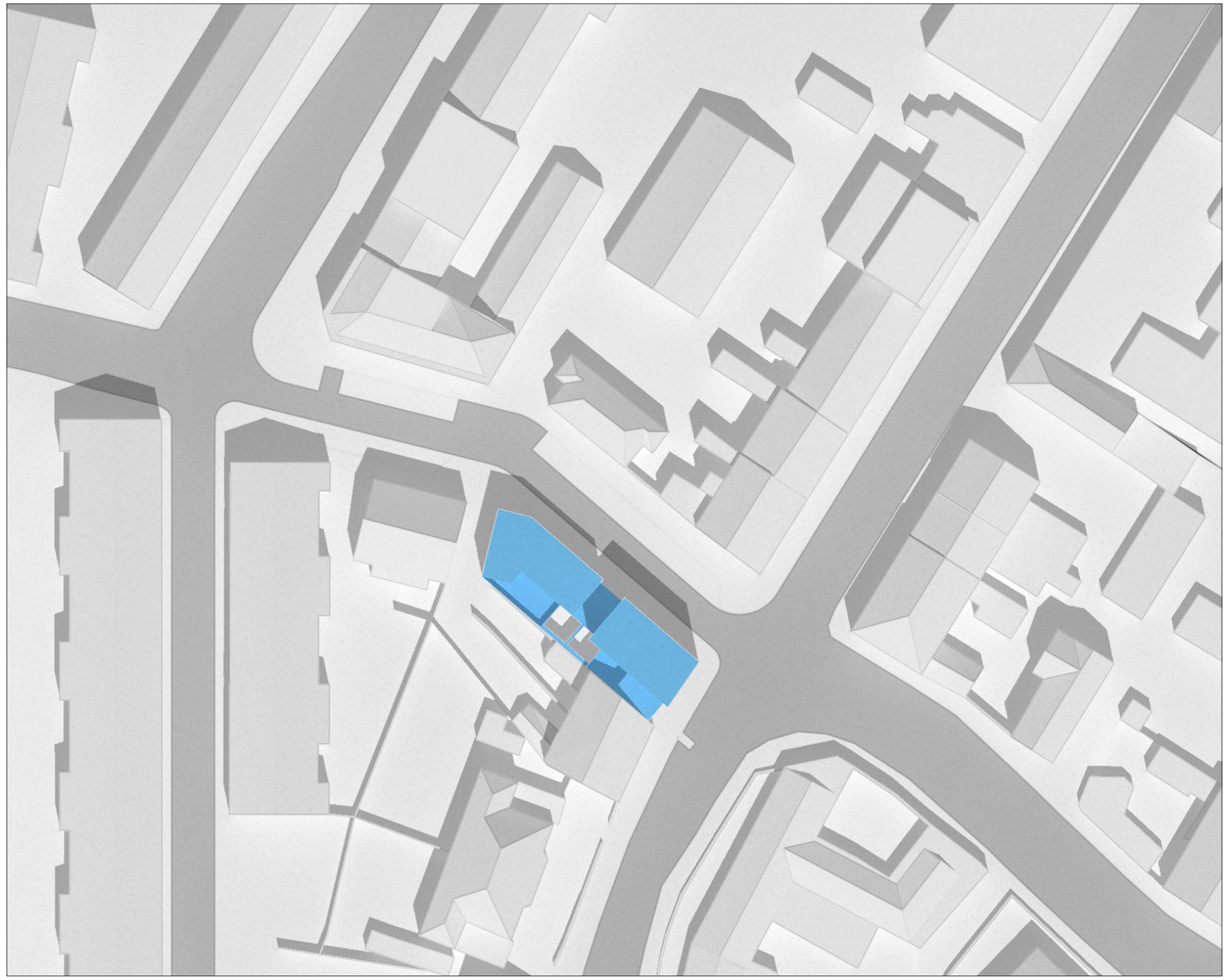

Sunlight and Daylight Access Analysis

of

the Proposed Residential Development

at

27 Patrick Street, Dun Laoghaire, Co. Dublin

July 2022

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1.0 Introduction

ARC Architectural Consultants Ltd has been retained by Dun Laogahire-Rathdown County Council to prepare this Sunlight and Daylight Access Analysis of the proposed development at 27 Patrick Street, Dun Laoghaire, Co. Dublin.

Note on Reference to Context under Technical and Guidance Documents and on Reference to Methodology

In order to avoid repetition, the sections outlining the relevant recommendations of technical and guidance documents and the methodologies used in undertaking this assessment have been set out in the Technical Appendix at the end of the written section of this report.

1.1 Receiving Environment

The application site comprises a vacant site on the southern side of Cross Avenue, Dun Laoghaire, which is now in use as car parking. The site is located a short distance from Dun Laoghaire Town Centre.

The site is located at the junction of Cross Avenue with Patrick Street. It is bounded to the south by the two storey semi-detached building at No. 28 Patrick Street and associated garden (in non-residential use); and, to the west, by the two storey dwellings at Nos. 1-3 Cross Avenue. The amenity area associated with the residences within the two storey terrace at Nos. 23-39 Wolfe Tone Avenue. Cross Avenue runs along the northern boundary of the site. Two storey semi-detached dwellings at Nos. 1a and 1b Cross Avenue and the side gable of No. 26 Patrick Street oppose the application site to the north. To the east, on the eastern side of Patrick Street, the terraced dwellings closest to the junction at Cross Avenue (i.e. Nos. 80, 81 and 82) are single storey in height.

1.2 Relevant Characteristics of the Proposed Development

The proposed development will comprise the construction of 4 no. apartments within a two to three storey block at the junction of Cross Avenue and Patrick Street, together with all ancillary development.

2.0 Assessment of the Impact of the Proposed Development on Sunlight Access

Sunlight is not defined in *Site layout planning for daylight and sunlight: a guide to good practice for the Building Research Establishment* (2011, 2nd ed., PJ Littlefair). The Commission Internationale de L'Éclairage / International Commission on Illumination defines sunlight as meaning the *"part of direct solar radiation capable of causing a visual sensation"* (Source: 17-29-103, CIE S 017:2020 ILV: *International Lighting Vocabulary*, 2nd edition). For the purpose of this analysis, Section 2.0 assesses the impact of the construction of the proposed development on the rays of the sun reaching defined opes in existing buildings (e.g. windows or other openings in existing buildings, such as patio doors) and reaching neighbouring gardens or amenity spaces. Shadow study diagrams illustrated the shadow environment surrounding the application site at several times of the day at the summer and winter solstices, and at the equinox are appended to this report.

In assessing the impact of a development on sunlight access, the comments of PJ Littlefair in *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide) should be taken into consideration. The BRE Guide states that *"it must be borne in mind that nearly all structures will create areas of new shadow, and some degree of transient overshadowing of a space is to be expected."*

The statistics of Met Eireann, the Irish Meteorological Service, indicate that the sunniest months in Ireland are May and June. During December, Dublin receives a mean daily duration of 1.7 hours of sunlight out of a potential 7.4 hours sunlight each day (i.e., only 22% of potential sunlight hours). This can be compared with a mean daily duration of 6.4 hours of sunlight out of a potential 16.7 hours each day received by Dublin during June (i.e., 38% of potential sunlight hours). Therefore, impacts caused by overshadowing are generally most noticeable during the summer months and least noticeable during the winter months. Due to the low angle of the sun in mid winter, the shadow environment in all urban and suburban areas is generally dense throughout winter.

2.1 Overview of the potential impact of shadows cast by the proposed development outside the application site

Having regard to the shape, layout and orientation of the application site relative to nearby development, to the separation distance between the proposed development and buildings to the north, and to the density of the shadow environment in Dun Laoghaire, the potential for development of modest height on the application site to result in impacts on lands outside the application site is low.

Specifically, the closest buildings to the application site are residences at Nos. 1-3 Cross Avenue, but this building does not have windows facing towards the proposed development and so is unlikely to be experience any material impact on sunlight access as a result of the construction of the proposed development.

The amenity area associated with Nos. 23-39 Wolfe Tone Avenue is also located at close proximity to the application site, but is situated to the south of the proposed new structure. Therefore, while there is a potential for shadows cast by the proposed development to extend into this amenity area during the very early mornings of the summer months, the impact of the proposed development on sunlight access to this space is likely to be so minor as to be "imperceptible". Shadows cast by the proposed development are unlikely to interfere with the potential for this space to appear adequately sunlit over the course of the year within the meaning of the BRE Guide, with the amenity area likely to receive considerably more than the recommended level of sunlight access after the construction of the proposed development. The proposed development is further unlikely to result in any material impacts on sunlight access to dwellings at Nos. 23-29 Wolfe Tone Avenue or to the buildings and associated gardens at Nos. 28, 29 and 30 Patrick Street.

