PAGERPOWER

Aviation Lighting Scheme

Plot G, Great Jackson Street

Great Jackson Street Estates Limited

September 2026



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ADMINISTRATION PAGE

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EXECUTIVE SUMMARY

Overview

Pager Power has been retained to determine the requirement of, and produce an aviation lighting scheme for, the consented Plot G, Great Jackson Street development (planning ref: 129273/FO/2021). The development is located in Manchester, UK. The development comprises two residential towers, both with a maximum height of 172.3m above ground level.

Aviation Lighting Scheme Considerations

The following was completed to determine the requirements of the aviation lighting scheme:

- A review of relevant guidance:
  - Air Navigation Order (ANO) Article 222;
  - Civil Aviation Authority (CAA) Civil Aviation Publication (CAP) 168;
  - UK Regulation (EU) 139/2014 – Aerodromes.
- A review of the obstacle assessment undertaken pre-planning (Pager Power ref: 9752A);
- The known lighting requirements of Manchester Airport Group for new developments in the city centre;
- The context of the wider Great Jackson Street Development cluster.

Lighting Scheme Overview

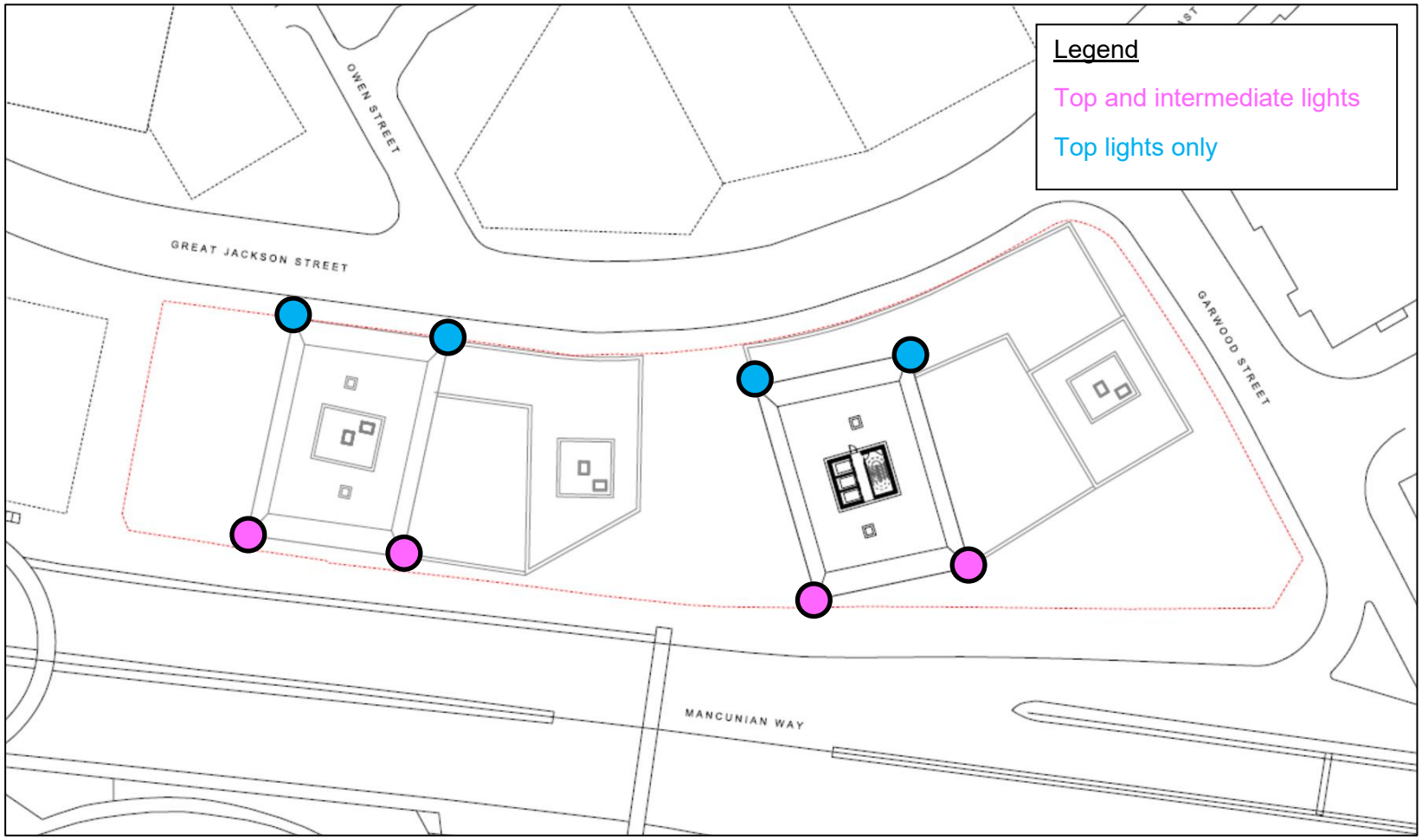
An overview of the recommended lighting scheme is presented in the table below.

Tower	Top Lights	Intermediate lights
West tower	Medium intensity, Type C, red lights marking the four corners	Medium intensity, Type C, red lights at levels 14, 28 and 42 Omitted on the two northern corners as they are deemed to be the inside of the building cluster Shielding where necessary to stop light spill towards the east tower and Plot D residents
East tower		Medium intensity, Type C, red lights at levels 14, 28 and 42 Omitted on the two northern corners as they are deemed to be the inside of the building cluster Shielding where necessary to stop light spill towards the west tower and Plot F and River Street tower residents

Recommended Lighting Scheme

Proposed Lighting Plan

The proposed lighting plan is presented in the figure below. Additional figures indicating the intermediate light shielding are shown in Section 5.



Proposed lighting plan – top down

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ABOUT PAGER POWER

Pager Power is a specialist technical consultancy based in the United Kingdom and has been providing independent expertise on planning issues for solar, wind, and building developments for over 20 years.

Established in 1997, the company initially specialised in assessing the impact of wind turbines on radar systems. Pager Power has since expanded into a multidisciplinary technical planning consultancy that offers a comprehensive range of services and has supported renewable and building projects in more than 60 countries.

Pager Power's core competencies now include:

- Aviation and Radar;
- Daylight, Sunlight and Overshadowing;
- Glint and Glare;
- Shadow Flicker;
- Telecommunications.

Using proprietary modelling software, each study is tailored to the individual project, ensuring that results are relevant, defensible, and aligned with current national and international standards. The company also provides planning support and stakeholder consultation across all service areas, helping clients to understand constraints, explore potential mitigation options, and forge a path forward for their projects.

Pager Power's work helps our clients identify potential risks, inform project design, and support the decision-making process, and can provide support at any stage of a project, from initial feasibility through to completion. Pager Power's assessments – recognised for their objectivity, accuracy, and technical integrity – are designed to withstand legal scrutiny and trusted by developers and stakeholders alike.

1 INTRODUCTION

1.1 Overview

Pager Power has been retained to determine the requirement of and produce an Aviation Lighting Scheme for the consented Plot G, Great Jackson Street development (planning ref: 129273/FO/2021). The development is located in Manchester, UK.

