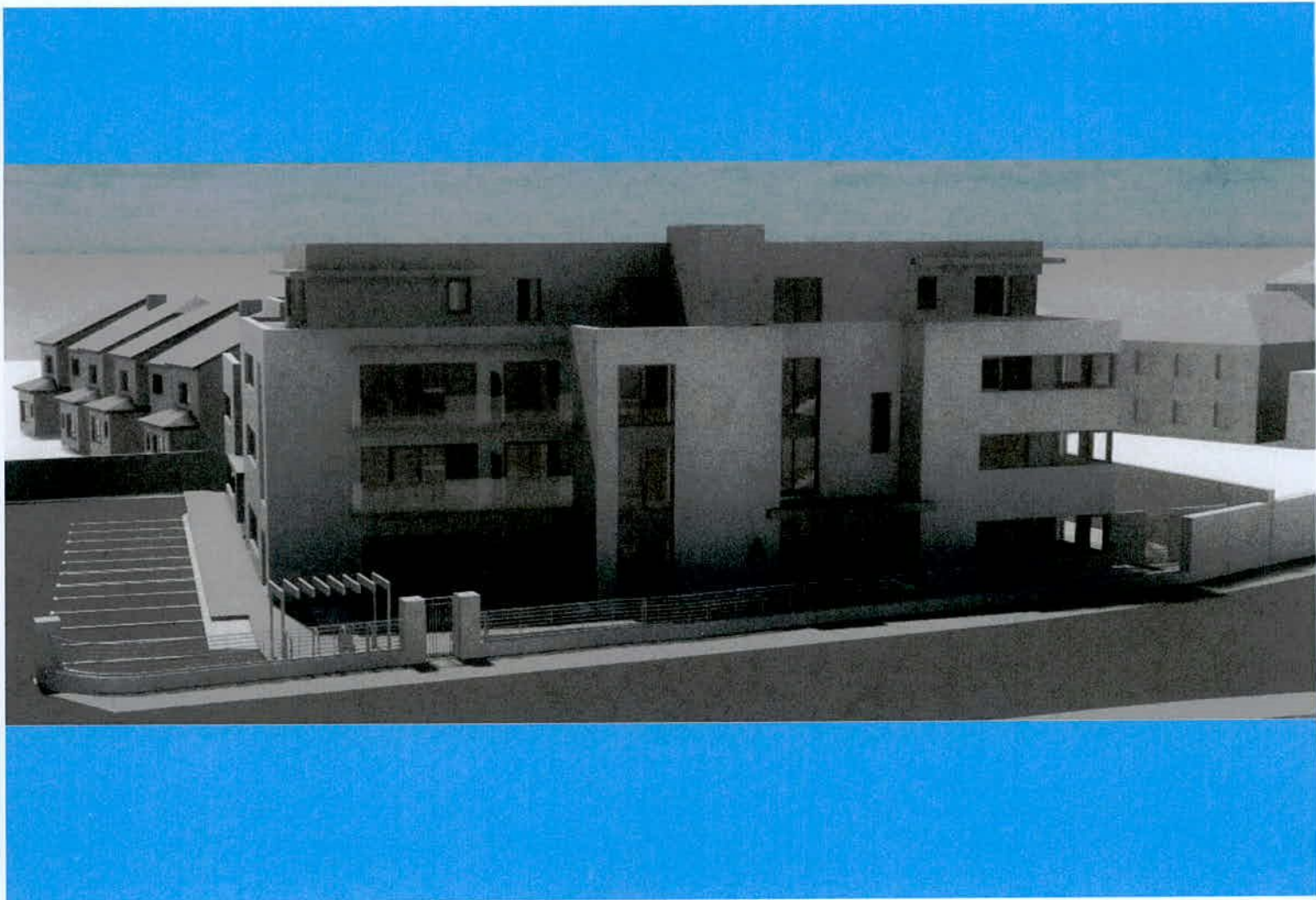


Daylight Analysis and Overshadowing

Hill House, Lucan, Co. Dublin

17/05/2022





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1. Executive Summary

H3D were engaged to provide a report on the impact of the proposed residential development at Hill House, Lucan, Co. Dublin. H3D were instructed to conduct the following:

- To create a 3D computer analysis model of the scheme based upon planning drawings provided by PMCA Architects.
- Conduct a shadow study demonstrating the shadowing being cast due to the proposed development.
- Conduct a study to investigate if the adjacent amenity areas achieve 2 hours of sunlight on March 21st.
- Analyse the Average Daylight Factor (ADF) for the proposed development.
- Investigate the effect of the new development on the adjoining sites to the calculating Vertical Sky Component (VSC).
- Prepare a report setting out the analysis and the findings.

Methodology

The assessment of the proposed development was prepared using the methodology's set out in the British Standard: Lighting for Buildings – Part 2: Code for Practice for Daylighting, BRE 209, 'Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice', Second Edition 2011, by P. J. Littlefair and the Design Standards for New Apartments - Guidelines for Planning Authorities (March 2018).

BRE Guide and Advisory Note

The numerical guidelines given in these documents are purely advisory. The BRE Guide states that:

“The advice given here is not mandatory and the guide should not be an instrument of planning policy; its aim is to help rather than constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in site layout design.”

“It is purely advisory and the numerical target values within it may be varied to meet the needs of the development and its location” (Section 1.6, p1)

Vertical Sky Component (VSC)

The BRE guidelines state that if the VSC at the centre of a window is more than 27% (or if not, then it is more than 80% of its former value), then the diffuse daylighting of the existing building will not be adversely affected.

All calculated windows analysed except one achieve the value of 27%. The window that falls short of this level has a value that is 0.94 of the existing level thus all windows analysed pass this BRE guideline.

Average Daylight Factor (ADF)

Average daylight factor (ADF) is a measure of the adequacy of diffuse daylight within a room, and accounts for factors such as the size of a window in relation to the size of the room; the reflectance of the walls; and, the nature of the glazing and number of windows. Clearly a small room with a large window will be better illuminated by daylight than a large room with a small window, and the ADF measure accounts for this.

BRE guidelines confirm that the acceptable minimum ADF target value depends on the room use. That is 1% for a bedroom, 1.5% for a living room and 2% for a family kitchen. In cases where one room serves more than one purpose, the minimum ADF should be that for the room type with the higher value. Notwithstanding this, the independent daylight and sunlight review states that, in practice, the principal use of rooms designed as a 'living room/kitchen/dining room' is as a living room. Accordingly, it would be reasonable to apply a target of 1.5% to such rooms.

All 51 no. habitable spaces in the proposed development exceed the BRE guidelines for Average Daylight Factor.

Sunlight Assessment on Amenity Space – 50% Rule

BRE Guide [3.3] It is recommended that for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21st March.

Of the three spaces analysed, all achieve 100% area receiving at least two hours of sunlight on March 21st.



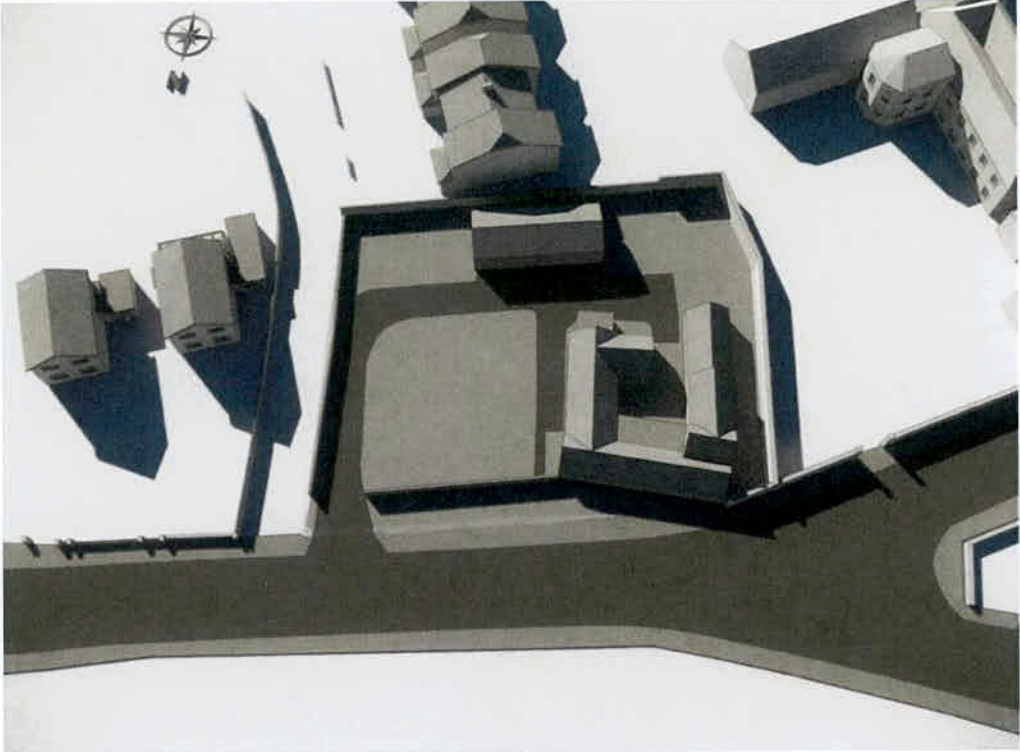
Cian Heffernan

MSc, BEng (Hon) Civil, PgD

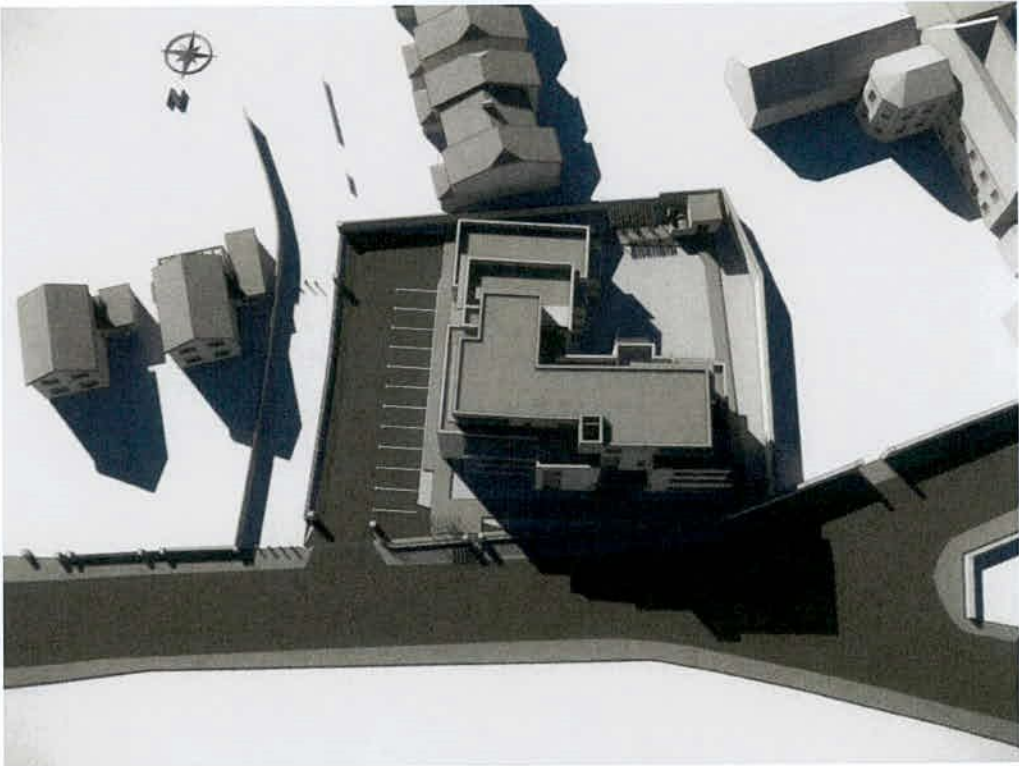


2. Overshadowing

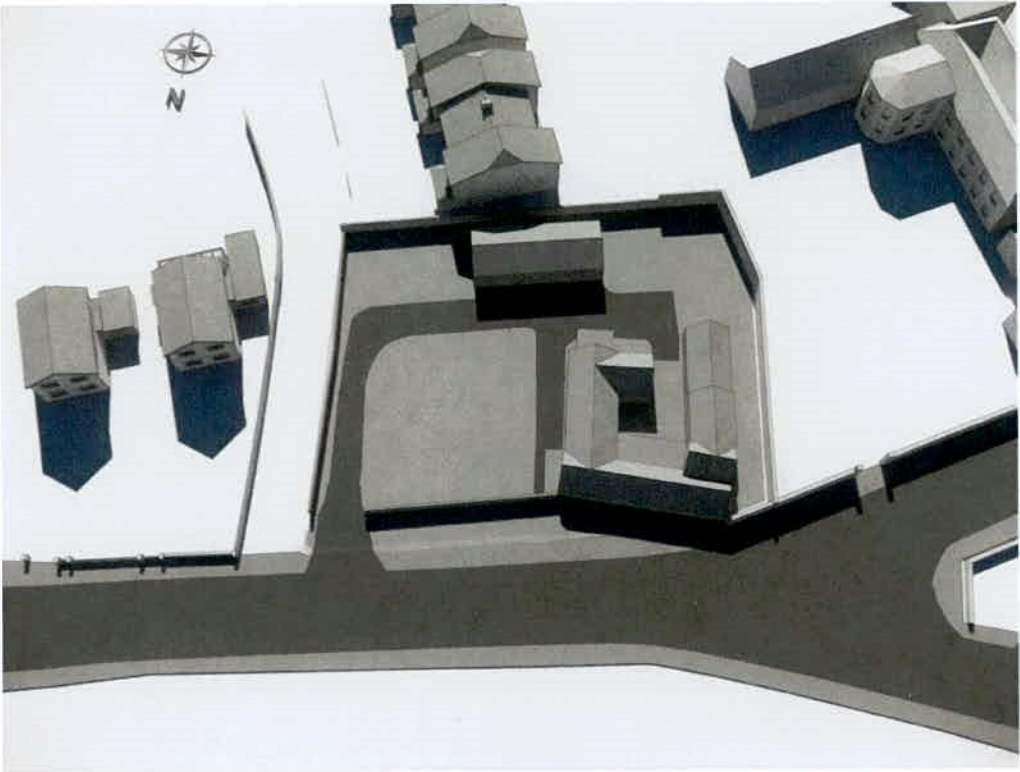
The following images illustrate the shadows cast on the neighbouring amenity areas between 10:00 and 16:00.