To the north, shadows cast by the proposed development are likely to extend to the footpaths and road at Cross Avenue resulting in an "imperceptible" to "not significant" change in the shadow environment. Shadows cast by the proposal are also likely to extend to buildings on the northern side of Cross Avenue and on Patrick Street north of the junction with Cross Avenue during the afternoons and evenings of the autumn, winter and spring months. However, the potential impact of shadows cast by the proposed development on sunlight access to these existing buildings is not likely to be noticeable. If noticeable, shadows cast by the proposed development are not likely to result in "significant consequences" for the character of the sunlight environment. This impact is assessed as "imperceptible" to "not significant".

Similarly, to the west, while shadows cast by the proposed development are likely to extend to the eastern side of Patrick Street to the south of the junction with Cross Avenue during the evenings of the summer months, this is likely to result in little or no change in sunlight access to existing buildings (e.g. such as No. 82 Patrick Street).

2.2 Detailed analysis of the potential impact of shadows cast by the proposed development on existing buildings outside the application site

This Sunlight and Daylight Access Analysis assesses the impact of the proposed development to all potential receptors surrounding the application site - these impacts are described in the section entitled "*Overview of the potential impact of shadows cast by the proposed development outside the application site*". However, by way of example in order to illustrate briefly the findings outlined in the overview section, ARC conducted detailed analysis of the potential for the proposed development to result in impacts on sunlight access to a representative sample of sensitive receptors (i.e. windows) in buildings in proximity to the application site (please see Figures 2.1-2.3).

2.2.1 Overview of and rationale for methodology for detailed quantitative analysis of the potential impact of shadows cast by the proposed development on existing buildings on lands outside the application site

The only Irish statutory guidance to provide advice on undertaking sunlight and daylight access impact analysis is set out in the *Advice Notes on Current Practice* prepared by the Environmental Protection Agency (2003), which accompany the *Guidelines on the Information to be Contained in Environmental Impact Statements* prepared by the Environmental Protection Agency (2002)[1]. These Advice notes state: *"Climate in an Environmental Impact Statement generally refers to the local climatological conditions or "microclimate"*

1 It is noted that updated drafts of these documents were not issued when the 2017 *Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* was published by the Environmental Protection Agency.

of an area, such as local wind flow, temperature, rainfall or solar radiation patterns ... it is important to identify receptors which may be ***particularly sensitive*** *to climate change."* [Emphasis added.] Having regard to the Advice Notes, ARC undertook detailed quantitative analysis of those receptors particularly sensitive to changes in the sunlight environment in order to illustrate the empirical basis for the conclusions outlined in Section 2.1 above.

In identifying receptors particularly sensitive to changes in the shadow environment, ARC considered two factors:

(i) ***the use of receptors (i.e. buildings) surrounding the application site***: buildings in residential use (and, particularly, the living rooms of residences) would be considered to be sensitive to changes in the shadow environment. Section 3.2.1 of the BRE Guide states: *"In designing a new development or extension to a building, care should be taken to safeguard the access to sunlight for existing dwellings, and for any nearby non-domestic buildings where there is a particular requirement for sunlight. People are particularly likely to notice a loss of sunlight to their homes..."*. Section 3.2.3 recommends checking the impact of shadows cast by development on all main living rooms of dwellings in particular;

(ii) ***the location of receptors relative to the application site:*** as set out in section 3.2.2 of the BRE Guide *"obstruction to sunlight may become an issue if some part of a new development is situated within 90˚ of due south of a main windows wall of an existing building"* and if *"in the section drawn perpendicular to this existing window wall, the new development subtends an angle greater than 25˚ to the horizontal measured from the centre of the* ***lowest window*** *to a main living room"* (Emphasis added).

Given this, the receptors most sensitive to changes in the sunlight environment as a result of the construction of development on the application site would be low level windows to the west, north and east of the proposal in buildings in residential use, which face within 90˚ of due south and which are in close proximity to the site (i.e. rooms in existing buildings no the northern side of Cross Avenue). Therefore, ARC identified sample windows at Nos. 1a and 1b Cross Avenue for detailed quantitative analysis. While the BRE Guide does not identify a need to analyse windows in existing buildings facing within 90˚ of due north, ARC also assessed the potential for shadows cast by the proposed development to affect sunlight access to sample windows facing north at Wolfe Tone Avenue and Patrick Street. That representative sample of buildings includes worst case scenario receptors, including windows in existing buildings closest to the proposed new structure and windows at lower levels of accommodation. Existing buildings were omitted from the sample where there was sufficient data within the sample to allow a reasonable inference to be made about the likely impact on that existing building (e.g. where the impact along the length of a street was likely to be similar, a sample of windows on that street was chosen; where the impact on an existing building closest to a new structure was included in the sample, windows in more distant buildings could be excluded from the sample). Please see Figures 2.1-2.3 for information on the location of sample windows studied as part of this analysis.

ARC referenced section 3.2.1 of the *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide), which provides as follows in relation to the assessment of the impact of development on sunlight access to existing buildings:

> *"If a living room of an existing dwelling has a main window facing within 90˚ of due south, and any part of a new development subtends an angle of more than 25˚ to the horizontal measured from the centre of the window in a vertical section perpendicular to the window, then the sunlighting of the existing dwelling may be adversely affected. This will be the case if the centre of the window:*
> - *receives less than 25% of annual probable sunlight hours, or less than 5% of annual probable sunlight hours between 21 September and 21 March* ***and***
> - *receives less than 0.8 times its former sunlight hours during either period* ***and***
> - *has a reduction in sunlight received over the whole year greater than 4% of annual probable sunlight hours."* [Emphasis added]

For further detail on the technical elements of the methodology, please refer to the Technical Appendix at the end of the written section of this report.

2.2.2 ***Results of the detailed quantitative analysis of the potential impact of shadows cast by the proposed development on existing buildings on lands outside the application site***

The results of ARC's analysis are set out in Table 2.1 below. This table indicates:

- The Annual Probable Sunlight Hours received by each sample receptor (i.e. window) under the existing scenario and the proposed scenario (i.e. if the development now proposed were constructed).
- Whether the studied sample window faces within 90˚ of due south.
- The extent of change to the studied sample window under the criteria outlined at section 3.2.1 of the BRE Guide. Specifically:
  - Would the window receive less than 25% of annual probable sunlight hours, or less than 5% of Annual Probable Sunlight Hours between 21st September and 21st March, after the construction of the proposed development?
  - Would the amount of Annual Probable Sunlight Hours received by the window fall to less than 0.8 times its former value over the course of the year?
  - Would the amount of Annual Probable Sunlight Hours received by the window fall to less than 0.8 times its former value during the winter period (e.g. between 21st September and 21st March)?
  - Would the reduction in sunlight received over the whole year be greater than 4% of annual probable sunlight hours?
- A description of the potential impact for each sample receptor / window.
- A comment interpreting the results for each sample receptor / window.

Figure 2.1: Indicative diagram showing locations of sample windows (pink dots) and gardens (in green) studied as part of this analysis.

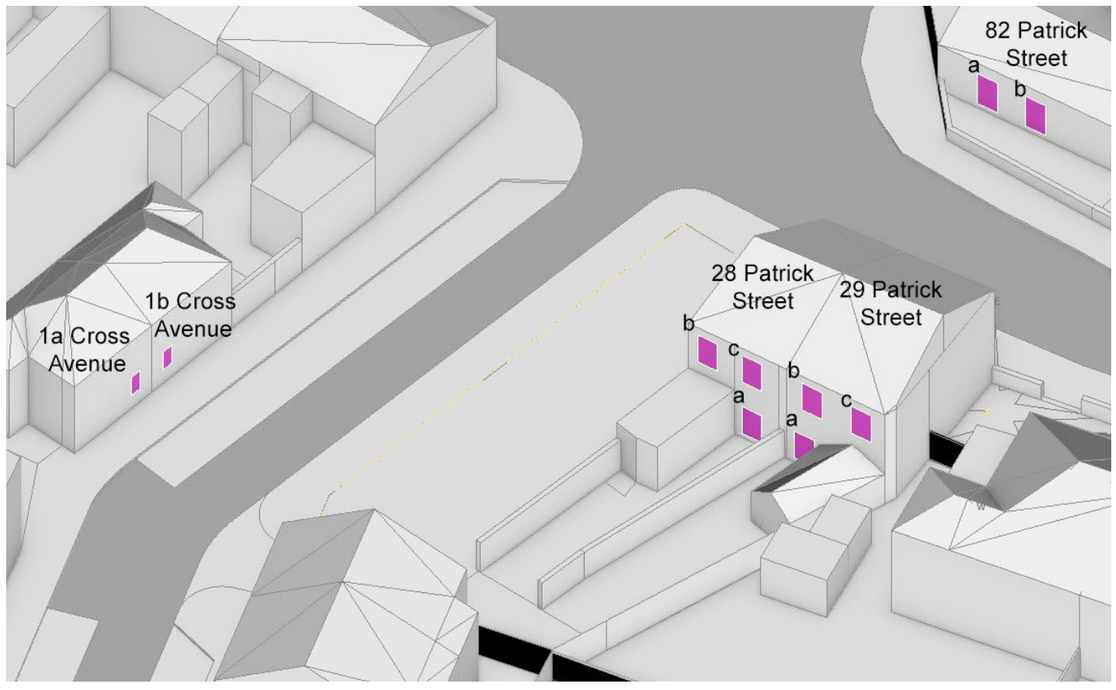

Figure 2.2: Indicative diagram showing location of sample windows (in pink) at Patrick Street and Cross Avenue assessed as part of this analysis.

