations - 0.6th Fresnel Zone with 25m buffer	15
Figure 5 Preseli to Croeserw and T1 exclusion zone calculations - Arqiva 100m clearance.....	15

LIST OF TABLES

Table 1 Proposed turbine coordinates	9
Table 2 Telecommunications stakeholder consultation.....	11
Table 3 Identified telecommunications links	13

ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 58 countries within Europe, Africa, America, Asia and Australasia.

The company comprises a team of experts to provide technical expertise and guidance on a range of planning issues for large and small developments.

Pager Power was established in 1997. Initially the company focus was on modelling the impact of wind turbines on radar systems. Over the years, the company has expanded into numerous fields including:

- Renewable energy projects.
- Building developments.
- Aviation and telecommunication systems.

Pager Power prides itself on providing comprehensive, understandable, and accurate assessments of complex issues in line with national and international standards. This is underpinned by its custom software, longstanding relationships with stakeholders and active role in conferences and research efforts around the world.

Pager Power's assessments withstand legal scrutiny and the company can provide support for a project at any stage.

1 BACKGROUND

1.1 Introduction

Pager Power has been commissioned to investigate the potential impact of a proposed wind development, located approximately 1 km to the northeast of the village of Tonmawr, Neath Port Talbot, Wales, upon wireless communications infrastructure (point-to-point links) in the surrounding area.

The proposed wind development comprises seven wind turbines with various dimensions of which the largest turbine has a maximum tip height of 200 metres above ground level (agl) and a rotor diameter of 150 metres. Coordinate data and turbine dimensions are presented in Section 2.2.

In detail, this report contains:

- Site description;
- Ofcom and stakeholder consultation to identify relevant:
 - Microwave links;
 - UHF Telemetry links.
- Technical analysis including:
 - Exclusion zone calculations (Ofcom-recommended methodology);
- High-level overview of common mitigation options.

2 PROPOSED WIND DEVELOPMENT DETAILS

2.1 Proposed Development Layout

The layout of the proposed development is shown in Figure 1 below. Turbine 2 is no longer to be progressed.



Figure 1 Proposed development layout

2.2 Coordinate Data

The proposed turbine coordinates are shown in Table 1 below. Turbine 2 is no longer to be progressed.

Turbine ID	Easting (British National Grid)	Northing (British National Grid)	Tip Height (m agl)	Rotor Diameter (m)	Hub Height (m agl)
1	281131	197711	180	150	105
2	280820	197190	165	150	90
3	280629	197599	180	150	105
4	283088	197744	200	150	145
5	282628	198074	200	150	145
6	282522	197493	200	150	125
7	282036	197830	200	150	125

Table 1 Proposed turbine coordinates

3 TELECOMMUNICATIONS CONSULTATION SUMMARY

3.1 Process

Pager Power has consulted wireless link operators to establish the most up to date wireless link network in the vicinity of the proposed development. Consultation was undertaken directly with the most prevalent operators¹ in order to obtain link details.

3.2 Consultation Overview

Table 2 below presents a summary of the consultation to date.

Stakeholder	Summary
Airwave (Motorola Solutions)	Airwave is a company that safeguards fixed communication links for the emergency services and does not provide link details due to confidentiality reasons. An Airwave assessment has not been progressed at this stage but is automatically undertaken where necessary following submission of a wind farm planning application.
Arqiva	21/10/22 – PP link request sent 31/10/22 – Follow up sent 31/10/22 – Response received Objection to Turbine 1. Link details provided². 09/11/22 – Arqiva undertook a preliminary desktop assessment and confirmed that there is a technically viable mitigation solution that does not involve turbine movement. Mitigation of the communications link will be agreed upon and implemented post-consent.
Atkins & Dwr Cymru (Welsh Water)	21/10/22 – PP link request sent 27/10/22 – Response received Request forwarded to Dwr Cymru (Welsh Water) 31/10/22 – Follow up sent to Dwr Cymru (Welsh Water) 31/10/22 – Response received No objection

¹ Based on Pager Power's experience and contacts database.

² Arqiva requested a 100-metre clearance to the centre of the link from the blade tip. The technical assessment in Section 4 presents exclusion zones based upon the 0.6th Fresnel zone (with a 25m buffer) and the requested 100m exclusion zone.