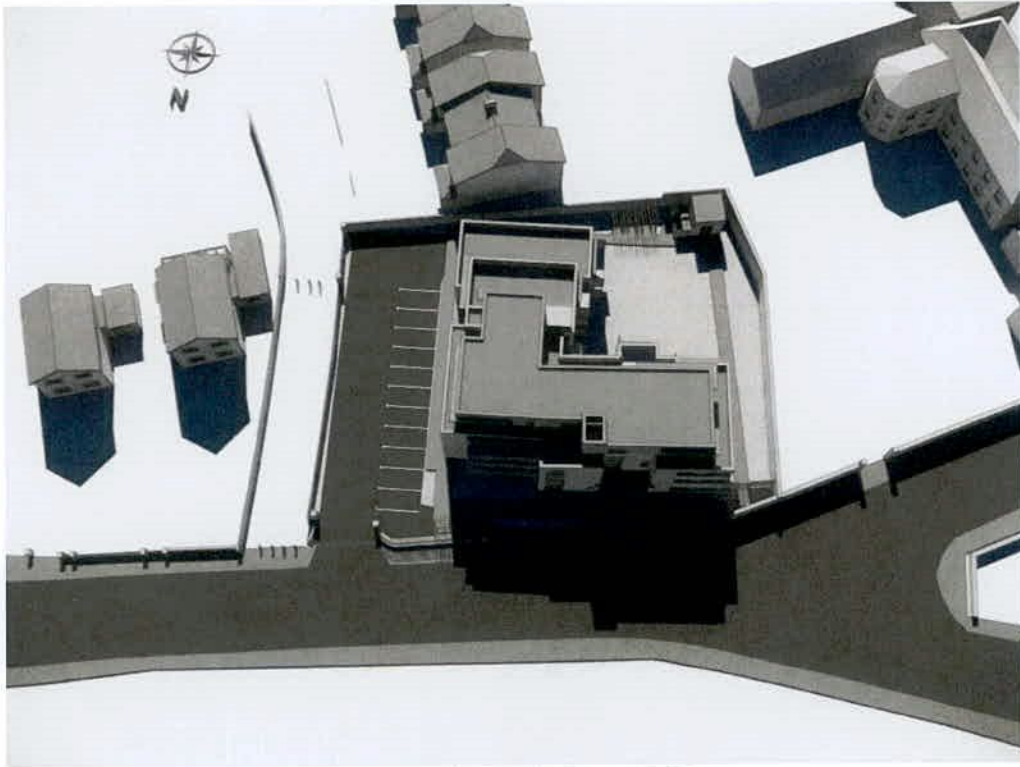
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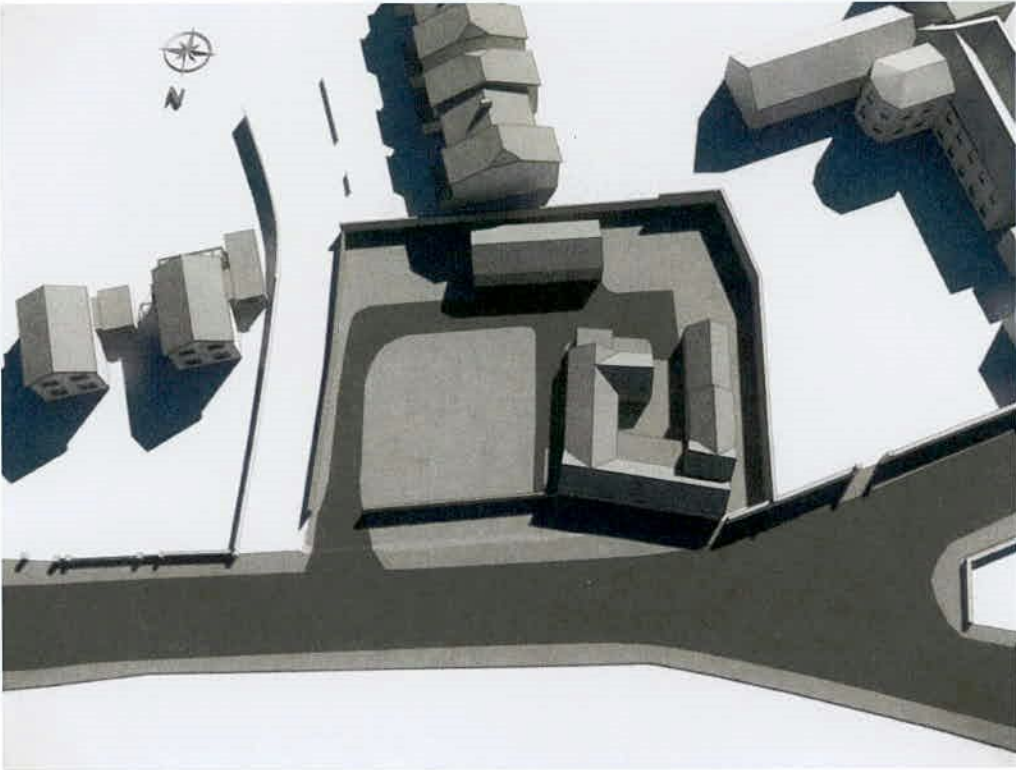
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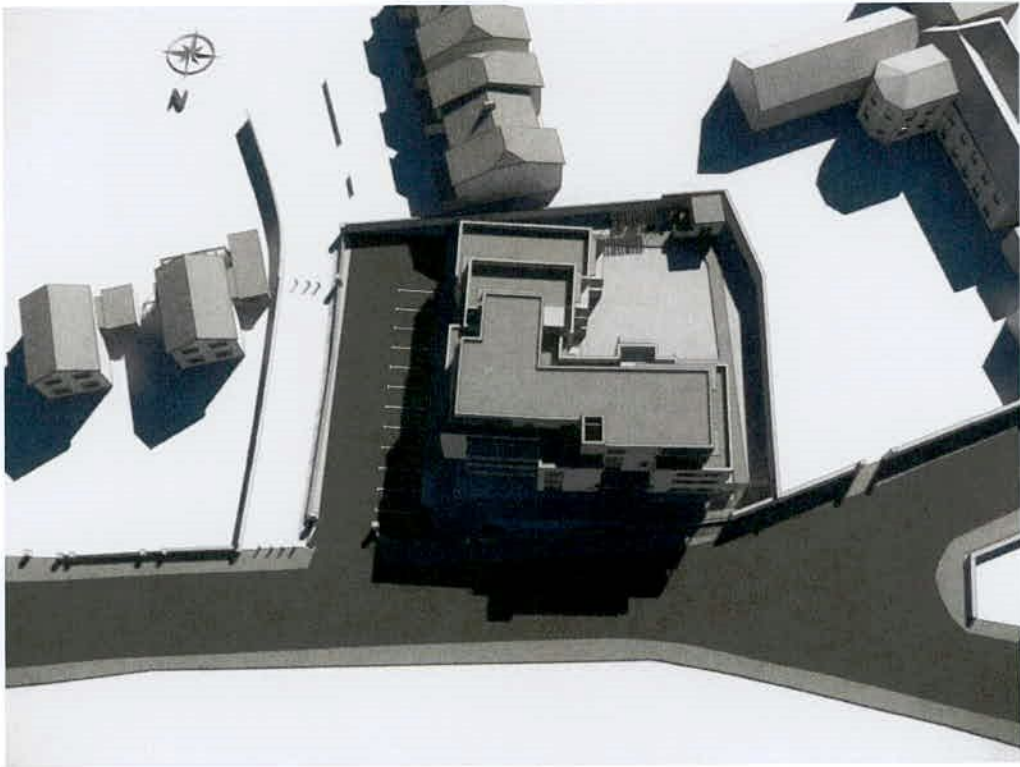
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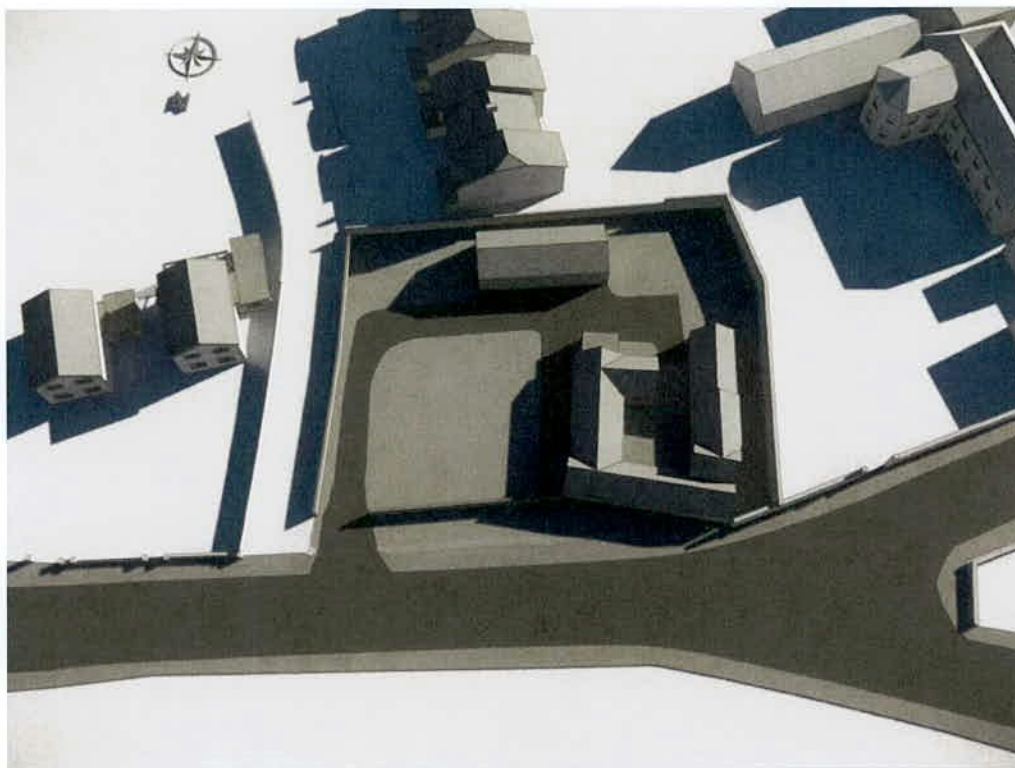
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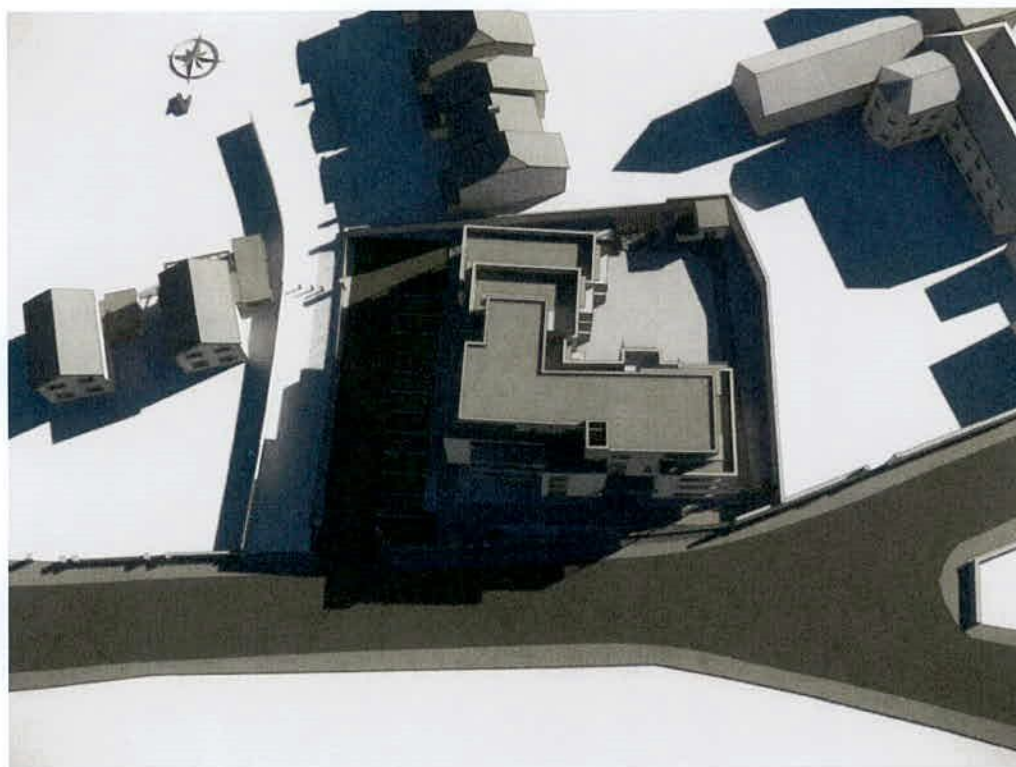
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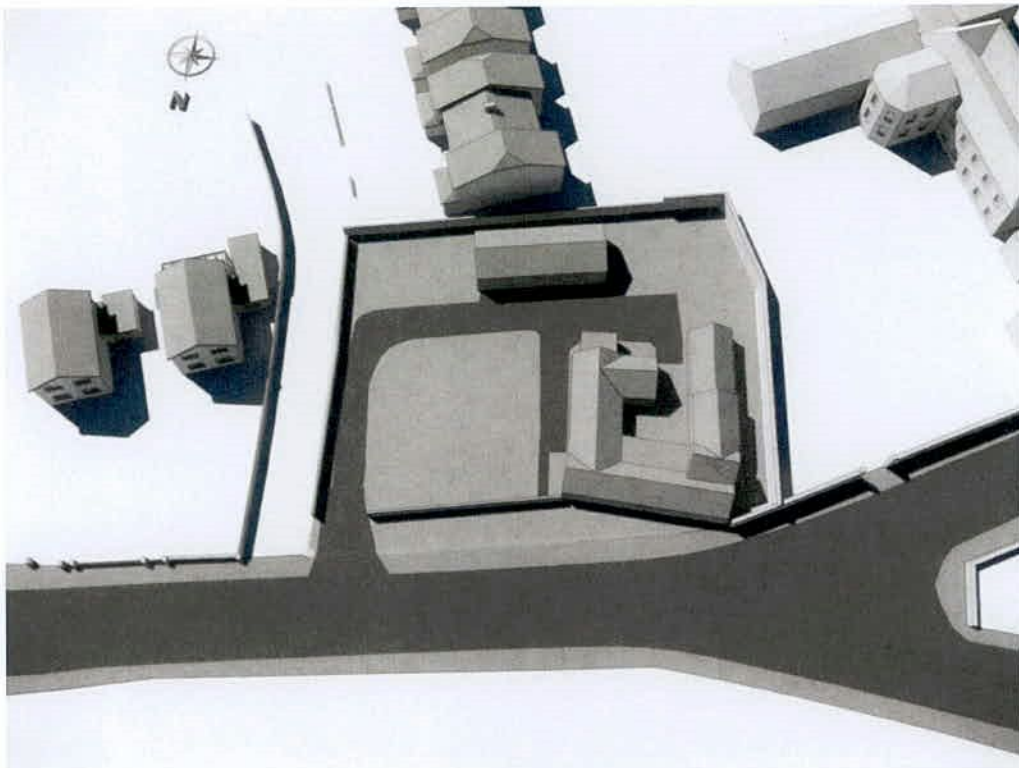