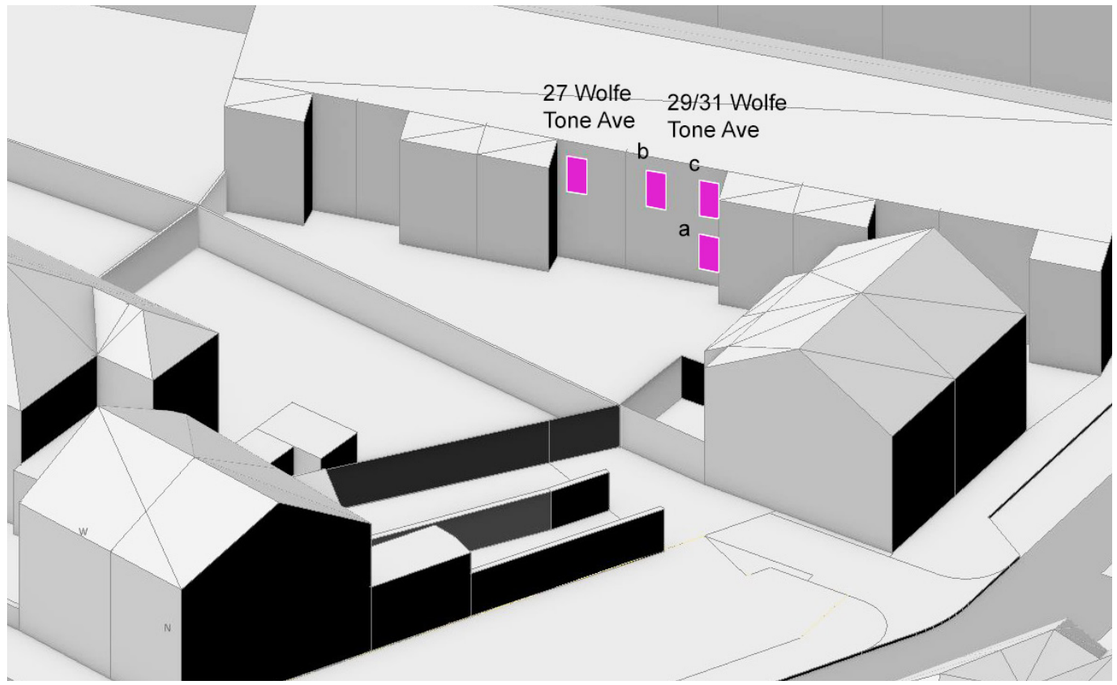

Figure 2.3: Indicative diagram showing location of sample windows (in pink) at Wolfe Tone Avenue assessed as part of this analysis.

*Table 2.1: Potential impact of the proposed development on sunlight access to sample windows** in neighbouring existing buildings*

Location	Window	Floor	Annual Probable Sunlight Hours						Does window face 90° of due south?	BRE Guide - Section 3.2.1 Criteria Please note that this section examines the difference between the Existing and Proposed Scenarios only				Potential Impact	Comment
			Existing			Proposed				Does window achieve 25% APSH, incl. 5% APSH in winter after construction of proposed development?	Annual Change (times former value)	Winter Change (times former value)	Is reduction greater than 4% over the course of the year?		
			Annual	Summer*	Winter*	Annual	Summer*	Winter*							
82 Patrick Street	a	Floor 00	25%	19%	6%	25%	19%	6%	No	Yes	1.00	1.00	No	None	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.
	b	Floor 00	26%	20%	6%	26%	20%	6%	No	Yes	1.00	1.00	No	None	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.
28 Patrick Street	a	Floor 00	23%	21%	2%	23%	21%	2%	No	No	1.00	1.00	No	None	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.
	b	Floor 01	32%	26%	6%	32%	26%	6%	No	Yes	1.00	1.00	No	None	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.
	c	Floor 01	32%	26%	6%	32%	26%	6%	No	Yes	1.00	1.00	No	None	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.
29 Patrick Street	a	Floor 00	4%	4%	0%	4%	4%	0%	No	No	1.00	1.00	No	None	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.
	b	Floor 01	31%	26%	5%	31%	26%	5%	No	Yes	1.00	1.00	No	None	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.
	c	Floor 01	31%	26%	5%	31%	26%	5%	No	Yes	1.00	1.00	No	None	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.
1a Cross Avenue	-	Floor 00	71%	49%	22%	60%	49%	11%	Yes	Yes	0.85	0.50	Yes	Imperceptible to Not Significant	As this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable. If noticeable, shadows cast by the proposed development are not likely to result in "significant consequences" for the character of the sunlight environment. This impact is assessed as "imperceptible" to "not significant".
1b Cross Avenue	-	Floor 00	71%	49%	22%	59%	49%	10%	Yes	Yes	0.83	0.45	Yes	Imperceptible to Not Significant	As this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable. If noticeable, shadows cast by the proposed development are not likely to result in "significant consequences" for the character of the sunlight environment. This impact is assessed as "imperceptible" to "not significant".
27 Wolfe Tone Avenue	-	Floor 01	28%	26%	2%	26%	24%	2%	No	No	0.93	1.00	No	Imperceptible	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest the impact of the proposed development on this window would be "imperceptible" as Annual Probable Sunlight Hours received by this window are not likely fall to less than 0.8 times their former value after the construction of the proposed development.
29/31 Wolfe Tone Avenue	a	Floor 00	43%	34%	9%	39%	30%	9%	No	Yes	0.91	1.00	No	Imperceptible	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, as this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.
	b	Floor 01	47%	36%	11%	44%	33%	11%	No	Yes	0.94	1.00	No	Imperceptible	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, as this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.
	c	Floor 01	47%	35%	12%	46%	34%	12%	No	Yes	0.98	1.00	No	Imperceptible	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, as this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development, the BRE Guide would suggest that the impact of the proposal is not likely to be noticeable.

* For the purposes of this calculation, summer is taken to mean the period between March and September, and winter is considered to be the period between September and March.
** While Section 3.2.1 of the BRE Guide refers to assessing the impact on living room windows, the windows assessed as part of this analysis have been chosen on the basis of potential for impact on sunlight access rather than the use of rooms.

2.3 *Detailed analysis of the potential impact of shadows cast by the proposed development on gardens and amenity areas outside the application site*

This analysis assesses the impact of the proposed development to all potential receptors surrounding the application site - these impacts are described above in the section above. However, by way of example in order to illustrate briefly the findings outlined in the overview section, ARC conducted detailed analysis of the potential for the proposed development to result in impacts on sunlight access to a representative sample of sensitive receptors (i.e. gardens) in proximity to the application site (please see Figure 2.1 above).

Insofar as amenity spaces / gardens are concerned, Section 3.3.17 of the BRE Guide provides that *"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 21 March. If as a result of new development an existing garden or amenity area does not meet the above, **and** the area which can receive two hours of sun on 21 March is less than 0.8 times its former value, then the loss of sunlight is likely to be noticeable."* [Emphasis added.] This suggests that where a garden or amenity area can receive two hours of sun over half its area on 21st March notwithstanding the construction of a proposed development, loss of sunlight as a result of additional overshadowing is not likely to be noticed.

Section 3.3.9 of the BRE Guide provides that the *"question of whether trees or fences should be included in the calculation depends upon the type of shade they produce. Normally trees and shrubs need not be included, and partly because the dappled shade of a tree is more pleasant than the deep shadow of a building (this applies especially to deciduous trees)."* Given this, existing and proposed landscaping was not included in the assessment model.

ARC identified a representative sample of amenity spaces associated with existing neighbouring houses in close proximity to the site (i.e. at Wolfe Tone Avenue and Patrick Street). Gardens were omitted from the sample where there was sufficient data within the sample to allow a reasonable inference to be made about the likely impact on that existing garden (e.g. where the impact on an existing garden closest to a new structure was included in the sample, more distant gardens could be excluded from the sample, etc).

Table 2.2 sets out the likely proportion of neighbouring gardens in sunlight before and after the construction of the proposed development throughout the day on 21st March. As illustrated by Table 2.2, shadows cast by the proposed development are unlikely to result in any impact on sunlight access to neighbouring amenity areas and gardens.