Stakeholder	Summary
British Telecom (BT)	21/10/22 – PP link request sent 26/10/22 – Response received No objection
Joint Radio Company (JRC)	21/10/22 – PP link request sent 21/10/22 – Response received JRC to undertake further analysis to determine if initial objection can be removed 24/10/22 – Response received No objection
MBNL ³	21/10/22 – PP link request sent 25/10/22 – Response received No objection
Virgin Media O2 ⁴	21/10/22 – PP link request sent 26/10/22 – Response received No objection
Vodafone	21/10/22 – PP link request sent 27/10/22 – Response received No objection

Table 2 Telecommunications stakeholder consultation

³ Mobile Broadband Network Limited (MBNL) is a joint venture between Everything Everywhere (EE) and Three.

⁴ Previously known as Telefonica.

4 TECHNICAL ASSESSMENT

4.1 Methodology

Microwave and UHF⁵ wireless communication links are used to transmit information between two antennae via radio waves within a particular frequency band.

The exclusion zones associated with the identified links have been calculated based on the telecommunications data provided. Further 2-dimensional clearance calculations have then been undertaken to determine the extent of any clearance or infringement of the proposed development. The following subsections present an overview of the interference mechanisms and methodology.

4.1.1 Fresnel Zones

A Fresnel Zone takes the form of an ellipsoid surrounding a link path and represents the area in which obstructions should not be sited in order to avoid diffraction losses. The width of the zone at any point along the link path is determined by the Fresnel Zone number, the frequency of the link and the distance from each link end. The width of the zone is maximal at the midpoint of the link path.

4.1.2 Diffraction – Microwave and UHF Links

Obstructions such as wind developments which are sited in between two microwave link antennae can partially block the radio signal passing between them, thereby reducing the functionality of the link. This can occur even if the obstruction is not directly between the antennae but close to the link boresight⁶. This kind of blocking is called 'diffraction'.

There are various approaches to safeguarding microwave links against from obstruction via wind developments. The most common approaches are:

1. Implementation of a fixed stand-off distance around the link boresight;
2. Safeguarding the relevant Fresnel Zone (discussed below).

The first approach is used by many operators who request a set buffer distance. Set stand offs are occasionally conservative and produce a large exclusion zone distance. The second approach is to assess an obstruction on a case-by-case basis to calculate the most accurate exclusion zone. Pager Power considers the Second Fresnel zone when assessing the effect of a wind turbine upon microwave and the 0.6th Fresnel zone when assessing UHF links¹.

⁵ Ultra-High Frequency

⁶ This is the straight line between the two antennae.

4.1.3 Reflections – UHF Links

Obstructions can affect UHF links by reflecting the signal between transmitter and receiver. This is not a significant concern for microwave links because they are highly directional. Reflection effects are not anticipated as no UHF links have been identified. Typically, diffraction effects are likely to be the most significant concern due to the greater abundance of microwave point-to-point links and because both microwave and UHF links are safeguarded against diffraction effects.

4.2 Identified Telecommunication Links

Table 3 below presents the details of the identified communications links.

Operator	Type	Link ID / Ref	Frequency	A End	B End
Arqiva	UHF ⁷	Preseli to Croeserw	470 – 694 MHz	217200E 230670N	285780E 195260N

Table 3 Identified telecommunications links

4.3 Arqiva UHF Link 2D Exclusion Zone Chart

The exclusion zone for a UHF communications link is defined by the 0.6th Fresnel zone radius [B], rotor radius [A/2], and additional 25-metre buffer zone [E]. This is shown in Figure 2 below. A 500-metre exclusion zone is applied to UHF link masts.

Arqiva requested a 100-metre clearance to the centre of the link from the blade tip. The technical assessment also presents the results of this 100m clearance.