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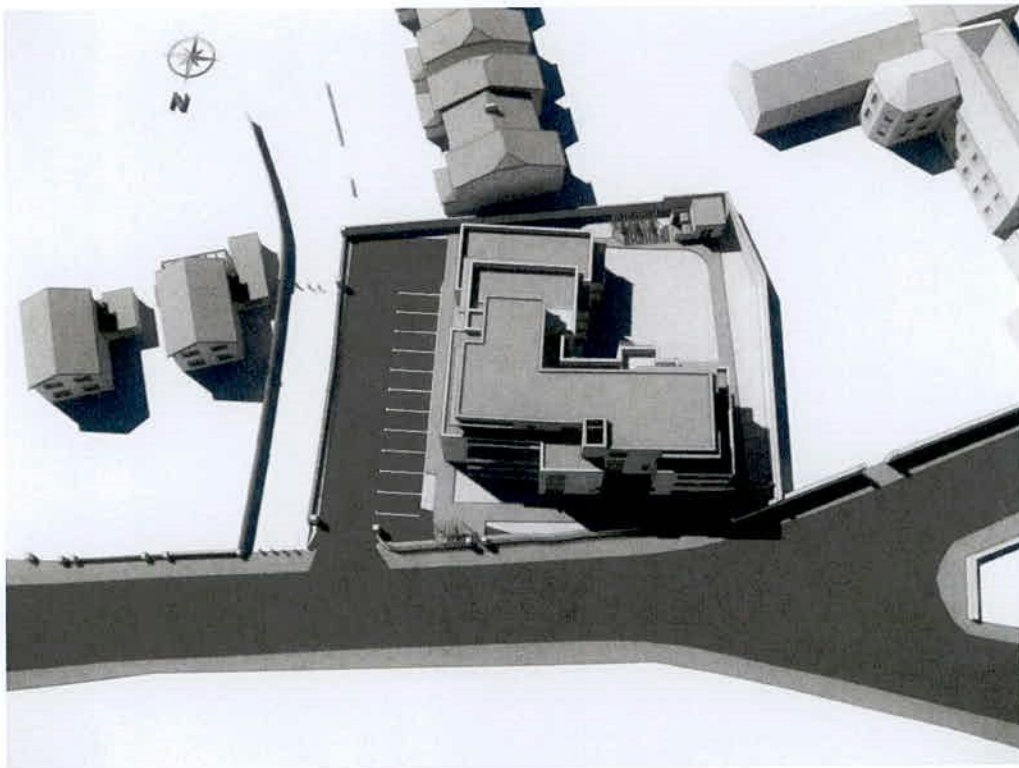
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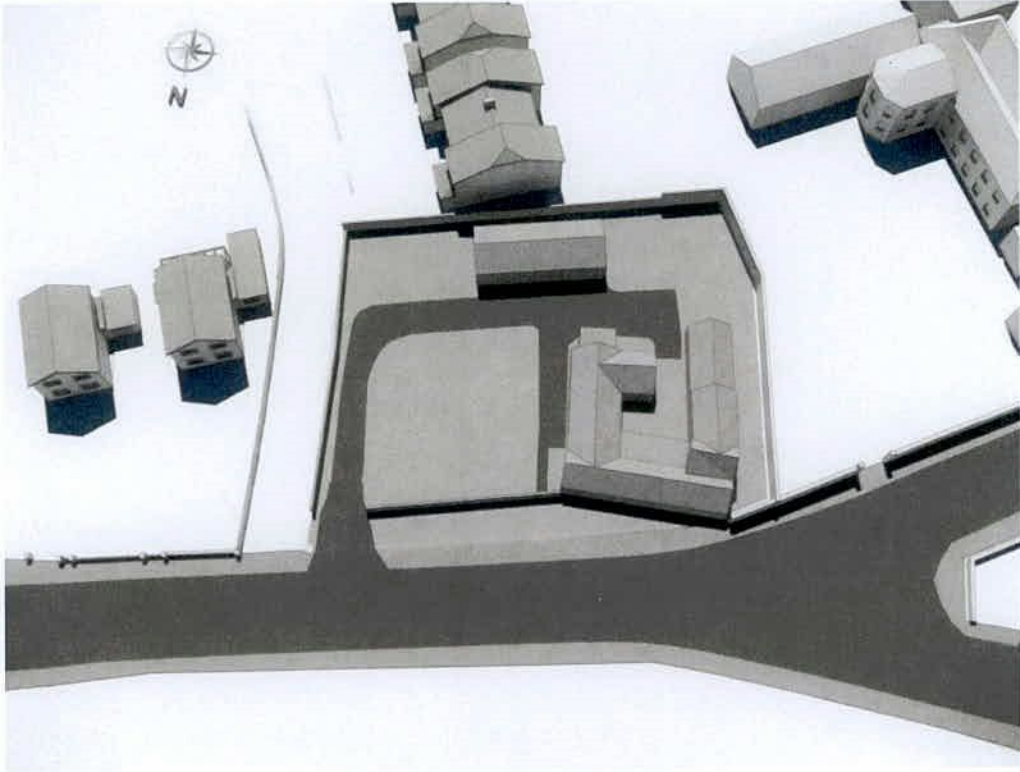
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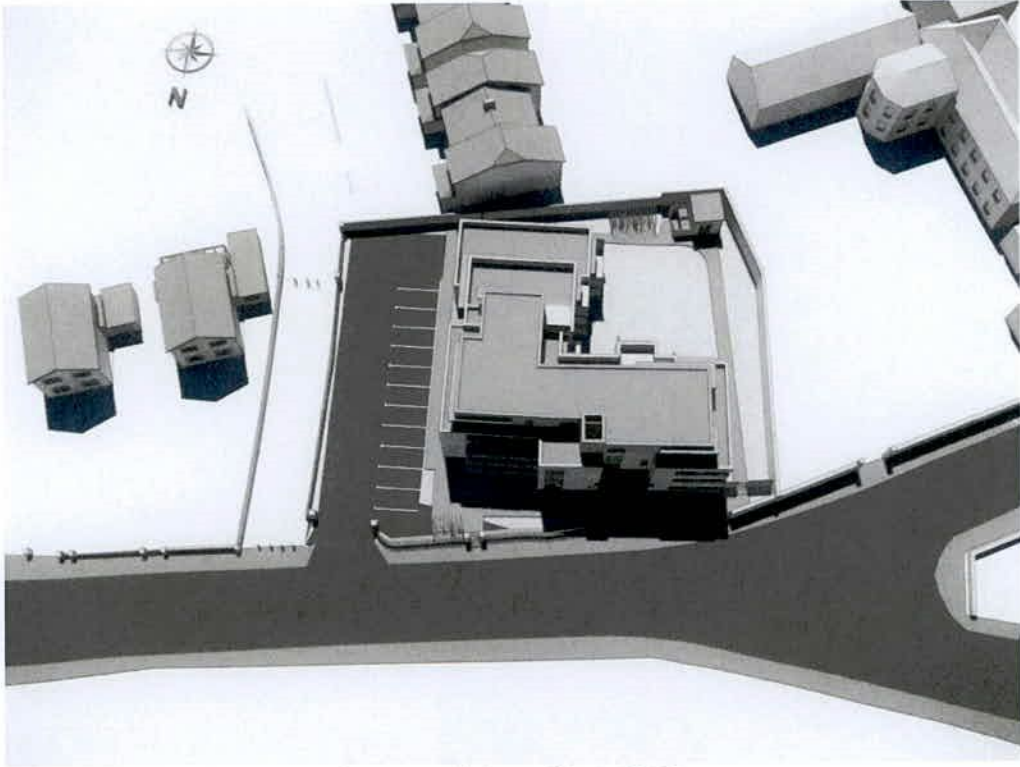
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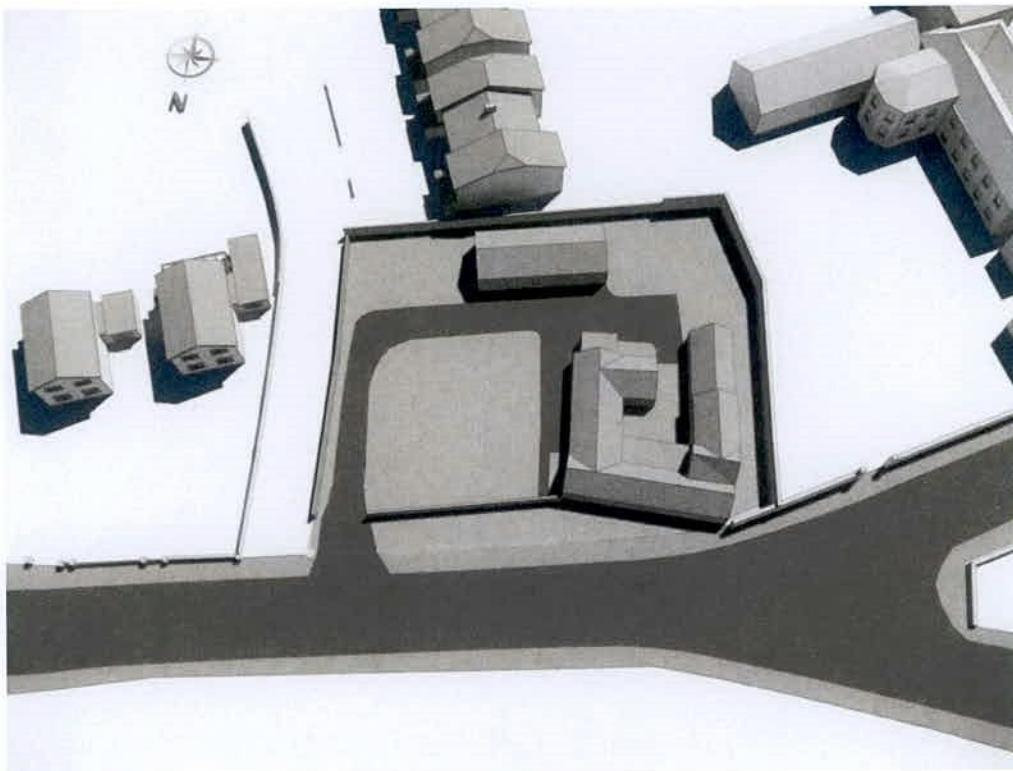
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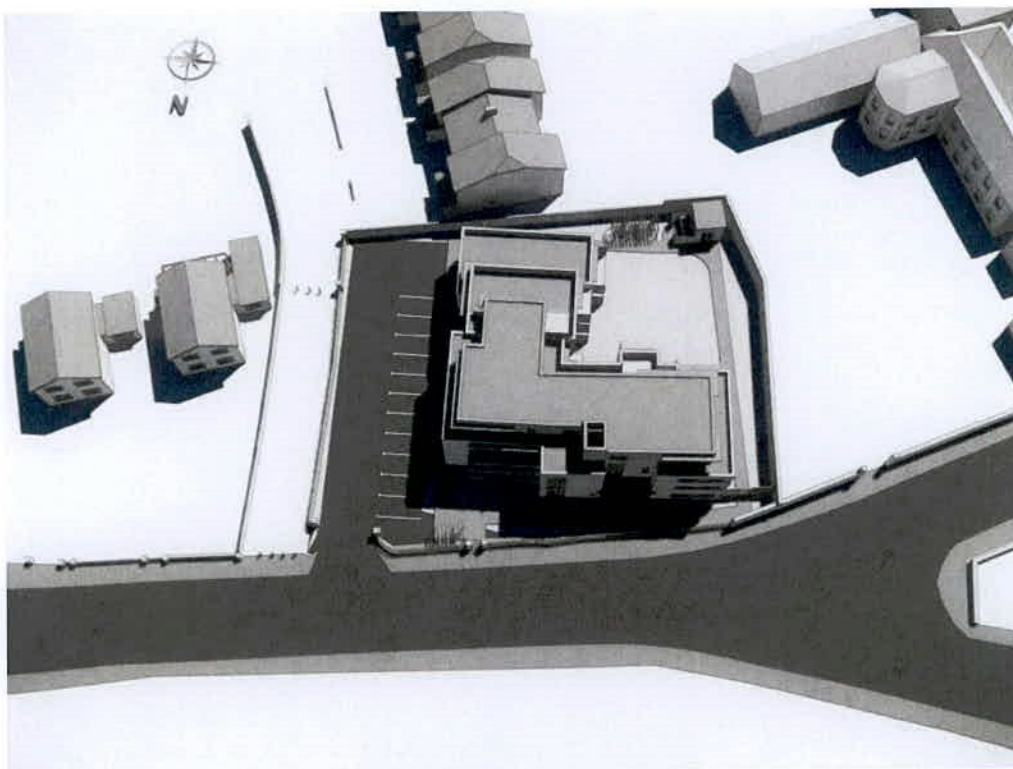
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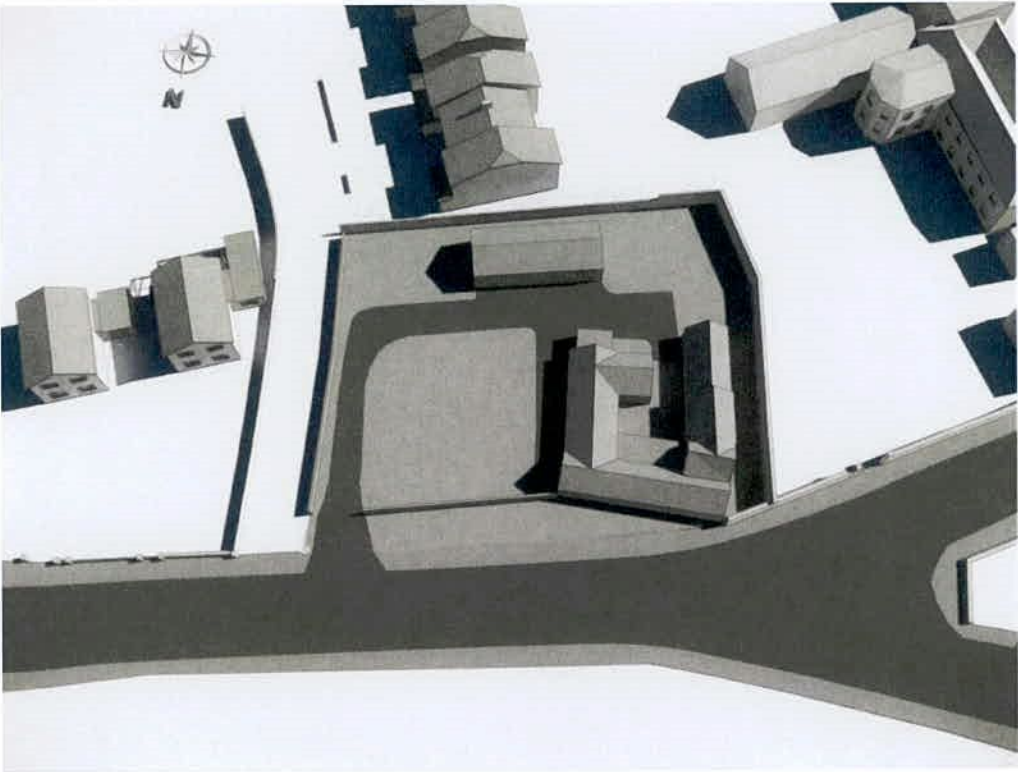