1.2 Aviation Lighting Scheme Considerations

The following was completed to determine the requirement of aviation lighting:

- A review of relevant guidance:
  - Air Navigation Order (ANO) Article 222;
  - Civil Aviation Authority (CAA) Civil Aviation Publication (CAP) 168;
  - UK Regulation (EU) 139/2014 – Aerodromes.
- A review of the obstacle assessment undertaken pre-planning (Pager Power ref: 9752A);
- The known lighting requirements of Manchester Airport Group for new developments in the city centre;
- The context of the wider Great Jackson Street Development cluster.

The proposed aviation lighting scheme designed based on the above is presented in Section 5.

2 DEVELOPMENT DETAILS

2.1 Development Description

The development comprises two residential towers, both with a maximum height of 172.3m above ground level.

2.2 3D Building Representation

A representative 3D aerial image of the development in the emerging Great Jackson Street Development cluster is shown in Figure 1 below.

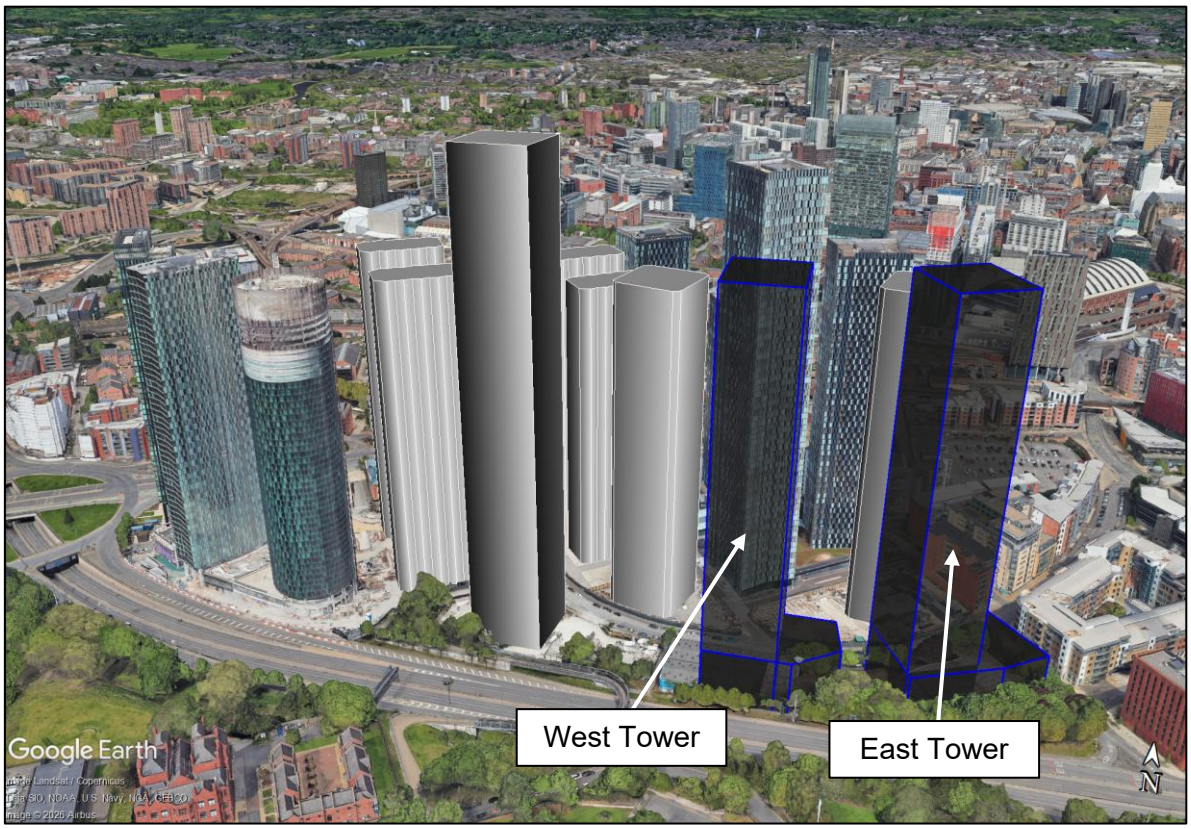


Figure 1 *3D building representation*

3 GUIDANCE REVIEW

3.1 Overview

The following section presents a review of the relevant aviation lighting guidance.

3.2 Air Navigation Order: Article 222

The following presents Article 222 of the Air Navigation Order. Key points relating to design of the lighting scheme are underlined.

Lighting of en-route obstacles

222.—*(1) The person in charge of an en-route obstacle must ensure that it is fitted with medium intensity steady red lights positioned as close as possible to the top of the obstacle and at intermediate levels spaced so far as practicable equally between the top lights and ground level with an interval of not more than 52 metres.*

(2) The person in charge of an en-route obstacle must, subject to paragraph (3), ensure that by night the lights required to be fitted by this article are displayed.

(3) In the event of the failure of any light which is required by this article to be displayed by night the person in charge must repair or replace the light as soon as reasonably practicable.

(4) At each level on the obstacle where lights are required to be fitted, sufficient lights must be fitted and arranged so as to show when displayed in all directions.

(5) In any particular case the CAA may direct that an en-route obstacle must be fitted with and must display such additional lights in such positions and at such times as it may specify.

(6) A permission may be granted for the purposes of this article for a particular case or class of cases or generally.

(7) This article does not apply to any en-route obstacle for which the CAA has granted a permission to the person in charge permitting that person not to fit and display lights in accordance with this article.

(8) In this article, an 'en-route obstacle' means any building, structure or erection, the height of which is 150 metres or more above ground level, but it does not include a building, structure or erection—

(a) which is in the vicinity of a licensed aerodrome; and

(b) to which section 47 of the Civil Aviation Act 1982(a) (warning of presence of obstructions near licensed aerodromes) applies.

3.2.1 Key Points

The key points presented within the guidance are discussed within Table 1 below.

Section	Comments and Discussion
222. (1)	It is stated that en-route obstacles should be lit with 'medium intensity steady red lights' as close to the top as possible, in addition to intermediate lighting at no bigger distance than 52 metres between each light.
222. (4)	It is stated that all lights should be visible from all directions.
222. (8)	It is stated that an 'en-route obstacle' means any building 150m agl or more excluding those 'in the vicinity' of a licensed aerodrome or where section 47 applies. In relation to Plot G: • The development may be considered an en-route obstacle because it is greater than 150m agl; • The term 'vicinity' is not defined by a set distance. The development is therefore considered an en-route obstacle.

Table 1 *ANO 222 comments and discussion*

3.3 CAP 168: Licensing of Aerodromes

The following text is taken from the relevant sections of CAP 168[1], which is relevant for licensed aerodromes in the UK, which Manchester Airport is not but it is still a useful form of reference. Some paragraphs have been omitted due to reference to wind turbines, masts etc. Key points relating to design of the lighting scheme are underlined.

Chapter 4 The assessment and treatment of obstacles

Lighting of obstacles

4.128 Obstacle lights should be used to indicate the existence of objects which are to be lit as follows:

4.129 Low intensity steady red obstacle lights should be used on obstacles less than 45 m high, except that medium intensity steady red lights should be used to light such obstacles as an elongated structure, an obstacle in the outer area of the approach or high ground adjacent to the aerodrome circuit.

4.130 There are two types of low intensity obstacle lights for fixed obstacles:

1. Group A and Group B (see table 6A.1).

2. Low intensity Group A lights should be used for obstacles on the movement area where Group B lights may cause dazzle.

[1] CAP 168 Licensing of Aerodromes, Edition 13, December 2025 (last accessed 26/06/26).

