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Television Baseline Survey Report

Mulbury New Cross (Goulden Street, Oldham Road and Bendix Street)

Mulbury Homes Limited

November, 2019

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Issue	Date	Detail of Changes
1	August, 2018	Initial issue
2	February, 2019	Second issue – administrative revisions
3	November, 2019	Third issue – following updated baseline survey (undertaken in November 2019)

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EXECUTIVE SUMMARY

Overview

Mulbury Homes Limited is proposing a three-site building development located within the New Cross Area of Manchester City Centre. The proposal will cause new tall structures to be introduced into the area – which could interact with wireless terrestrial television signals and cause interference.

Report Purpose

This report presents the results of the Television Baseline Reception Survey, undertaken to investigate the potential impact of the Proposed Development upon television signals in the surrounding area. The Proposed Development consists of three Sites which are closely located (Goulden Street, Oldham Road and Bendix Street) and therefore the effects of television interference have been considered within one survey and report, with the results being equally applicable to each.

Results

- The Proposed Development is within the coverage area for the Winter Hill television transmitter.
- Any interference would be due to shadowing effects i.e. the weakening of the transmitted signal due to the physical presence of the buildings.
- A site survey was undertaken on 20 November 2019 to confirm the relevant transmitter and record the signal quality.
- Terrestrial coverage is generally good in the surrounding area. Existing tall buildings may already attenuate signals from Winter Hill, particularly at lower levels.
- It is possible that there will be no impact on television signals due to the Proposed Development because small/moderate losses may not result in noticeable interference in the context of the surrounding area. Any impacts would most likely be in the shadow zone within one kilometre of the Proposed Development.

Recommendation

Any reported television interference should be investigated by means of a reception measurement.

Mitigation

Technical mitigation solutions have been identified for implementation if an impact occurs. The most likely options, in the event a mitigation requirement transpires, would be:

- Replacement of receiving aerial with a more directional or higher gain aerial.
- Replacement of terrestrial reception equipment with satellite reception equipment or cable.

Mitigation measures should only be installed if reported effects are found to be attributable to the Proposed Development. There is no reason to install pre-emptive mitigation due to the distinct possibility that no noticeable effects will occur.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 46 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

A television baseline reception survey has been completed for three proposed residential units within the New Cross Area of Manchester City Centre. The three Sites are known as Goulden Street (8 storeys), Oldham Road (11 storeys) and Bendix Street (9 storeys). The Sites are closely located and therefore the effects of television interference have been considered within one survey and report, with the results being equally applicable to each.

Each Site will introduce a new tall structure into the New Cross Area – these could interact with wireless terrestrial television signals and cause interference in the surrounding area. This report produces the results of the baseline survey along with a prediction of the expected impact.

The Sites are collectively referred to as 'Proposed Development' throughout this report.

1.2 Site Boundaries

The Site boundaries are shown in Figures 1-3[1] below and on the following pages.

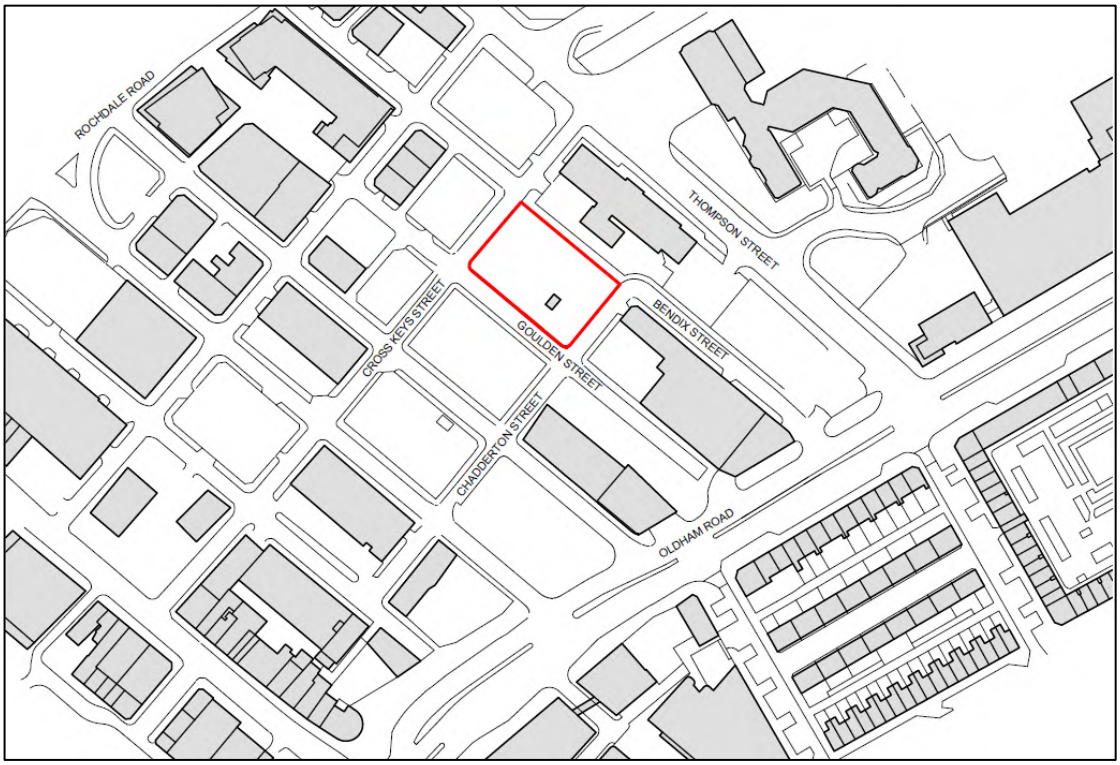

Figure 1 *Site boundary – Goulden Street*

[1] Source: Tim Groom Architects (cropped).