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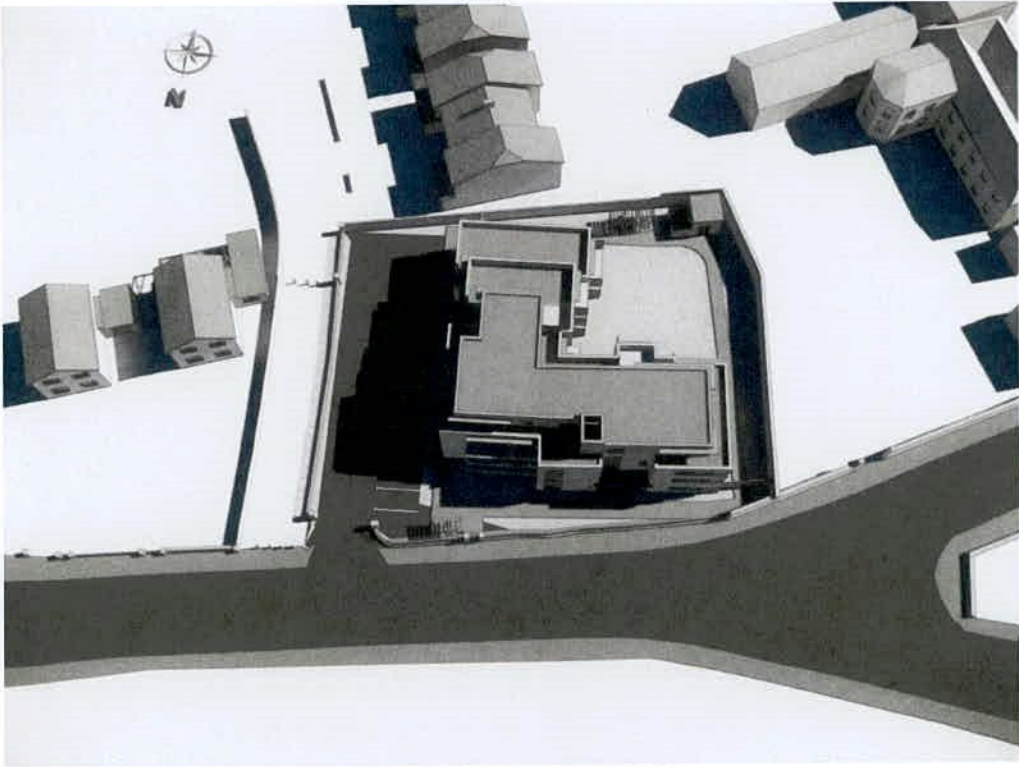
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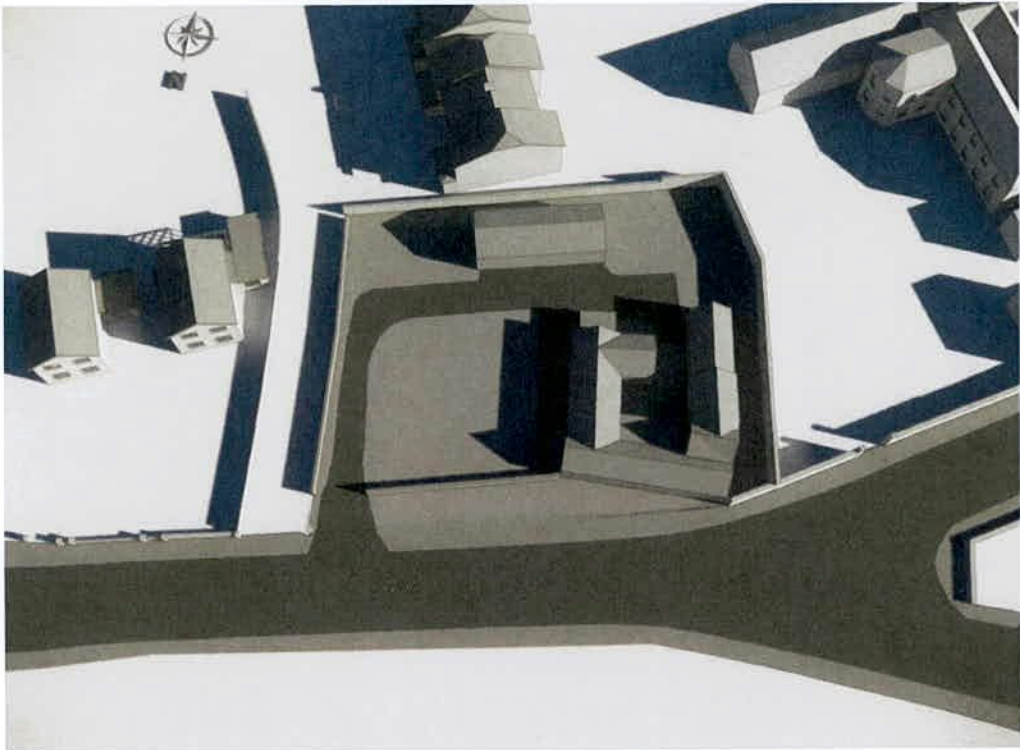
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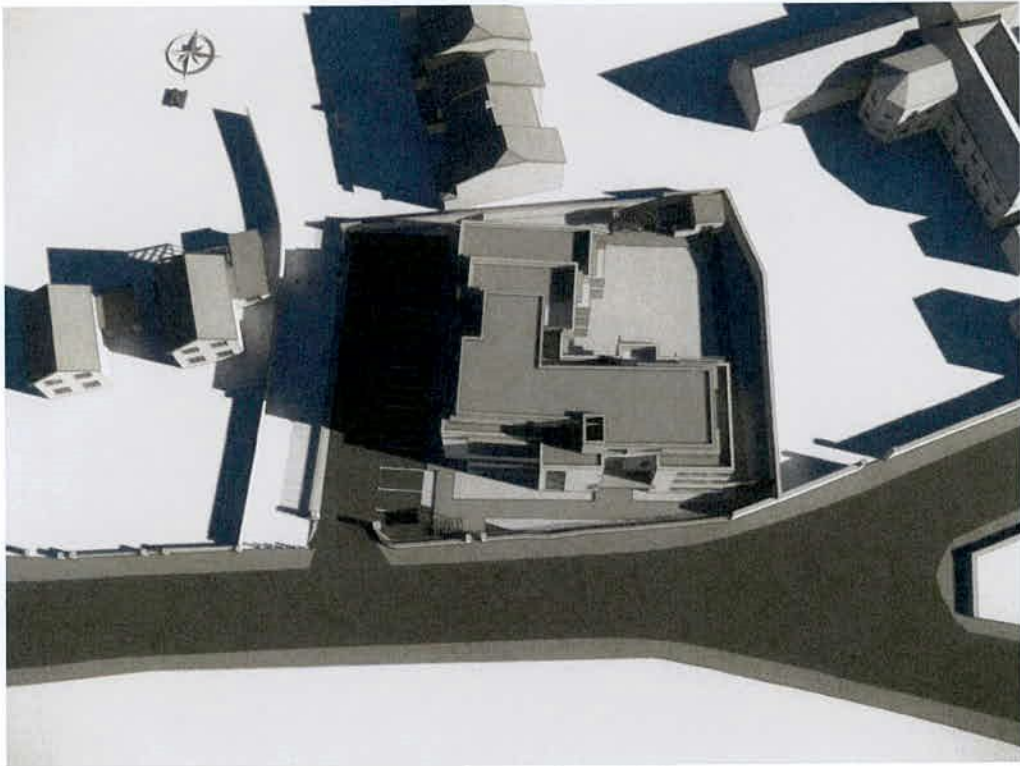
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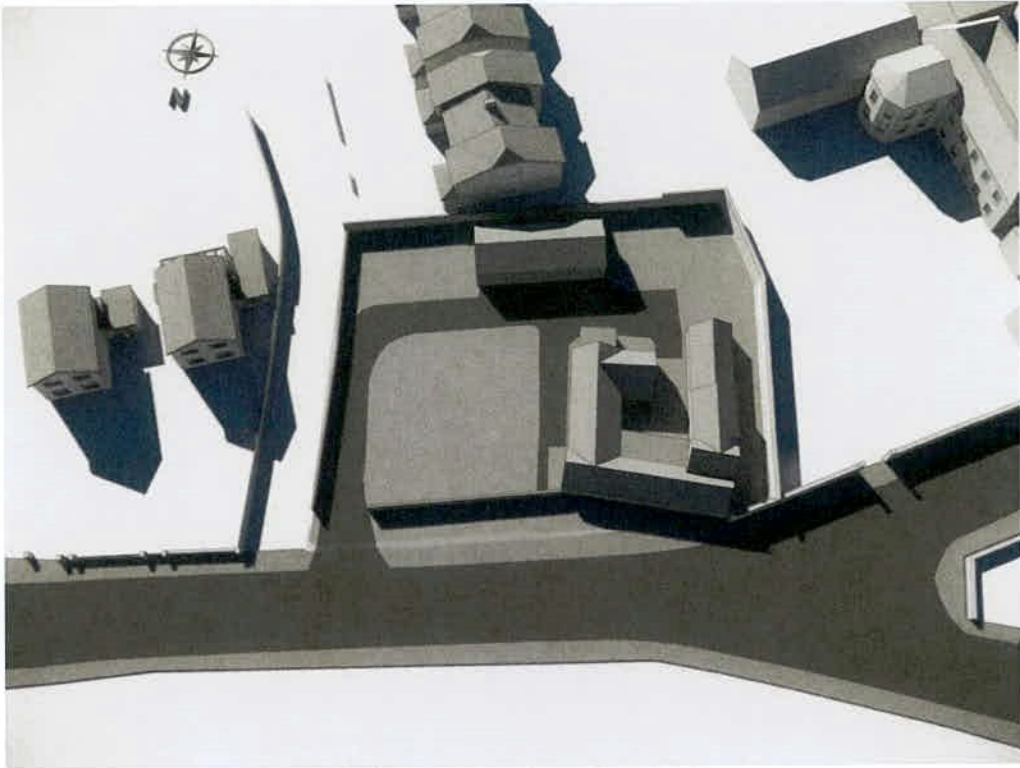
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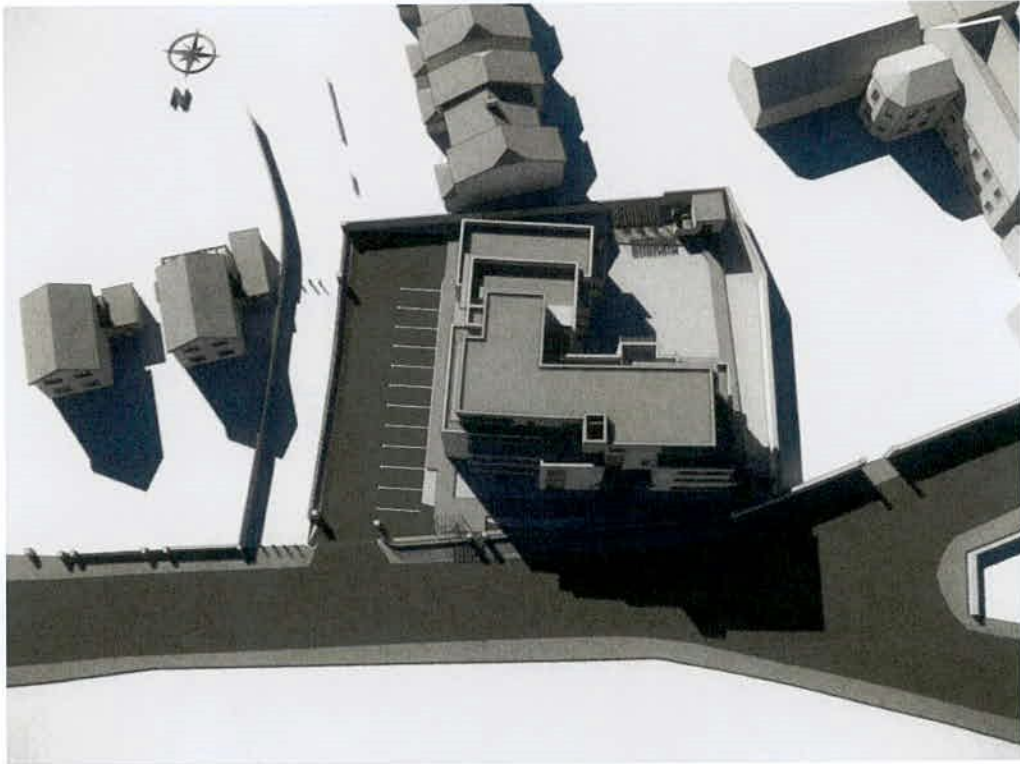
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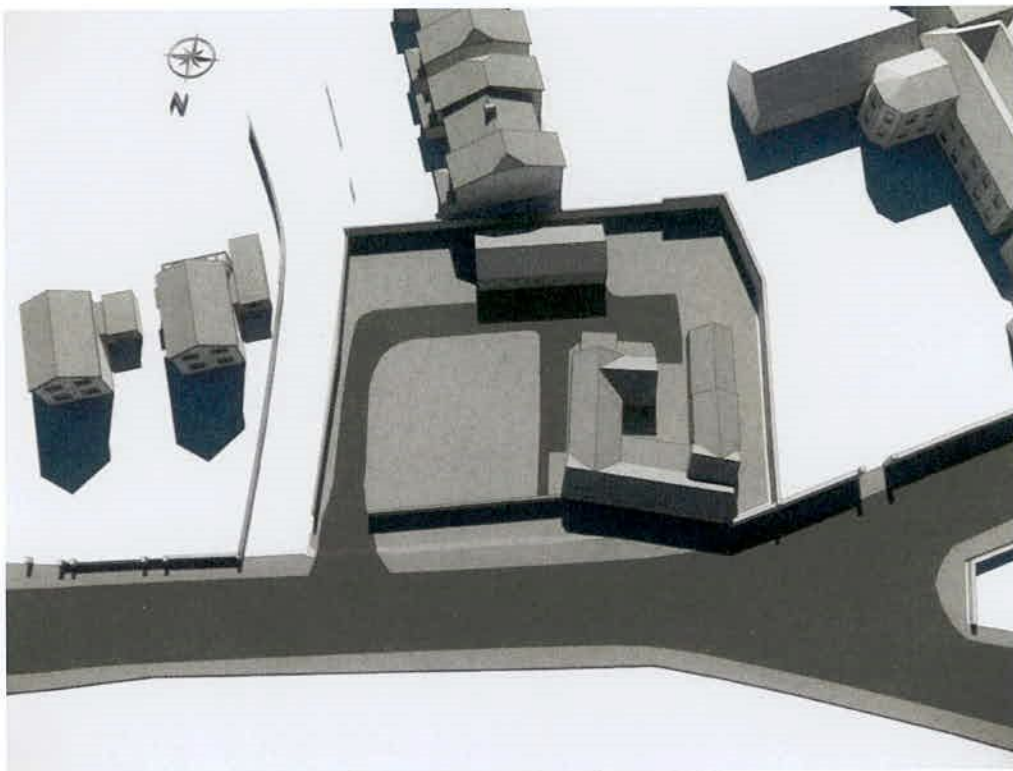