4.131 Low intensity Group B lights should be used away from the movement area or in areas on the movement area with high levels of background illuminance.

4.132 Medium intensity red steady obstacle lights should be used on obstacles between 45 m and less than 150 m in height.

4.133 Medium intensity steady red obstacle lights should be used to indicate the presence of:

1. *An obstacle if its height is 150 m or more; or*
2. *A tower supporting overhead wires, cables etc. of any height where an aeronautical study indicates such lights to be essential for recognition of the presence of the obstacle.*

4.134 Where an aeronautical study conducted by the CAA concludes that greater conspicuity of the obstacle through the use of a higher specification light is required, the use of a high intensity flashing white obstacle light will be considered by the CAA.

4.135 The combination of white and red obstacle lights should not be used at the same time to light an obstacle.

Location of obstacle lights (figure 4.18) (presented in Figure 2 on the following page)

The top light

4.136 Except in the case of a chimney or other similar structure, one or more lights should be located at the top of the obstacle.

4.137 The lights should be so arranged as to indicate the highest points or edges of the obstacle relative to the obstacle limitation surface.

4.138 If two or more edges are of the same height, the edge nearest the flight path should be lit.

4.139 On facing sides of groups of obstacles, lights may be omitted with the approval of the CAA, and the group treated as one solid obstacle.

Figure 4.18 Lighting of objects

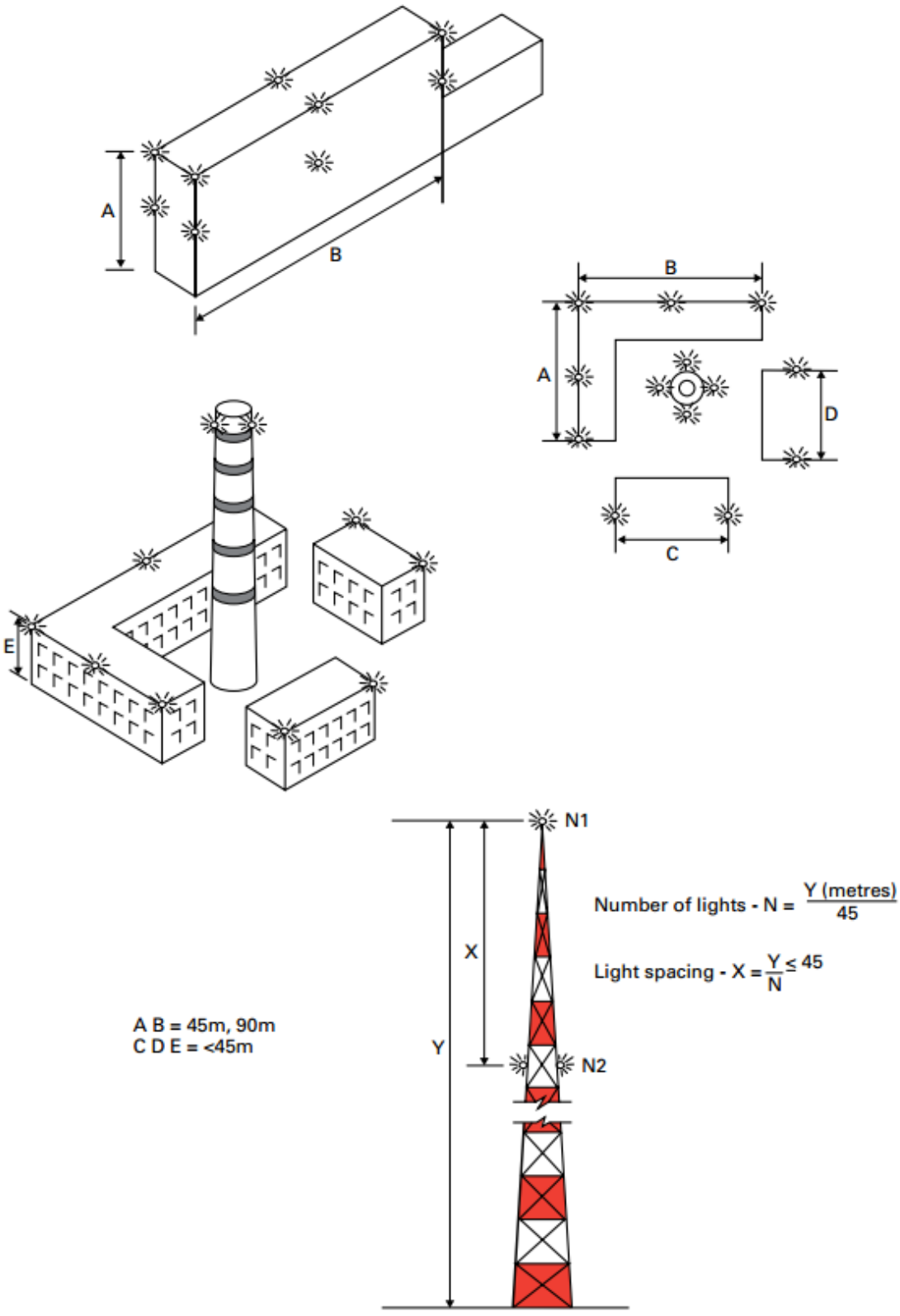


Figure 2 *CAP 168 Figure 4.18 – Lighting of Objects*

Intermediate lights

4.143 Where the top of an obstacle is more than 45 m above the level of the surrounding ground, additional lights should be provided at intermediate levels. These additional lights should be spaced as equally as practicable between the top light and ground level as follows:

> *1. when low or medium intensity obstacle lights are used the spacing should not exceed 52 m;*

Light characteristics

Low intensity obstacle lights

4.156 On fixed obstacles, low intensity lights should be steady red and omnidirectional.

Medium intensity obstacle lights

4.157 Medium intensity obstacle lights should be steady red light.

Objects to be marked and/or lighted within the lateral boundaries of the obstacle limitation surfaces

4.170 The marking and/or lighting of obstacles is intended to reduce hazards to aircraft by indicating the presence of the obstacles. It does not necessarily reduce operating limitations which may be imposed by an obstacle.

4.171 Other objects inside the obstacle limitation surfaces should be marked and/or lighted if a safety assessment indicates that the object could constitute a hazard to aircraft (this includes objects adjacent to visual routes e.g. waterway or highway).

4.172 Overhead wires, cables, etc., crossing a river, waterway, valley, or highway should be marked and their supporting towers marked and lighted if a safety assessment indicates that the wires or cables could constitute a hazard to aircraft.

Lighting of fixed objects with a height 150 m or more above ground level

4.211 High-intensity obstacle lights, Type A, should be used to indicate the presence of an object if its height above the level of the surrounding ground exceeds 150 m and a safety assessment indicates such lights to be essential for the recognition of the object by day.

4.212 Where high-intensity obstacle lights, Type A, are used, they should be spaced at uniform intervals not exceeding 105 m between the ground level and the top light(s) except where an object to be marked is surrounded by buildings, the elevation of the tops of the buildings may be used as the equivalent of the ground level when determining the number of light levels.

4.213 Where an object is indicated by medium-intensity obstacle lights, Type A, additional lights should be provided at intermediate levels. These additional intermediate lights should be spaced, as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 105 m.