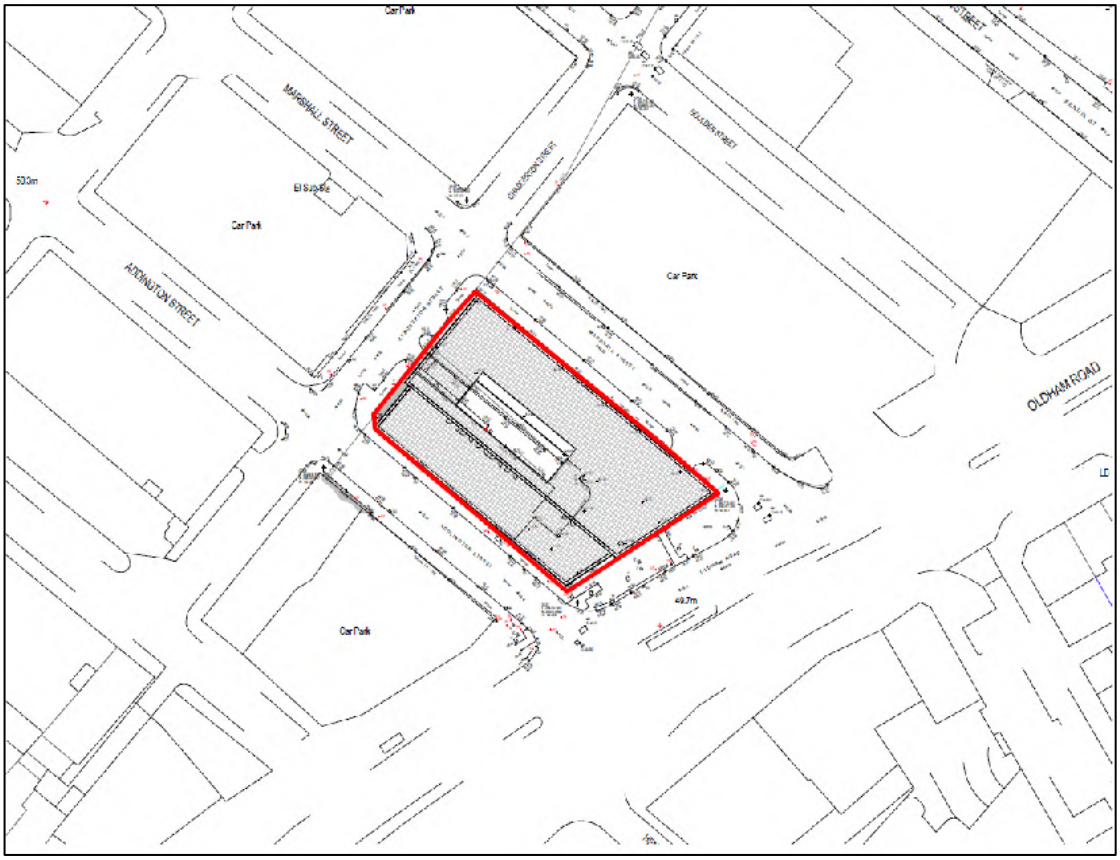

Figure 2 *Site boundary – Oldham Road*

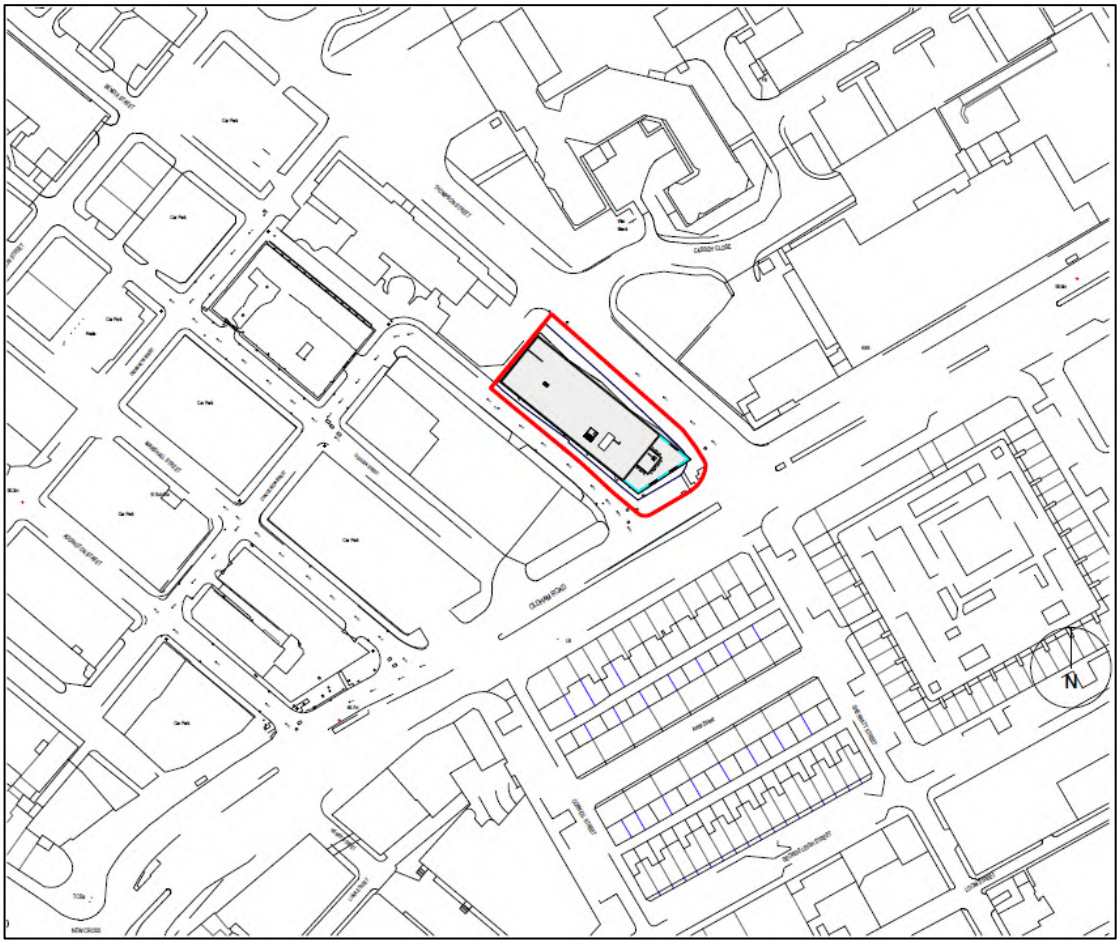

Figure 3 *Site boundary – Bendix Street*

1.3 Site Boundaries – Aerial Image

The Site boundaries are shown in Figure 4[2] below.

Figure 4 *Site boundaries – aerial image*

[2] Copyright © 2019 Google.

2 TELEVISION TRANSMITTER DETAILS

2.1 Relevant Transmitter

A comprehensive search of transmitter and coverage maps revealed that the Winter Hill transmitter serves the area around the Proposed Development.

Digital television services are broadcast via Ultra High Frequency (UHF) signals; no analogue television signals are broadcast. The transmitter information is presented below[3].

2.2 Winter Hill Main Transmitter

Winter Hill is one of the UK's main television transmitters located approximately 24.4km northwest of the Proposed Development (published coordinates SD66051446). The main digital services provided are shown in Table 1 below.

	Public (PSB)			Commercial (COM)		
Service	BBC A	Digital 3&4	BBC B	SDN	Arqiva A	Arqiva B
Channel	50	59	54-	58	49	55
Power	100 kilo-Watts (kW)					

Table 1 *Winter Hill main transmissions*

Additional Winter Hill transmissions are shown in Table 2 below.

	Local Multiplexes			
Service	COM 7	COM8	LM/LL/LPR	GIM
Channel	31	37	56	57
Power	25.7 kW	22.6kW	2 kW	1 kW

Table 2 *Winter Hill additional transmissions*

[3] Source: Ofcom

2.3 Television Transmitter Location

The location of the Winter Hill transmitter relative to the Proposed Development is shown in Figure 5[4] below.

Figure 5 *Television transmitter and Proposed Development relative location*

[4] Copyright © 2019 Google.

3 BUILDINGS AND TELEVISION INTERFERENCE

3.1 Technical Overview

Terrestrial television services are provided by means of UHF radio waves which propagate from transmitters to receiving aerials which then relay the signal to a television set.