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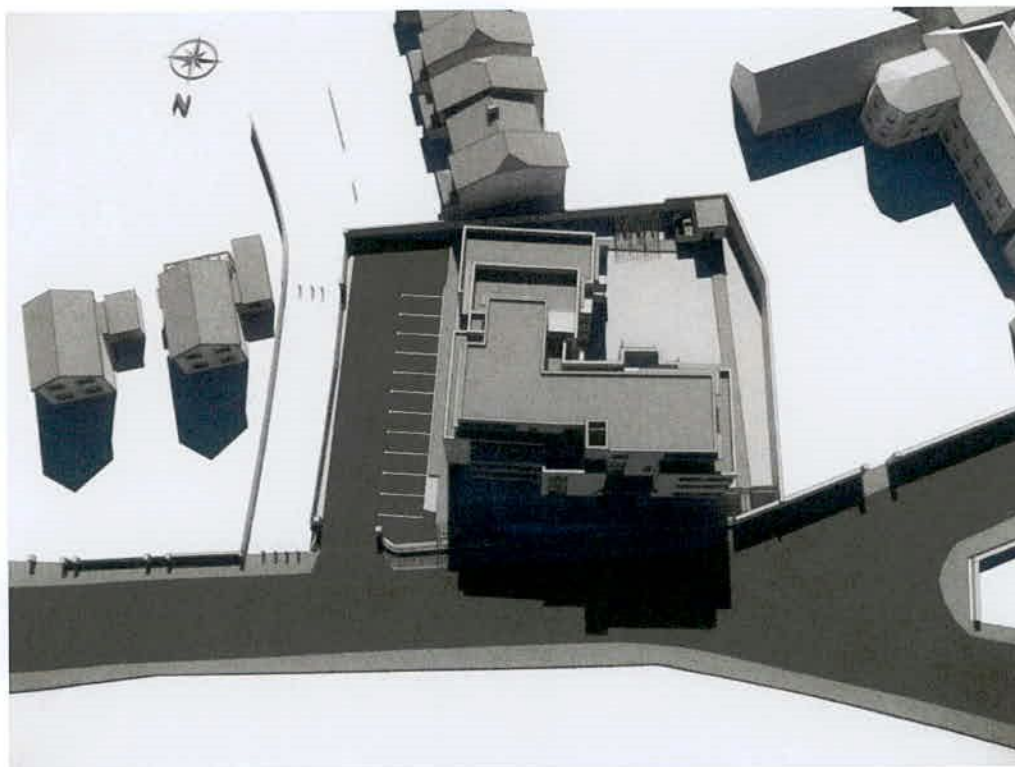
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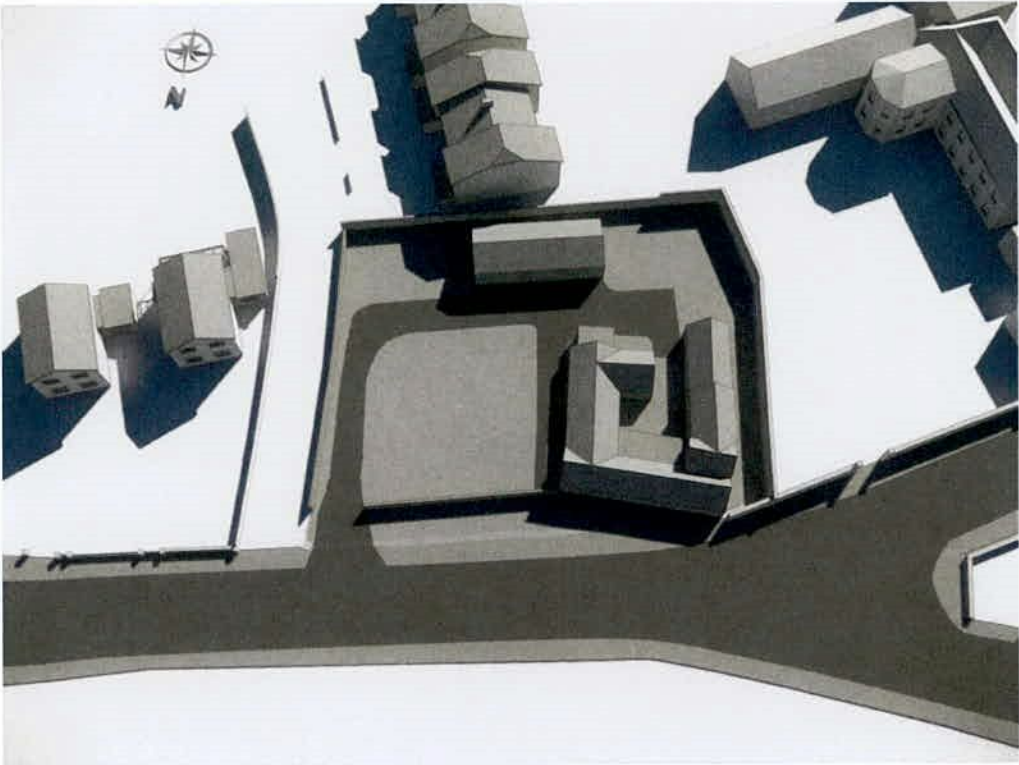
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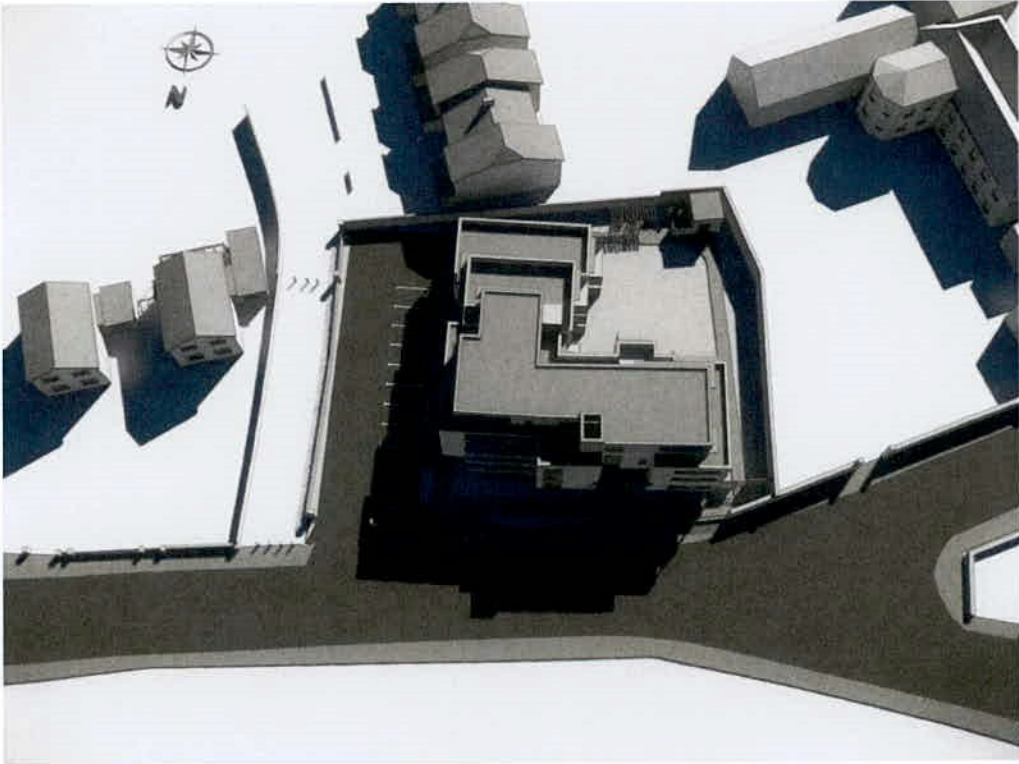
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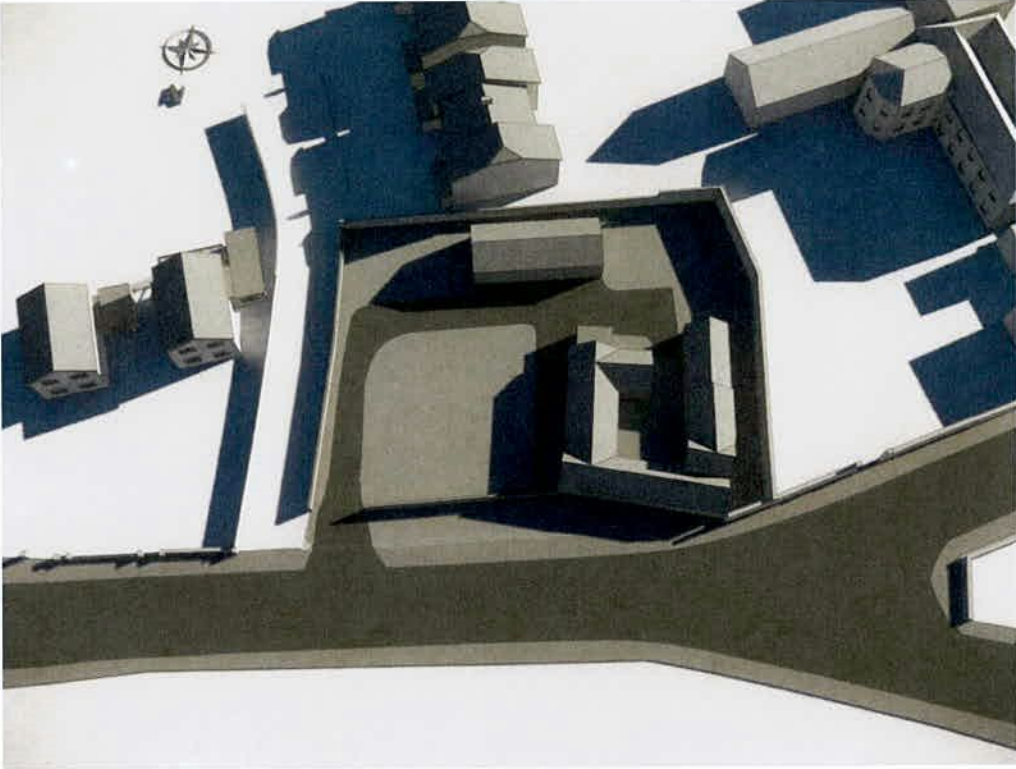
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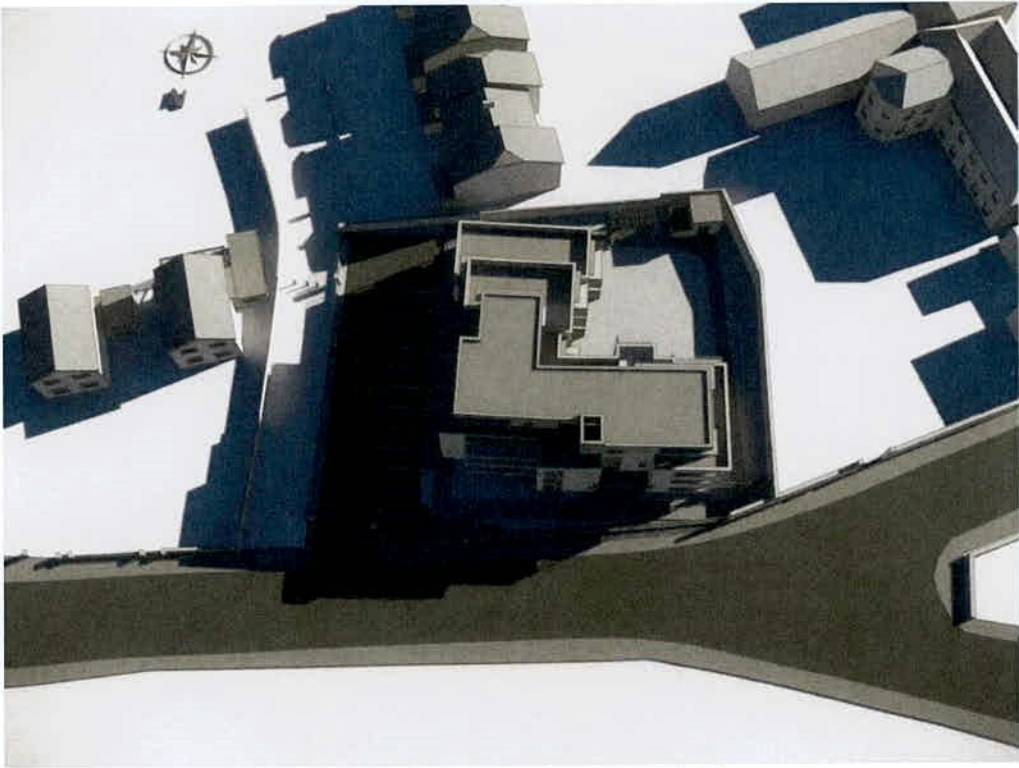
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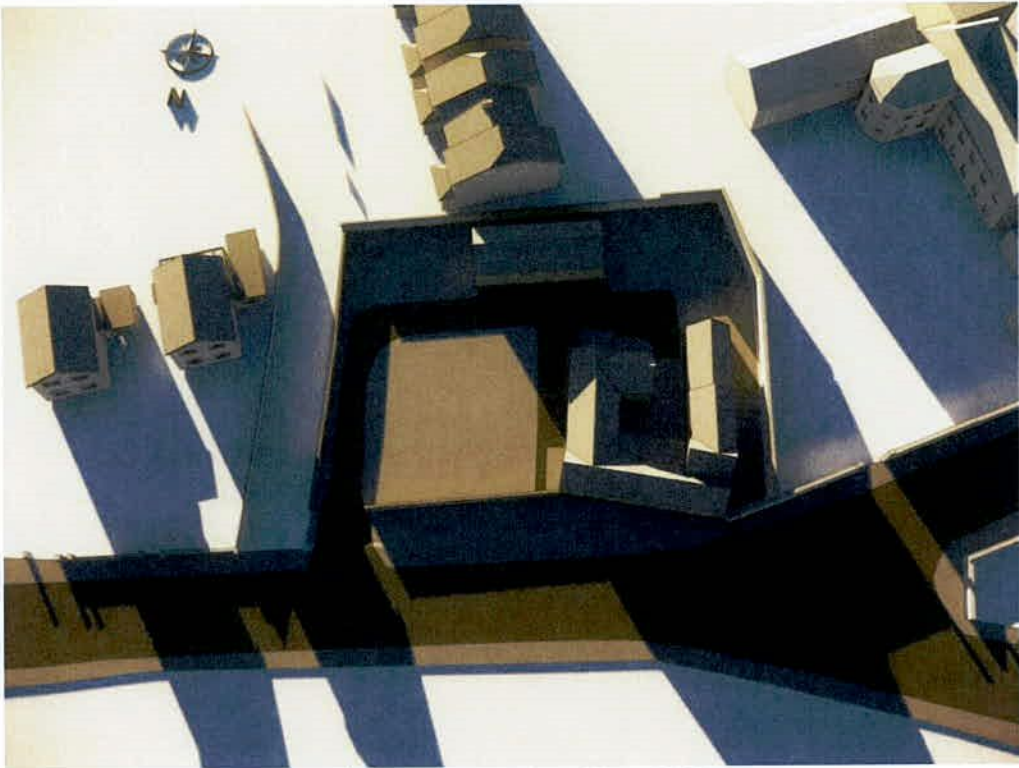