4.214 Where an object is indicated by medium-intensity obstacle lights, Type B, additional lights should be provided at intermediate levels. These additional intermediate lights should be alternately low-intensity obstacle lights, Type B, and medium-intensity obstacle lights, Type B, and should be spaced, as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

4.215 Where an object is indicated by medium-intensity obstacle lights, Type C, additional lights should be provided at intermediate levels. These additional intermediate lights should be spaced, as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

3.3.1 Key Points

The key points presented within the guidance are presented, and discussed where necessary, within Table 2 below.

Section	Comments and Discussion
4.133 – 1	En-route objects 150m agl or more should be lit. Those less than 150m agl could still require lighting if it is deemed a potential hazard to safety. The development is considered to be en-route obstacle because the maximum height is greater than 150m agl.
4.136	Lighting should be located at the top of the obstacle.
4.137	Lighting should indicate the highest point of the obstacle relative to the Obstacle Limitation Surfaces. The development is under the Outer Horizontal Surface, which is flat, therefore the level of infringement is consistent across the two towers.
4.139	Lighting may be omitted in a group of obstacles on sides facing one another, with approval from the CAA[2]. The Great Jackson Street development cluster is considered to be a group of obstacles and therefore it is proposed lighting is omitted where facing inwardly on the cluster.
4.143	Intermediate lighting is required for obstacles above 45m agl and should be spaced as equally as practicable with no more than 52m in vertical spacing.
4.157	Medium intensity obstacle lights should be steady red.

[2] In practice, the CAA is expected to defer this decision to Manchester Airport as it is within their controlled airspace.

Section	Comments and Discussion
4.215	Where Type C lights are used, additional Type C lights should be used at intermediate levels with spacing no greater than 52m. It is recommended that Type C lights are used due to the requirement for steady lighting and precedence in Manchester city centre.

Table 2 *CAP 168 comments and discussion*

3.4 UK Regulation (EU) 139/2014 - Aerodromes

The following text is taken from the relevant sections of UK Regulation (EU) 139/2014[3]. These are the rules retained following the United Kingdom's withdrawal from the European Union (EU) and are relevant to CAA certificated aerodromes such as Manchester Airport.

CHAPTER Q — VISUAL AIDS FOR DENOTING OBSTACLES

CS ADR-DSN.Q.840 Objects to be marked and/or lighted within the lateral boundaries of the obstacle limitation surfaces

(a) Applicability: The specifications for objects to be marked and/or lighted within the lateral boundaries of the obstacle limitation surfaces apply only to the area under control of the aerodrome operator.

(b) Elevated aeronautical ground lights within the movement area should be marked so as to be conspicuous by day. Obstacle lights should not be installed on elevated ground lights or signs in the movement area.

(c) All obstacles within the distance specified in Table D-1, column (11), (12) or (13), from the centre line of a taxiway, an apron taxiway or aircraft stand taxilane should be marked and, if the taxiway, apron taxiway or aircraft stand taxilane is used at night, lighted.

(d) A fixed obstacle that extends above a take-off climb, approach or transitional surface within 3 000 m of the inner edge of the take-off climb or approach surface should be marked and if the runway is used at night, lighted, except that:

> *(1) such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle;*
>
> *(2) the marking may be omitted when the obstacle is lighted by medium-intensity obstacle lights, Type A, by day, and its height above the level of the surrounding ground does not exceed 150 m;*
>
> *(3) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day if medium intensity lights, Type A, are deemed insufficient; and*

[3] UK Regulation (EU) 139/2014 – Aerodromes, Second Edition, October 2025, last accessed 30/06/26.

(4) the lighting may be omitted where the obstacle is a lighthouse and an safety assessment indicates the lighthouse light to be sufficient.

(e) A fixed object, other than an obstacle, adjacent to a take-off climb, approach or transitional surface should be marked and, if the runway is used at night, lighted, if such marking and lighting is considered necessary to ensure its avoidance, except that the marking may be omitted when:

(1) the object is lighted by medium-intensity obstacle lights, Type A, by day, and its height above the level of the surrounding ground does not exceed 150 m; or

(2) the object is lighted by high-intensity obstacle lights by day if medium intensity lights, Type A, are deemed insufficient.

(f) A fixed obstacle that extends above a horizontal surface should be marked and if the aerodrome is used at night, lighted, except that:

(1) such marking and lighting may be omitted when: (i) the obstacle is shielded by another fixed obstacle; or

(ii) for a circuit extensively obstructed by immovable objects or terrain, procedures have been established to ensure safe vertical clearance below prescribed flight paths; or

(iii) an safety assessment shows the obstacle is not of operational significance.

(2) the marking may be omitted when the obstacle is lighted by medium-intensity obstacle lights, Type A, by day, and its height above the level of the surrounding ground does not exceed 150 m;

(3) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day if medium intensity lights, Type A, are deemed insufficient; and

(4) the lighting may be omitted where the obstacle is a lighthouse and a safety assessment indicates the lighthouse light to be sufficient.

(g) A fixed object that extends above an obstacle protection surface should be marked and, if the runway is used at night, lighted, except that such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle.

CS ADR-DSN.Q.846 Lighting of fixed objects

(a) The presence of objects which should be lighted, as specified in CS ADR-DSN.Q.840 and CS ADR- DSN.Q.841 should be indicated by low-, medium- or high-intensity obstacle lights, or a combination of such lights.

(b) Low-intensity obstacle lights, Types A, B, C and D, medium-intensity obstacle lights, Types A, B and C and high-intensity obstacle lights Types A and B, should be in accordance

with the specifications in Table Q-1, CS ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.

(c) The number and arrangement of low-, medium- or high-intensity obstacle lights at each level to be marked should be such that the object is indicated from every angle in azimuth. Where a light is shielded in any direction by another part of the object or by an adjacent object, additional lights should be provided on that adjacent object, or the part of the object that is shielding the light, in such a way as to retain the general definition of the object to be lighted. If the shielded light does not contribute to the definition of the object to be lighted, it may be omitted.

(d) In case of an object to be lighted one or more low-, medium- or high-intensity obstacle lights should be located as close as practicable to the top of the object.

(e) In the case of chimney or other structure of like function, the top lights should be placed sufficiently below the top so as to minimise contamination by smoke, etc. (see Figure Q-2).

(f) In the case of a tower or antenna structure indicated by high-intensity obstacle lights by day with an appurtenance such as a rod or an antenna greater than 12 m where it is not practicable to locate a high-intensity obstacle light on the top of the appurtenance, such a light should be located at the highest practicable point, and, if practicable, a medium-intensity obstacle light, Type A, mounted on the top.

(g) In the case of an extensive object or of a group of closely spaced objects to be lighted that are:

> *(1) Penetrating a horizontal obstacle limitation surface (OLS) or located outside an OLS, the top lights should be so arranged as to at least indicate the points or edges of the object highest in relation to OLS or above the ground, and so as to indicate the general definition and the extent of the objects; and*
>
> *(2) Penetrating a sloping OLS, the top lights should be so arranged as to at least indicate the points or edges of the object highest in relation to the OLS, and so as to indicate the general definition and the extent of the objects. If two or more edges are of the same height, the edge nearest the landing area should be marked.*

(h) When the obstacle limitation surface concerned is sloping and the highest point above the obstacle limitation surface is not the highest point of the object, additional obstacle lights should be placed on the highest point of the object.

