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Television Baseline Survey Report

Prepared for:

Select Property Group and Bruntwood

Circle Square Phase 1B and Phase 1C (Plot 9)

December, 2016

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ADMINISTRATION PAGE

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1	August, 2015	Initial issue (8534A)
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5	December, 2016	Fifth issue – specific reference to plot 9

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EXECUTIVE SUMMARY

Report Purpose

This report presents the results of the television baseline reception survey undertaken with regard to the proposed Former BBC Site. The survey was conducted based on potential interference zones for the full Former BBC Site masterplan, therefore the results are applicable to each of the development phases including plot 9.

Background

- The relevant TV transmitter serving the area is Winter Hill;
- Interference due to reduced TV signal strength is most likely in the 'shadow' of the buildings, which is an area to the southeast of the proposed development;
- Interference outside the shadow of the buildings due to reflection effects is unlikely. Shadowing issues have formed the focus of this report.

Survey

- Measurements to quantify current signal strength and quality were taken at six locations in the building's shadow zone on 05 August 2015.

Results

- Interference due to reduced TV signal strength in the building's shadow is considered to be more likely than interference due to reflection effects. This is because the coverage of the transmitter outside the shadow zone is very good based on bare earth terrain analysis;
- The table below summarises the results of the survey. A high level assessment of the likelihood of interference has been determined based on the results of the survey and the two-dimensional extent of the diffraction zone:

Location	Baseline Reception Survey Result	High Level Assessment Conclusion
01	Current reception is of low quality.	TV services are currently of poor quality for an aerial at 10 metres above ground. Reception may be better for significantly elevated aerials. Interference is possible, however there are very few residential TV aerials within the shadow zone at this location. **Interference is considered possible.**
02	Current reception is of very good quality.	TV services are currently of very good quality, however this location is less than 1 km from the proposed development. It is possible that degradation of the signal would lead to noticeable interference. **Interference is considered possible.**

Location	Baseline Reception Survey Result	High Level Assessment Conclusion
03	Current reception is of good quality.	TV services are currently of good quality. It is possible that degradation of the signal would lead to a minor reduction in signal strength, however this is unlikely to result in noticeable interference. **Interference is considered unlikely in practice.**
04	Current reception is of low to moderate quality.	TV services are of poor quality at this location, possibly due to existing sources of interference. It is possible that further degradation of the signal may be noticeable for some residences. However, based on the distance to the development and the apparent reliance on other sources of TV (i.e. satellite dishes), issues are not considered likely. **Interference is considered unlikely in practice.**
05 & 06	Current reception is of very good quality.	Significant disruption to the signal is unlikely at this range and current signal quality is very good. **Interference is considered unlikely.**

- It is possible there will be no impact on TV signals due to the proposed development;
- If an impact were to occur this would most likely be in the shadow zone within 1 km of the proposed development.

Recommendations

- A post-construction TV reception survey could be considered;
- Any reported TV interference should be investigated by means of a reception measurement. Further modelling could be undertaken to determine the expected losses due to the proposed development and compare this with losses due to existing buildings. This will determine whether the effect is attributable to the development.

Mitigation

- Technical mitigation solutions have been identified for implementation in the event that an impact occurs. These 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;
    - A combination of the above;
    - Replacing terrestrial reception equipment with satellite reception equipment or cable.

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LIST OF CONTENTS

Administration Page 2
Executive Summary 5
Report Purpose 5
Background 5
Survey 5
Results 5
Recommendations 6
Mitigation 6
List of Contents 7
List of Figures 9
List of Tables 9
1 Introduction 10
1.1 Overview 10
1.2 Coordinate System 10
1.3 Relevant Transmitter 10
1.4 Winter Hill Main Transmitter 10
1.5 TV Transmitter Location 11
2 Buildings and TV Interference 12
2.1 Technical Overview 12
2.2 Obstruction of the signal 12
2.3 Reflection of the signal 13
2.4 Baseline Reception Survey 15
2.5 Potential Interference Areas 16
2.6 Potential Diffraction Issues 17
2.7 Potential Reflection Issues 17
3 Baseline Survey 18
3.1 Overview 18
3.2 Survey Locations 18
4 Mitigation 21
4.1 Mitigation Requirement 21
4.2 Mitigation Options 21
4.3 Recommended Option 21
5 Conclusions 22
5.1 Results Summary 22
Appendix A Massing Images 23
Appendix B Detailed Baseline Survey Results 24

Appendix C Aerial image of Survey Locations (Sourced from Google) 26
Appendix D Survey Photos 27

LIST OF FIGURES

Figure 1 TV transmitter and development location 11
Figure 2 Diffraction Loss Zones (Source: Ofcom publication) 13
Figure 3 Reflection Zones (Source: Ofcom guidance) 14
Figure 4 Interference areas 16
Figure 5 Interference Zones (map) 17
Figure 6 Survey Locations and Potential Interference Zones 18

LIST OF TABLES

Table 1 Winter Hill Transmissions 10
Table 2 TV Signal Strength Categories 15
Table 3 Survey Results 20
Table 4 Results Summary 22

1 INTRODUCTION

1.1 Overview

The assessment considers the proposed Circle Square Masterplan, Oxford Road, Manchester, including the proposals for plot 9.

The massing images for these development phases are shown in Appendix A (provided to Pager Power Limited by the project team). The development will introduce additional physical structures in the area which, consequently, can adversely affect TV reception. The most significant impact is likely to be the weakening of the received signal in the shadow of the buildings.

