

Technical Aerodrome Safeguarding Assessment

Albert Bridge House

Oval Real Estate

December 2022

PLANNING SOLUTIONS FOR:

- Solar
- Telecoms
- Railways
- Defence
- Buildings
- Wind
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- Radar
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ADMINISTRATION PAGE

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1	October 2022	Initial issue
2	December 2022	Comments on updated site plans

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EXECUTIVE SUMMARY

Report Purpose

Pager Power has been commissioned to investigate the potential impact of the proposed Albert Bridge House development upon aviation infrastructure in the surrounding area, namely operations at Manchester Airport, which is located approximately 13.4km south of the proposed development.

Proposed Development

The proposed development is located on St Mary's Parsonage in central Manchester and will consist of two buildings. and will have a maximum height of 177.56 metres above ordnance datum (AOD).

Assessed Scenario

The following technical aerodrome safeguarding assessment was completed based on a previous site design, with a maximum height of 176.6 metres AOD. The difference in maximum heights between the assessed scenario and up to date site plans is minimal and of no significant consequence with respect to the conclusions of the following analysis.

Results Summary

The key aviation risk identified was the potential impact upon the Secondary Surveillance Radar (SSR) at Manchester Airport. The secondary risks identified include the obstacle limitation surfaces (OLS) for Manchester Airport, their Instrument Flight Procedures (IFPs), and the aviation lighting requirement (specifically for crane usage).

The proposed development will be visible to the SSR at Manchester Airport. NATS may have concerns regarding this visibility. It is unlikely that the impact upon the radar would be a 'showstopper' if mitigation is implemented which would be payable to NATS.

The proposed development will not infringe the OLS at Manchester Airport. Aviation lighting is not required for either building due to their height above ground level and no infringement of the OLS. A lighting requirement for the cranes during construction is however predicted.

No impact upon the Manchester Airport's IFPs was identified based on a high-level review.

The results of this report should be made available to Manchester Airport, NATS and the local planning authority.

A technical breakdown of the results is presented on the following page.

Analysis Results

Manchester Airport's Obstacle Limitation Surfaces

- The proposed development is beneath the Outer Horizontal Surface (OHS) of Manchester Airport;
- The analysis has shown that neither building within the proposed development would infringe the OHS. The minimum margin of clearance is 30m;
- Crane usage will need to be considered due to the close proximity and possible infringement of the OHS. It is likely a Crane Operations Scheme will be required;
- Consultation with the safeguarding team at Manchester Airport should be undertaken to discuss the infringement of any crane. Any crane will be expected to require aviation lighting.

Manchester Airport SSR

- The proposed development is located approximately 15.8km from the SSR at Manchester Airport;
- Building B will be significantly screened from the SSR by existing buildings along the line of sight path such that no impacts would be expected;
- Building A will not be significantly screened from the SSR due to its increased height, and over 1/3 of the building will be visible to the SSR;
- The design of Building A is multifaceted, with many small facades making up the face of the development in view of the SSR;
- The line of sight profile is also encompassed by existing and proposed taller buildings within the city centre, including Deansgate Square and Crown Street. This will weaken the signal from the SSR that illuminates the proposed development and reduce the likelihood of significant reflection effects;
- Whilst no significant shadowing effects are anticipated, reflection effects are still possible as the proposed development will introduce new unobstructed 'reflectors' to the line of sight of the SSR – there are however mitigating factors, as listed above;
- Consultation with NATS, who safeguard the Manchester Airport radar, is therefore recommended to discuss the requirement for mitigation due to reflection effects. If mitigation is requested, it is expected that it will be a technical fix applied to the radar and implemented by NATS. This solution has been implemented for many developments of this type in the vicinity of SSR and typically costs in the region of £45k.

Instrument Flight Procedures at Manchester Airport – High-Level

A high-level review of the IFPs relative to the proposed development indicates sufficient clearances. There are also taller existing buildings in the immediate surrounding area that already co-exist with the current IFPs. Therefore, no impact upon the IFPs is predicted and no

detailed IFP assessment is recommended. It is possible however that this could still be requested by Manchester Airport.

Aviation Lighting Requirement

There is no aviation lighting requirement for the proposed development; however, any crane used in construction will likely measure to 150m or more above ground and will therefore need to be lit with medium intensity aviation lighting.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 54 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's 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 the proposed Albert Bridge House development upon aviation infrastructure in the surrounding area, namely operations at Manchester Airport, which is located approximately 13.4km south of the proposed development.

Building developments have the potential to affect aviation operations in numerous ways. The most common impacts relate to building developments as physical obstructions to both aircraft and wireless signals used for radar and radio systems. This assessment has identified and assessed all of the aviation constraints for the proposed development. In detail the report includes:

- Proposed development details;
- Identification of relevant aviation infrastructure including:
 - Aerodromes (licensed, unlicensed and military);
 - Radar;
 - Radio navigation aids.
- Radar line of sight analysis;
- Obstacle limitation surfaces (OLS) assessment for Manchester Airport;
- High-level Instrument Flight Procedures assessment;
- High-level comments regarding aviation lighting;
- Overall risk and key issues.

Following the technical analysis, the overall conclusions and recommendations are presented.

1.2 Proposed Development

The proposed development is located on St Mary's Parsonage in central Manchester and will consist of two buildings. and will have a maximum height of 177.56 metres above ordnance datum (AOD).

1.3 Assessed Scenario

The following technical aerodrome safeguarding assessment was completed based on a previous site design, with a maximum height of 176.6 metres AOD. The difference in maximum heights between the assessed scenario and up to date site plans is minimal and of no significant consequence with respect to the conclusions of the following analysis.

1.4 Assessment Data

Unless otherwise stated all coordinates used within this report are in British National Grid (OSGB36 datum) or WGS84 latitude and longitude. All distances are in kilometres (km) or metres (m).

2 DEVELOPMENT PLANS¹

2.1 Proposed Development Elevations

The maximum height of each building above ordnance datum (AOD) and above ground level (agl)² is presented below:

- Building A: Maximum height AOD = 176.600m. Maximum height agl = 145.600m.
- Building B: Maximum height AOD = 114.590m. Maximum height agl = 82.340m.

2.1.1 Proposed Development Location

Table 1 below presents the representative points of each building used within the technical analysis presented in this report. These are shown in Figure 2 on page 12.

ID	Longitude (°)	Latitude (°)
A	-2.251846	53.481740
B1	-2.250911	53.481972
B2	-2.250656	53.481629

Table 1 *Proposed development representative centre points*

¹ These are based on a previous site design. The difference between these and the latest development plans have no significant consequence with respect to the conclusions of the following analysis.

² Considering a ground level of 27.4m as per drawing 10364-Z1-SHP-G200-SE-0001.

2.2 Proposed Development Boundary

The red line boundary for the proposed development and ground level footprints for buildings A and B are shown in Figure 1³ below.



Figure 1 Proposed development red line boundary

³ Source: Studio Egret West (cropped).

2.3 Proposed Development Red Line Boundary – Aerial Imagery

The red line boundary for the proposed development overlaid on aerial imagery is shown in Figure 2 below. The building footprints (blue lines) are also shown.