(i) Where lights are applied to display the general definition of an extensive object or a group of closely spaced objects, and

> *(1) Low-intensity lights are used, they should be spaced at longitudinal intervals not exceeding 45 m.*
>
> *(2) Medium-intensity lights are used, they should be spaced at longitudinal intervals not exceeding 900 m.*

(j) High-intensity obstacle lights, Type A, and medium-intensity obstacle lights, Types A and B, located on an object should flash simultaneously.

(k) The installation setting angles for high-intensity obstacle lights, Type A, should be in accordance with Table Q-5.

CS ADR-DSN.Q.849 Lighting of fixed objects with a height 150 m or more above ground level

(a) High-intensity obstacle lights, Type A, should be used to indicate the presence of an object if its height above the level of the surrounding ground exceeds 150 m and a safety assessment indicates such lights to be essential for the recognition of the object by day.

(b) Where high-intensity obstacle lights, Type A, are used, they should be spaced at uniform intervals not exceeding 105 m between the ground level and the top light(s) specified in CS ADR- DSN.Q.846(d), except where an object to be marked is surrounded by buildings, the elevation of the tops of the buildings may be used as the equivalent of the ground level when determining the number of light levels.

(c) Where an object is indicated by medium-intensity obstacle lights, Type A, additional lights should be provided at intermediate levels. These additional intermediate lights should be spaced, as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 105 m.

(d) Where an object is indicated by medium-intensity obstacle lights, Type B, additional lights should be provided at intermediate levels. These additional intermediate lights should be alternately low-intensity obstacle lights, Type B, and medium-intensity obstacle lights, Type B, and should be spaced, as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

(e) Where an object is indicated by medium-intensity obstacle lights, Type C, additional lights should be provided at intermediate levels. These additional intermediate lights should be spaced, as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

Table 3 and Table 4 and on the following pages are taken from the document and pertain to the text on the previous pages.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Light type	Colour	Signal type/ (Flash Rate)	Peak intensity (cd) at given Background Luminance (b)			Light Distribution Table
			Day (Above 500 cd/m2)	Twilight (50-500 cd/m2)	Night (Below 50 cd/m2)	
Low-intensity Type A (fixed obstacle)	Red	Fixed	N/A	N/A	10	Table Q-2
Low-intensity Type B (fixed obstacle)	Red	Fixed	N/A	N/A	32	Table Q-2
Low-intensity Type C (mobile obstacle)	Yellow/ Blue (a)	Flashing (60-90 fpm)	N/A	40	40	Table Q-2
Low-intensity Type D (follow-me vehicle)	Yellow	Flashing (60-90 fpm)	N/A	200	200	Table Q-2
Low-intensity, Type E	Red	Flashing (c)	N/A	N/A	32	Table Q-2 (Type B)
Medium-intensity Type A	White	Flashing (20-60 fpm)	20 000	20 000	2 000	Table Q-3
Medium-intensity Type B	Red	Flashing (20-60 fpm)	N/A	N/A	2 000	Table Q-3
Medium-intensity Type C	Red	Fixed	N/A	N/A	2 000	Table Q-3
High-intensity Type A	White	Flashing (40-60 fpm)	200 000	20 000	2 000	Table Q-3
High-intensity Type B	White	Flashing (40-60 fpm)	100 000	20 000	2 000	Table Q-3
(a) CS ADR-DSN.Q.850(b)						

Table 3 *Characteristics of obstacle lights (Table Q-1.)*

	Minimum intensity (a)	Maximum intensity (a)	Vertical beam spread (f)	
			Minimum beam spread	Intensity
Type A	10 cd (b)	N/A	10°	5 cd
Type B	32 cd (b)	N/A	10°	16 cd
Type C	40 cd (b)	400 cd	12(d)	20 cd
Type D	200 cd (c)	400 cd	N/A(e)	N/A

Note: This table does not include recommended horizontal beam spreads. CS ADR-DSN.Q.846(c) requires 360° coverage around an obstacle. Therefore, the number of lights needed to meet this requirement will depend on the horizontal beam spreads of each light as well as the shape of the obstacle. Thus, with narrower beam spreads, more lights will be required.

(a) 360° horizontal. For flashing lights, the intensity is read into effective intensity, as determined in accordance with ICAO, Aerodrome Design Manual, Part 4, Visual Aids.

(b) Between 2 and 10° vertical. Elevation vertical angles are referenced to the horizontal when the light is levelled.

(c) Between 2 and 20° vertical. Elevation vertical angles are referenced to the horizontal when the light is levelled.

(d) Peak intensity should be located at approximately 2.5° vertical.

(e) Peak intensity should be located at approximately 17° vertical.

(f) Beam spread is defined as the angle between the horizontal plan and the directions for which the intensity exceeds that mentioned in the 'intensity' column.

Table 4 *Light distribution for low-intensity obstacle light (Table Q-2.)*

3.4.1 Key Points

The key points presented within the guidance are presented, and discussed where necessary, within Table 5 below.

Section	Comments and Discussion
Q.840 (a)	The development is within Manchester Airport's Control Zone and therefore under their control.
Q.840 (f)	An obstacle should be lit when it infringes a horizontal surface. The development infringes the Outer Horizontal Surface. No mentioned omissions apply to the development.
Q.840 (g)	An obstacle should be lit when it infringes a horizontal surface. The development infringes the Outer Horizontal Surface. The two mentioned omissions do not apply to the development.
Q.846 (a)	The guidance states that an object that should be lit, should be illuminated by low, medium or high intensity obstacle lights.
Q.846 (c)	The number and arrangement of obstacle lights at each level should be marked such that the object is indicated from every angle in azimuth. Where a light is shielded, additional lights should be provided on that object in such a way as to retain the general definition of the object to be lighted. If the shielded light does not contribute to the definition of the object to be lighted, it may be omitted. The development does not infringe upon the OLS as defined within the EASA guidance however the development is close to these surfaces.
Q.846 (d)	In case of an object to be lighted, one or more low-, medium- or high-intensity obstacle lights should be located as close as practicable to the top of the object.
Q.846 (g)	Lights should be so arranged as to indicate the tallest object and the extent of the group of objects. The development is located in the Great Jackson Street development cluster and therefore consideration of the group of objects is required.
Q.846 (i)	(i) Where lights display or a group of closely spaced objects, and medium-intensity lights are used, they should be spaced at longitudinal intervals not exceeding 900 m.

Section	Comments and Discussion
Q.849 (e)	Where an object is indicated by medium-intensity obstacle lights, Type C, and the top of the object is more than 45m above the level of the surrounding ground or objects (when the object to be marked is surrounded by buildings), additional lights should be provided at intermediate levels. These additional intermediate lights should be spaced as equally as practicable, between the top lights and ground level or the tops of nearby objects as appropriate, with the spacing not exceeding 52m. Intermediate lighting may be required for this site, as the building extends more than 45m above the surrounding buildings.
Table Q-1	The characteristics of medium-intensity Type C lights are fixed red at 2,000 candela. The light distribution should be in accordance with Table Q-2.

Table 5 *UK Regulation (EU) 139/2014 comments and discussion*

3.5 Guidance Conclusion

The relevant guidance, namely the Air Navigation Order (ANO) 222 and UK Regulation (EU) 139/2014, state that medium intensity red lighting (Type C) on the top corners of the towers, with intermediate Type C lighting spaced no more than 52m apart, are required.

The guidance documents make specific recommendations for lighting of groups of objects. Consideration of the development in the context of the Great Jackson Street Development cluster is therefore necessary.