1.2 Coordinate System

Unless otherwise stated all coordinates used within this report are in British National Grid (OSGB36 datum).

1.3 Relevant Transmitter

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

Digital TV services are broadcast. The relevant transmitter information is presented in the section below[1].

1.4 Winter Hill Main Transmitter

Winter Hill is one of the UK's main TV transmitters located approximately 25 km northwest of the proposed development (published coordinates SD66051446). The published digital services provided are shown 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 Transmissions*

[1] Source: Ofcom

1.5 TV Transmitter Location

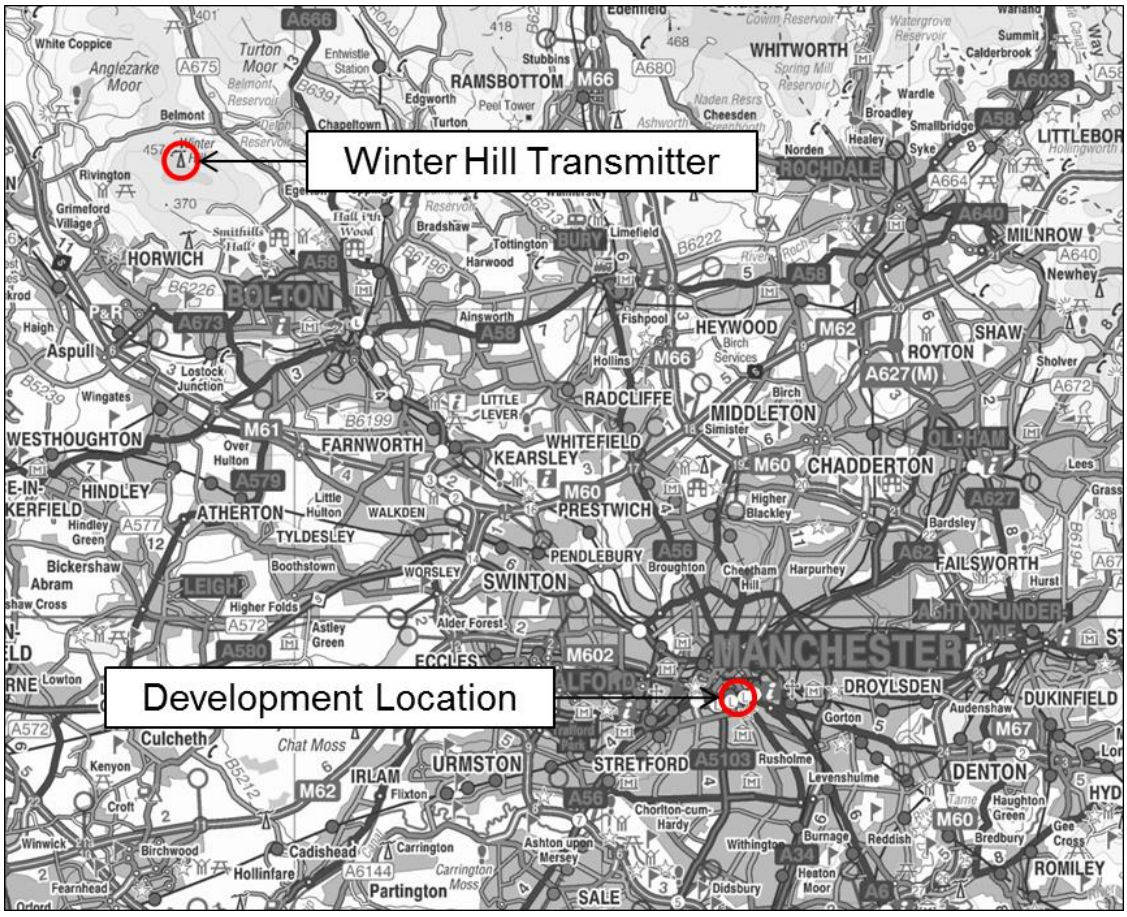


Figure 1 *TV transmitter and development location*

2 BUILDINGS AND TV INTERFERENCE

2.1 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 TV set.

The quality of the image and sound on a TV 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.

2.2 Obstruction of the signal

This is caused by the building physically blocking the transmitted TV 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 development.

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

Ofcom has produced a document[2] offering guidance on this issue. It is stated within this document 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 the figure on the following page, taken from Section 3.2 of the Ofcom guidance regarding the impact of buildings on broadcast signals.

[2] Ofcom (2009): Tall Structures and their impact on broadcast and other wireless services