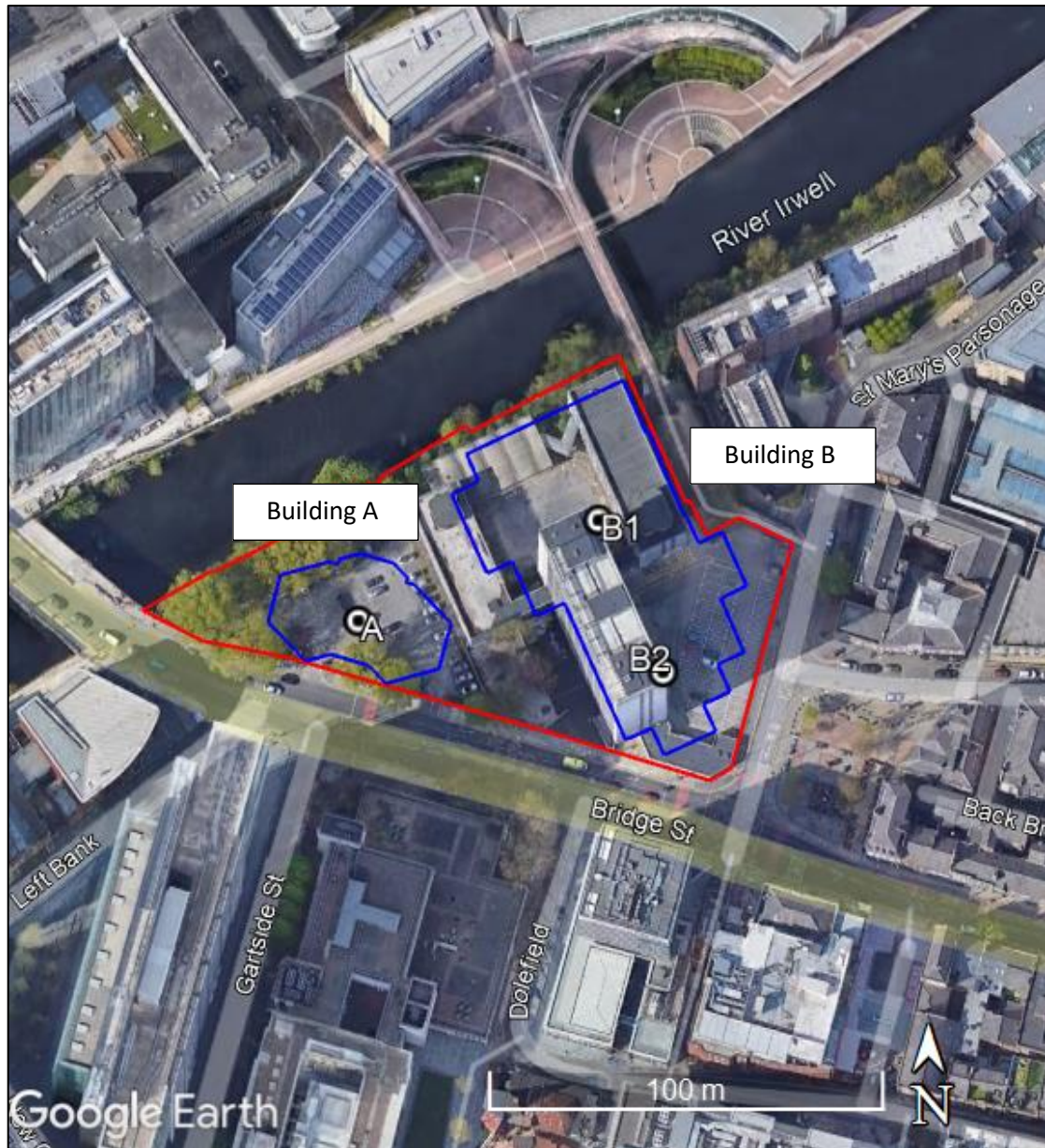


Figure 2 Proposed development red line boundary overlaid on aerial imagery

2.4 Proposed Development – Building A Representative Elevation

A representative elevation for Building A is shown in Figure 3⁴ on the following page.

⁴ Source: Studio Egret West (cropped).
Technical Aerodrome Safeguarding Assessment

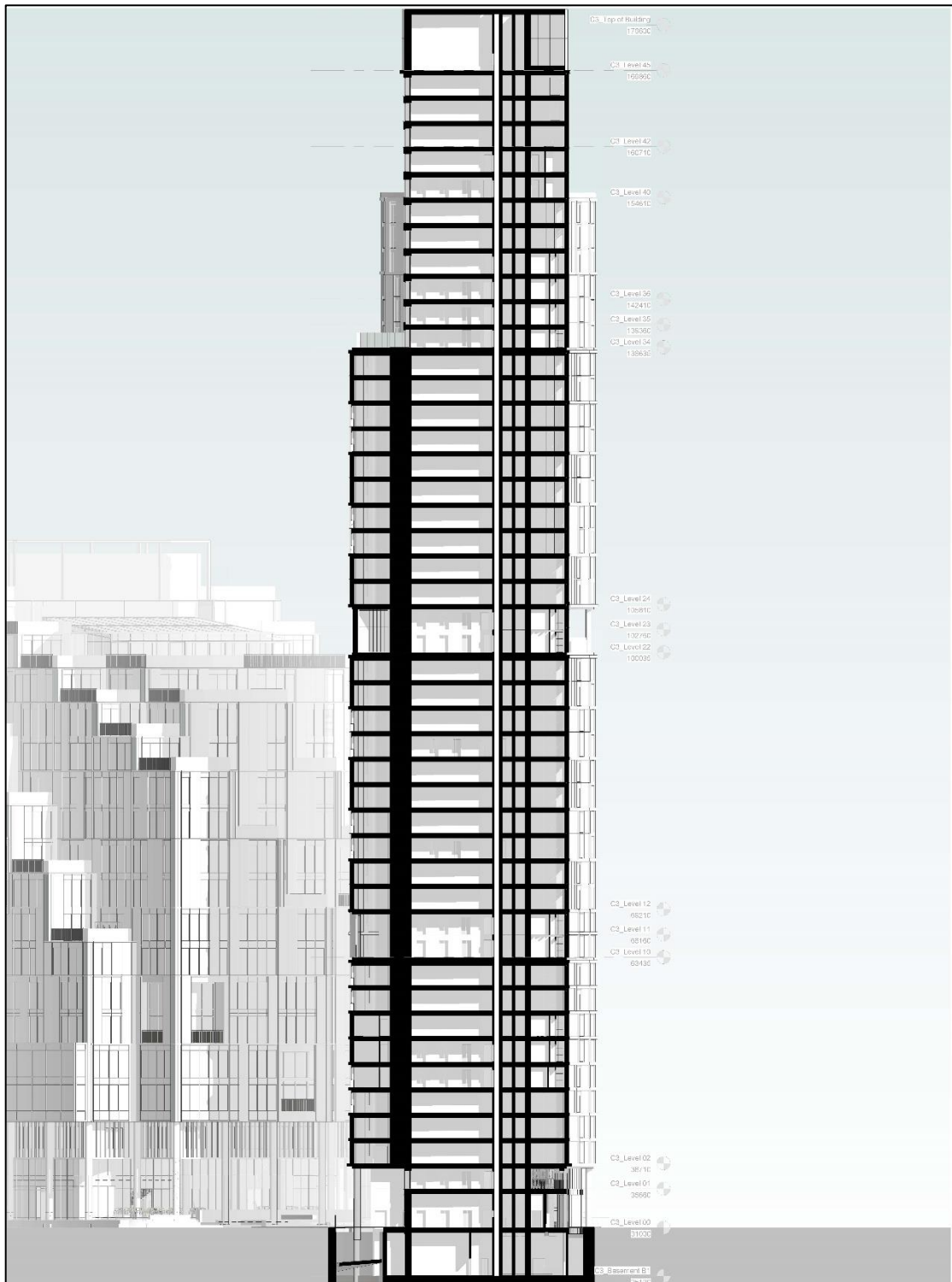


Figure 3 Proposed development elevation – building A

2.5 Proposed Development Footprint and Elevations

A representative elevation for Building B is shown in Figure 4⁵ below.



Figure 4 Proposed development elevation – building B

⁵ Source: Studio Egret West (cropped).

2.6 Proposed Development 3D Representation

Figure 5 below shows a 3D representation of buildings A and B.

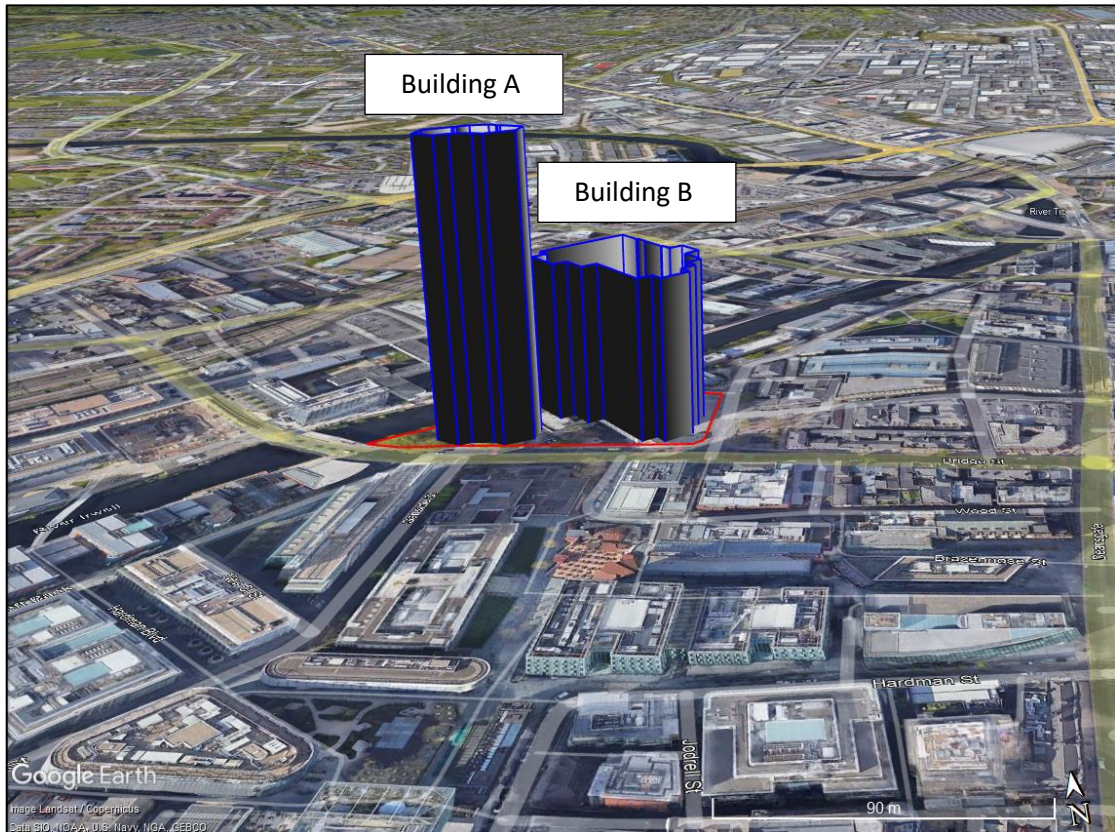


Figure 5 Proposed development 3D representation

3 KEY AVIATION RISKS

3.1 Overview

An aviation risk assessment was undertaken to identify the key aviation risk with respect to the proposed development. The results of the analysis are presented in the following sub-sections.