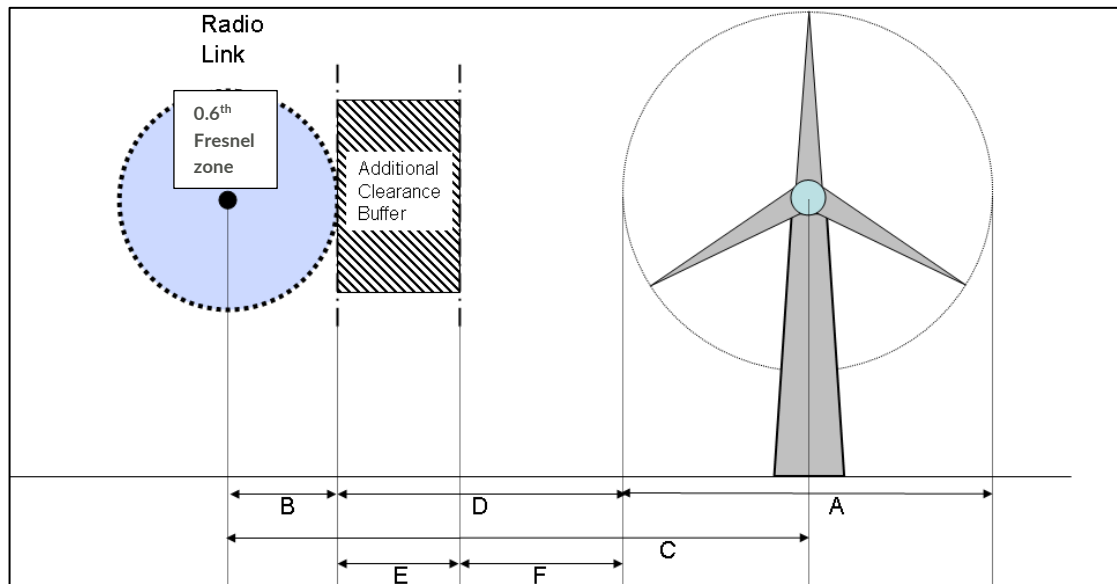


Figure 2 Exclusion zone calculation based on 0.6th Fresnel zone

⁷ The affected link is a Digital TV Re-Broadcast Link (RBL)

Figure 3 below shows the telecommunications link exclusion zone chart for the identified UHF link. Each exclusion zone is represented by two lines, each marking an edge of the exclusion zone. Any turbine(s) located between the lines would infringe the zone in two dimensions. Figure 3 shows the two calculations of the exclusion zone:

- 0.6th Fresnel zone⁸ with a 25-metre buffer (pink lines).
- Arqiva's 100m requested clearance to the centre of the link from the blade tip (black lines).

The Arqiva 100m clearance is the more restrictive of the two exclusion zones. The results for both exclusion zones are presented in the following subsections. Turbine 1 (T1) infringes the exclusion zone associated with the Arqiva link path.