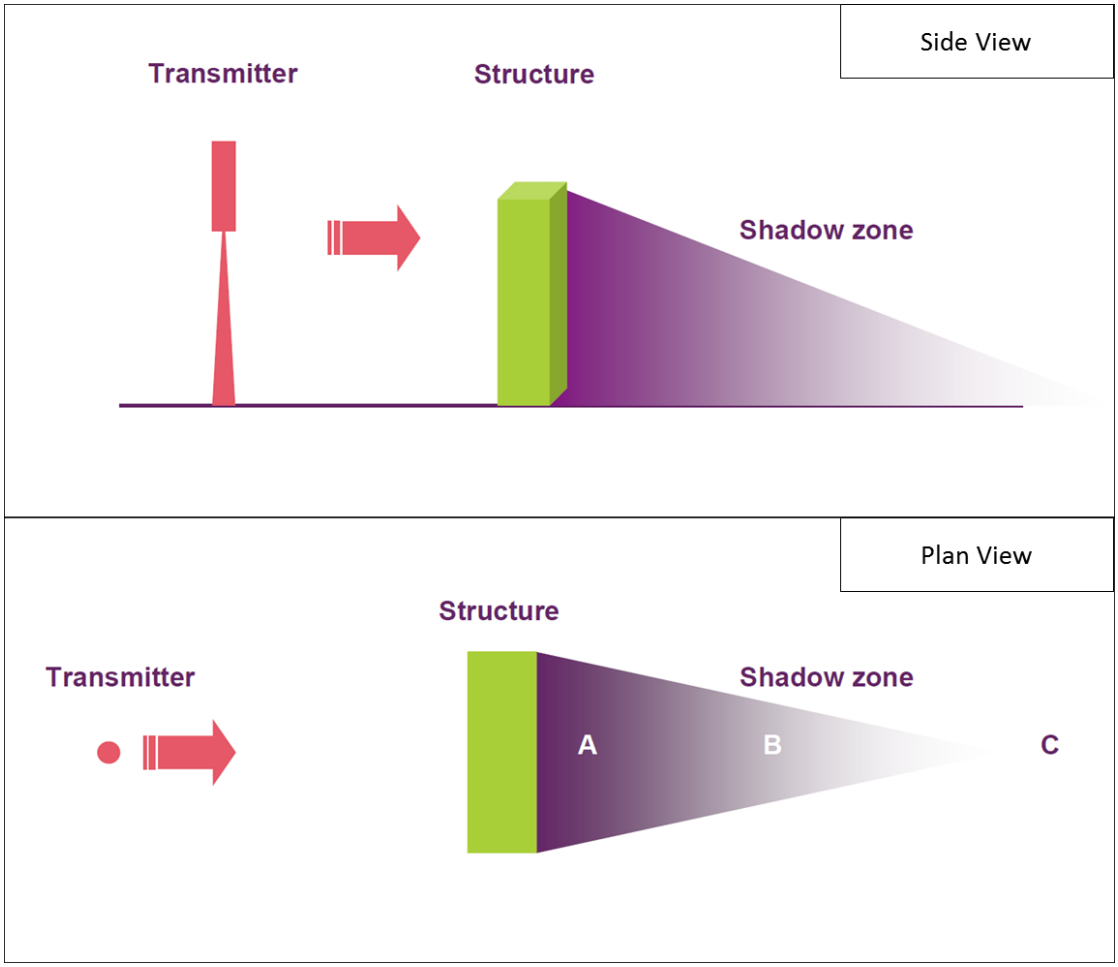


Figure 2 *Diffraction Loss Zones (Source: Ofcom publication)*

2.3 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.

The figure on the following page (taken from Section 3.3 of the Ofcom guidance referenced above) illustrates this effect.