4 ADDITIONAL CONSIDERATIONS

4.1 Overview

A requirement for aviation lighting has been identified following a review of the available guidance. However, the wider context of the Great Jackson Street Development cluster and Manchester Airport Group's known lighting requirements for buildings in the city centre is required to confirm the specific lighting scheme. These are discussed in this section.

4.2 Wider Context

The development is located on the south side of the Great Jackson Street Development cluster meaning the northern side of the towers are facing within the building cluster. This means they will not be presented to an aircraft from any direction. Intermediate lights on the northern corners of the towers would therefore only serve as pointing into the surrounding residences, causing a nuisance to residents and impacting on their quality of life.

Similarly, the southwest of the west tower is in close proximity to Plot D, the southeast corner of the west tower is in close proximity to the east tower, and the southwest corner of the east tower is in close proximity to the west tower and River Street tower. Unobstructed intermediate lights could therefore cause a nuisance to residents and impact their quality of life the light spill is reaches their residence.

Lighting omissions and shielding at specific bearings can be utilised to ensure that wider amenity issues are not encountered by light spill whilst adhering to the relevant lighting guidance.

4.3 Manchester Airport Group Requirements

Special dispensation was previously given to other developments in the Great Jackson Street Development cluster which omitted intermediate lighting. The position of Manchester Airport is now that intermediate lighting is required unless only considered to cause an amenity issue for residents in surrounding developments without an improvement to aviation safety.

The development is located entirely in Manchester Airport's controlled airspace and therefore any reduced lighting compared to the relevant guidance must be approved by the airport and/or the CAA.

5 PROPOSED LIGHTING SCHEME

5.1 Lighting Scheme Overview

Table 6 below summarises the recommended lighting scheme design.

Tower	Top Lights	Intermediate lights
West tower	Medium intensity, Type C, red lights marking the four corners	Medium intensity, Type C, red at levels 14, 28 and 42 Omitted on the two northern corners as they are deemed to be the inside of the building cluster Shielding where necessary to stop light spill towards the east tower and Plot D residents
East tower		Medium intensity, Type C, red lights at levels 14, 28 and 42 Omitted on the two northern corners as they are deemed to be the inside of the building cluster Shielding where necessary to stop light spill towards the west tower and Plot F and River Street tower residents

Table 6 *Recommended lighting scheme*

5.2 Proposed Lighting Scheme Diagrams

Figure 3 on the following page shows a plan of the proposed lighting scheme as viewed from above. Figure 4 and Figure 5 on the pages 27 and 28 show 3D representations of the proposed lighting scheme as viewed from the southwest and southeast, respectively.

Figure 6 and Figure 7 on pages 29 and 30 show the lateral positions where the intermediate lighting will be visible and therefore, in contrast, where the lighting will be shielded.