Table 2.2: Potential impact of the proposed development on sunlight access to sample neighbouring gardens

Zone	21st March Time	Percentage area in sunlight	
		Existing	Proposed
Garden 1 Wolfe Tone Avenue Amenity Area	09:00	46%	46%
	10:00	64%	64%
	11:00	78%	78%
	12:00	81%	81%
	13:00	90%	90%
	14:00	54%	54%
	15:00	23%	23%
	16:00	2%	2%
	17:00	0%	0%
No potential impact on sunlight access on 21st March. ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access to this amenity area on 21st March.			
Garden 2 28 Patrick Street Rear Garden	09:00	8%	6%
	10:00	24%	24%
	11:00	42%	42%
	12:00	50%	50%
	13:00	41%	41%
	14:00	29%	29%
	15:00	11%	11%
	16:00	8%	8%
	17:00	0%	0%
No potential impact on sunlight access on 21st March. ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access to this garden on 21st March.			
Garden 3 29 Patrick Street Rear Garden	09:00	0%	0%
	10:00	23%	23%
	11:00	50%	50%
	12:00	55%	55%
	13:00	42%	42%
	14:00	30%	30%
	15:00	13%	13%
	16:00	0%	0%
	17:00	0%	0%
No potential impact on sunlight access on 21st March. ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access to this garden on 21st March.			
Garden 4 30 Patrick Street Rear Garden	09:00	16%	16%
	10:00	23%	23%
	11:00	40%	40%
	12:00	56%	56%
	13:00	71%	71%
	14:00	78%	78%
	15:00	65%	65%
	16:00	52%	52%
	17:00	4%	4%
No potential impact on sunlight access on 21st March. ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access to this garden on 21st March.			

3.0 Assessment of the Impact of the Proposed Development on Daylight Access

The BRE Guide provides that *"The quantity and quality of daylight inside a room will be impaired if obstructing buildings are large in relation to their distance away"*. Generally speaking, new development is most likely to affect daylight access in existing buildings in close proximity to the application site.

3.1 Overview of the potential impact of the proposed development on daylight access to existing buildings outside the application site

ARC's analysis indicates that the construction of the proposed development has the potential to result in minor changes in daylight access to neighbouring existing buildings. The potential impact of the proposed development on daylight access within neighbouring existing buildings surrounding the application site (e.g. at Wolfe Tone Avenue, Cross Avenue and Patrick Street) is likely to range from none to "imperceptible" to "not significant". The proposed development is not predicted to result in any undue adverse impacts on daylight access to neighbouring existing buildings within the meaning of the Building Research Establishment's *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide).

Given that the potential for development to result in impacts on daylight access diminishes with distance, it is the finding of ARC's analysis the proposed development will have no undue adverse impact on daylight access within buildings in the wider area surrounding the application site.

3.2 Detailed analysis of the potential impact of the proposed development on daylight access to existing buildings outside the application site

This Sunlight and Daylight Access Analysis assesses the impact of the proposed development to all potential receptors surrounding the application site - these impacts are described in the section entitled "*Overview of the potential impact of the proposed development on daylight access to existing buildings outside the application site*". However, by way of example in order to illustrate briefly the findings outlined in the overview section, ARC conducted detailed analysis of the potential for the proposed development to result in impacts on daylight access to a representative sample of sensitive receptors (i.e. rooms) in buildings in proximity to the application site (please see Figures 3.1-3.3). The representative sample of buildings includes worst case scenario examples, such as rooms at close proximity to the proposed development and rooms at low levels of accommodation.

3.2.1 Overview of and rationale for methodology for detailed quantitative analysis of the potential impact of the proposed development on daylight access within existing buildings outside the application site

The only Irish statutory guidance to provide advice on undertaking sunlight and daylight access impact analysis is set out in the *Advice Notes on Current Practice* prepared by the Environmental Protection Agency (2003), which accompany the *Guidelines on the Information to be Contained in Environmental Impact Statements* prepared by the Environmental Protection Agency (2002)[2]. These Advice notes state: *"Climate in an Environmental Impact Statement generally refers to the local climatological conditions or "microclimate" of an area, such as local wind flow, temperature, rainfall or solar radiation patterns ... it is important to identify receptors which may be* ***particularly sensitive*** *to climate change."* [Emphasis added.] Having regard to the Advice Notes, ARC undertook detailed quantitative analysis of those receptors particularly sensitive to changes in the daylight environment in order to provide an empirical basis for the conclusions outlined in Section 3.1 above.

In identifying receptors particularly sensitive to changes in the daylight environment, ARC considered two factors:

(i) ***the use of receptors (i.e. buildings) surrounding the application site***: Section 2.2.2 of the BRE Guide provides: *"The guidelines here are intended for use for rooms in adjoining dwellings where daylight is required, including living rooms, kitchens and bedrooms. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be analysed. The guidelines may also be applied to any existing non-domestic building where the occupants have a reasonable expectation of daylight; this would normally include schools, hospitals, hotels and hostels, small workshops and some offices"*;

(ii) ***the location of receptors relative to the application site:*** as set out in section 2.2.21 of the BRE Guide *"If any part of a new building or extension, measured in vertical section perpendicular to a main window wall of an existing building, from the centre of the* ***lowest window****, subtends to an angle of more than 25° to the horizontal, then the diffuse daylighting of the existing building may be adversely affected."* (Emphasis added).

Given this, the receptors most sensitive to changes in the daylight environment as a result of the construction of development on the application site would be windows facing towards the proposal at low levels of accommodation in buildings in residential use in close proximity to the site. Therefore, ARC identified a representative sample of rooms and windows in existing residences at Cross Avenue, Patrick Street and Wolfe Tone Avenue for detailed quantitative analysis. Existing buildings or windows were omitted from the sample where there was sufficient data within the sample to allow a reasonable inference to be made about the likely impact on that existing building (e.g. where the impact on an existing building closest to a new structure was included in the sample, windows in more distant buildings could be excluded from the sample).

In carrying out the detailed analysis of the proposed development on neighbouring existing buildings, ARC measured daylight access to existing buildings before and after the construction of the proposed development with reference to Vertical Sky Component. The Building Research Establishment's *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide) defines Vertical Sky Component as the *"Ratio of that part of illuminance, at a point on a given vertical plane, that 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"*.

Section 2.2.21 of the BRE Guide suggests that:

> *"If any part of a new building or extension, measured in a vertical section perpendicular to a main window wall of an existing building, from the centre of the lowest window, subtends an angle of more than 25° to the horizontal, then the diffuse daylighting of the existing building may be adversely affected. This will be the case if ...*
>
> - *the VSC measured at the centre of an existing main window is less than 27%, and less than 0.8 times its former value..."*

For further detail on the technical elements of the methodology, please refer to the Technical Appendix at the end of the written section of this report.

3.2.2 Results of the detailed quantitative analysis of the potential impact of the proposed development on daylight access within existing buildings outside the application site

The results of ARC's analysis are set out in Table 3.1 below. This table indicates:

- The Vertical Sky Component received by each sample receptor (i.e. window) under the existing scenario and the proposed scenario (i.e. if the development now proposed were constructed).
- The extent of change to the studied sample window under the criteria outlined at section 2.2.2.1 of the BRE Guide. Specifically:
  - Would the window receives less than 27% Vertical Sky Component after the construction of the proposed development?
  - Would the Vertical Sky Component received by the window fall to less than 0.8 times its former value over the course of the year?
- A description of the potential impact for each sample receptor / window.
- A comment interpreting the results for each sample receptor / window.

4.0 Assessment of Daylight Access within the Proposed Development

2 It is noted that updated drafts of these documents were not issued when the 2017 *Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* was published by the Environmental Protection Agency.

Figure 3.1: Indicative diagram showing locations of sample windows (pink dots) and gardens (in green) studied as part of this analysis.

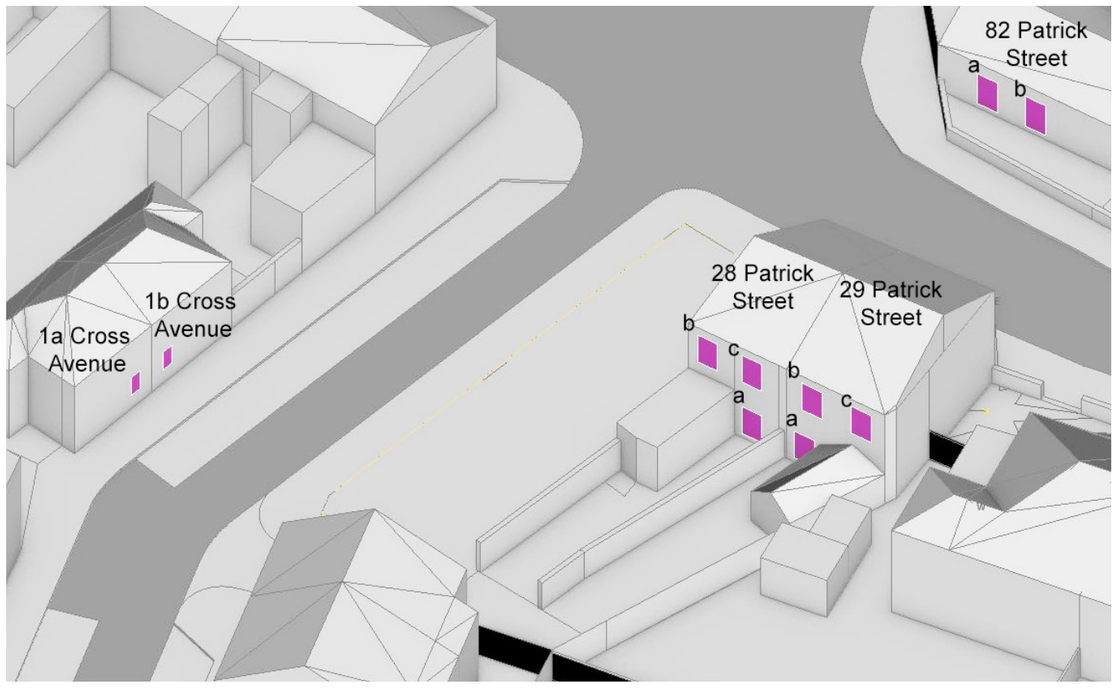

Figure 3.2: Indicative diagram showing location of sample windows (in pink) at Patrick Street and Cross Avenue assessed as part of this analysis.