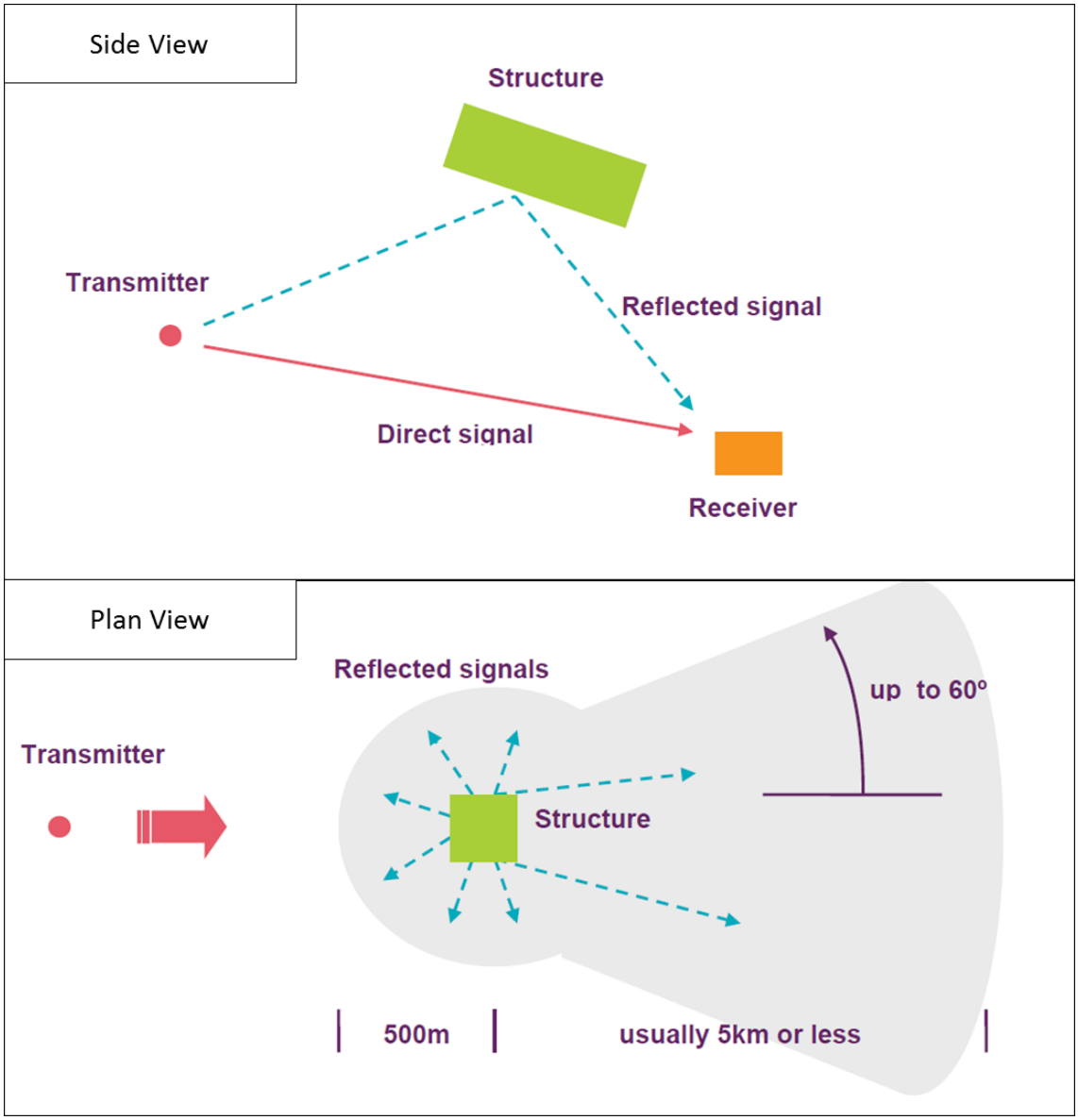


Figure 3 *Reflection Zones (Source: Ofcom guidance)*

In practice, it is considered highly unlikely that reflections will have an effect for receivers in front of the buildings 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[3] .

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.

[3] 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.

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 buildings is strong (e.g. clear radio line of sight from the transmitter to the buildings and the buildings 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.

2.4 Baseline Reception Survey

The baseline reception survey assists determination of the likelihood of interference by providing a quantified measure of signal quality prior to construction of the development. Furthermore, it facilitates a 'before and after' measurement in the event that complaints were to be received following construction of the development.

Survey measurements have been 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 TV analyser to record the signal strength and stability.

The strength of the recorded signals has been categorised in accordance with the table below.

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

Table 2 *TV Signal Strength Categories*

2.5 Potential Interference Areas

The figure 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 5 km beyond the buildings 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 2 in the previous section.

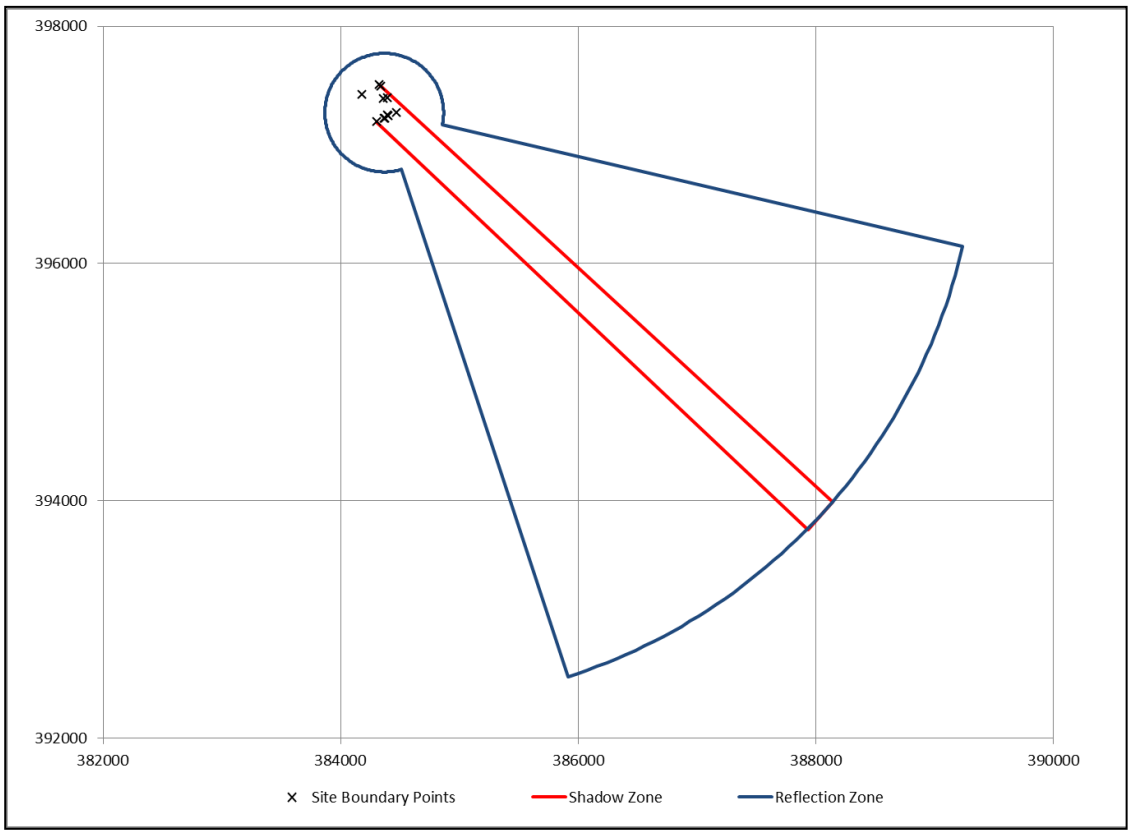


Figure 4 *Interference areas*

The figure on the following page shows the interference zones overlaid onto a map.