3.2 Identified Infrastructure

Table 2 below presents the key identified risks for the proposed development.

Aviation Risk	Distance	Risk Level
Manchester SSR	15.8 km	Medium
Manchester Airport	13.4 km	Medium – potential concerns regarding the OLS.
Instrument Flight Procedures (IFPs) for Manchester Airport	-	Low
Aviation lighting requirement		Low

Table 2 Identified aviation and radar risks

3.3 Aviation Risk Assessment Summary

The initial assessment identified two key risks; the SSR at Manchester Airport (safeguarded by NATS) and the OLS defined around the Manchester Airport.

Secondary risks include IFPs with respect to Manchester Airport's operations and the requirements for aviation lighting. These have also been explored.

The following sections provide further details and assessment of each identified risk in greater detail.

4 RADAR INTERFERENCE

4.1 Overview

An overview of the various possible interference mechanisms is presented in the following subsections.

4.2 Interference

Buildings, structures and terrain can interfere with SSR. The level of interference normally depends on the size of the interfering structure and its distance from the radar. A larger structure closer to the radar is more likely to interfere than a smaller structure that is further away. The two predominant forms of interference are considered in the sub-sections below.

4.2.1 Reflections

Reflections from a structure can potentially result in genuine aircraft returns being plotted in the wrong place as a result of the structure reflecting signals in a specular (mirror-like) way. This means that an air traffic controller could mis-manage aircraft, leading to safety implications.

Both in-bound and out-bound signals are weakened due to reflections because they are reflected by a structure in both directions.

4.2.2 Shadowing

Radar signals are weakened by physical obstacles. The most significant signal blocking is often caused by terrain. Large obstructions within a radar's area of coverage can have a 'shadowing' effect, reducing the signal strength immediately behind them.

This effect is most pronounced immediately behind the structure and becomes less pronounced with distance. This is important because it means a structure's 'shadow' does not block radar coverage indefinitely, and the areas with the highest losses should be considered in an operational context.

Both in-bound and out-bound signals are weakened by shadowing because signals are attenuated by a structure in both directions.

4.3 SSR Capabilities

The radar is a Secondary Surveillance Radar (SSR) fitted with a Large Vertical Aperture (LVA) antenna. The radar is located to the south of Manchester Airport. It is a Mode S monopulse SSR supplied by Raytheon Systems Limited as part of a nationwide contract to upgrade NATS' national network of twenty sites.

The radar is understood to be a Condor 300 dual channel system with Mode S capabilities. This radar has a range of advanced built-in capabilities for increasing its reliability and

performance. Specific features that reduce the radar's susceptibility to interference from buildings are listed in Table 3 on the following pages.

Feature	Form of interference	How feature reduces interference	Additional Information
Integral Tracking Function	Reflections	More likely to determine return is genuine if it moves as an aircraft return is expected to.	Ensures good false target suppression.
Refined Algorithms	Reflections and Shadowing	Experience on many sites used to enhance performance.	Ensures good performance in complex environments.
Identification and rejection of false replies	Reflections	False returns are rejected	If two or more replies are identified from the same source all but the first is rejected.
Side Lobe Suppression	Reflections	False returns arising from antenna sidelobes are rejected	P1 and P2 pulses are used. This is an encoding system which enables sidelobe signals to be detected by comparing pulse sizes.
Sensitivity Time Control (STC)	Reflections	Removes reflections	Removes relatively low amplitude replies
Minimum Detection Signal Level (MDS)	Shadowing	Maximises radar coverage whilst minimising noise detections	-
Dynamic Threshold	Shadowing	Weak signals stronger than any interference signals are detected.	-
Reply to Reply Correlation	Reflections	Multiple replies required for target processing	Single reply reports are rejected.

Feature	Form of interference	How feature reduces interference	Additional Information
FRUIT ⁶ Rejection	Reflections	Track initiation only allowed if report contains two or more correlating replies in the same SSR mode	e.g. two or more Mode A replies
Track Processing	Reflections and Shadowing	Improvements are made in target location using history of target position.	Improvements made when confidence in location information is low
False Target Processing	Reflections	Advanced processing that applies a series of tests to identify and reject false returns	Techniques include: 1: Check whether Mode A code is unique 2: Check “known” reflection zones 3: Use geometric analysis for checking reflection zones 4: Self adaptive processing

Table 3 Radar features for reducing interference

⁶ FRUIT – False Replies Unsynchronized in Time

5 RADAR LINE OF SIGHT AND INTERFERENCE ANALYSIS

5.1 Methodology

The approach taken within this report is presented in the following section below:

- Radar line of sight assessment based on the co-ordinates representative of the centre of each building at their relative height above ground level;
- Screening assessment to determine whether existing buildings and/or landscape features would hide/shield the proposed development from the SSR;
- Consideration of the distance from the SSR.

5.2 Line of Sight Analysis

A radar line of sight assessment⁷ was completed for the proposed development – considering the representative locations of the two buildings presented in Section 2.1. Figure 6 on the following pages show the line of sight charts from Manchester Airport SSR to the building locations A and B1. The chart for B2 can be provided upon request.

The box labelled ‘certainty’ in the figures provides the distance (in metres) by which the specific point is within line of sight to the assessed radar (rounded to one decimal place).

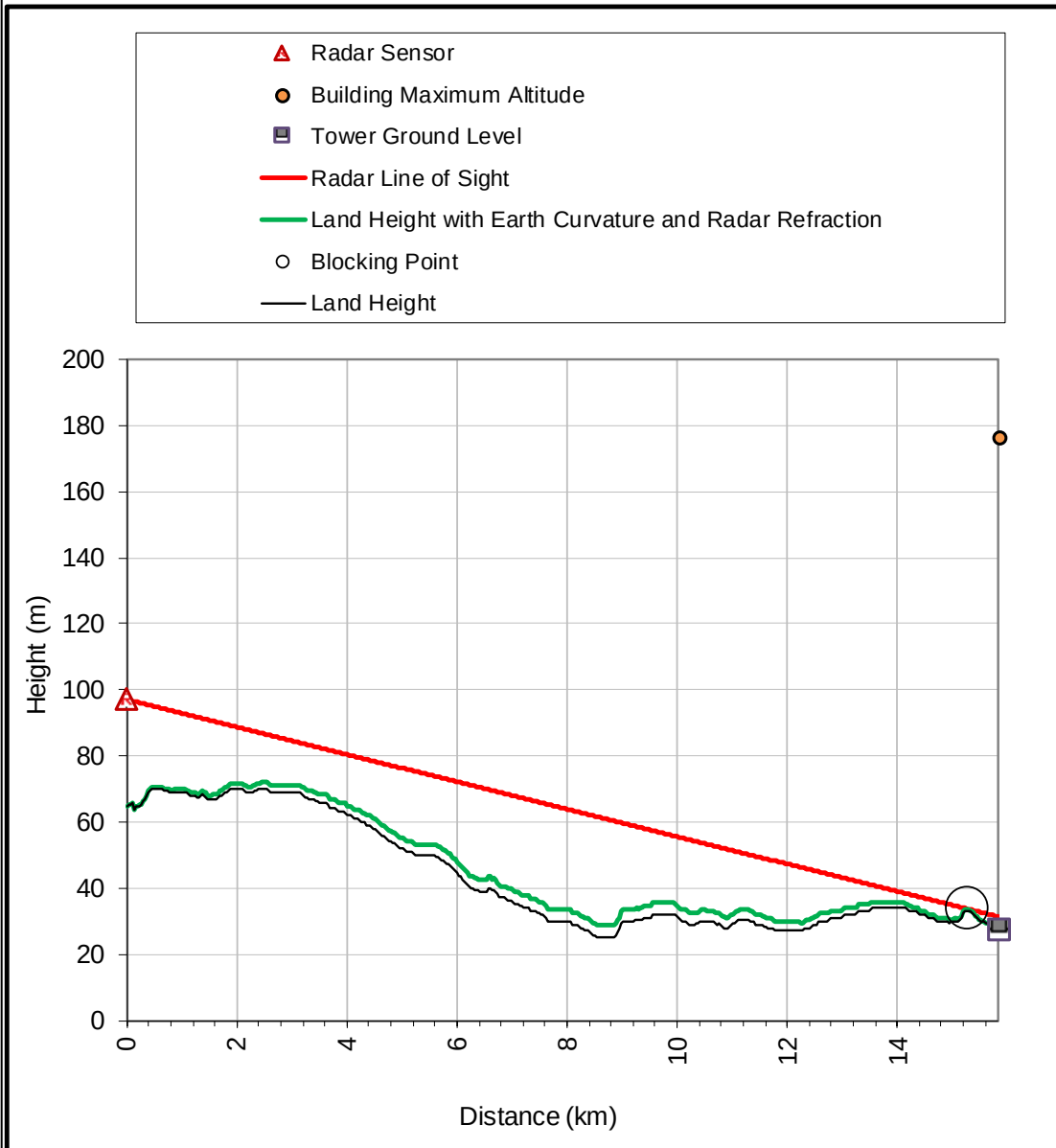
⁷ Based on the latest site design with the slightly higher maximum height above ground, any quoted building heights or vertical clearance margins may be slightly different but there are no significant implications to the overall results.