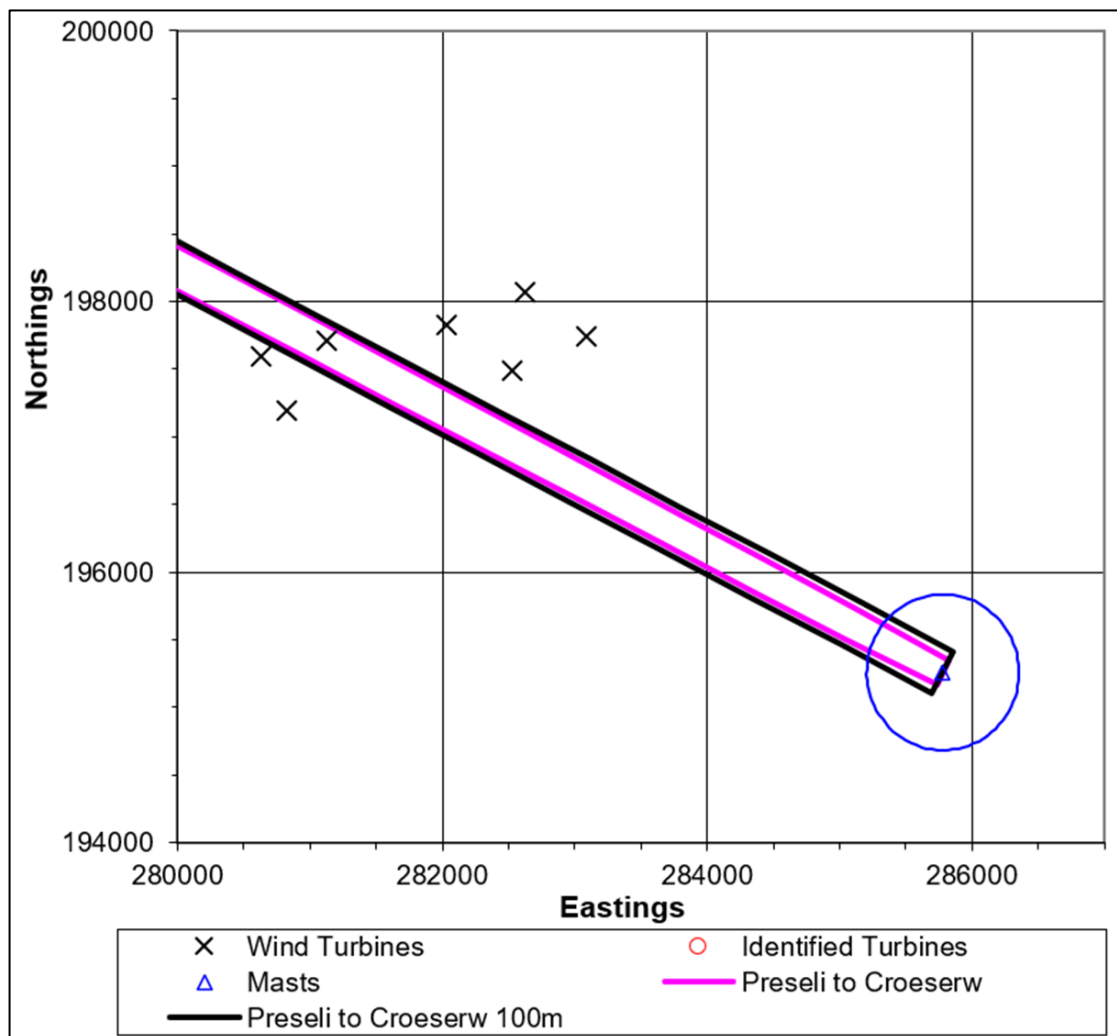


Figure 3 Telecommunications link exclusion zone chart - Arqiva UHF Link Preseli to Croeserw

⁸ Assessed with a link frequency of 470 MHz on a conservative basis.

4.3.1 Arqiva UHF Link Preseli to Croeserw – 0.6th Fresnel Zone with 25m buffer

The 2D exclusion zone calculations for the Arqiva UHF Link Preseli to Croeserw and T1, based upon the 0.6th Fresnel Zone with 25m buffer, are shown in Figure 4 below.

Link Type	UHF			
Link Description	Preseli to Croeserw			
	A End	Z End		
Easting	217200	285780	Turbine Distance from A End (km)	71.9
Northing	230670	195260	Turbine Distance from Z End (km)	5.3
Frequency GHz (e.g. 13)	0.47		Link Length (km)	77.2
Turbine	1		0.6th Fresnel Zone Radius [B] (m)	43.3
Turbine Easting	281131		Turbine Distance from Link Path [C] (m)	44.9
Turbine Northing	197711		Clearance between Tip and Zone [D] (m)	-73.4
Turbine Rotor Diameter [A]	150		Additional Clearance [E] (m)	25
Calculation Reference	A1		Remaining Clearance Tip - Zone [F] (m)	-98.4

Figure 4 Preseli to Croeserw and T1 exclusion zone calculations - 0.6th Fresnel Zone with 25m buffer

The figure shows that T1 infringes the 2D communications link exclusion zone by 73.4 metres, based on the Ofcom recommended guidance.

With the addition of an additional 25-metre buffer zone applied to account for limitations of desk-based analysis, the turbine infringes the exclusion zone by 98.4 metres.

4.3.2 Arqiva UHF Link Preseli to Croeserw – Arqiva 100m clearance

The 2D exclusion zone calculations for the Arqiva UHF Link Preseli to Croeserw and T1, based upon the Arqiva's 100m requested clearance to the centre of the link from the blade tip, are shown in Figure 5 below.

Link Type	UHF			
Link Description	Preseli to Croeserw 100m			
	A End	Z End		
Easting	217200	285780	Turbine Distance from A End (km)	71.9
Northing	230670	195260	Turbine Distance from Z End (km)	5.3
Frequency GHz (e.g. 13)	0.47		Link Length (km)	77.2
Turbine	1		0.6th Fresnel Zone Radius [B] (m)	N/A
Turbine Easting	281131		Turbine Distance from Link Path [C] (m)	44.9
Turbine Northing	197711		Clearance between Tip and Zone [D] (m)	-30.1
Turbine Rotor Diameter [A]	150		Additional Clearance [E] (m)	100
Calculation Reference	A2		Remaining Clearance Tip - Zone [F] (m)	-130.1

Figure 5 Preseli to Croeserw and T1 exclusion zone calculations - Arqiva 100m clearance

The figure shows that T1 infringes the 2D communications link exclusion zone by 130.1 metres, based on Arqiva's 100m requested clearance to the centre of the link from the blade tip.

5 MITIGATION

5.1 Microwave Link Mitigation

5.1.1 Overview

When an impact on a microwave link has been identified, the recommended solutions to consider could include:

- Micrositing / Layout Optimisation;
- Re-networking of the link via existing telecommunications sites;
- Use of a leased line.