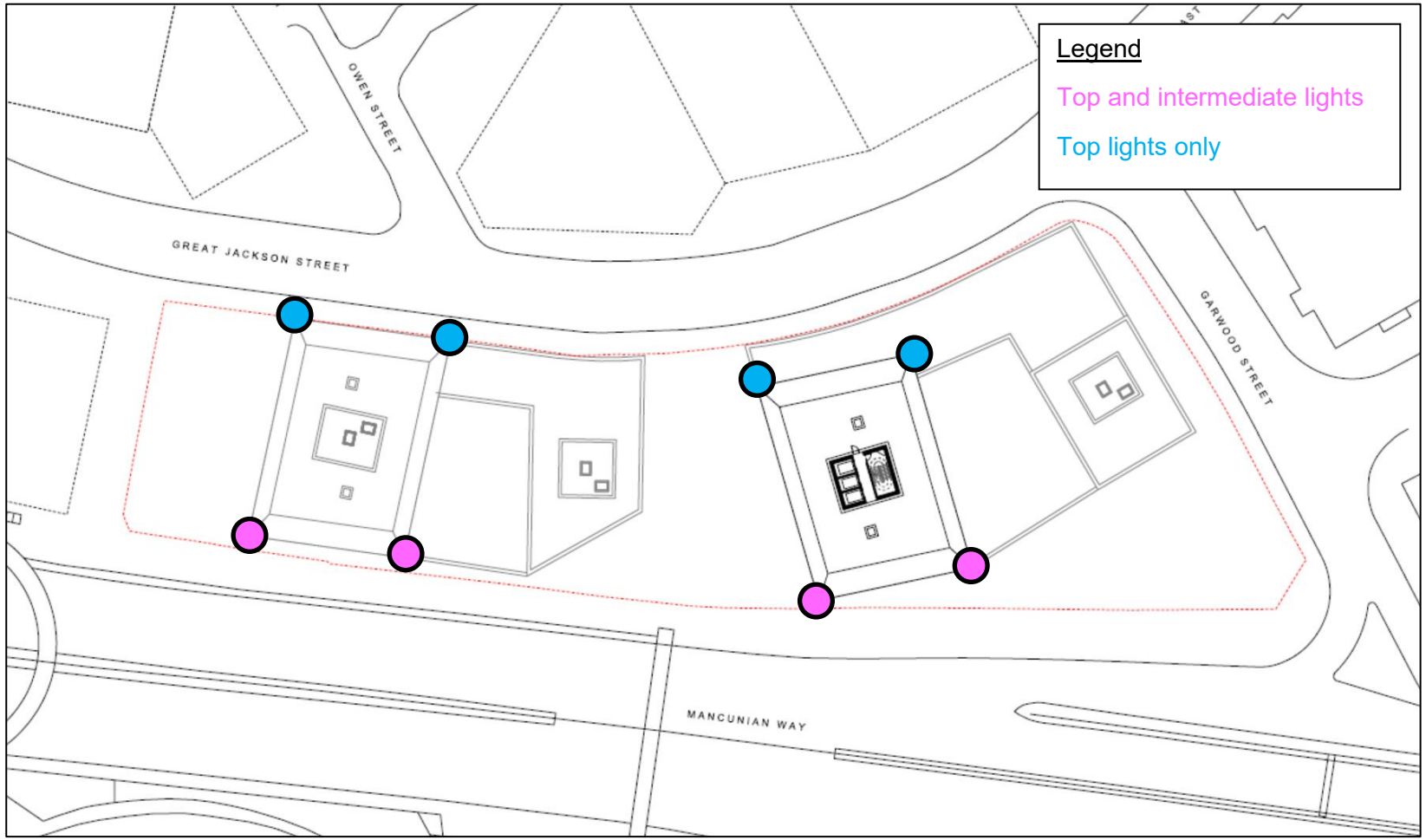


Figure 3 *Proposed lighting scheme – top down*

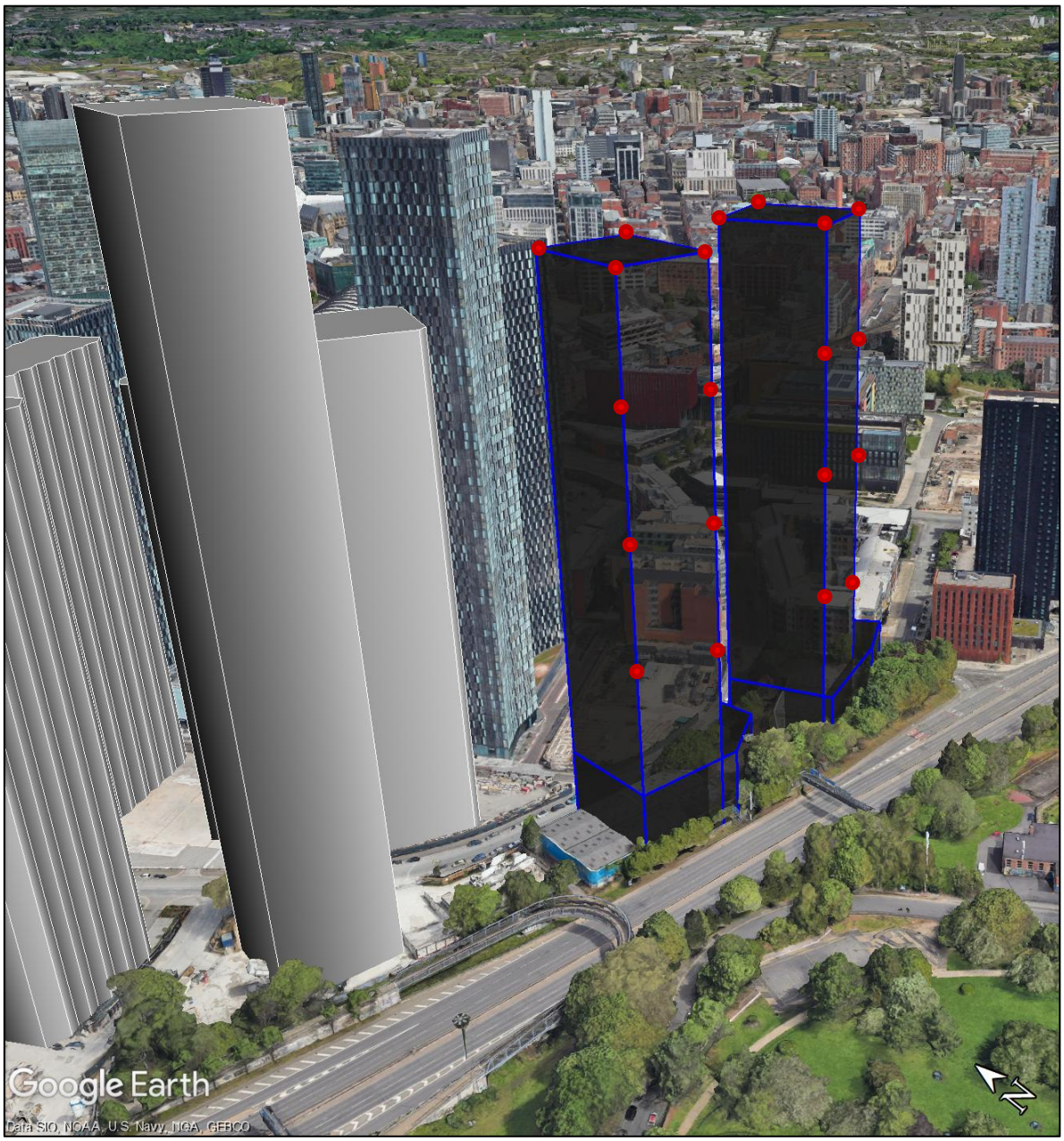


Figure 4 *Proposed lighting scheme – 3D representation SW*

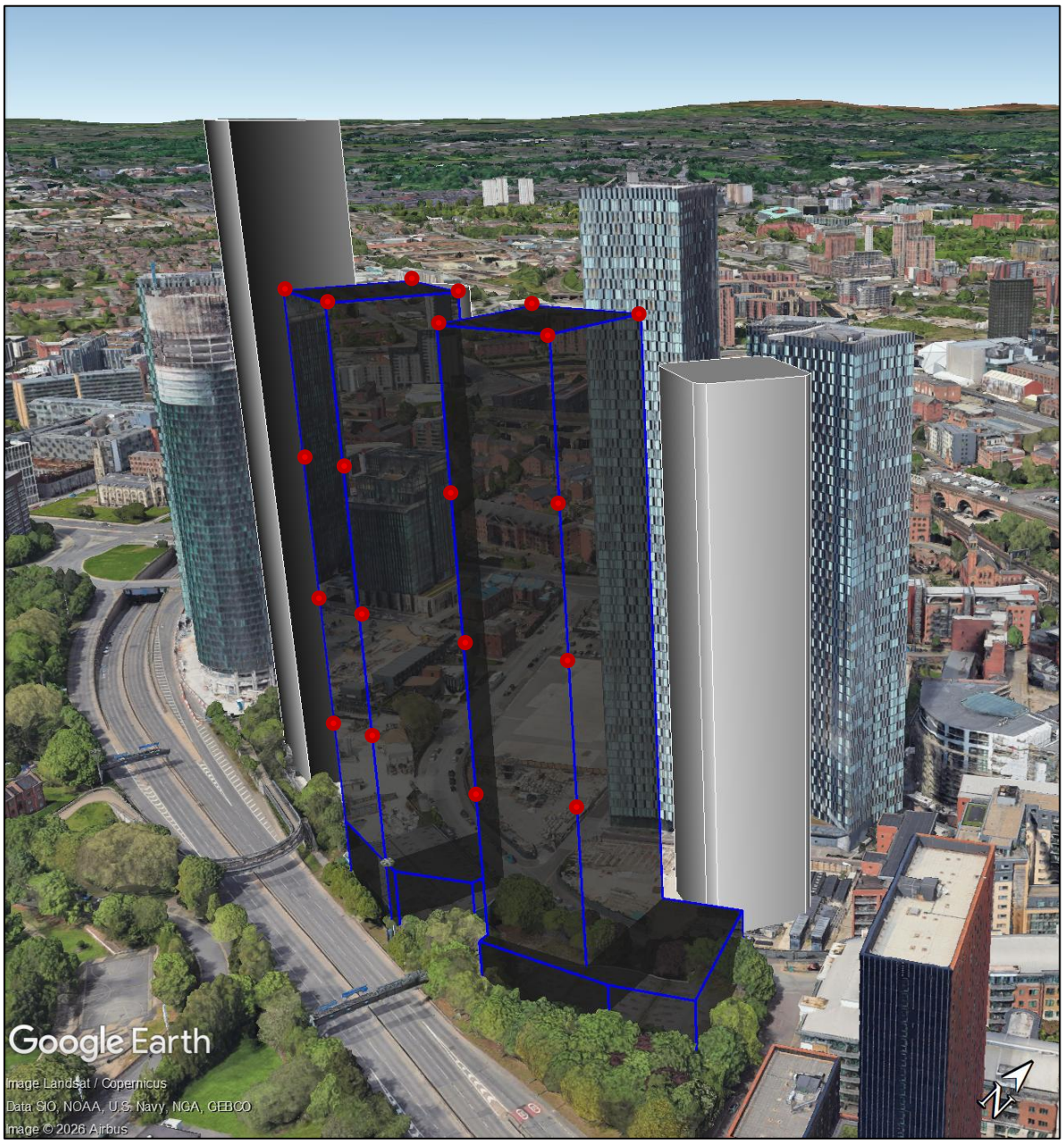


Figure 5 *Proposed lighting scheme – 3D representation SE*