The quality of the image and sound on a television set is dependent on both the strength of the signal received directly from the transmitter (carrier signal) and the strength of any interference signals from other sources.

To achieve good quality reception an aerial must receive a strong carrier signal but weak interference signals.

There are two ways that buildings can cause interference to television reception, these are described below.

3.2 Obstruction of the Signal

This is caused by the building physically blocking the transmitted television signal, reducing the strength of the carrier signal in the shadow of the building. In the case of Winter Hill transmissions, this would affect residences to the southeast of the Proposed Development. Specifically:

- The highest losses (greatest interference) will be located immediately behind the building;
- Losses near the edge of the shadow zone will be less significant due to diffraction effects (bending of the signal).

The Ofcom document states that:

"In general, there will be three 'zones' behind the structure:

Zone A - close behind the structure (typically a few tens of metres) there may be a large reduction in signal level with a possible complete loss of reception

Zone B - further away (typically a few hundred metres) the signal reduction is less severe and the shadow will be smaller as diffraction effects partially fill in the shadow. Depending on the size of the structure, some locations could still lose reception completely

Zone C - some distance away (1-5km) the shadow will effectively have disappeared."

The zones mentioned are illustrated in Figure 6[5] on the following page, taken from Section 3.2 of an Ofcom paper[6] regarding the impact of buildings on broadcast signals.

---

[5] Source: Ofcom (2009): Tall Structures and their impact on broadcast and other wireless services.
[6] Reference as above.