Radar Line of Sight Calculation

Manchester Airport SSR

LOS Manchester Airport SSR

Building	A
Result	VISIBLE
Certainty	144.9 metres



Building Height (m)	149.2
Building Elevation (m)	27.4
Building Location	E383384 N398365
Distance to radar (km)	15.8
Blocking Point Location	E383312 N397831
Distance to BP (km)	0.5

Additional Analysis

Maximum Height	4.25 metres
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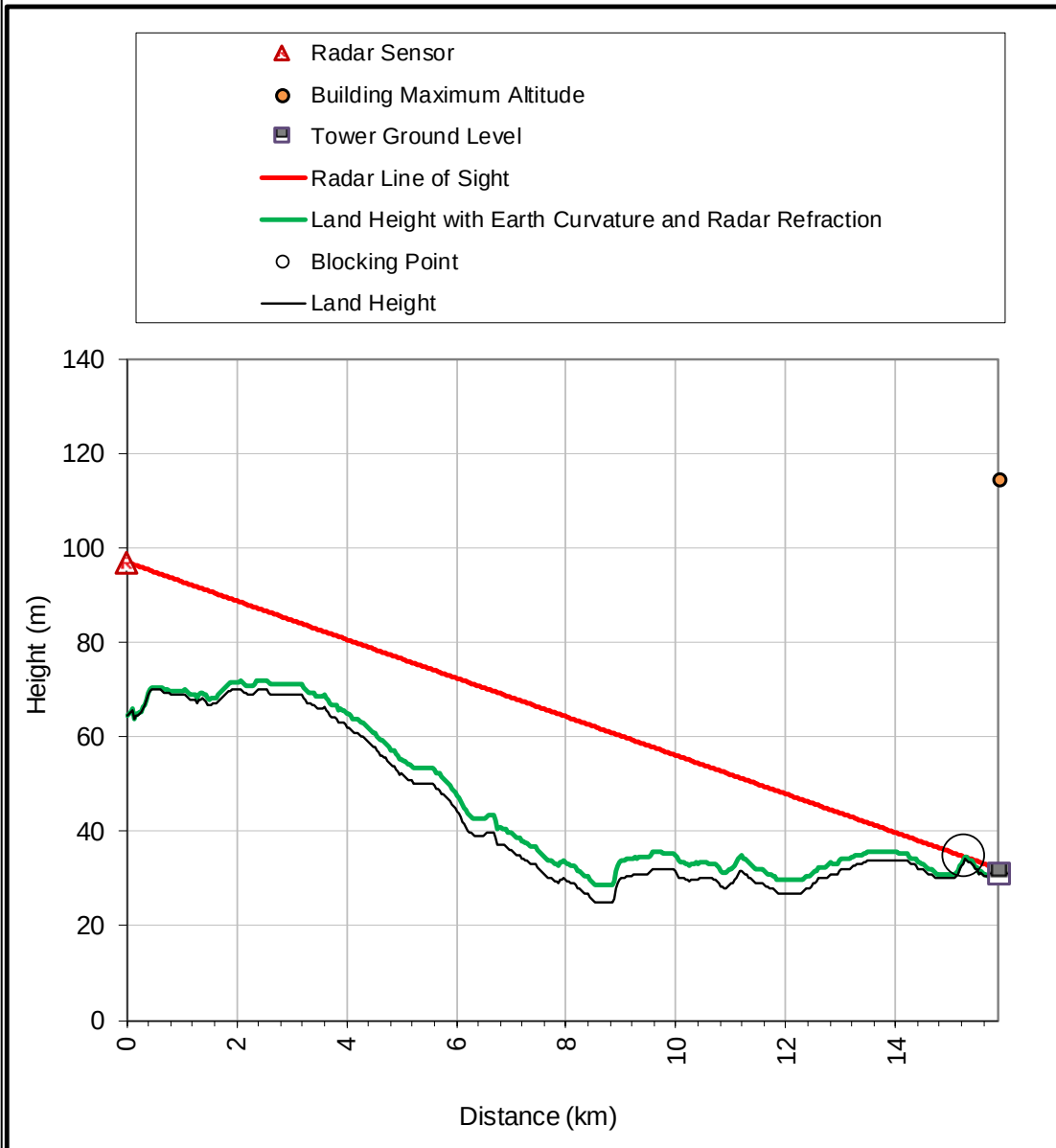
Figure 6 Manchester Airport SSR visibility for building A

Radar Line of Sight Calculation

Manchester Airport SSR

LOS Manchester Airport SSR

Building	B1
Result	VISIBLE
Certainty	82.4 metres



Building Height (m)	83.7
Building Elevation (m)	30.9
Building Location	E383446 N398390
Distance to radar (km)	15.9
Blocking Point Location	E383363 N397792
Distance to BP (km)	0.6

Additional Analysis

Maximum Height	1.25 metres
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Figure 7 Manchester Airport SSR visibility for building B1

5.2.1 Line of Sight Results – Bare Earth Terrain

The overall results are presented in Table 4 below.

ID	Result and Visibility
A	144.9m – Building almost entirely visible
B1	82.4m – Building almost entirely visible
B2	82.0m – Building almost entirely visible

Table 4 *Line of sight results for each assessed building – bare earth terrain*

5.2.2 Additional Screening

A review of the line of sight profiles was undertaken to identify any potential additional screening that may significantly reduce the visibility of the buildings to the SSR. The proposed development benefits from screening from other buildings within the city centre. This is particularly true for Building B which will be fully screened from the SSR by existing developments in the city centre as it has a lower proposed elevation (82.340m agl).

Building A is considerably taller (145.600m agl) and therefore screening from the SSR is much more limited. The most significant building producing screening is that provided by the building at No1 Spinningfields, which is approximately 90m agl. This obstruction has been incorporated into the line of sight profile and is presented in Figure 8 on the following page.

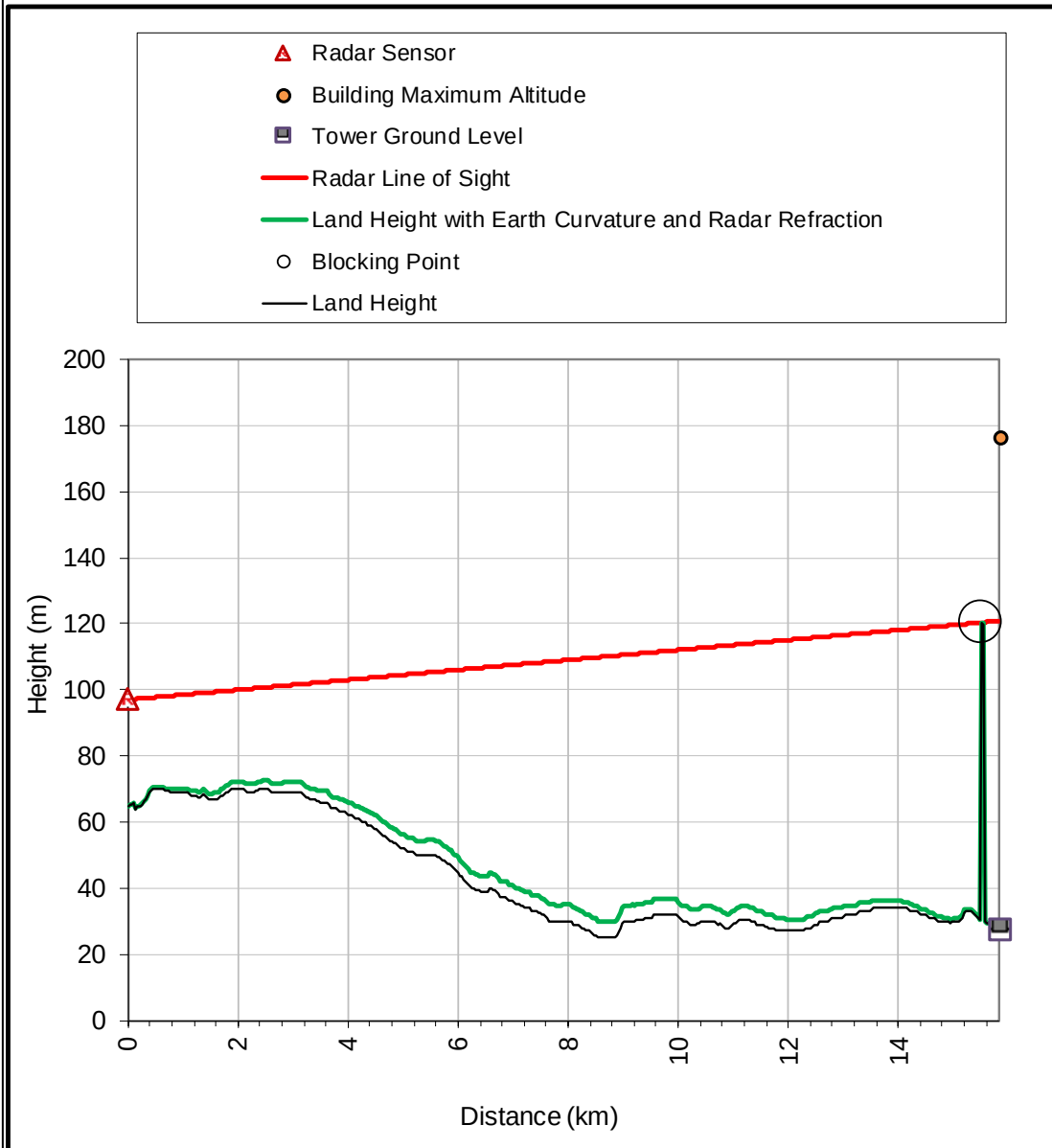
Two representative 3D images taken from Google Earth are presented in Figures 9 and 10 on pages 25 and 26. The appropriate details are annotated. Buildings highlighted green are known consented development that are yet to be built.