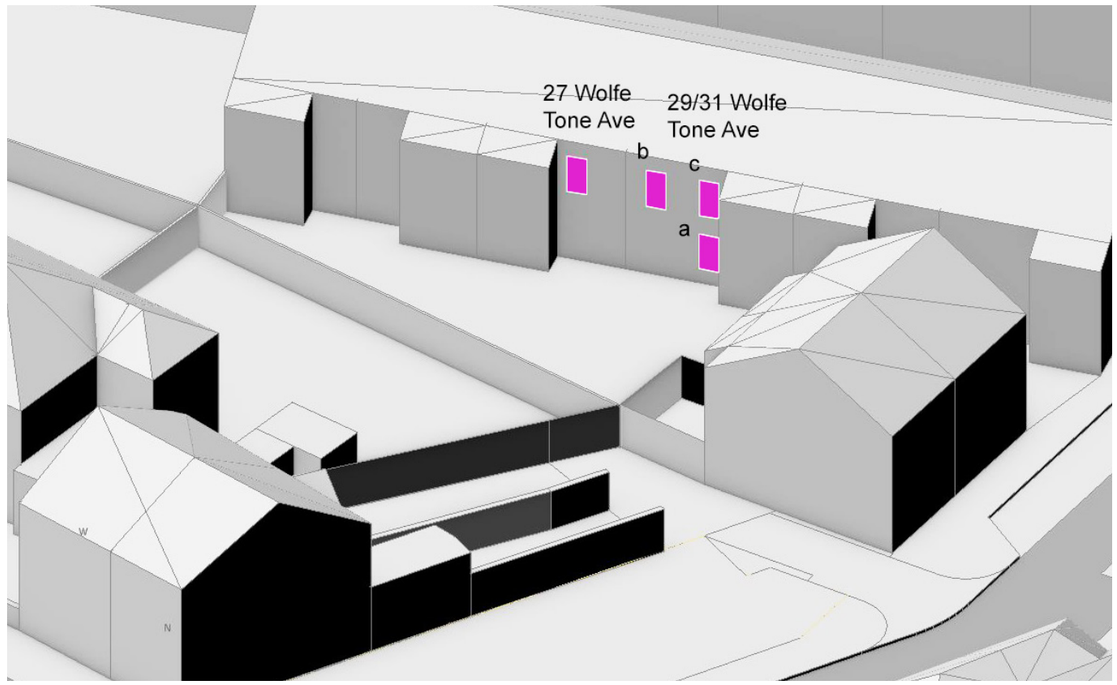

Figure 3.3: Indicative diagram showing location of sample windows (in pink) at Wolfe Tone Avenue assessed as part of this analysis.

Table 3.1: Results of ARC's analysis of the potential impact of the proposed development on daylight access (Vertical Sky Component) to windows within neighbouring existing buildings

Location	Window	Floor	Vertical Sky Component				
			Existing	Proposed	Change Change under proposed scenario expressed as "times existing value"	Potential Impact	Comment
82 Patrick Street	a	Floor 00	32.50%	29.20%	0.90	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component after the construction of the proposed development, the potential impact of the proposed development on this window is assessed as "imperceptible".
	b	Floor 00	32.40%	29.40%	0.91	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component after the construction of the proposed development, the potential impact of the proposed development on this window is assessed as "imperceptible".
28 Patrick Street	a	Floor 00	23.50%	23.50%	1.00	None	ARC's analysis indicates that the proposed development is not likely to result in any change in Vertical Sky Component at this window.
	b	Floor 01	37.00%	34.20%	0.92	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component after the construction of the proposed development, the potential impact of the proposed development on this window is assessed as "imperceptible".
	c	Floor 01	36.90%	35.50%	0.96	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component after the construction of the proposed development, the potential impact of the proposed development on this window is assessed as "imperceptible".
29 Patrick Street	a	Floor 00	23.70%	23.00%	0.97	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is not likely to fall to less than 0.8 times its former value, the potential impact of the proposed development on this window is assessed as "imperceptible".
	b	Floor 01	36.70%	36.00%	0.98	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component after the construction of the proposed development, the potential impact of the proposed development on this window is assessed as "imperceptible".
	c	Floor 01	36.20%	35.80%	0.99	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component after the construction of the proposed development, the potential impact of the proposed development on this window is assessed as "imperceptible".
1a Cross Avenue	-	Floor 00	34.20%	27.80%	0.81	Imperceptible to Not Significant	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. While the BRE Guide would suggest that an impact of this extent is not likely to be noticeable, taking a conservative approach, this impact is assessed as "imperceptible" to "not significant" as the construction of the proposal is likely to reduce Vertical Sky Component at the window from above the recommended 27% Vertical Sky Component to just below it.
1b Cross Avenue	-	Floor 00	34.50%	27.10%	0.79	Imperceptible to Not Significant	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. While the BRE Guide would suggest that an impact of this extent is not likely to be noticeable, taking a conservative approach, this impact is assessed as "imperceptible" to "not significant" as the construction of the proposal is likely to reduce Vertical Sky Component at the window from above the recommended 27% Vertical Sky Component to just below it.
27 Wolfe Tone Avenue	-	Floor 01	32.00%	31.00%	0.97	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component after the construction of the proposed development, the potential impact of the proposed development on this window is assessed as "imperceptible".
29/31 Wolfe Tone Avenue	a	Floor 00	24.70%	23.20%	0.94	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is not likely to fall to less than 0.8 times its former value, the potential impact of the proposed development on this window is assessed as "imperceptible".
	b	Floor 01	35.20%	34.10%	0.97	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component after the construction of the proposed development, the potential impact of the proposed development on this window is assessed as "imperceptible".
	c	Floor 01	29.10%	28.10%	0.97	Imperceptible	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component after the construction of the proposed development, the potential impact of the proposed development on this window is assessed as "imperceptible".

4.1 Introduction

The *Sustainable Urban Housing: Design Standards for New Apartments Guidelines for Planning Authorities* provide that *"planning authorities should have regard to quantitative performance approaches to daylight provision outlined in guides like the BRE guide 'Site Layout Planning for Daylight and Sunlight' (2nd edition) or BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting' when undertaken by development proposers which offer the capability to satisfy minimum standards of daylight provision."*

The *BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting'* was withdrawn in May 2019, while *BS EN 17037: Daylight in Buildings* was adopted in the United Kingdom in May 2019. In Ireland, *IS EN 17037: Daylight in Buildings* was published by the National Standards Authority of Ireland on 28th January 2019.

This report assesses daylight access within habitable rooms with reference to IS EN 17037 and to BS EN 17037 (Section 4.2 below), as well as with reference to the standards for daylight access (and the methodologies recommended for assessing whether rooms meet those standards) set out in the BRE Guide (see Section 4.3).

The locations of the sample study rooms analysed as part of this analysis of daylight access within residences within the proposed development are illustrated at Figures 4.1-4.3 below. For more detail on the methodology used in assessing daylight access, please refer to the Technical Appendix of this Report.

4.2 Results of Assessment of Daylight Access within the Proposed Development - Daylight Factor (IS EN 17037 / BS EN 17037)

Under a minimum scenario, *IS EN 17037: Daylight in Buildings* recommends a target illuminance of 300 lux across 50% of a reference plane (a horizontal plane 0.85 m above the ground within a studied room) and a minimum target illuminance of 100 lux across 95% of that reference plane (Table A.1 for vertical windows). Applying Method 1, this corresponds to a recommendation to achieve 2.0% daylight factor across 50% of the reference plane and 0.7% daylight factor across 95% of the reference plane (see Table A.3 for Ireland, Dublin).

The IS EN 17037 does not identify daylighting targets for specific room types. The National Annex attached to the *BS EN 17037: Daylight in Buildings* states as follows:

> *"The UK committee supports the recommendations for daylight in buildings given in BS EN 17037: 2018; however, it is the opinion of the UK committee that the recommendations for daylight provision in a space... may not be achievable for some buildings, particularly dwellings."*

The BS EN 17037 goes on to recommend that at least 50% of a horizontal reference plane (at 0.85 m) achieve the following target illuminances for each room type: 100 lux for bedrooms, 150 lux for living rooms and 200 lux for kitchens. This is understood to correspond to a recommendation to achieve 0.7% daylight factor for bedrooms, 1.1% daylight factor for living rooms and 1.4% daylight factor for kitchens over 50% of the horizontal reference plane.