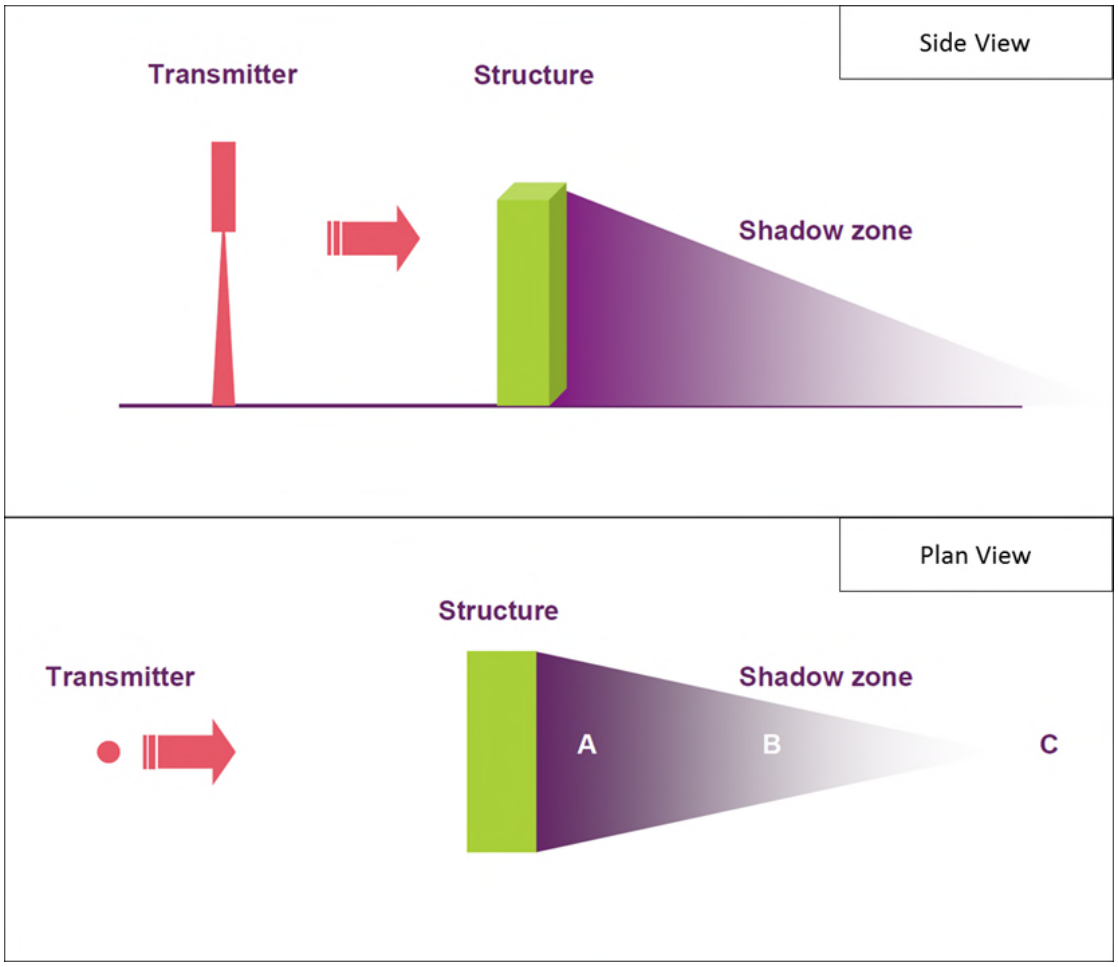

Figure 6 *Diffraction Loss Zones*

3.3 Reflection of the Signal

For large developments with straight edges, the transmitted signal can be reflected by the building itself. This causes an effect known as 'multipath interference' whereby the signal is received twice by an aerial at different times. The direct signal arrives first because it has a shorter distance to travel.

Figure 7 on the following page (taken from Section 3.3 of the Ofcom document referenced above) illustrates this effect.

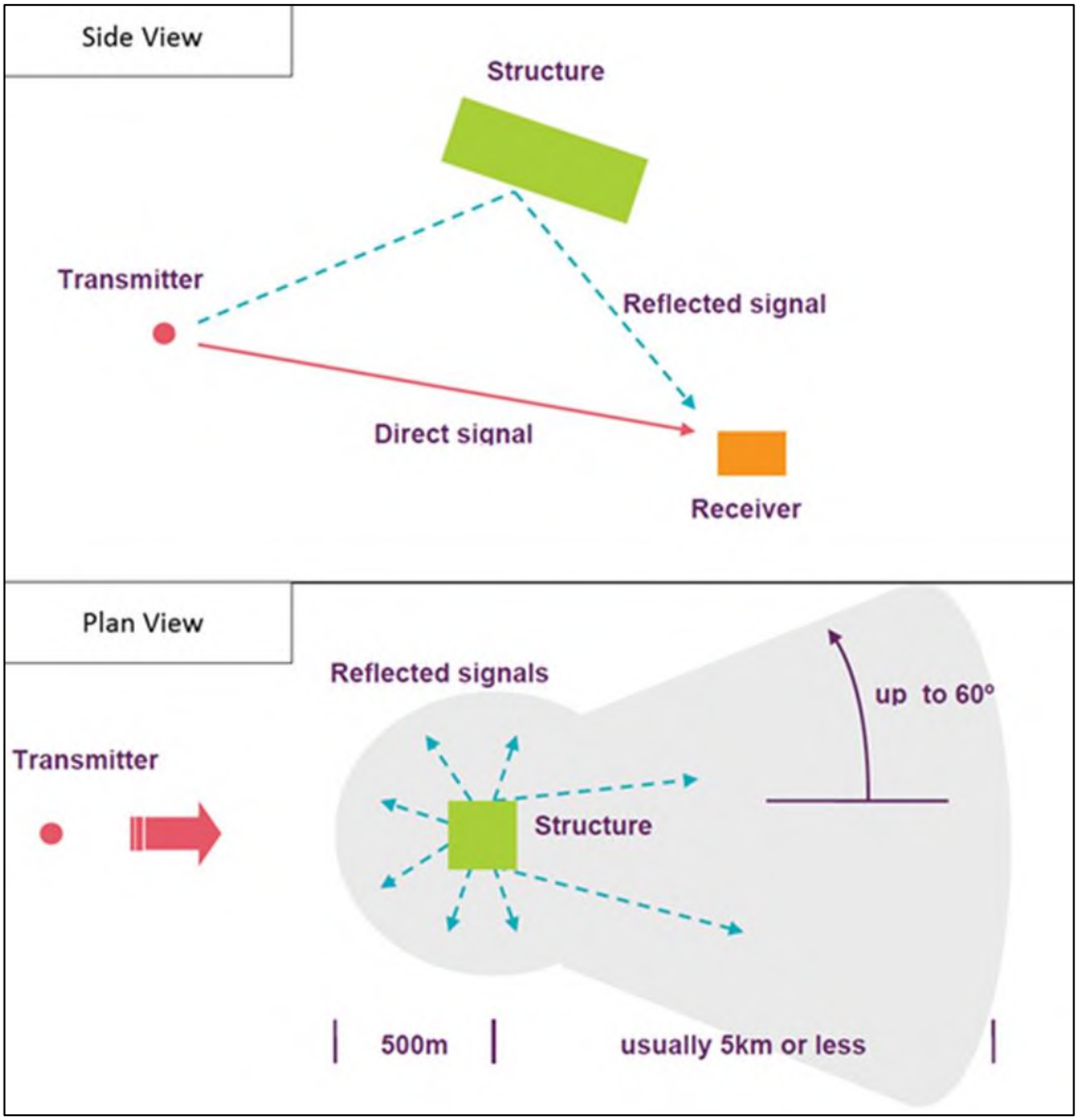

Figure 7 *Diffraction Loss Zones*

In practice, it is considered highly unlikely that reflections will have an effect for receivers in front of the building or on either side when viewed from the location of the transmitter. For digital transmissions in particular, it is unlikely that issues will occur if the angle between the direct signal and the reflected signal is more than 30 degrees[7].