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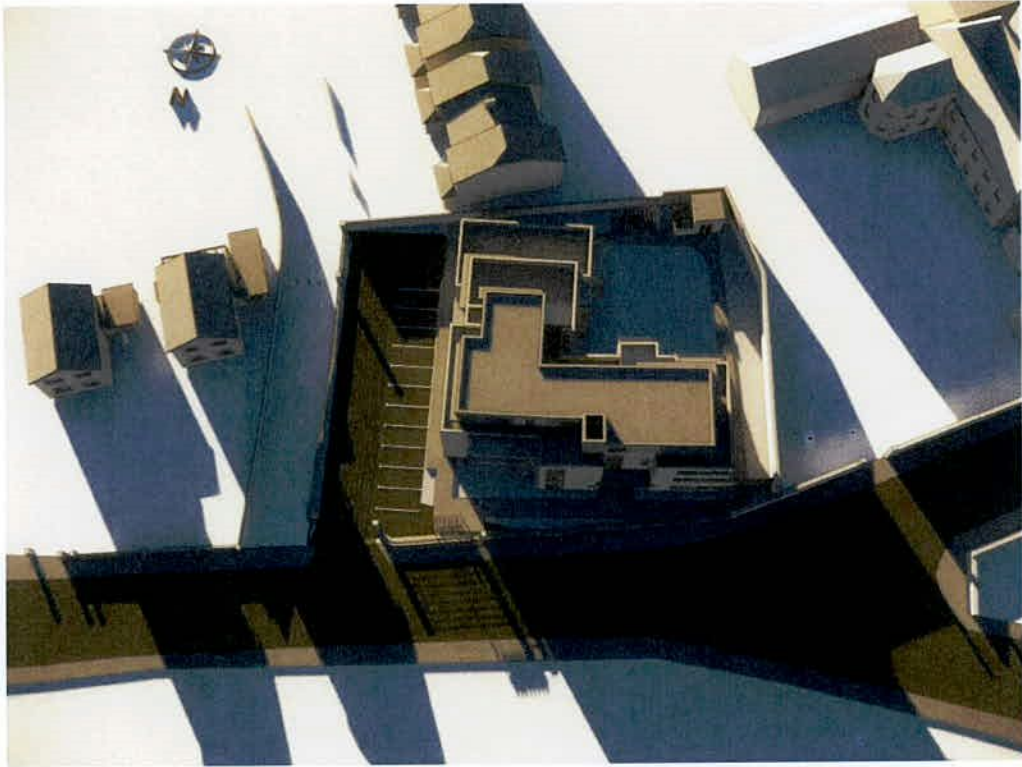
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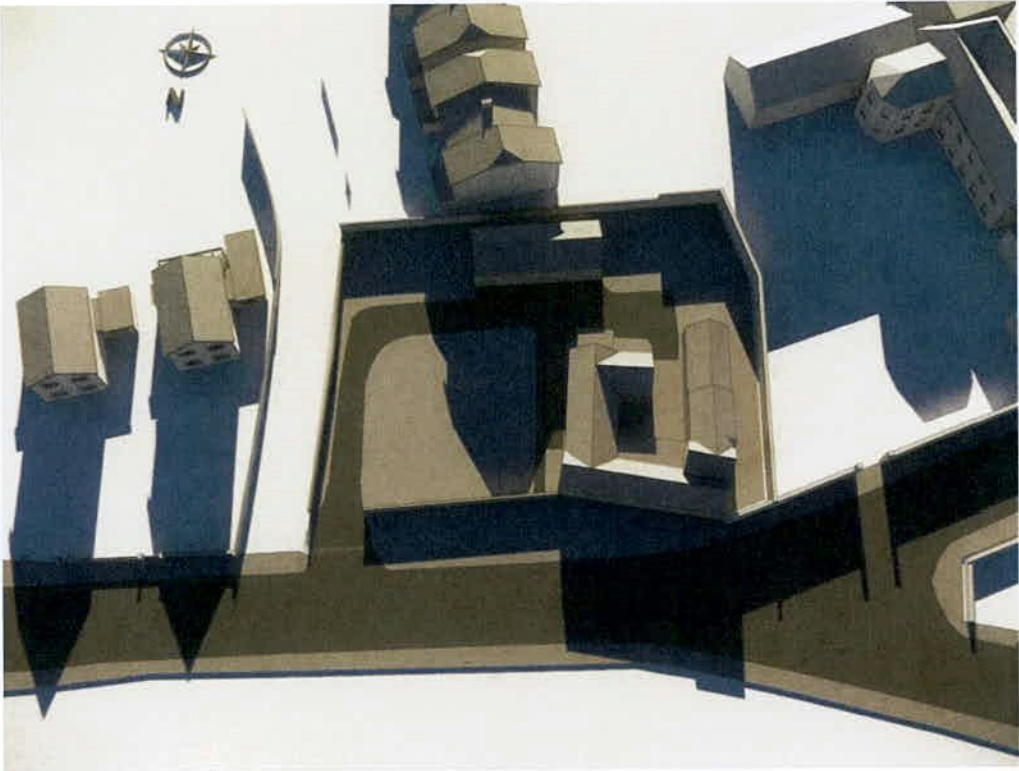
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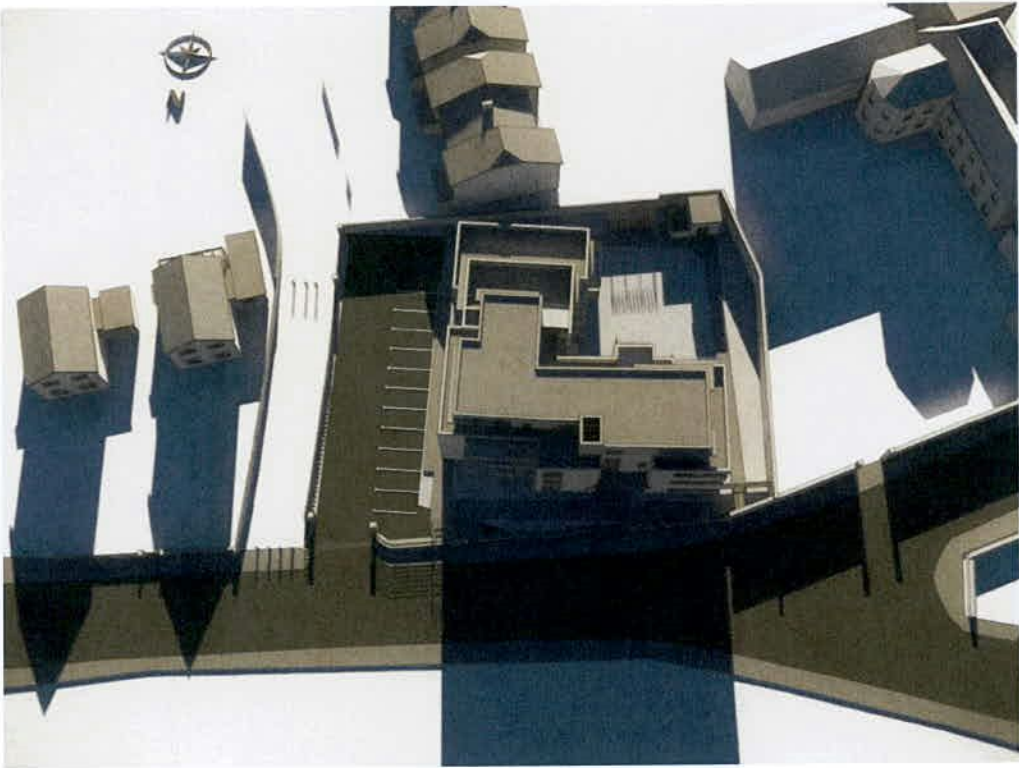
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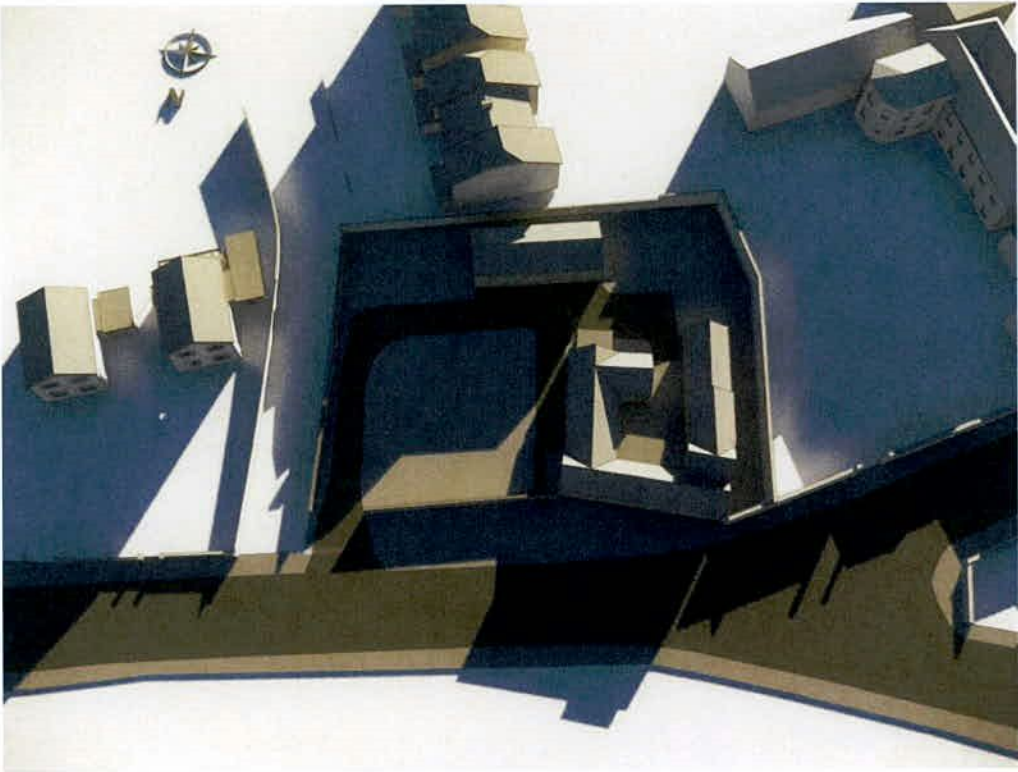
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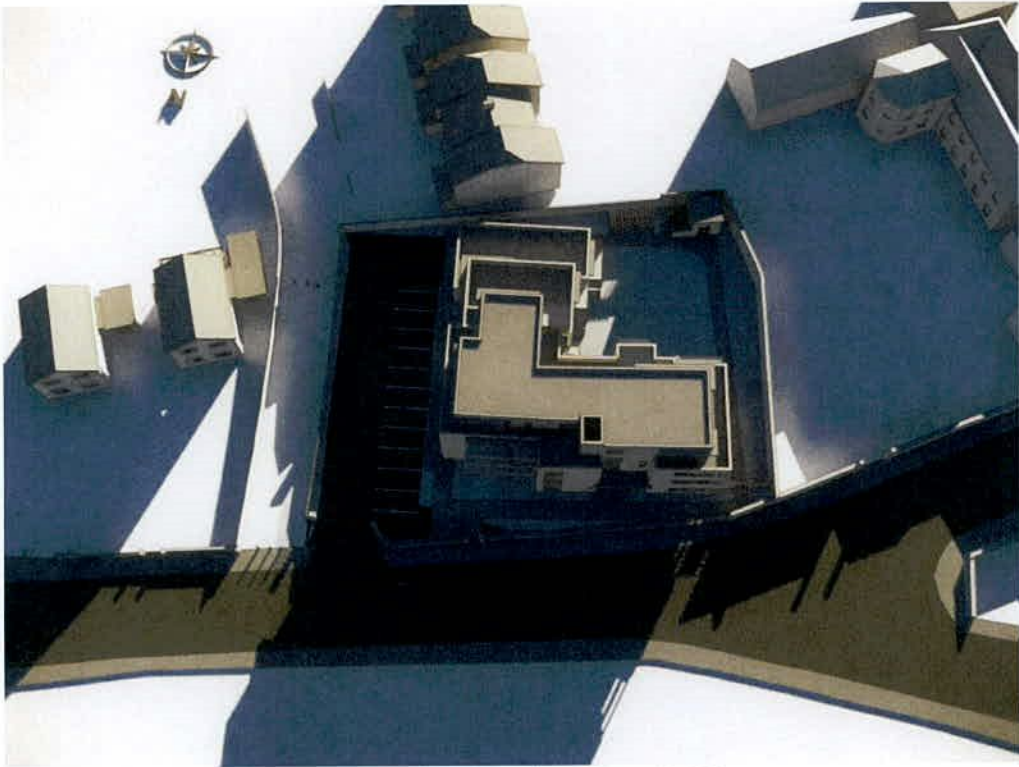
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Proposed: December 21st, 12:00