Further information regarding these options is given below. Other options that can be considered are:

- Construction of a new telecommunications site for the purpose of re-networking solution;
- Use of an alternative technology such as a satellite link.

These options are less likely to be feasible and are not discussed in detail. They could be explored if an impact could not be mitigated by other means.

5.1.2 Micrositing / Layout Optimisation

This is potentially the simplest solution, depending on the available site area.

Ensuring that replanted turbines remain outside the exclusion zones associated with the microwave links and remain more than 250 metres from a microwave link end is likely to remove any potential impact.

5.1.3 Re-networking Solution

In some cases, it is possible to re-network a microwave link via an existing telecommunications site that lies away from the wind farm.

This involves adding an extra node on the link path, so that instead of the signal being sent from End A to End B, it is sent from End A to a re-networking site, and from the re-networking site to End B.

Implementation of such a solution requires identification of a suitable re-networking site, and assessment of the intervening terrain to ensure the appropriate Fresnel zone would not be infringed by terrain for the re-networked link.

The costs and timescales associated with such a solution are variable, however it is likely to be more cost-effective and have a shorter timescale than construction of a new telecommunications site.

5.1.4 Use of a Leased Line

In some cases, it is possible to replace the wireless link with a leased line between the link ends, thereby avoiding potential interference due to the wind development.

The feasibility of such a solution is dependent on the accessibility of each link end with regard to installation of a leased line.

The costs and timescales of the solution are variable and dependent on the individual site locations and the distance between them.

5.2 UHF Telemetry Links

5.2.1 Overview

Three of the most common and cost-effective mitigation options for UHF telemetry link that are affected by wind turbines are:

- Micrositing / Layout Optimisation;
- Use of an alternative scanner;
- Replacement of the UHF telemetry link with a microwave link.

Further information regarding these options is given below. Other options that can be considered are:

- Use of a leased line or fibre optic connection;
- Construction of a new scanning station;
- Use of an alternative technology such as a satellite link.

These options are less likely to be feasible and are not discussed in detail. They could be explored if an impact could not be mitigated by other means.

5.2.2 Micrositing / Layout Optimisation

This is potentially the simplest solution, depending on the available site area. Relocation of any turbines that have the largest interference contribution could prevent any impacts on the link.

Relocating problem turbines away from the link paths may be sufficient to overcome the operator's concerns.

5.2.3 Use of an Alternative Scanner

In some cases, it is possible to direct the outstations to an alternative scanner. Discussions with the link operator would be required to establish the suitability of such a solution.

Costs are not known for such a solution, however these are likely to be of the order of £5,000 per link.

5.2.4 Replacement of the UHF Link with a Microwave Link

In cases where reflection issues are the only concern, replacement of the UHF link with a microwave link. This is because microwave links are not prone to reflection issues in the way that UHF telemetry links are.

However, microwave links do require radio line of sight to operate, which UHF telemetry links do not. Therefore, detailed assessment of the technical feasibility of such a solution would be required. This would include assessment of radio line of sight between the link ends and establishment of whether the intervening terrain would obstruct the appropriate Fresnel zone.

If the solution is feasible costs are expected to be of the order of £15,000 per link.

6 CONCLUSIONS

6.1 Overall Results

British Telecom (BT), Mobile Broadcast Network Limited (MBNL), Virgin Media O2, and Vodafone have confirmed they have no objections to the proposed development based on the current turbine layout.

Atkins had passed on the request for link information onto Dwr Cymru (Welsh Water) who have subsequently confirmed that they have no objections to the proposed development based on the current turbine layout.

Following further analysis undertaken by the Joint Radio Company (JRC) an initial objection to the proposed development was removed. Therefore, the JRC have no objections to the proposed development based on the current turbine layout.

The applicant and Pager Power have had correspondence with Arqiva with respect to their communication infrastructure. The proposed development is predicted to affect one UHF communication link, which traverses the proposed development site. Following consultation, Arqiva undertook a preliminary desktop assessment and confirmed that there is a technically viable mitigation solution that does not involve turbine movement. Mitigation of the communications link will be agreed upon and implemented post-consent.

6.2 Mitigation

Due to an infringement of the exclusion zone, mitigation will be a requirement for Turbine 1. An agreement with Arqiva will be made to ensure that a suitable form of mitigation is implemented.

An overview of possible mitigation strategies has been provided for reference (see Section 5).



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