[7] This is known to be the angle that Arqiva considers when safeguarding its Television Re-Broadcast Links with regard to reflections from wind turbines – whilst wind turbines cause issues that are different to buildings this particular issue is similar for the two.

The reflection zone has been constructed in accordance with the Ofcom approach, however the angle considered is 30 degrees rather than 60 degrees. This is in order to represent a more realistic scenario for digital transmissions.

It should be noted that no location can be affected by both diffraction (shadowing) and direct reflections.

Reflection issues are most likely to cause a noticeable impact if:

- The direct signal from transmitter to receiver is weak (e.g. obstructed by terrain or buildings);
- The reflected signal from the building is strong (e.g. clear radio line of sight from the transmitter to the building and the building to the receiver).

The worst case scenario is for both of the above conditions to be satisfied. The best case scenario is for neither of the above conditions to be satisfied.

4 TECHNICAL ASSESSMENT

4.1 Potential Interference Areas

Figure 8 below shows the potential interference areas associated with the Proposed Development.

These have been defined based on the geometry of the potential interference zones as set out in the previous section. Both zones extend to a distance of 5km beyond the Proposed Development location in accordance with the Ofcom guidance.

In the case of the shadow zone, this has been modelled as having straight sides in order to be conservative. In actuality due to diffraction effects the zone would have a more triangular shape as shown in Figure 6 in the previous section.

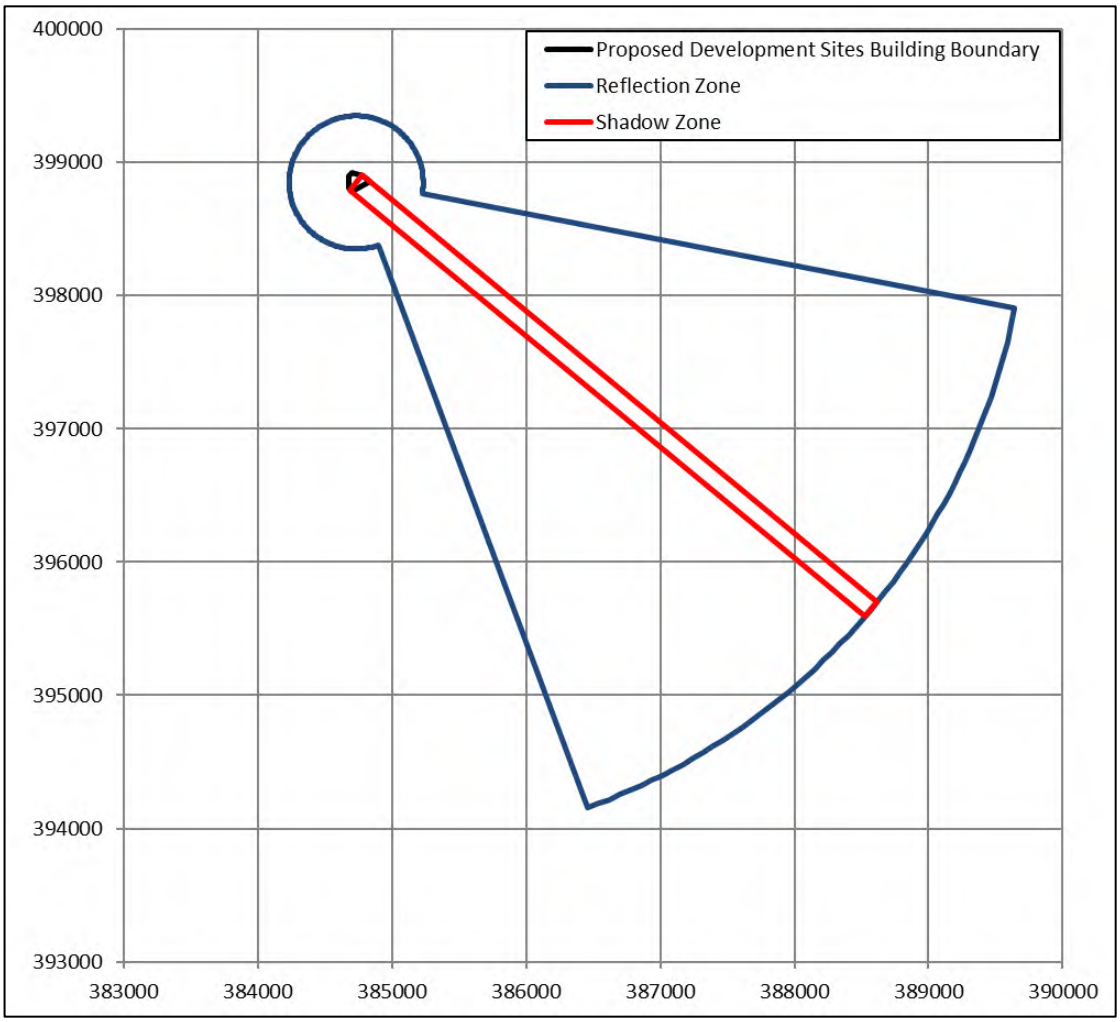

Figure 8 *Interference areas*

Figure 9[8] below shows the interference zones overlaid onto mapping of the area.