Existing: December 21st, 14:00



Proposed: December 21st, 14:00

3. Gardens and Open Spaces Overshadowing

As per section 3.3 of 'Site layout Planning for daylight and Sunlight' by Paul Littlefair it is recommended that at least half of the neighbouring garden areas should receive at least two hours of sunlight on March 21st.

To investigate this, the area of sunlit garden is calculated as a percentage of the total area.

Paragraph 3.3.11 states that if the area is poorly lit and does not achieve the minimum two hours but the value is no less than 0.8 times the current state then further loss of light would not be significant.

An analysis was carried out by calculating the area of sunlight that received a minimum of two hours of sunlight on March 21st. Below are results in numerical and graphical form followed by images at one hour intervals for context.

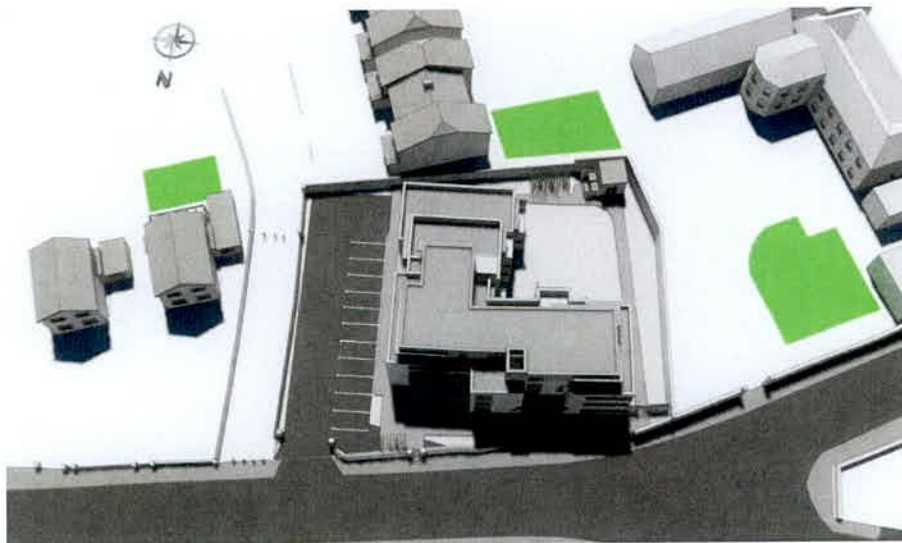


Figure 1: Red < 1 hour, 1 hour < Orange < 2 hours, 2 hours < Green

Amenity Overshadowing (Adjacent to Site)						
Address	Garden Space Analysed (m ²)	Area receiving 2 hours of sunlight on March 21 st (%)	Minimum area receiving 2 hours of sunlight on March 21 st (%)	Existing Area receiving 2 hours of sunlight (%)	>0.8 Existing	Compliance Demonstrated
Pieta House	70.9	100	50	70.9	Yes	Yes
Pres Mission House	211.7	100	50	211.7	Yes	Yes
4 The Cloisters	148.6	100	50	148.6	Yes	Yes

Table 1: Amenity Overshadowing Analysis

4. Vertical Sky Component (VSC)

The BRE document definition of the Vertical Sky Component (VSC) is: Ratio of the part of illuminance, at a point on a given vertical plane, which is received directly from a CIE standard overcast sky, to illuminance on a horizontal plane due to an unobstructed hemisphere of this sky. Usually the 'given vertical plane' is the outside of a window wall. The VSC does not include reflected light, either from the ground or from other buildings.

The VSC is usually expressed as a percentage and the maximum value for a completely unobstructed window is slightly less than 40%. The recommendations set down in the BRE report, 'Site layout for daylight and sunlight, a guide to good practice,' would indicate, for residential properties, that a VSC value of greater than 27% is acceptable. However, a 20% VSC is good for an urban area.

If a window does not achieve 27% a further investigation should be carried out to calculate the existing VSC. If the value of the predicted VSC is not more than 20% lower than the VSC in the existing scenario the windows pass for VSC according to BRE BR209.

It should be noted that the Guide itself, within the introduction, states that the advice given was not mandatory and the Guide should not be an instrument of planning policy, its aim being to help rather than constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly.

A VSC Analysis was conducted on the windows of the adjacent properties facing the proposed development.