Radar Line of Sight Calculation

Manchester Airport SSR

LOS Manchester Airport SSR

Building	A
Result	VISIBLE
Certainty	55.7 metres



Building Height (m)	149.2
Building Elevation (m)	27.4
Building Location	E383384 N398365
Distance to radar (km)	15.8
Blocking Point Location	E383312 N397831
Distance to BP (km)	0.5

Additional Analysis

Maximum Height	93.48 metres
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Figure 8 Manchester Airport SSR visibility for building A with screening incorporated

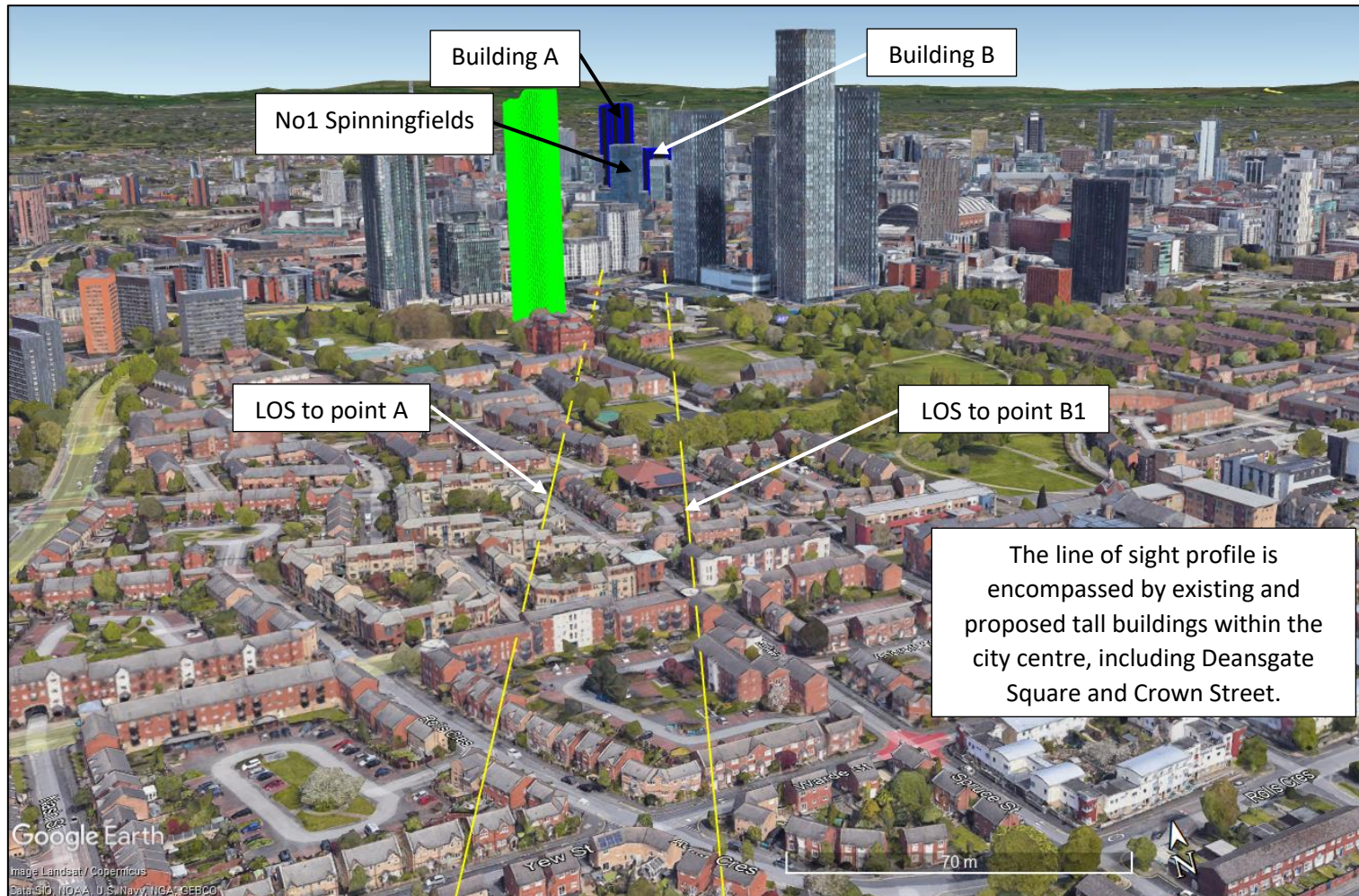


Figure 9 Representative 3D image from the Manchester Airport SSR - 1

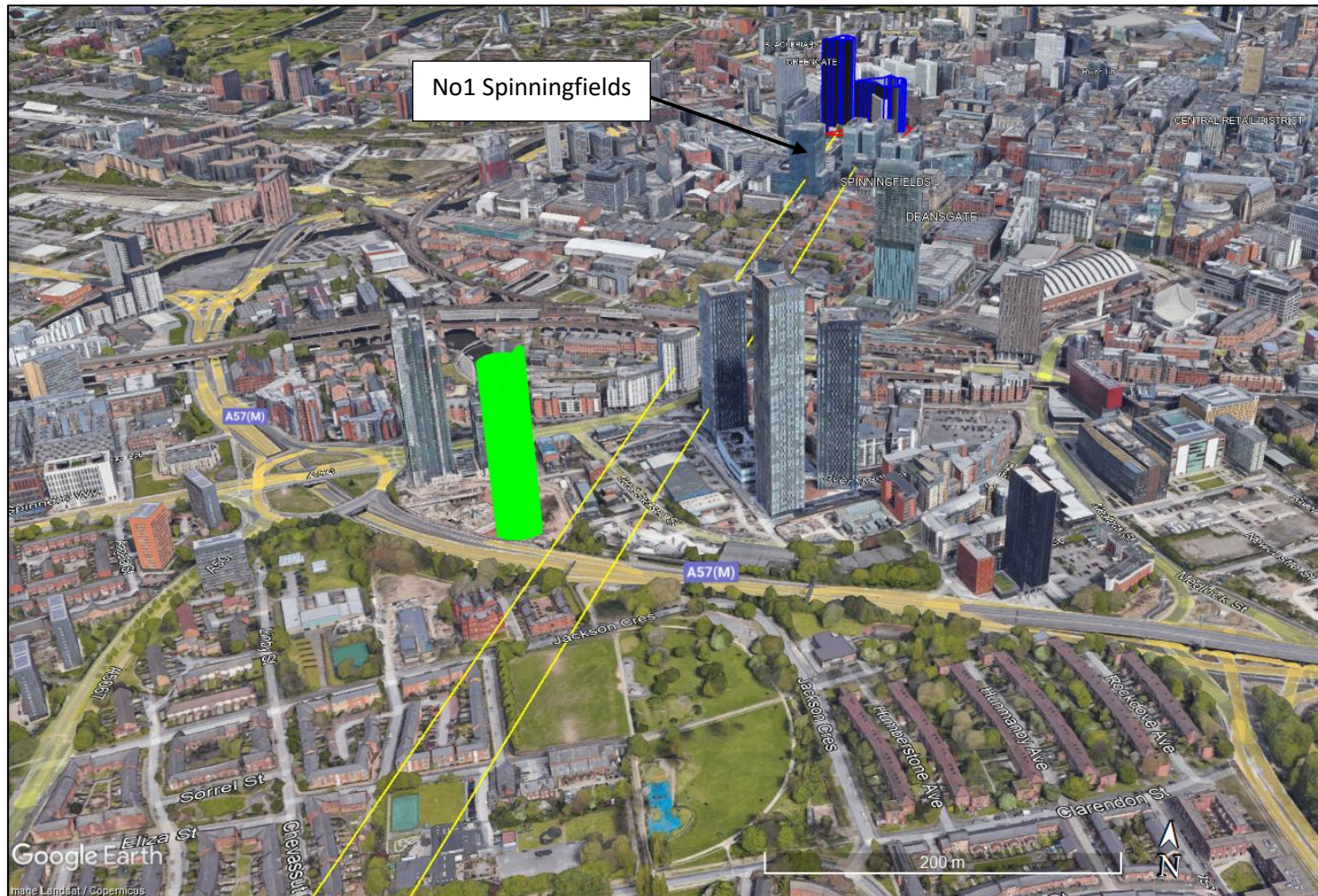


Figure 10 Representative 3D image from the Manchester Airport SSR - 2

5.2.3 Radar Line of Sight Conclusions

The results show that Building B would be significantly screened from the SSR at Manchester Airport and therefore no technical or operational impacts upon the radar are possible for this building.