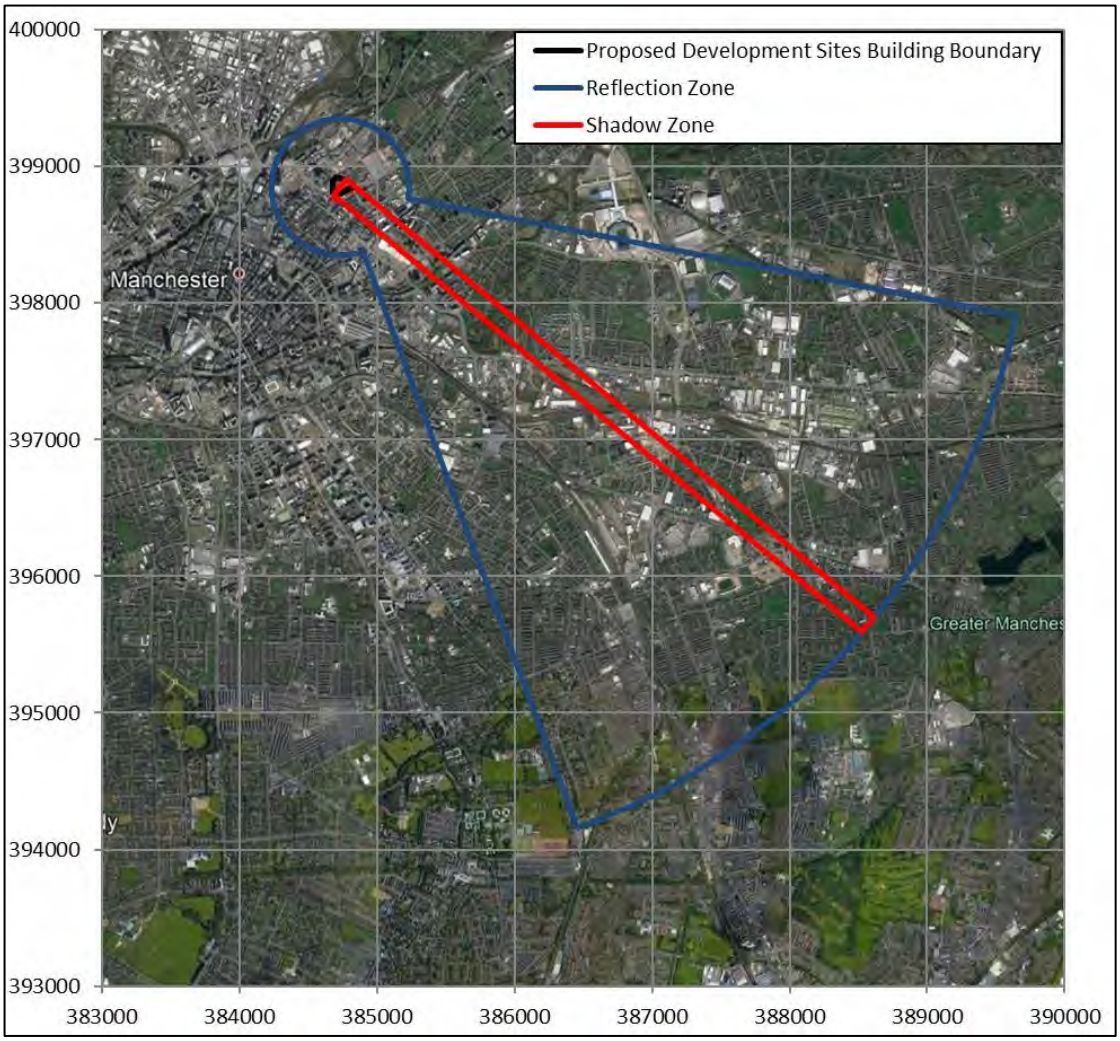

Figure 9 *Interference zones map*

[8] Copyright © 2019 Google.

4.2 Potential Diffraction Issues

It can be seen that the shadow zone passes over areas that are mostly urban containing industrial buildings as well as high and low-rise residential developments. Areas closest to the Proposed Development are at the highest risk of experiencing television interference.

4.3 Potential Reflection Issues

Reflection effects are most likely if the transmitter does not have direct radio line of sight to the receiving aerial.

Based on bare-earth terrain, the Winter Hill transmitter has coverage below ten metres for the populated areas within the reflection zone. This means that any receivers that have a low signal strength are likely to be affected by existing obstructions. For interference to occur due to reflections, the following criteria would need to be met:

- The receiving aerial would be already obstructed by a building or other existing obstacle;
- The reflected signal path via the Proposed Development would have to be relatively unobstructed;
- The angle between the reflected signal via the Proposed Development and the direct signal would have to be small.

In practice it is unlikely that all of the above criteria would be met. Impacts due to reflections are considered unlikely.

5 TELEVISION BASELINE SURVEY

5.1 Overview

The purpose of a baseline survey is to establish current television signal strength and quality in the area. The baseline survey serves three purposes these are:

1. It confirms which transmitter is serving most homes in the areas surveyed;
2. It provides an indicator regarding the likelihood of interference. If current signals are of good quality, minor degradation is less likely to have a noticeable effect; and
3. It allows a 'before and after' comparison to be made in the event that a complaint is received.

A baseline television reception survey was undertaken for the Proposed Development on 20 November 2019.

Survey measurements were taken using Pager Power's custom survey vehicle with a wideband UHF aerial extended to a height of 10 metres above ground level. This was connected to television analyser to record the signal strength and stability.