ARC analysed each habitable room within the proposed development with reference to these criteria and the results are set out in Table 4.1 below. Where rooms achieve the relevant criteria, it is highlighted in green. Please note that, in relation to the assessment under BS EN 17037, the results of analysis are provided only in relation to the relevant room type (e.g. for a bedroom, the proportion of the room achieving 0.7% daylight factor across the working plane is provided and the table cell related to the proportion of the room achieving 1.4% daylight factor (i.e. the standard for kitchens) is marked as "N/A" as this is not applicable to the assessment).

Table 4.1: EN 17037: Predicted daylight access to sample rooms within the proposed development

Location	Floor	Room Type	IS EN 17037		BS EN 17037	
			Minimum Target Daylight Factor (D_{TM}) Proportion (%) of room achieving 0.7% daylight factor (Target = 95%)	Target Daylight Factor (D_T) Proportion (%) of room achieving 2.0% daylight factor (Target = 50%)	Proportion (%) of room achieving 0.7% daylight factor Target for bedrooms = 50%	Proportion (%) of room achieving 1.4% daylight factor Target for kitchens / KLDs = 50%
Zone 01_01	Floor 00	Bedroom	100%	25%	100%	N/A
Zone 01_02	Floor 00	KLD	100%	60%	N/A	91%
Zone 01_03	Floor 00	KLD	100%	54%	N/A	90%
Zone 01_04	Floor 00	Bedroom	100%	58%	100%	N/A
Zone 02_01	Floor 01	KLD	100%	100%	N/A	100%
Zone 02_02	Floor 01	Bedroom	100%	95%	100%	N/A
Zone 02_03	Floor 01	Bedroom	100%	100%	100%	N/A
Zone 02_04	Floor 01	Bedroom	100%	51%	100%	N/A
Zone 03_01	Floor 02	KLD	100%	100%	N/A	100%

As illustrated by Table 4.1 above, most rooms will achieve the IS EN 17037 recommendations for daylight access (i.e. 4 out of 4 kitchen / living / dining rooms; and 4 out of 5 bedrooms). ARC's analysis further predicts that all habitable rooms within the proposed development will achieve the recommendations set out in the National Annex attached to attached to the *BS EN 17037: Daylight in Buildings*.

4.3 Results of Assessment of Daylight Access within the Proposed Development - Average Daylight Factor (BRE Guide)

The BRE Guide states as follows (at paragraph 2.1.8) in relation to daylight access within new development:

> *"2.1.8 Daylight provision in new rooms may be checked using the average daylight factor (ADF). The ADF is a measure of the overall amount of daylight in a space... BS 8206-2 Code of practice for daylighting, recommends an ADF of 5% for a well daylit space and 2% for a partly daylit space. Below 2% the room will look dull and electric lighting is likely to be turned on. In housing BS 8206-2 also gives minimum value of ADF of 2% for kitchens, 1.5% for living rooms and 1% for bedrooms."*

While not expressly discussed in the BRE Guide, Section 5.6 of the *BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting'* (withdrawn in May 2019) states as follows in relation to multi-function rooms: *"Where one room serves more than one purpose, the minimum average daylight factor should be that for the room type with the highest value. For example, in a space which combines a living room and a kitchen the minimum average daylight factor should be 2%."*

ARC analysed each habitable room within the proposed development with reference to these criteria and the results are set out in Table 4.2 below. Where rooms achieve the relevant criteria, it is highlighted in green.

Table 4.2: Average Daylight Factor: Predicted daylight access to sample rooms within the proposed development

Location	Floor	Room Type	Predicted Average Daylight Factor	Achieves minimum recommendation
Zone 01_01	Floor 00	Bedroom	1.88%	Yes
Zone 01_02	Floor 00	Kitchen / Living / Dining Room	3.11%	Yes
Zone 01_03	Floor 00	Kitchen / Living / Dining Room	2.97%	Yes
Zone 01_04	Floor 00	Bedroom	2.97%	Yes
Zone 02_01	Floor 01	Kitchen / Living / Dining Room	5.37%	Yes
Zone 02_02	Floor 01	Bedroom	4.44%	Yes
Zone 02_03	Floor 01	Bedroom	4.90%	Yes
Zone 02_04	Floor 01	Bedroom	2.56%	Yes
Zone 03_01	Floor 02	Kitchen / Living / Dining Room	5.96%	Yes

ARC's analysis predicts that all sample study rooms within the proposed development will achieve levels of daylight access at or above the minimum Average Daylight Factor recommended by the BRE Guide for living rooms (i.e. 1.5% Average Daylight Factor) and for bedrooms (i.e. 1% Average Daylight Factor). ARC's analysis further indicates that all kitchen / living / dining rooms in the proposed new apartments are likely to receive a level of daylight access in excess of the recommended 2% Average Daylight Factor for mixed function rooms[3].

Amy Hastings BCL BL MSc (Spatial Planning) MIPI
March 2022

3 The British Standard states that: *"Where one room serves more than one purpose, the minimum average daylight factor should be that for the room type with the highest value. For example, in a space which combines a living room and a kitchen the minimum average daylight factor should be 2%."*

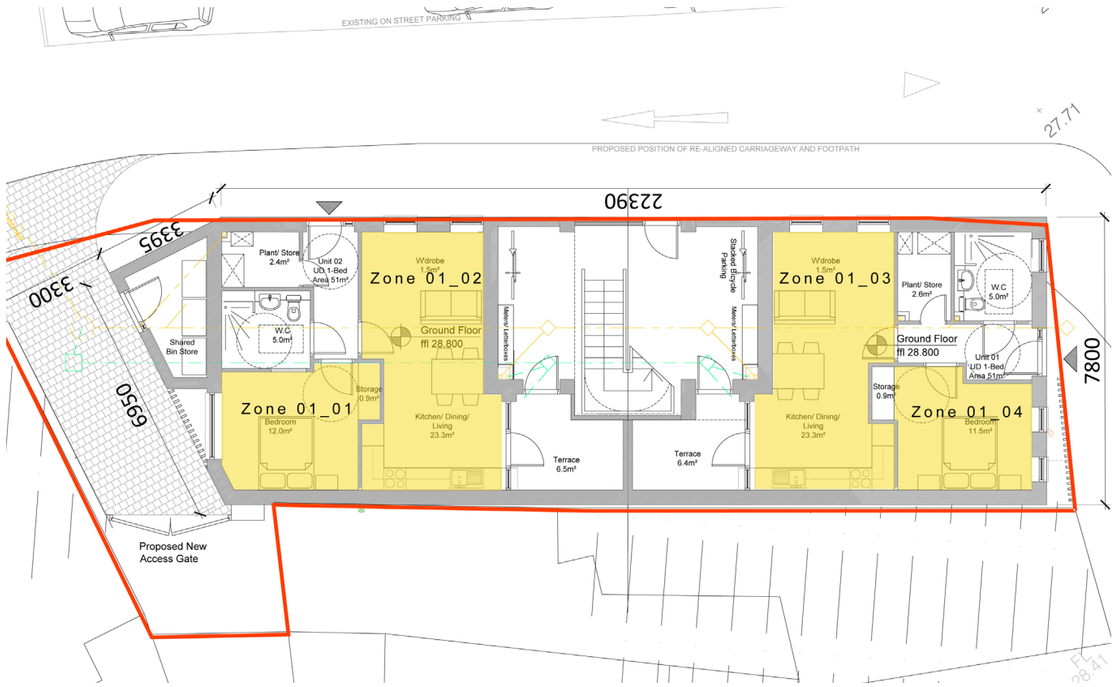

Figure 4.1: Indicative diagram based on floor plan prepared by Dun Laoghaire-Rathdown County Council showing location of sample rooms analysed as part of this assessment of daylight access within the proposed development – Floor 00 – annotated in yellow by ARC