For Building A, the results show that over 1/3 of the building would be visible to the SSR and therefore technical and subsequent operational impacts upon the radar are possible. These are discussed further in the following section.

5.3 Interference Assessment

SSR radar broadcast interrogating radio signals that are detected by aircraft with on-board transponders. The transponder responds by broadcasting a radio reply which normally contains identification and altitude information. The SSR determines the aircraft's horizontal position from the orientation of the antenna and the time taken to receive a response from the interrogation.

Buildings, structures and terrain can interfere with SSR. The level of interference normally depends on the size of the interfering structure and its distance from the radar. A larger structure closer to the radar is more likely to interfere than a smaller structure which is further away. Two forms of interference have been considered. These are:

1. Reflections – Either in-bound or out-bound signals are reflected off a structure;
2. Shadowing – Either in-bound or out-bound signals are weakened because they are attenuated by a structure.

The location, height and orientation of Building A have been reviewed and the reflection and shadow zones considered at a high level.

5.3.1 Reflection Effects

The proposed development consists of multiple flat façades acting as multiple reflectors. Reflection effects caused by static structures have the potential to create false targets, azimuth errors and target fading issues. These could occur when an obstruction reflects the outgoing and/or incoming radar signals between the SSR and an aircraft. To be received by the radar the signals also have to be strong enough to be detected. A radar return that is reflected via a building will be significantly weaker than a return received directly from an aircraft. Furthermore, a radar antenna is also designed to have reduced gain at very low angles to reduce ground clutter returns. Overall, radar returns that are reflected via buildings are significantly weaker than those that are received directly from aircraft.

Considering the proposed development's location relative to the radar, previous consultation with NATS, the current baseline scenario where taller buildings are already present in the city centre, and a SSR's in-built capability to deal with technical impacts generated by reflections, no significant reflection effects are anticipated that cannot be mitigated.

5.3.2 Shadowing Effects

Shadowing effects are possible that would lead to a potential loss of low-level coverage beyond the buildings on the bearing from the radar. Considering existing developments within Manchester city centre, the potential impact of the proposed development on low-level coverage and the typical operation for aircraft over Manchester city centre, no significant impacts with respect to shadowing are anticipated.

5.4 Assessment Conclusions

The modelling has revealed that the proposed development will be significantly visible to the SSR at Manchester Airport considering the baseline scenario. The design is however multifaceted, with many small facades making up the face of the development in view of the SSR. The line of sight profile is also encompassed by existing and proposed taller buildings within the city centre, including Deansgate Square and Crown Street. This will weaken the signal from the SSR that illuminates the proposed development and reduce the likelihood of significant reflection effects.

The proposed development may have an impact upon the SSR due to reflection effects. Consultation with NATS, who safeguard the radar, should therefore be undertaken. Mitigation may be required at the cost of the developer and typically costs in the region of £45k.

6 OBSTACLE LIMITATION SURFACES

6.1 Overview

The obstacle limitation surfaces (OLS) for Manchester Airport have been modelled with respect to the representative building centre points presented in Section 2.1. The aim is to identify whether the proposed development infringes the OLS at Manchester Airport.⁸

6.2 Obstacle Limitation Surfaces

Obstacle limitation surfaces are imaginary planes defined in three dimensions for physical safeguarding purposes (i.e. ensuring that physical structures do not present a safety hazard at an airfield) and are defined around licensed airfields.

The dimensions and geometry of the surfaces are constructed based on detailed rules defined in the UK Civil Aviation Authority's Civil Aviation Publication 168. The size of the surfaces is dependent on the number of runways, their dimensions and the procedures carried out at the airfield.

6.2.1 Obstacle Limitation Surfaces at Manchester Airport

The OLS for Manchester Airport has been modelled with respect to the representative buildings points defined in Section 2.1. The OLS chart is shown in Figure 11 on the following page. The centre points are shown by the red crosses – due to the scale they appear as a single icon. The coloured lines represent the individual surfaces that make up the OLS for Manchester Airport. The grey circular line represents the extent of the outer horizontal surface (OHS). The graph's axis are in longitude (x) and latitude (y).

⁸ Based on the latest site design with the slightly higher maximum height above ground, any quoted building heights or vertical clearance margins may be slightly different but there are no significant implications to the overall results.

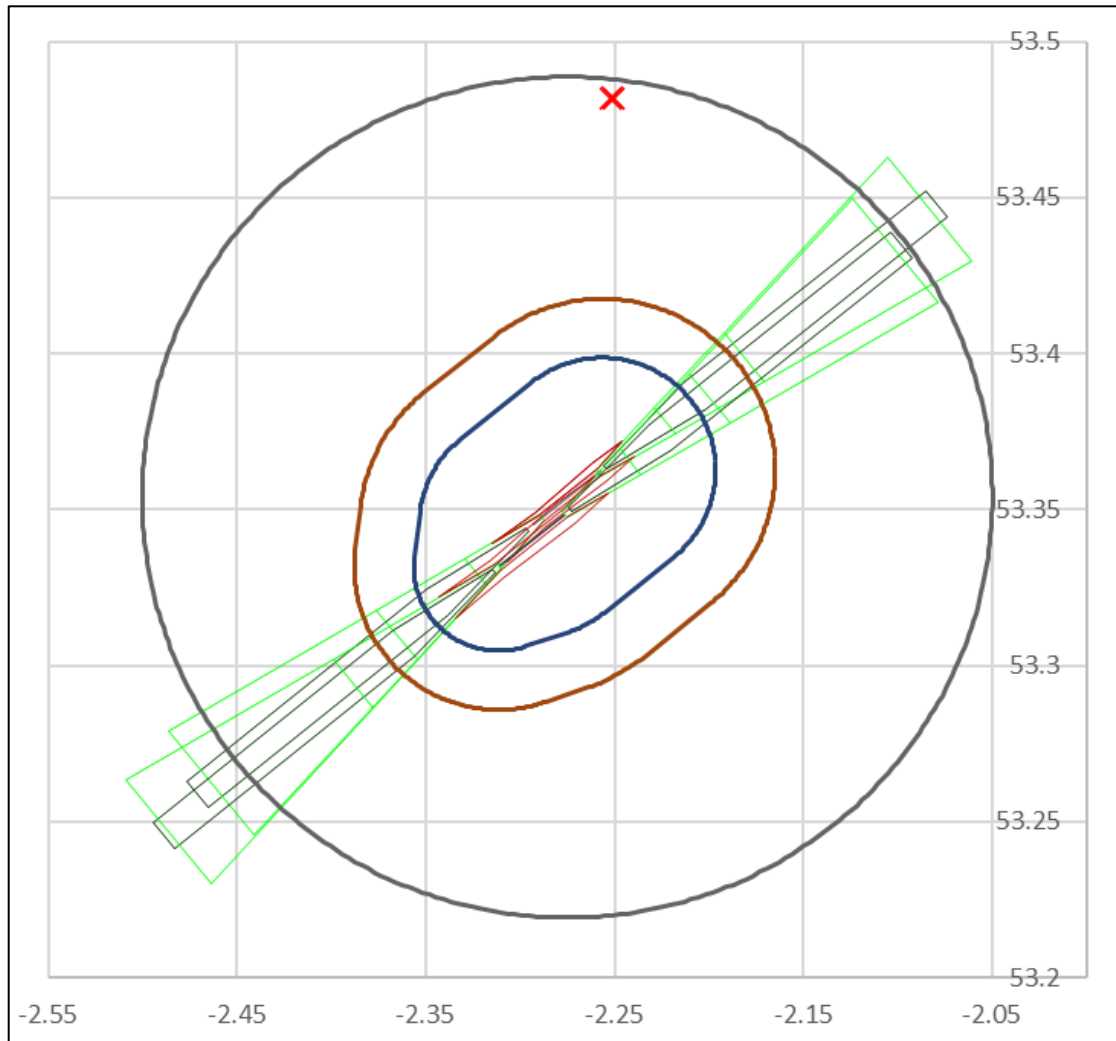


Figure 11 OLS chart for Manchester Airport

The proposed development lies below the OHS. The OHS is a flat surface that has an altitude of 206.6m. Table 5 below presents the results for the representative centre points used within the technical analysis.