The strength of the recorded signals is categorised in accordance within Table 3 below.

Average Signal Strength (dB)	Subjective Signal Strength Definition
<35	Low
35-45	Moderate
45-55	Good
55+	Very Good

Table 3 *Television signal strength categories*

5.2 Survey Locations

Figure 10[9] below shows the survey locations overlaid onto aerial photography. The Proposed Development's location and the shadow zone are also shown. Survey locations were chosen pre-survey (within the shadow zone) however safe and available access influenced the specific position on the day. The locations below show the actual survey locations.

Figure 10 *Survey locations*

[9] Copyright © 2019 Google.

5.3 Survey Results

An overview of the survey results is presented in Table 4 below whilst the full survey results are shown in Appendix A. Survey photographs are shown in Appendix B.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
1	Main TV MUX: 41 (Moderate) Local TV MUX: 37 (Moderate)	Horizontally polarised aerials directed towards the Winter Hill transmitter and satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplexes were not decoded at this location.	The survey location is within 200m of the closest of the Proposed Development. Effects are possible based on the proximity to the Proposed Development. This could depend on the relative height of the building development and any receiving aerials.
2	Main TV MUX: 49 (Good) Local TV MUX: 39 (Moderate)	External aerials were not visible at this location. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplexes were not decoded at this location.	The survey location is within 700m of the closest of the Proposed Development. Considering the existing signal strength and the proximity to the Proposed Development, impacts are possible at this location.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
3	Main TV MUX: 42 (Moderate) Local TV MUX: 36 (Moderate)	Horizontally polarised aerials directed towards the Winter Hill transmitter and satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. Two local multiplexes were not decoded at this location.	The survey location is within 1.3km of the closest of the Proposed Development. In principle, further degradation of the weaker signals could result in noticeable effects. In practice, noticeable losses are unlikely at this range from the Proposed Development.
4	Main TV MUX: 50 (Good) Local TV MUX: 38 (Moderate)	Very few external aerials were visible at this location. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.	The survey location is within 1.9km of the Proposed Development. Considering the existing signal strength and quality noticeable losses are unlikely at this range from the Proposed Development.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
5	Main TV MUX: 70 (Very Good) Local TV MUX: 51 (Good)	Horizontally polarised aerials directed towards the Winter Hill transmitter and satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.	It is unlikely that significant losses would be experienced at this location (approximately 3.2km from the Proposed Development) considering the existing signal strength and distance. Impacts are unlikely.
6	Main TV MUX: 64 (Very Good) Local TV MUX: 48 (Good)	Horizontally polarised aerials directed towards the Winter Hill transmitter and satellite dishes were observed. All main multiplexes displayed fine picture and audio quality, with signal fluctuations of less than 1dB and no signs of interference. One local multiplex was not decoded at this location.	It is highly unlikely that noticeable losses would occur at the outer extremities (4.5km) of the shadow zone. No interference is predicted.

Table 4 *Baseline survey results*

6 MITIGATION

6.1 Mitigation Requirement

If an adverse effect on television services occurs and is attributable to the Proposed Development, mitigation will be required.

6.2 Mitigation Options

The most effective form of mitigation is dependent on the specific impact. Common options are shown below.

Mitigation options for television include:

- Replacement of receiving aerial with a more directional or higher gain aerial.
- Repositioning the receiving aerial so that the received signal is stronger.
- Directing the receiving aerial to an alternative transmitter that covers the area and retuning the television accordingly.
- Upgrading antenna cabling and connections.
- Installation of signal amplifiers.
- Development of a bespoke local solution using a receiving aerial some distance from the dwelling.
- Replacing terrestrial reception equipment with satellite reception equipment, cable or provision via the internet.

6.3 Recommended Options

If interference were to occur for a small number of homes, it is likely that installation of satellite television would be the most suitable option.

If effects are experienced for dwellings with poor quality or low receiving aerials, the best option may be to upgrade and/or elevate the existing aerial.

6.4 Recommended Process

It is possible that no adverse effects will occur due to the current reception quality in the majority of the surrounding area.

It is therefore recommended to investigate any reports of interference in order to determine whether these are attributable to the Proposed Development. If this is found to be the case, mitigation can be applied.

There is no reason to install pre-emptive mitigation.

7 CONCLUSIONS

7.1 Findings

- Residences in the area surrounding the Proposed Development receive television services from the Winter Hill transmitter. The strength and quality of the signal varies at each location but it is determined to be 'Moderate' at worst.
- The Proposed Development will introduce a new structure that will have a shadowing effect to the southeast.
- Receiving aerials in the Proposed Development's shadow, within approximately one kilometre, may experience degradation of terrestrial television reception quality.
- Receptors at greater distances are unlikely to experience noticeable impacts in practice.
- In the event that effects are reported, it is recommended that a reception measurement is undertaken (post-construction) to investigate the likely cause of the interference.
- If mitigation is required, provision of alternative receiving equipment such as a satellite dish or cable television is likely to be most appropriate solution.
- No requirement for pre-emptive mitigation has been identified.

APPENDIX A – DETAILED SURVEY RESULTS

Location 1 (GPS Coordinates: SJ 84876 98748 +/- 27 ft)					
Channel	Service	Signal Strength (dBμV)	BER	Picture	Audio
31	COM7	42.2 ± 0.2	0%	Good	Good
37	COM8	52.1 ± 0.2	$1x10^{-8}$	Good	Good
49	Arqiva A	42.2 ± 0.2	$3x10^{-6}$	Good	Good
50	BBC A	43.3 ± 0.2	$4x10^{-7}$	Good	Good
54-	BBC B	43.5 ± 0.2	0%	Good	Good
55	Arqiva B	37.5 ± 0.2	0%	Good	Good
56	LM/LL/LPR	25.6 ± 0.2	-	-	-
57	GIM	27.1 ± 0.2	-	-	-
58	SDN	41.0 ± 0.3	$4x10^{-7}$	Good	Good
59	Digital 3&4	39.6 ± 0.3	$8x10^{-8}$	Good	Good

Notes: UHF aerials directed towards the Winter Hill transmitter and satellite dishes were observed.