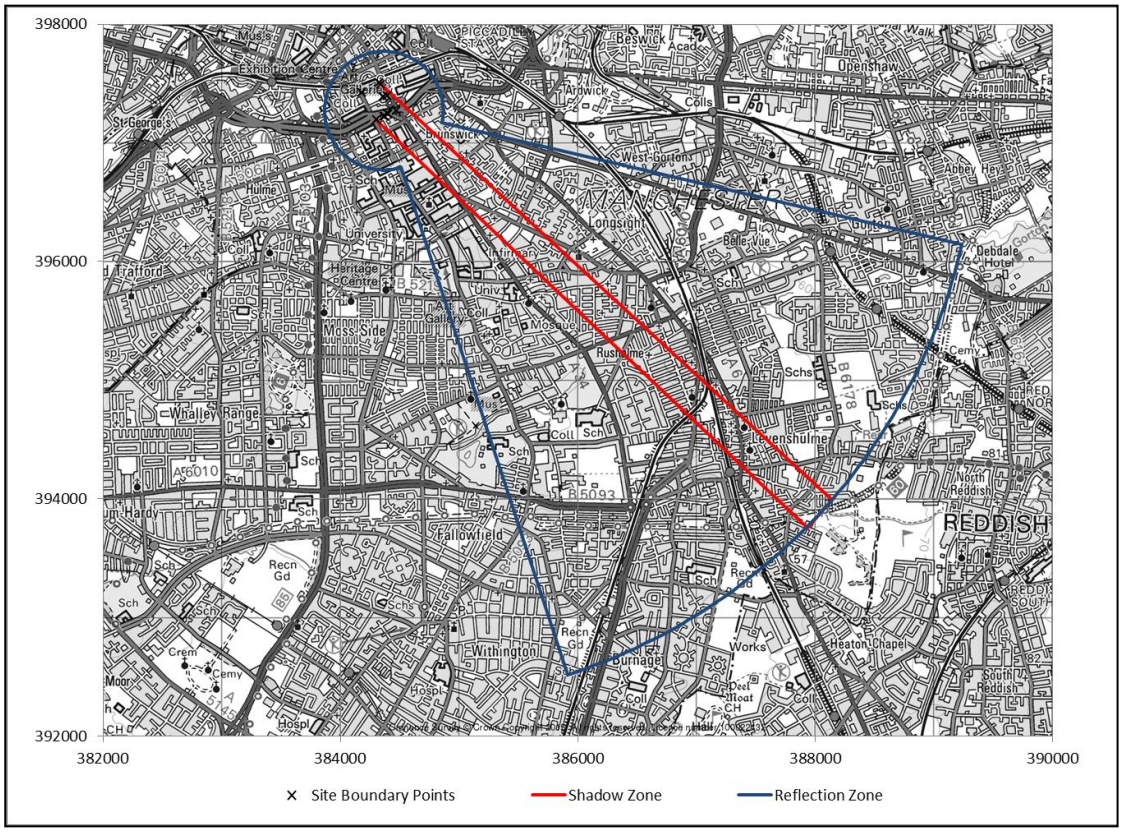


Figure 5 *Interference Zones (map)*

2.6 Potential Diffraction Issues

It can be seen that the Shadow Zone passes over many populated areas, with those closest the development at the highest risk.

Baseline reception measurements were taken at seven locations in the shadow zone out to 5km from the proposed development. An additional measurement was taken to the northwest of the buildings for comparative purposes

2.7 Potential Reflection Issues

Reflection effects are most likely if the transmitter does not have direct radio line of sight to the receiving aerial. The Winter Hill transmitter has radio line of sight below 10 metres for the entirety of the reflection zone, based on bare-earth terrain.

Overall it is unlikely that reflection issues will occur.

3 BASELINE SURVEY

3.1 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.

3.2 Survey Locations

The figure below shows the locations that have been surveyed in the context of the shadow zone discussed in the previous section.