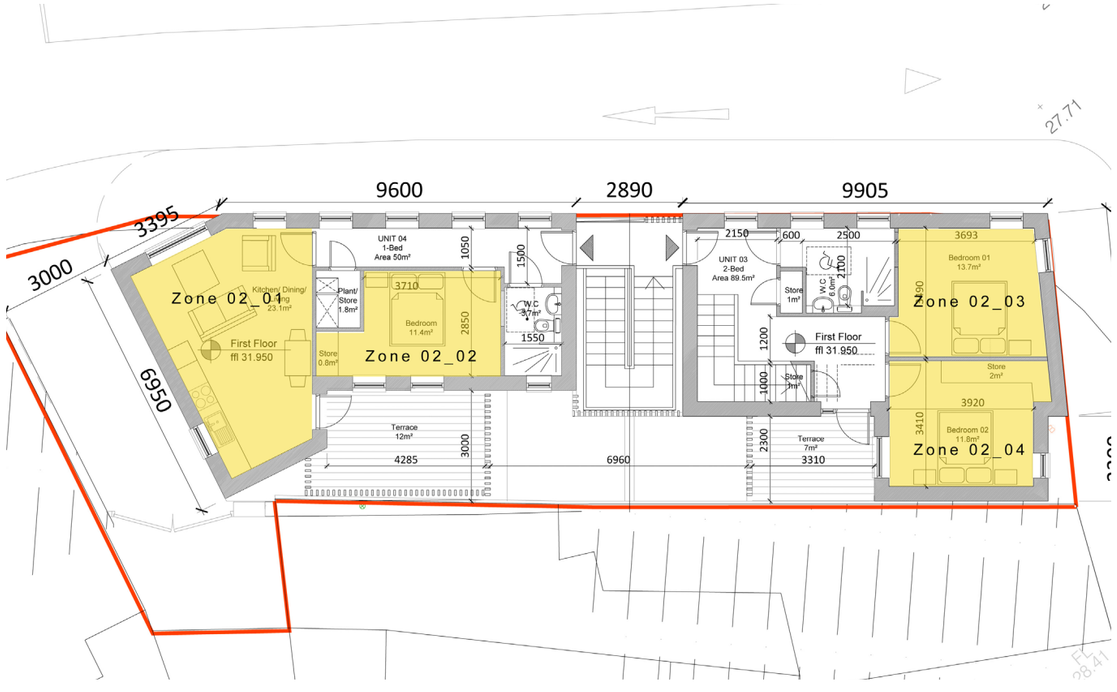

Figure 4.2: Indicative diagram based on floor plan prepared by Dun Laoghaire-Rathdown County Council showing location of sample rooms analysed as part of this assessment of daylight access within the proposed development – Floor 01 – annotated in yellow by ARC

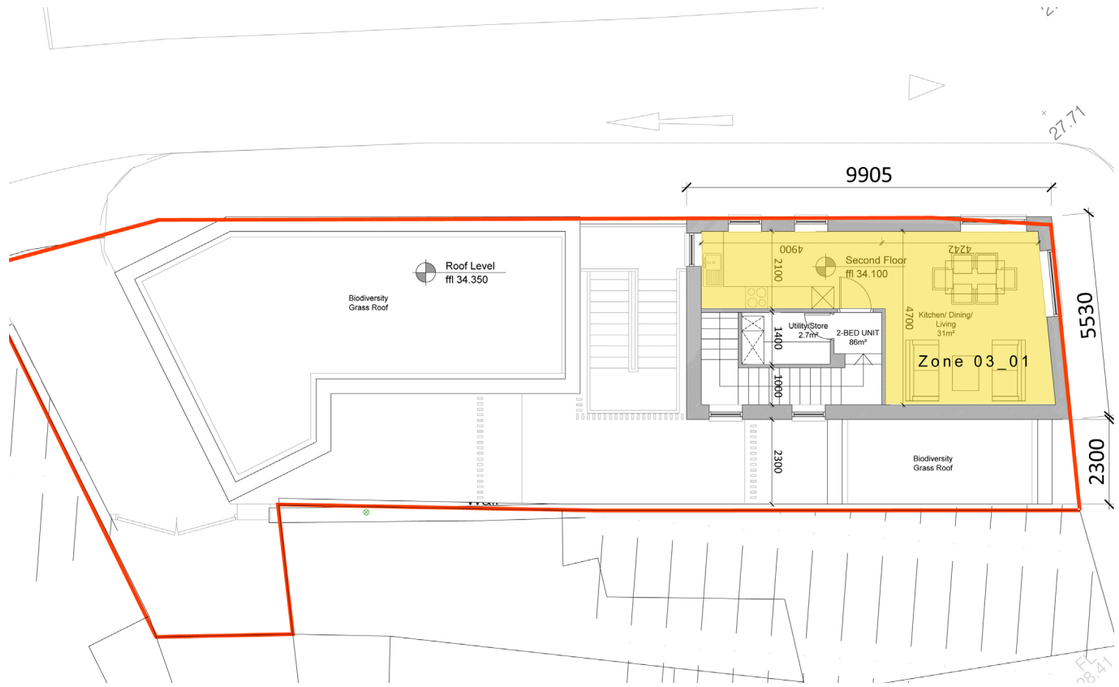

Figure 4.3: Indicative diagram based on floor plan prepared by Dun Laoghaire-Rathdown County Council showing location of sample rooms analysed as part of this assessment of daylight access within the proposed development – Floor 02 – annotated in yellow by ARC

Technical Appendix

Explanatory Note

In assessing sunlight and daylight access, Irish practitioners tend to refer to the relevant PJ Littlefair's 2011 revision of the 1991 publication *Site layout planning for daylight and sunlight: a guide to good practice* for the Building Research Establishment (the BRE Guide).

Section 1.7 of the BRE Guide provides: *"The guidance here is intended for use in the UK and Republic of Ireland"*. Its use in assessing impacts on sunlight and daylight access as part of the planning process is supported by national government planning policy including:

- The *Guidelines for Planning Authorities on Sustainable Residential Development in Urban Areas*, which, at Section 7.2 states: *"Planning authorities should require that daylight and shadow projection diagrams be submitted in all such proposals. The recommendations of "Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice" (B.R.E. 1991)*[1] *or B.S. 8206 "Lighting for Buildings, Part 2 1992: Code of Practice for Daylighting" should be followed in this regard."*

- The *Sustainable Urban Housing: Design Standards for New Apartments Guidelines for Planning Authorities*, which, at Section 6.6, states: *"Planning authorities should have regard to quantitative performance approaches to daylight provision outlined in guides like the BRE guide 'Site Layout Planning for Daylight and Sunlight' (2nd edition) or BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting' when undertaken by development proposers which offer the capability to satisfy minimum standards of daylight provision."*

The standards for daylight and sunlight access in buildings (and the methodologies for assessment of same) suggested in the BRE Guide have been referenced in this report.

The BRE Guide does not set out rigid standards or limits, but is preceded by the following very clear warning as to how the design advice contained therein should be used:

> *"The advice given here is not mandatory and* ***the guide should not be seen as 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."* [Emphasis added.]

This report is prepared by ARC Architectural Consultants Ltd for the benefit of the Applicant and in accordance with our instructions. ARC Architectural Consultants Ltd disclaims any liability, legal or otherwise, from any party, other than the Applicant, seeking to rely upon the content of this report. The purpose of this report is to provide a general indication of daylight performance and sunlight access within the proposed development on the basis of numerous assumptions outlined below and with reference to design tools set out in the guidance documents referenced above as part of the planning process. ARC takes no responsibility for any errors introduced by the third party proprietary sunlight and daylight analysis software used to perform the quantitative assessment. This report does not offer a guarantee of daylight performance or sunlight access to existing or future occupants or owners of the application site or neighbouring lands or any other party.

1 The *Guidelines for Planning Authorities on Sustainable Residential Development in Urban Areas* refer to the first edition of the BRE Guide as published in 1991. A second edition of the Guide was published in 2011.

Sunlight Access to Buildings and Open Spaces

Context under Technical and Guidance Documents

Section 3.2.1 of the *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide) provides as follows in relation to the assessment of the impact of development on sunlight access to existing buildings.

> *"If a living room of an existing dwelling has a main window facing within 90° of due south, and any part of a new development subtends an angle of more than 25° to the horizontal measured from the centre of the window in a vertical section perpendicular to the window, then the sunlighting of the existing dwelling may be adversely affected. This will be the case if the centre of the window:*
> - *receives less than 25% of annual probable sunlight hours, or less than 5% of annual probable sunlight hours between 21 September and 21 March* ***and***
> - *receives less than 0.8 times its former sunlight hours during either period* ***and***
> - *has a reduction in sunlight received over the whole year greater than 4% of annual probable sunlight hours."* [Emphasis added]

The BRE Guide states that *"Any reduction in sunlight access below this level should be kept to a minimum. If the available sunlight hours are both less than the amount above and less than 0.8 times their former value, either over the whole year or just in the winter months (21 September to 21 March), then the occupants of the existing building will notice the loss of sunlight … The room may appear colder and less cheerful and less pleasant"*.

Section 3.3 of the Building Research Establishment's *Site layout planning for daylight and sunlight: a guide to good practice* sets out design advice and recommendations for site layout planning to ensure good sunlight access to amenity spaces and to minimise the impact of new development on existing amenity spaces. The Guide suggests 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 sunlight on 21st March. The BRE Guide recommends that, as a rule of thumb, the centre of the space should receive at least two hours of sunlight on the 21st March in order to appear adequately sunlit throughout the year.

Assessment Methodology for Sunlight Access

A three dimensional digital model of the proposed development and of existing buildings in the area was constructed by ARC Consultants based on drawings supplied by the Design Team; and with reference to on-site, satellite and aerial photography and to the online planning register, where relevant. Section 3.3.9 of the BRE Guide provides that the *"question of whether trees or fences should be included in the calculation depends upon the type of shade they produce. Normally trees and shrubs need not be included, and partly because the dappled shade of a tree is more pleasant than the deep shadow of a building (this applies especially to deciduous trees)."* Given this, existing and proposed landscaping was not included in the assessment model.