Location 2 (GPS Coordinates: SJ 85340 98356 +/- 24 ft)					
Channel	Service	Signal Strength (dBμV)	BER	Picture	Audio
31	COM7	45.1 ± 0.2	0%	Good	Good
37	COM8	54.2 ± 0.4	$6x10^{-8}$	Good	Good
49	Arqiva A	54.0 ± 0.2	$2x10^{-8}$	Good	Good
50	BBC A	55.0 ± 0.2	$1x10^{-8}$	Good	Good
54-	BBC B	51.2 ± 0.2	0%	Good	Good
55	Arqiva B	43.8 ± 0.3	0%	Good	Good
56	LM/LL/LPR	25.6 ± 0.2	-	-	-
57	GIM	29.2 ± 0.2	-	-	-
58	SDN	45.7 ± 0.3	$3x10^{-6}$	Good	Good
59	Digital 3&4	46.5 ± 0.2	$2x10^{-8}$	Good	Good

Notes: External aerials were not observed at this location.

Location 3 (GPS Coordinates: SJ 85728 97982 +/- 12 ft)					
Channel	Service	Signal Strength (dBμV)	BER	Picture	Audio
31	COM7	42.0 ± 0.2	0%	Good	Good
37	COM8	49.1 ± 0.2	$1x10^{-8}$	Good	Good
49	Arqiva A	42.0 ± 0.2	$2x10^{-6}$	Good	Good
50	BBC A	44.2 ± 0.2	$1x10^{-8}$	Good	Good
54-	BBC B	42.8 ± 0.2	0%	Good	Good
55	Arqiva B	36.7 ± 0.2	0%	Good	Good
56	LM/LL/LPR	25.6 ± 0.2	-	-	-
57	GIM	26.1 ± 0.2	-	-	-
58	SDN	42.3 ± 0.2	$1x10^{-8}$	Good	Good
59	Digital 3&4	42.9 ± 0.2	$1x10^{-8}$	Good	Good

Notes: UHF aerials directed towards the Winter Hill transmitter and satellite dishes were observed.

Location 4 (GPS Coordinates: SJ 86201 97642 +/- 19 ft)					
Channel	Service	Signal Strength (dBμV)	BER	Picture	Audio
31	COM7	42.4 ± 0.5	0%	Good	Good
37	COM8	52.0 ± 0.3	$3x10^{-7}$	Good	Good
49	Arqiva A	47.5 ± 0.4	$4x10^{-7}$	Good	Good
50	BBC A	49.9 ± 0.2	$1x10^{-8}$	Good	Good
54-	BBC B	50.1 ± 0.2	0%	Good	Good
55	Arqiva B	44.8 ± 1.2	0%	Good	Good
56	LM/LL/LPR	25.7 ± 0.1	-	-	-
57	GIM	31.2 ± 0.2	$1x10^{-5}$	Good	Good
58	SDN	53.2 ± 0.2	$1x10^{-8}$	Good	Good
59	Digital 3&4	51.8 ± 0.2	$1x10^{-9}$	Good	Good

Notes: Very few external aerials were visible at this location.

Location 5 (GPS Coordinates: SJ 87220 96759 +/- 29 ft)					
Channel	Service	Signal Strength (dBμV)	BER	Picture	Audio
31	COM7	65.8 ± 0.3	0%	Good	Good
37	COM8	75.6 ± 0.2	$1x10^{-8}$	Good	Good
49	Arqiva A	74.3 ± 0.2	$1x10^{-8}$	Good	Good
50	BBC A	75.1 ± 0.3	$1x10^{-8}$	Good	Good
54-	BBC B	71.2 ± 0.2	0%	Good	Good
55	Arqiva B	71.2 ± 0.2	0%	Good	Good
56	LM/LL/LPR	26.4 ± 0.2	-	-	-
57	GIM	37.9 ± 0.2	$1x10^{-8}$	Good	Good
58	SDN	65.0 ± 0.3	$1x10^{-8}$	Good	Good
59	Digital 3&4	64.4 ± 0.2	$1x10^{-8}$	Good	Good

Notes: UHF aerials directed towards the Winter Hill transmitter were observed.

Location 6 (GPS Coordinates: SJ 88289 95937)					
Channel	Service	Signal Strength (dBμV)	BER	Picture	Audio
31	COM7	60.7 ± 0.2	0%	Good	Good
37	COM8	69.4 ± 0.2	$1x10^{-8}$	Good	Good
49	Arqiva A	67.4 ± 0.2	$1x10^{-8}$	Good	Good
50	BBC A	68.7 ± 0.2	$1x10^{-8}$	Good	Good
54-	BBC B	65.6 ± 0.2	0%	Good	Good
55	Arqiva B	58.1 ± 0.2	0%	Good	Good
56	LM/LL/LPR	25.6 ± 0.2	-	-	-
57	GIM	35.6 ± 0.2	$1x10^{-8}$	Good	Good
58	SDN	61.4 ± 0.2	$1x10^{-8}$	Good	Good
59	Digital 3&4	60.5 ± 0.2	$1x10^{-9}$	Good	Good

Notes: UHF aerials directed towards the Winter Hill transmitter were observed.

APPENDIX B – SURVEY PHOTOGRAPHS

Location 1

Location 2

Location 3

Location 4

Location 5

Location 6

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