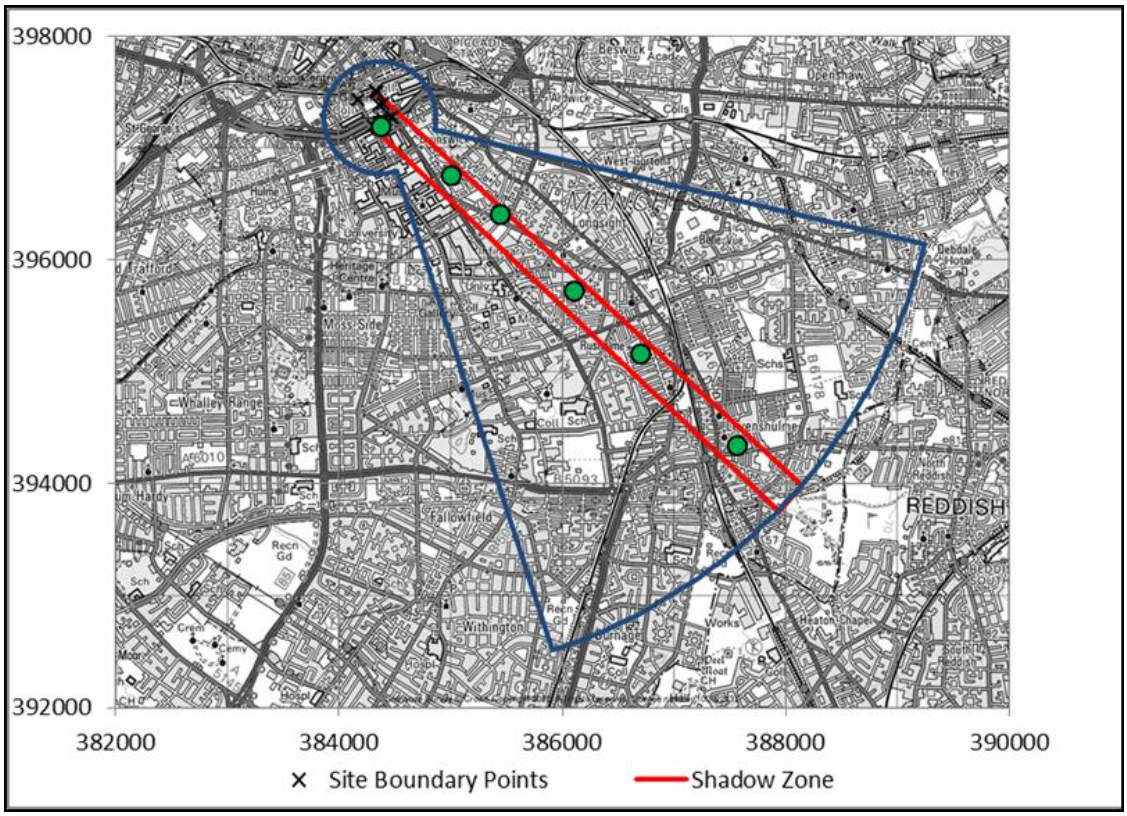


Figure 6 *Survey Locations and Potential Interference Zones*

The survey confirmed that the Winter Hill transmitter is serving the areas around the proposed development. The table on the following page summarises the results of the survey. Detailed survey results are shown in Appendix B, an aerial image of the survey locations is shown in Appendix C and photos taken at the individual survey locations are shown in Appendix D.

The likelihood of interference is given based on the survey results and the two-dimensional extent of the diffraction/reflection zone. Further certainty could be gained by:

- Detailed modelling of expected losses; and
- Comparison of the proposed building heights with existing building heights in the shadow zone.

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
01 SJ 84377 97193	26 (Low)	TV services were not decoded at this location. The poor reception is likely to be due to existing large buildings that are obstructing the signal. Visible aerials at this location were located on top of tall buildings. It is possible that increased diffraction losses could affect aerials on these buildings.	TV services are currently of poor quality for an aerial at 10 metres above ground. Reception may be better for significantly elevated aerials. Interference is possible, however there are very few residential TV aerials within the shadow zone at this location. **Interference is considered possible.**
02 SJ 85010 96750	58 (Very Good)	TV services were decoded for all channels at this location and showed excellent picture and sound.	TV services are currently of very good quality, however this location is less than 1 km from the proposed development. It is possible that degradation of the signal would lead to noticeable interference. **Interference is considered possible.**
03 SJ 85446 96411	53 (Good)	TV services were decoded for all channels at this location and showed excellent picture and sound.	TV services are currently of good quality. It is possible that degradation of the signal would lead to a minor reduction in signal strength, however this is unlikely to result in noticeable interference. **Interference is considered unlikely in practice.**
04 SJ 86102 95727	35 (Low / Moderate)	TV services were not decoded for most channels at this location. One channel was decoded but showed interference. Aerials at this location were directed towards Winter Hill, however many of them appeared to be old aerials, possibly from before the digital rollout. A high number of satellite dishes were observed at this location.	TV services are of poor quality at this location, possibly due to existing sources of interference. It is possible that further degradation of the signal may be noticeable for some residences. However, based on the distance to the development and the apparent reliance on other sources of TV (i.e. satellite dishes), issues are not considered likely. **Interference is considered unlikely in practice.**

Location	Average Measured Signal Strength (dB)	Remarks	High Level Conclusion
05 SJ 86698 95160	65 (Very Good)	TV services were decoded for all channels at this location and showed excellent picture and sound.	Significant disruption to the signal is unlikely at this range and current signal quality is very good. **Interference is considered unlikely.**
06 SJ 87567 94346	65 (Very Good)	TV services were decoded for all channels at this location and showed excellent picture and sound.	Significant disruption to the signal is unlikely at this range and current signal quality is very good. **Interference is considered unlikely.**

Table 3 *Survey Results*

4 MITIGATION

4.1 Mitigation Requirement

If an adverse effect on TV services occurs and is attributable to the development, mitigation will be required.

4.2 Mitigation Options

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

1. Replacement of receiving aerial with a more directional or higher gain aerial.
2. Repositioning the receiving aerial so that the received signal is stronger.
3. Directing the receiving aerial to an alternative transmitter that covers the area and retuning the television accordingly.
4. Upgrading antenna cabling and connections.
5. Installation of signal amplifiers.
6. Development of a bespoke local solution using a receiving aerial some distance from the dwelling.
7. A combination of the above.
8. Replacing terrestrial reception equipment with satellite reception equipment or cable.

4.3 Recommended Option

If interference were to occur for a small number of homes or for numerous locations that were far from each other, it is likely that installation of satellite TV would be the most suitable option.