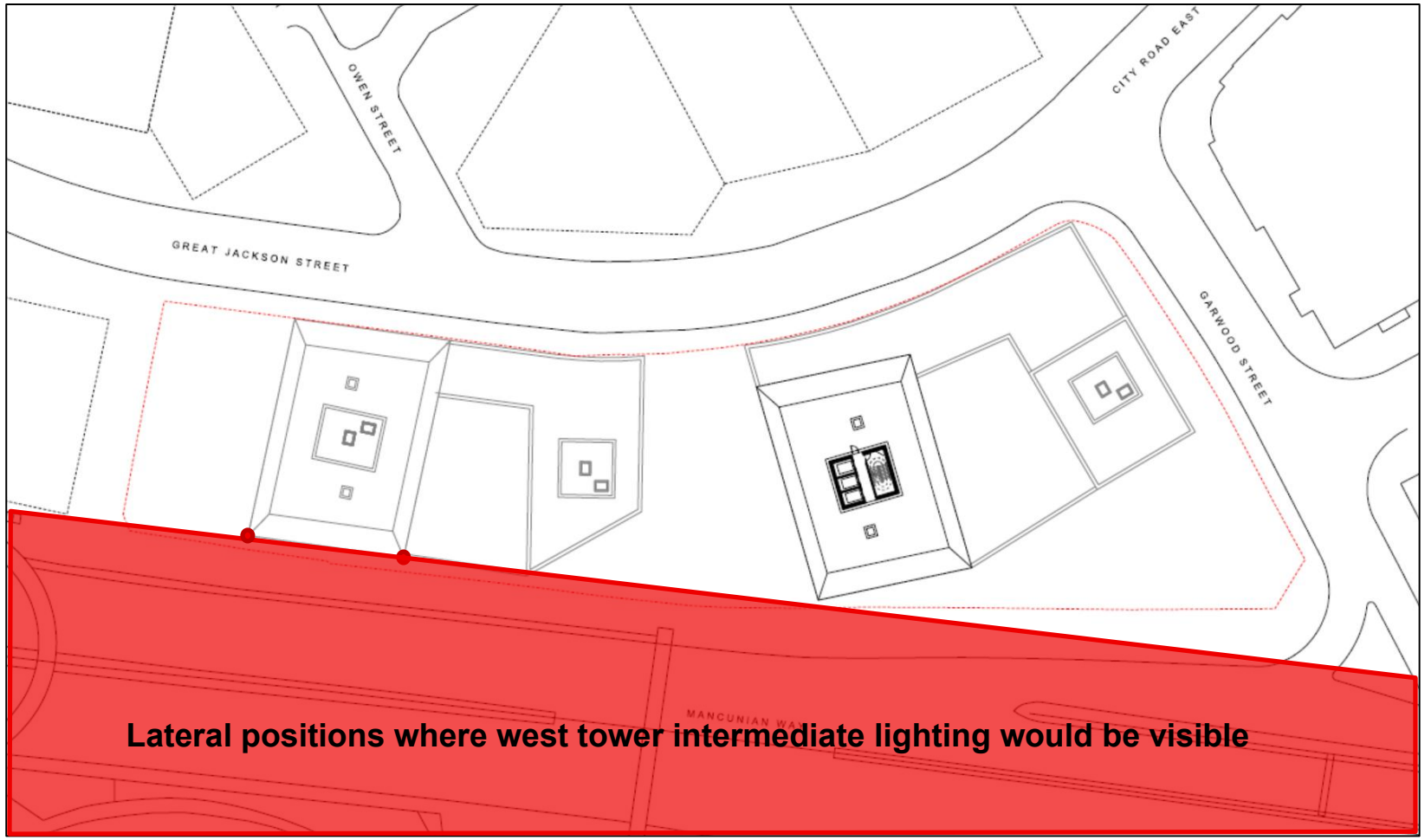


Figure 6 *West tower intermediate lighting visibility*

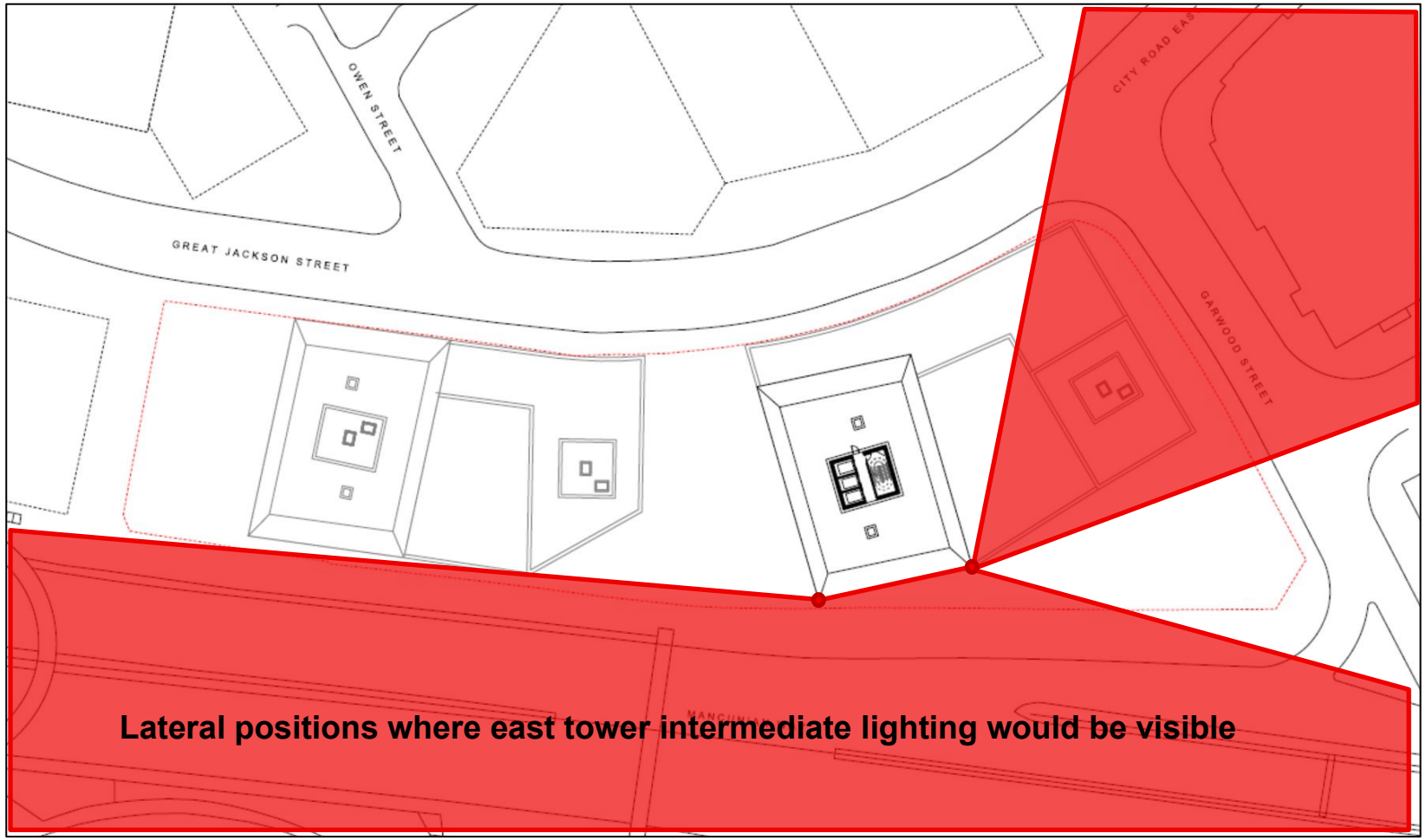


Figure 7 *East tower intermediate lighting visibility*



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