ID	Longitude (°)	Latitude (°)	Building Altitude (m AOD)	Infringement/Clearance
A	-2.251846	53.481740	176.600m	30.0928
B1	-2.250911	53.481972	114.590m	92.1028
B2	-2.250656	53.481629		

Table 5 Detailed OLS assessment results

6.3 Obstacle Limitation Surfaces Conclusions

The analysis has shown that the proposed development lies beneath the OHS in accordance with Manchester Airport's OLS model. The proposed development however does not infringe the OHS, with the smallest margin of clearance being more than 30m.

6.4 Important Consideration – Crane Usage

The analysis within the section does not account for crane usage which should be considered within the design of the proposed development and its construction. It is possible that Building A will be constructed with a crane that infringes the OHS unless it is less than 30m taller than the building.

Consultation with Manchester Airport should be conducted regarding crane usage and any temporary infringement of the OLS. Aviation lighting will be required on the crane as it is expected they will extend to 150m or more above ground level (see Section 8).

A Crane Operations Scheme will likely be requested regardless of any infringement of the OLS.

7 HIGH-LEVEL INSTRUMENT FLIGHT ANALYSIS

7.1 Overview

Aircraft flying IFR (Instrument Flight Rules) have been assessed at a high-level by considering:

- Impact on Maximum Elevation Figures (MEF) shown on national aeronautical charts;
- Impact on Manchester Airport Surveillance Minimum Altitude Chart (SMAC);
- Impact on current Manchester Airport Standard Instrument Departures;
- Impact on current Manchester Airport Standard Arrival Charts;
- Impact on current Manchester Airport Instrument Approach Charts.

This has been undertaken to determine whether an impact upon Instrument Flight Procedures (IFP) is likely or whether further, more detailed, analysis is required.⁹ Any quoted clearance margins

7.2 Area Minimum Altitude

The Area Minimum Altitude provides the minimum obstacle clearance above all obstacles (terrain and structures) in a particular quadrangle of an aeronautical chart. The Area Minimum Altitude shown for the quadrangle in which the development is located is 3,500 feet AOD. The proposed development has a maximum altitude of 579.4 feet which is 2,920.6 feet below the Area Minimum Altitude. The proposed development will therefore not affect the current Area Minimum Altitude.

7.3 Surveillance Minimum Altitude Chart (SMAC)

Surveillance Minimum Altitude Charts (SMAC)¹⁰ are published to show the lowest altitude a pilot will be instructed to fly whilst receiving an air traffic control service. The Manchester Airport SMAC shows that the minimum altitude for the sector above is 2,400 feet AOD. The proposed development has a maximum altitude of 579.4 feet. The vertical clearance between aircraft subject to a radar control service and the top of both buildings will be at least 1,820.6 feet. This is 836.6 feet greater than the specified clearance of 984 feet¹¹ in the CAA publication (CAP 777) for designing SMACs. This means that aircraft flying IFR and receiving a radar control service will have an acceptably low collision risk. It should also be noted that taller and similarly sized structures are in the same area.

⁹ Based on the latest site design with the slightly higher maximum height above ground, any quoted building heights or vertical clearance margins may be slightly different but there are no significant implications to the overall results.

¹⁰ AD 2.EGCC-5-1, dated 08 Oct 19. Accessed 17/08/2021 (cropped).

¹¹ 300 metres

ATC SURVEILLANCE MINIMUM BEARINGS, TRACKS AND RADIALS ARE MAGNETIC
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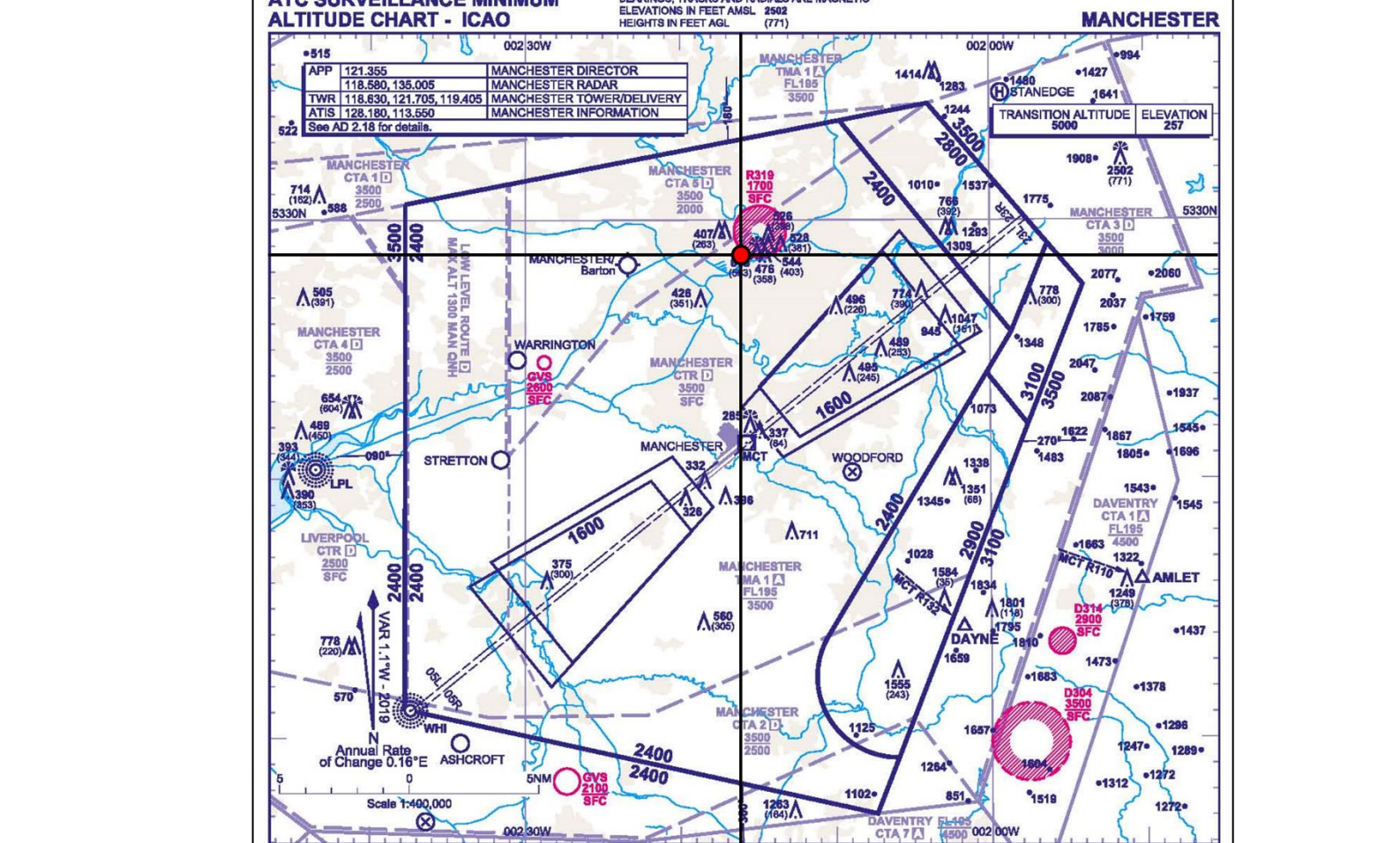


Figure 12 Manchester Airport ATC Surveillance Minimum Altitude Chart

7.4 High-level IFP Assessment – Obstacle Clearance Margins

As a general rule Instrument Flight Procedures (IFPs) are designed so that there are vertical and horizontal safety margins between the specified trajectory and surrounding terrain and obstacles. These margins vary depending on the phase of flight and whether UK, European or International rules are being considered. Nevertheless, the vertical margins are always 1,000 feet or less (except in particularly mountainous regions, which Manchester is not). This means that if the vertical clearance between an IFP route and the top of the proposed

development exceeds 1,000 feet then it will not have a significant safety impact on aircraft flying the route. The maximum altitude of the proposed development is 580 feet¹².

This means that aircraft subject to any IFP route or limit which is more than 1,580 feet will have an acceptably low collision risk. A detailed IFP assessment is not recommended considering the results of this high-level assessment.

7.5 Standard Instrument Departures (SIDs)

Manchester Airport has seven published Standard Instrument Departure procedures (SIDs). Each of these has been assessed with respect to the proposed development. Results of the assessment are shown in Table 6 below.