5 CONCLUSIONS

5.1 Results Summary

- Interference due to reduced TV signal strength in the building's shadow is considered to be more likely than interference due to reflection effects. This is because the coverage of the transmitter outside the shadow zone is very good based on bare earth terrain analysis;
- The table below summarises the results of the survey. A high level assessment of the likelihood of interference has been determined based on the results of the survey and the two-dimensional extent of the diffraction zone:

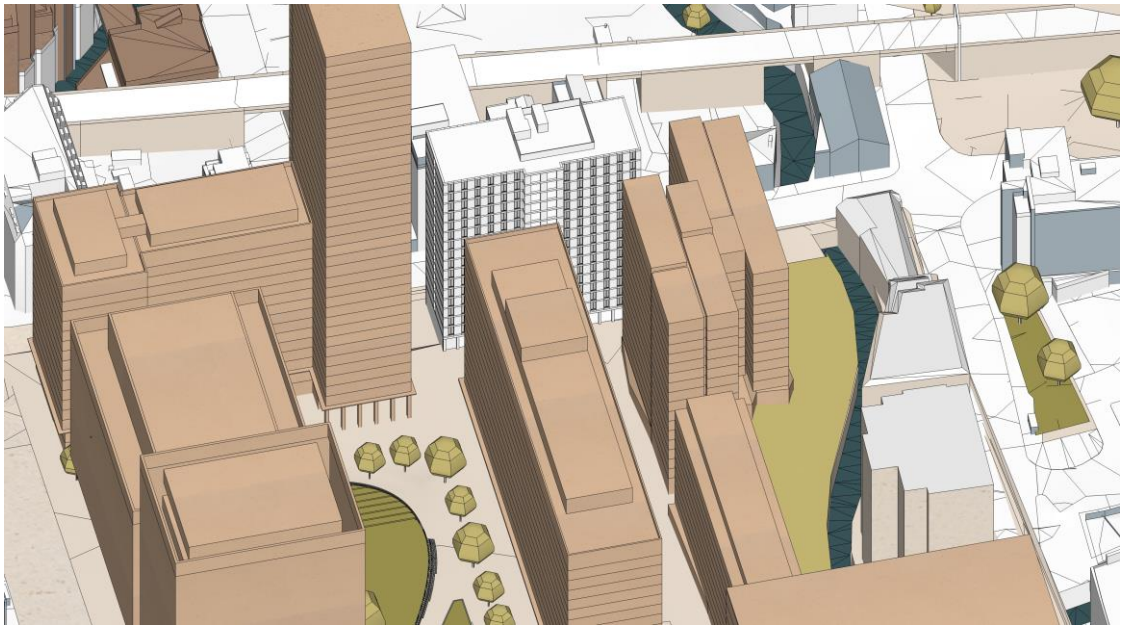
Location	High Level Assessment Conclusion
01	TV services are currently of poor quality for an aerial at 10 metres above ground. Reception may be better for significantly elevated aerials. Interference is possible, however there are very few residential TV aerials within the shadow zone at this location. **Interference is considered possible.**
02	TV services are currently of very good quality, however this location is less than 1 km from the proposed development. It is possible that degradation of the signal would lead to noticeable interference. **Interference is considered possible.**
03	TV services are currently of good quality. It is possible that degradation of the signal would lead to a minor reduction in signal strength, however this is unlikely to result in noticeable interference. **Interference is considered unlikely in practice.**
04	TV services are of poor quality at this location, possibly due to existing sources of interference. It is possible that further degradation of the signal may be noticeable for some residences. However, based on the distance to the development and the apparent reliance on other sources of TV (i.e. satellite dishes), issues are not considered likely. **Interference is considered unlikely in practice.**
05	Significant disruption to the signal is unlikely at this range and current signal quality is very good. **Interference is considered unlikely.**
06	

Table 4 *Results Summary*

- It is possible there will be no impact on TV signals due to the proposed buildings;
- If an impact were to occur this would most likely be in the shadow zone in close proximity to the proposed development.

APPENDIX A MASSING IMAGES

Circle Square Masterplan Including Plot 9



APPENDIX B DETAILED BASELINE SURVEY RESULTS

Location 1				
Channel	**Service**	**Signal Strength (dBµV)**	**Typical Fluctuation (dB)**	**Picture / Sound Quality**
49	Arqiva A	27.1	0.3	Not decoded.
50	BBC A	26.3	0.6	
54-	BBC B	26.0	0.4	-
55	Arqiva B	25.4	0.5	Not decoded.
58	SDN	28.2	0.4	
59	Digital 3&4	25.0	0.5	

Location 2				
Channel	**Service**	**Signal Strength (dBµV)**	**Typical Fluctuation (dB)**	**Picture / Sound Quality**
49	Arqiva A	57.1	0.4	Excellent
50	BBC A	56.5	0.4	
54-	BBC B	58.5	0.2	-
55	Arqiva B	57.0	0.4	Excellent
58	SDN	59.9	0.4	
59	Digital 3&4	59.8	0.3	