Figure 2: VSC Analysis Results – Pieta House

Window	Proposed	<27% Yes/No	Existing	Difference	>0.8 Existing	Compliance Demonstrated
1	39.38	Yes	40.11	0.98	Yes	Yes
2	39.21	Yes	39.87	0.98	Yes	Yes
3	39.15	Yes	39.89	0.98	Yes	Yes
4	38.76	Yes	40.03	0.97	Yes	Yes
5	27.47	No	29.79	0.92	Yes	Yes

Table 2: VSC Results – Pieta House

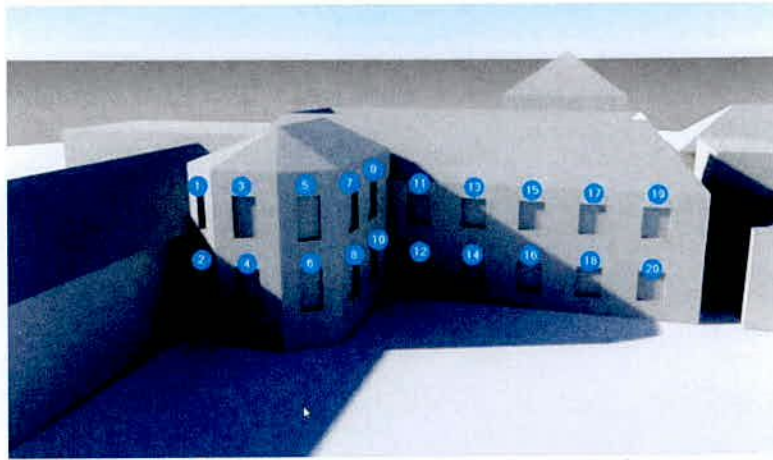


Figure 3: VSC Analysis Results – Presentation Mission House

Window	Proposed	<27% Yes/No	Existing	Difference	>0.8 Existing	Compliance Demonstrated
1	39.07	Yes	39.75	0.98	Yes	Yes
2	38.26	Yes	39.16	0.98	Yes	Yes
3	38.34	Yes	39.67	0.97	Yes	Yes
4	37.18	Yes	39.14	0.95	Yes	Yes
5	38.47	Yes	39.73	0.97	Yes	Yes
6	37.44	Yes	39.41	0.95	Yes	Yes
7	36.79	Yes	37.1	0.99	Yes	Yes
8	32.07	Yes	32.75	0.98	Yes	Yes
9	33.37	Yes	33.94	0.98	Yes	Yes
10	27.21	Yes	28.01	0.97	Yes	Yes
11	29.45	Yes	30.81	0.96	Yes	Yes
12	25.5	No	27.22	0.94	Yes	Yes
13	35.81	Yes	36.67	0.98	Yes	Yes
14	31.78	Yes	33.35	0.95	Yes	Yes
15	37.34	Yes	38.52	0.97	Yes	Yes
16	35.08	Yes	36.85	0.95	Yes	Yes
17	38.06	Yes	39.13	0.97	Yes	Yes
18	36.15	Yes	38.09	0.95	Yes	Yes
19	38.28	Yes	39.49	0.97	Yes	Yes
20	36.74	Yes	38.77	0.95	Yes	Yes

Table 3: VSC Results – Presentation Mission House

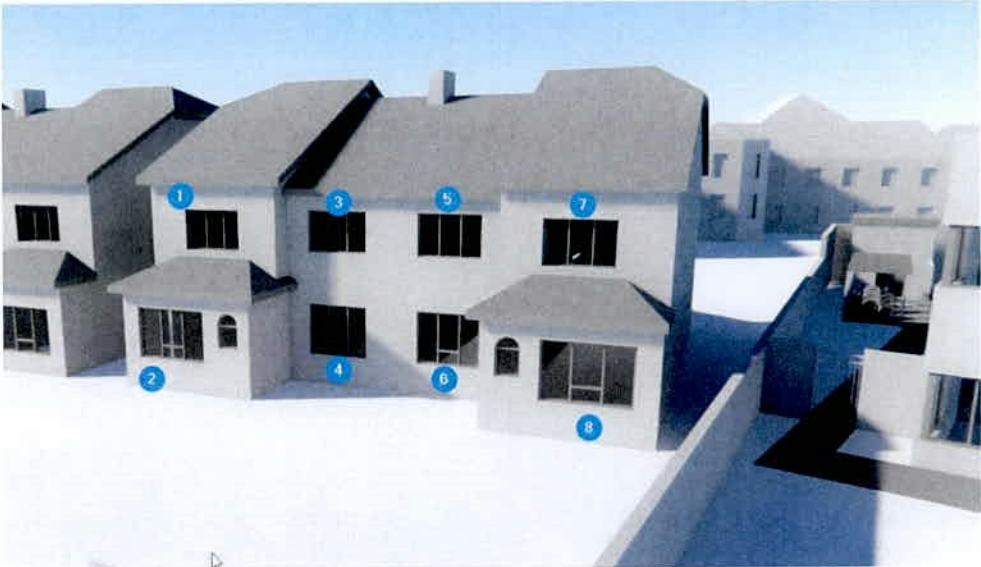


Figure 4: VSC Analysis Results – 3-4 The Cloisters

Window	Proposed	<27% Yes/No	Existing	Difference	>0.8 Existing	Compliance Demonstrated
1	39.22	Yes	39.44	0.99	Yes	Yes
2	38.98	Yes	39.11	1.00	Yes	Yes
3	39.21	Yes	39.4	1.00	Yes	Yes
4	39.01	Yes	39.12	1.00	Yes	Yes
5	39.21	Yes	39.39	1.00	Yes	Yes
6	39.11	Yes	39.31	0.99	Yes	Yes
7	39.22	Yes	39.34	1.00	Yes	Yes
8	38.91	Yes	38.97	1.00	Yes	Yes

Table 3: VSC Results – 3-4 The Cloisters

5. Average Daylight Factor (ADF)

This portion of the report considers the daylight analysis of the proposed development at Hill House, Lucan, Co. Dublin. The objective of this analysis is to demonstrate that the proposed residential units provided as part of the proposed development provide an acceptable standard of amenity in respect of daylight.

The BRE document defines ADF as: The ratio of total daylight flux incident on the working plane to the area of the working plane, expressed as a percentage of the outdoor illuminance on a horizontal plane due to an unobstructed CIE standard overcast sky.

In housing *BS 8206-2:2008: Lighting for buildings - Part 2: Code of practice for daylighting*¹ gives minimum values of ADF of 2% for kitchens, 1.5% for living rooms and 1% for bedrooms. The results of the ADF for the tested rooms are shown in the tables below.

The calculations were carried out using the 'IES Virtual Environment' software and based on the layout drawings prepared by PMCA Architects.

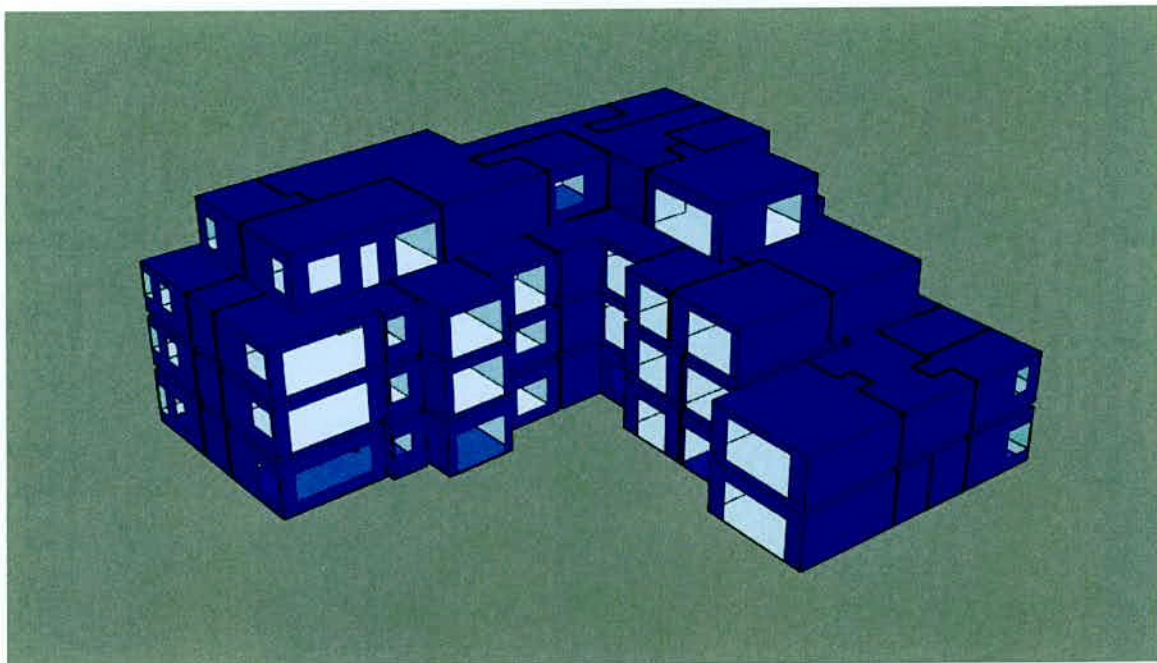


Figure 5: IES VE Analysis Model

¹ It is noted that BS 8206-2:2008: Lighting for buildings - Part 2: Code of practice for daylighting was recently replaced with BS EN 17037:2018 Daylight in Buildings. However, given that the Sustainable Urban Housing: Design Standards for New Apartments Guidelines for Planning Authorities refer to the BS 8206-2:2008 and not to BS EN 17037:2018, BS 8206:2008 has been referenced in the preparation of this report

Average Daylight Factor (ADF)					
Floor	Unit	Room	Minimum ADF recommended in BS 8206 ¹ (%)	Predicted ADF	Compliance Demonstrated
Ground Floor	01	Bedroom 1	1.0	7.9	Yes
	01	Bedroom 2	1.0	4.0	Yes
	01	KLD	2.0	5.4	Yes
	02	Bedroom 1	1.0	3.7	Yes
	02	KLD	2.0	3.4	Yes
	03	Bedroom 1	1.0	4.0	Yes
	03	Bedroom 2	1.0	3.0	Yes
	03	KLD	2.0	1.6	Yes
	12	Bedroom 1	1.0	3.8	Yes
	12	Bedroom 2	1.0	3.6	Yes
	12	KLD	2.0	5.5	Yes
	13	Bedroom 1	1.0	4.8	Yes
	13	KLD	2.0	4.2	Yes
	14	Bedroom 1	1.0	4.3	Yes
	14	Bedroom 2	1.0	8.4	Yes
14	KLD	2.0	4.0	Yes	

Table 3: Ground Floor - ADF Results

Average Daylight Factor (ADF)					
Floor	Unit	Room	Minimum ADF recommended in BS 8206 ¹ (%)	Predicted ADF	Compliance Demonstrated
First Floor	04	Bedroom 1	1.0	8.0	Yes
	04	Bedroom 2	1.0	3.9	Yes
	04	KLD	2.0	5.6	Yes
	05	Bedroom 1	1.0	4.1	Yes
	05	KLD	2.0	3.6	Yes
	06	Bedroom 1	1.0	3.9	Yes
	06	Bedroom 2	1.0	3.0	Yes
	06	KLD	2.0	2.1	Yes
	15	Bedroom 1	1.0	3.6	Yes
	15	Bedroom 2	1.0	3.5	Yes
	15	KLD	2.0	5.3	Yes
	16	Bedroom 1	1.0	5.3	Yes
	16	KLD	2.0	3.2	Yes
	17	Bedroom 1	1.0	4.2	Yes
	17	Bedroom 2	1.0	7.3	Yes
	17	KLD	2.0	4.1	Yes

Table 4: First Floor - ADF Results

Average Daylight Factor (ADF)					
Floor	Unit	Room	Minimum ADF recommended in BS 8206 ¹ (%)	Predicted ADF	Compliance Demonstrated
Second Floor	07	Bedroom 1	1.0	7.9	Yes
	07	Bedroom 2	1.0	3.9	Yes
	07	KLD	2.0	5.7	Yes
	08	Bedroom 1	1.0	5.3	Yes
	08	KLD	2.0	3.9	Yes
	09	Bedroom 1	1.0	3.8	Yes
	09	Bedroom 2	1.0	3.3	Yes
	09	KLD	2.0	2.7	Yes
	18	Bedroom 1	1.0	3.6	Yes
	18	Bedroom 2	1.0	3.6	Yes
	18	KLD	2.0	6.2	Yes
	19	Bedroom 1	1.0	4.1	Yes
	19	KLD	2.0	3.8	Yes

Table 5: Second Floor - ADF Results

Average Daylight Factor (ADF)					
Floor	Unit	Room	Minimum ADF recommended in BS 8206 ¹ (%)	Predicted ADF	Compliance Demonstrated
Third Floor	10	Bedroom 1	1.0	8.0	Yes
	10	Bedroom 2	1.0	4.3	Yes
	10	KLD	2.0	5.4	Yes
	11	Bedroom 1	1.0	4.5	Yes
	11	Bedroom 2	1.0	3.7	Yes
	11	KLD	2.0	6.9	Yes

Table 6: Third Floor - ADF Results

6. Conclusion

Vertical Sky Component (VSC)

The BRE guidelines state that if the VSC at the centre of a window is more than 27% (or if not, then it is more than 80% of its former value), then the diffuse daylighting of the existing building will not be adversely affected.

All calculated windows analysed except one achieve the value of 27%. The window that falls short of this level has a value that is 0.94 of the existing level thus all windows analysed pass this BRE guideline.

Average Daylight Factor (ADF)

Average daylight factor (ADF) is a measure of the adequacy of diffuse daylight within a room, and accounts for factors such as the size of a window in relation to the size of the room; the reflectance of the walls; and, the nature of the glazing and number of windows. Clearly a small room with a large window will be better illuminated by daylight than a large room with a small window, and the ADF measure accounts for this.

BRE guidelines confirm that the acceptable minimum ADF target value depends on the room use. That is 1% for a bedroom, 1.5% for a living room and 2% for a family kitchen. In cases where one room serves more than one purpose, the minimum ADF should be that for the room type with the higher value. Notwithstanding this, the independent daylight and sunlight review states that, in practice, the principal use of rooms designed as a 'living room/kitchen/dining room' is as a living room. Accordingly, it would be reasonable to apply a target of 1.5% to such rooms.

All 51 no. habitable spaces in the proposed development exceed the BRE guidelines for Average Daylight Factor.

Sunlight Assessment on Amenity Space – 50% Rule

BRE Guide [3.3] It is recommended that for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21st March.

Of the three spaces analysed, all achieve 100% area receiving at least two hours of sunlight on March 21st.





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