SID Name	Observations	Assessed Impact	Recommendation
MONTY 1R 1S 1Y 1Z	Passes over 2.7 nm to south west.	No impact due to horizontal and vertical clearance.	No further action.
ASMIM 1S 1Z/KUXEM 1R 1Y/EKLAD 1R 1Y	Passes over 2.7 nm to south west.	No impact due to horizontal and vertical clearance.	No further action.
LISTO 2S 2Z	Southerly SID. Well clear.	No impact due to horizontal clearance.	No further action.
LISTO 2R 2Y	Southerly SID. Well clear.	No impact due to horizontal clearance.	No further action.
POL 5R 4S 1Y 1Z	Passes more than 5nm to east.	No impact due to horizontal clearance.	No further action.
SONEX 1R 1Y/DESIG 1S 1Z	Minimum altitude 5,000 feet over central Manchester.	No impact due to vertical clearance.	No further action.
SANBA 1R 1Y	South westerly SID.	No impact due to horizontal clearance.	No further action.

Table 6 Standard Instrument Departure (SID) assessment results

The proposed development and associated cranes are likely to present an acceptably low collision risk to aircraft flying all Standard Instrument Departure routes.

¹² Rounded up to the nearest foot.

7.6 Standard Arrival Charts (STARs)

Manchester Airport has four published Standard Arrival (STARs) Charts. Each of these has been assessed with respect to the proposed development. The results of the assessment are shown in Table 7 below.

STAR Name	Observations	Assessed Impact	Recommendation
via ROSUN (north)	Minimum Altitude FL70	No impact due to vertical clearance	No further action
via ROSUN (east)	Minimum Altitude FL70	No impact due to vertical clearance	No further action
via MIRSI	Minimum Altitude 6,000 feet	No impact due to vertical clearance	No further action
via DAYNE	Minimum Altitude FL70	No impact due to vertical clearance	No further action

Table 7 Standard Arrival Chart (STARs) Assessment results

Aircraft flying Manchester Airport's Standard Arrival Routes will be at least 5,420 feet vertically clear of the buildings. This means that such aircraft will have an acceptably low collision risk.

7.7 Instrument Approach Charts

Manchester Airport has fifteen published Instrument Approach Charts. Each of these has been assessed with respect to the proposed development. For each, the following have been considered:

- The final approach phase;
- Earlier approach phases shown on the chart;
- Missed approach procedure;
- Decision heights and circling minima;
- Minimum Safe Altitude (MSA) within 25 nautical miles.

Results of the assessment are shown in Table 8 on the following page¹³.

¹³ V= vertically and H= horizontally.

Name	Final Approach	Earlier Approach	Missed Approach	Decision and Circling	MSA	Assessed Impact	Recommended Action
ILS/DME (I-MC) RWY 05R	OK H	OK V,H	OK H	OK H	OK V	None	None
ILS/DME (MCT) RWY 05R	OK H	OK V,H	OK H	OK H	OK V	None	None
LOC/DME (I-MC) RWY 05R	OK H	OK V,H	OK H	OK H	OK V	None	None
VOR/DME RWY 05R	OK H	OK V,H	OK H	OK H	OK V	None	None
ILS/DME (I-MM) RWY 05L	OK H	OK V,H	OK V,H	OK H	OK V	None	None
ILS/DME (MCT) RWY 05L	OK H	OK V,H	OK V,H	OK H	OK V	None	None
LOC/DME RWY 05L	OK H	OK V,H	OK V,H	OK H	OK V	None	None
VOR/DME RWY 05L	OK H	OK V,H	OK V,H	OK H	OK V	None	None
ILS/DME (I-NN) RWY 23R	OK H	OK V	OK V, H	OK H	OK V	None	None
ILS/DME (MCT) RWY 23R	OK H	OK V	OK V, H	OK H	OK V	None	None
LOC/DME RWY 23R	OK H	OK V	OK V, H	OK H	OK V	None	None
VOR/DME RWY 23R	OK H	OK V	OK V, H	OK H	OK V	None	None
VOR/DME RWY 23L	OK H	OK V	OK H	OK H	OK V	None	None
RNP RWY 23L	OK H	OK V,H	OK H	OK H	OK V	None	None

Table 8 Instrument Approach Charts assessment results

The proposed development is likely to present an acceptably low collision risk to aircraft flying all Instrument Approach Procedures. No further action is recommended.

7.8 High-level IFP Assessment – Obstacle Clearance Margins Conclusions

As a general rule, IFPs are designed so that there are vertical and horizontal safety margins between the specified trajectory and surrounding terrain and obstacles. It is likely that if an obstacle does not infringe the OLS, it will not adversely affect the IFP. The OLS will not be affected by the proposed development. A high-level review of the IFPs relative to the proposed development indicates sufficient clearances. There are also taller existing buildings in the surrounding area that already co-exist with the current IFPs. Therefore, no impact upon the IFPs is predicted and no detailed IFP assessment is recommended. It is possible however that this could still be recommended by Manchester Airport.

8 HIGH-LEVEL AVIATION LIGHTING CONSIDERATIONS

8.1 Overview

Aviation lighting is required where an object becomes a collision risk. This is most likely where there is an infringement of the OLS. It also becomes mandatory to have lighting where an object extends to 150m above ground level or more¹⁴. The following section explores the requirement for aviation lighting at a high-level. Separately a detailed lighting scheme has been produced.¹⁵

8.2 Lighting Requirements

The following is true regarding the proposed development:

- Both buildings do not extend above 150m agl (Building A = 145.600m and Building B = 82.340m agl);
- Both buildings do not infringe the OLS;
- Cranes are expected to be above 150m agl and may infringe the OHS of Manchester Airport.

On this basis, aviation lighting is not mandatory for the proposed development as per the associated Air navigation Order guidance. Cranes will however require lighting. The following lighting arrangements are therefore recommended:

- The top of any associated crane will be lit with medium intensity lights;
- Any associated crane will be marked on CAA Aeronautical charts or a Notice to Airmen (NOTAM) will have been issued advising of the crane's height and location.

¹⁴ Air Navigation Order, 2016. There is a requirement unless the CAA allow otherwise. Last accessed 26.10.22.

¹⁵ Based on the latest site design with the slightly higher maximum height above ground, any quoted building heights or vertical clearance margins may be slightly different but there are no significant implications to the overall results.

9 CONCLUSIONS

9.1 Analysis Results

The results of the analysis for the key identified aviation risks are presented below.

9.1.1 Manchester Airport's Obstacle Limitation Surfaces

- The proposed development is beneath the OHS of Manchester Airport;
- The analysis has shown that neither building within the proposed development would infringe the OHS. The minimum margin of clearance is 30m;
- Crane usage will need to be considered due to the close proximity and possible infringement of the OHS. It is likely a Crane Operations Scheme will be required;
- Consultation with the safeguarding team at Manchester Airport should be undertaken to discuss the infringement of any crane. Any crane will be expected to require aviation lighting.

9.1.2 Manchester Airport SSR

- The proposed development is located approximately 15.8km from the SSR at Manchester Airport;
- Building B will be significantly screened from the SSR by existing buildings along the line of sight path such that no impacts would be expected;
- Building A will not be significantly screened from the SSR due to its increased height, and over 1/3 of the building will be visible to the SSR;
- The design of Building A is multifaceted, with many small facades making up the face of the development in view of the SSR;
- The line of sight profile is also encompassed by existing and proposed taller buildings within the city centre, including Deansgate Square and Crown Street. This will weaken the signal from the SSR that illuminates the proposed development and reduce the likelihood of significant reflection effects;
- Whilst no significant shadowing effects are anticipated, reflection effects are still possible as the proposed development will introduce new unobstructed 'reflectors' to the line of sight of the SSR – there are however mitigating factors, as listed above;
- Consultation with NATS, who safeguard the Manchester Airport radar, is therefore recommended to discuss the requirement for mitigation due to reflection effects. If mitigation is requested, it is expected that it will be a technical fix applied to the radar and implemented by NATS. This solution has been implemented for many developments of this type in the vicinity of SSR and typically costs in the region of £45k.

9.1.3 Instrument Flight Procedures at Manchester Airport – High-Level

A high-level review of the IFPs relative to the proposed development indicates sufficient clearances. There are also taller existing buildings in the immediate surrounding area that already co-exist with the current IFPs. Therefore, no impact upon the IFPs is predicted and no detailed IFP assessment is recommended. It is possible however that this could still be requested by Manchester Airport.

9.1.4 Aviation Lighting Requirement

There is no aviation lighting requirement for the proposed development; however, any crane used in construction will likely measure to 150m or more above ground and will therefore need to be lit with medium intensity aviation lighting.

9.2 Overall Conclusions

The results of the analysis revealed that the proposed development would not infringe the OLS at Manchester Airport. Aviation lighting is not required for either building due to their height above ground level. A lighting requirement for the cranes during construction is predicted. No impact upon IFPs is expected.

NATS may have concerns regarding the visibility of the proposed development to the SSR. It is unlikely that the impact upon the radar would be a 'showstopper' if mitigation is implemented, the fee for which would be payable to NATS.



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