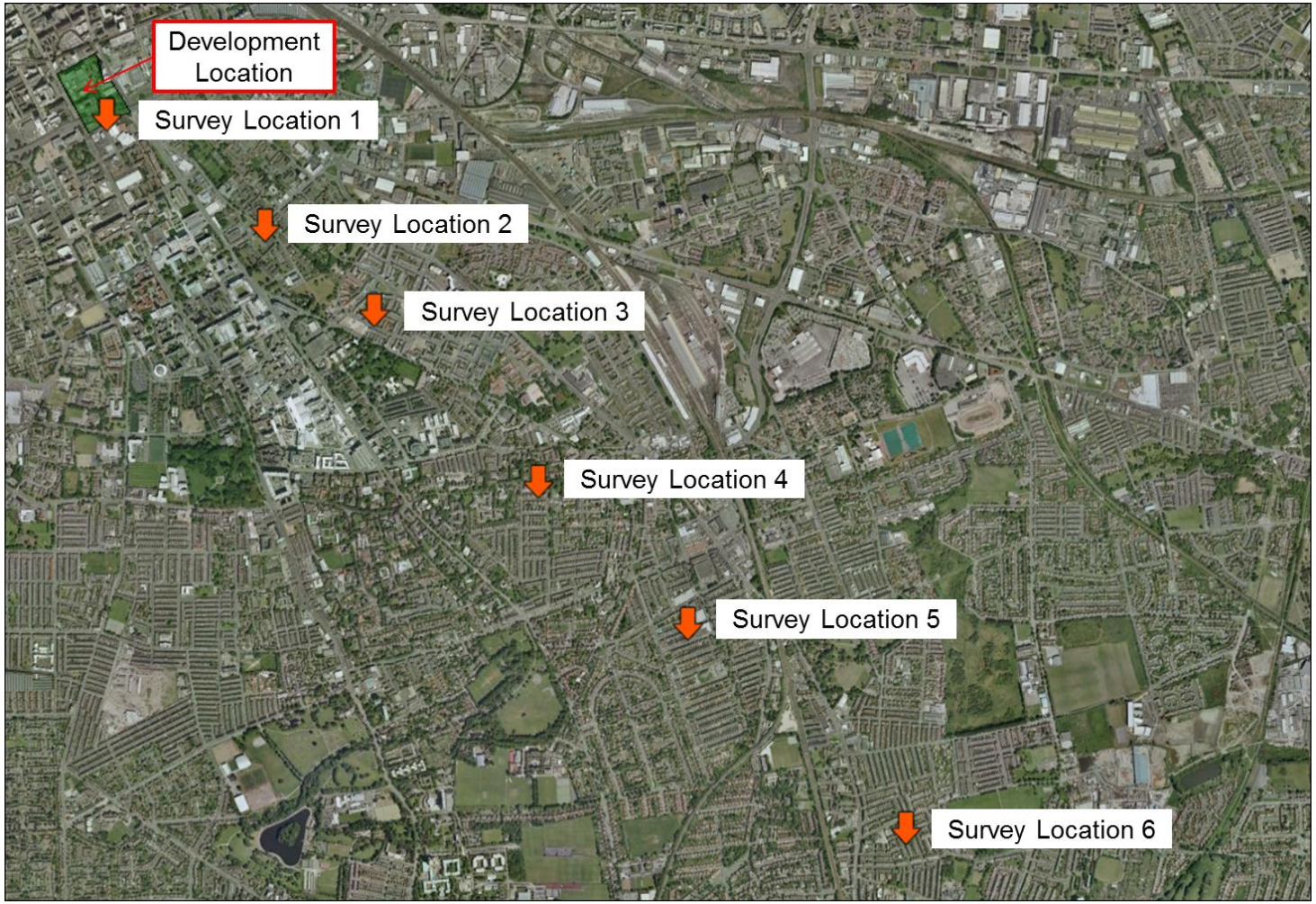
Location 3				
Channel	**Service**	**Signal Strength (dBµV)**	**Typical Fluctuation (dB)**	**Picture / Sound Quality**
49	Arqiva A	53.0	0.6	Excellent
50	BBC A	53.6	0.5	
54-	BBC B	53.3	0.3	-
55	Arqiva B	52.3	0.3	Excellent
58	SDN	55.1	0.4	
59	Digital 3&4	52.9	0.4	

Location 4				
Channel	**Service**	**Signal Strength (dBµV)**	**Typical Fluctuation (dB)**	**Picture / Sound Quality**
49	Arqiva A	34.0	2.0	Not decoded
50	BBC A	38.2	1.0	
54-	BBC B	31.8	0.5	-
55	Arqiva B	34.0	3.0	Not decoded
58	SDN	39.0	2.5	Intermittent disruption to sound and pixilation of the picture.
59	Digital 3&4	34.0	4.0	Not decoded

Location 5				
Channel	**Service**	**Signal Strength (dBµV)**	**Typical Fluctuation (dB)**	**Picture / Sound Quality**
49	Arqiva A	66.3	0.4	Excellent
50	BBC A	64.6	0.5	
54-	BBC B	65.2	0.2	-
55	Arqiva B	64.7	0.3	Excellent
58	SDN	65.4	0.4	
59	Digital 3&4	64.9	0.3	

Location 6				
Channel	**Service**	**Signal Strength (dBµV)**	**Typical Fluctuation (dB)**	**Picture / Sound Quality**
49	Arqiva A	66.3	0.5	Excellent
50	BBC A	65.0	0.5	
54-	BBC B	65.0	0.2	-
55	Arqiva B	64.8	0.4	Excellent
58	SDN	66.0	0.7	
59	Digital 3&4	64.4	0.3	

APPENDIX C AERIAL IMAGE OF SURVEY LOCATIONS (SOURCED FROM GOOGLE)



APPENDIX D SURVEY PHOTOS

Location 1:



Location 2:



Location 3:



Location 4:



Location 5:



Location 6:





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