Using the digital model, shadows were cast by ARC at several times of the day at the summer and winter solstices, and at the equinox. An equinox occurs twice a year: the March or vernal equinox (typically in or around the 20th to 21st March) and the September or autumnal equinox (typically in or around the 21st to 23rd September). For the purposes of this analysis and with reference to the BRE Guide, shadows were cast at several times of the day on 21st March.

The results are presented in shadow study diagrams associated with this report. Two separate pages have been prepared for each time period on each representative date as follows:

- ***Existing shadow baseline:*** this page shows the shadows cast by the existing buildings only. Existing buildings surrounding the application site are shown in light grey, while existing buildings on the application site are shown in orange. The shadows cast are shown in a dark grey tone.
- ***Proposed shadow environment:*** this page shows the shadows cast by the existing buildings together with the shadows cast by the proposed development. The existing buildings surrounding the site are shown in light grey, while the proposed development on the application site is shown in blue. The shadows cast are shown in a dark grey tone.

In order to calculate sunlight access to rooms, ARC referenced the methodology outlined in *Appendix A: Indicators to calculate access to skylight, sunlight and solar radiation* of the BRE Guide. Using proprietary sunlight and daylight access analysis software, ARC analysed a sunpath diagram overlaid with a shading mask corresponding to the existing or proposed shadow environment (as appropriate) and the sunlight probability diagram for a latitude of 53° N for a reference point (i.e. the centre point) of each sample study window. The sunlight availability indicator has 100 spots on it. Each of these represents 1% of annual probable sunlight hours (APSH). The percentage of APSH at the reference point is found by counting up all the unobstructed spots.

Definition of Impacts on Sunlight Access

The assessment of the impact of the proposed development on sunlight access had regard to the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* prepared by the Environmental Protection Agency (Draft of 2017), and to Directive 2011/92/EU (as amended by Directive 2014/52/EU) on the assessment of the likely effects of certain public and private projects on the environment.

In assessing whether a predicted effect of the proposal on sunlight access is likely to be "imperceptible", "not significant", "slight", "moderate", "significant", "very significant" or "profound" within the meaning of the EPA's *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*, ARC referred to Appendix I of the BRE Guide sets out advice on environment impact assessment. It states:

> *I4 The assessment of impact will depend on a combination of factors, and there is no simple rule of thumb that can be applied.*
>
> *I5 Where the loss of skylight or sunlight fully meets the guidelines in this book, the impact is assessed as negligible or minor adverse. Where the loss of light is well within the guidelines, or only a small number of windows or a limited area of open space lose light (within the guidelines), a classification of negligible impact is more appropriate, especially if there is a particularly strong requirement for daylight and sunlight in the affected building or open space.*
>
> *I6 Where the loss of skylight or sunlight does not meet the guidelines in this book, the impact is assessed as minor, moderate or major adverse. Factors tending towards a minor adverse impact include:*
> - *only a small number of windows or limited area of open space are affected*
> - *the loss of light is only marginally outside the guidelines*
> - *an affected room has other source of skylight or sunlight*
> - *the affected building or open space only has a low level requirement for skylight or sunlight*
> - *there are particular reasons why an alternative, less stringent, guidelines should be applied (see Appendix F).*
>
> *I7 Factors tending towards a major adverse impact include:*
> - *a large number of windows or large area of open space are affected*
> - *the loss of light is substantially outside the guidelines*
> - *all the windows in a particular property are affected*
> - *the affected indoor or outdoor spaces have a particularly strong requirement for skylight or sunlight, eg a living room in a dwelling or a children's playground.*

Having considered the factors outlined in Appendix I of the BRE Guide, ARC's assessment classifies the impact of the proposed development on sunlight access within existing buildings or open spaces with reference to the list of definitions set out at Table 3.3: Descriptions of Effects contained in the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* prepared by the Environmental Protection Agency. The definitions from the EPA document are in italics, while some comment is also given below on what ARC considers these definitions might imply in the case of sunlight access (e.g. having regard to Appendix I of the BRE Guide). Please note that, for the purpose of this report, the word "effect" is taken to have the same meaning as the word "impact".

- ***Imperceptible:*** *An effect capable of measurement but without significant consequences.* The definition implies that the development would cause a change in the sunlight received at a location, capable of measurement, but not noticeable to the casual observer. If the development caused no change in sunlight access, there could be no effect. Examples of "imperceptible" impacts on sunlight access would include:
  - (a) a scenario where the proposed development is predicted to reduce the amount of sunlight received by a sample window, but the sample window will continue to receive the relevant recommended level of Annual Probable Sunlight Hours after the construction of the proposed development; and
  - (b) a scenario where the proposed development is predicted to reduce the Annual Probable Sunlight Hours received by a sample window to not less than 0.8 times its existing value (i.e. the BRE Guide threshold for an adverse impact). Similarly, where sunlight access to a sample garden is reduced, the impact of proposed development could be considered to be "imperceptible" or "not significant" where the sample garden continues to the receive at least two hours of sunlight over half its area on 21st March, and, where the area of the garden capable of receiving sunlight on 21st March does not drop to less than 0.8 times its existing level after the construction of the proposed development.

- ***Not Significant:*** *An effect which causes noticeable[2] changes in the character of the environment but without significant consequences* (the footnote "2" to the word *"noticeable"* is: *"for the purposes of planning consent procedures"*). The definition implies that the development would cause a change in the sunlight received at a location, which is capable of measurement and capable of being noticed by an observer who is taking an active interest in the extent to which the proposal might affect sunlight access.

- ***Slight:*** *An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.* For this definition to apply, the amount of sunlight received at a location would be changed by shadows cast by the development to an extent that is both capable of measurement and is noticeable to a minor degree. However, the shadow environment of the surrounding environment should remain largely unchanged. An example of a "slight" impact would be a scenario where, although the impact of the proposed development is not predicted to reduce the amount of sunlight received by a sample window or garden to less than 0.8 times its former value, the amount of light received by the sample window or garden is predicted to fall below a key recommended level, whether that is the BRE Guide recommended target value or an alternative target value. A further example of a "slight" impact would be where, although the construction of the proposed development is predicted to reduce the amount of light received to a level below the BRE Guide threshold for an adverse impact, the predicted reduction is just outside that BRE Guide threshold (e.g. the amount of daylight received by a sample window or sunlight received by a sample window or garden falls to not less than 0.7 times its existing value*). A "slight" impact could also occur where there is a more considerable reduction in sunlight by a sample window within an existing building, but only a small number of windows within that property are affected to that extent.

- ***Moderate:*** *An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.* In this case, a development must bring about a change in the shadow environment of the area; and this change must be consistent with a pattern of change that is already occurring or is likely to occur. A moderate effect would occur where other developments were bringing about changes in sunlight access of similar extent in the area. A "moderate" impact might also be considered to occur where the level of sunlight access to a sample window or garden falls below the BRE Guide recommended level and to between 0.5 and 0.7 times its existing value, subject to consideration of other factors*.

- ***Significant:*** *An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment*. The definition implies that the existence of the development would change the extent of sunlight access in a manner that is not *"consistent with existing and emerging baseline trends"*. For example, a development resulting in a *"significant"* diminution of sunlight access would overshadow a location to the extent that there is a significant change in the amount of direct sunlight received at that location. A "significant" impact could occur where the predicted reduction in sunlight access is greater than what is envisaged to occur if the application site were developed in line with existing and emerging baseline trends. Subject to consideration of other factors, a "significant" impact could occur where sunlight access to the sample window or garden falls to between 0.25 and 0.5 times its former value*.

- ***Very Significant:*** *An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment*. For example, a *"very significant"* reduction in sunlight access would occur where the development overshadows a location for most of the time that the location would have been in sunlight prior to the construction of the development and where overshadowing of that magnitude is not *"consistent with existing and emerging baseline trends"*. A "very significant" impact could occur where the predicted reduction in sunlight access is considerably greater than what is envisaged to occur if the application site were developed in line with existing and emerging baseline trends. Subject to consideration of other factors, a "very significant" impact could occur where sunlight access to the sample window or garden falls to between 0.01 and 0.25 times its former value*.

- ***Profound:*** *An effect which obliterates sensitive characteristics.* Examples of development resulting in a *"profound"* effect on sunlight access would include facilitating sunlight access at a location where that location has previously had none (e.g. facilitating sunlight access as a result of the demolition of a building) or by removal of all access to sunlight at a location.

* Please note that, while this section sets out indicative quantitative ranges that could apply to each type of impact, this assessment considers a range of factors (such as relevant target values, the use of the affected building, the number of rooms affected within the building, etc) in classifying impacts.

Daylight Access to Buildings

Context under Technical and Guidance Documents
Section 2.2.21 of the BRE Guide suggests that:

> *"If any part of a new building or extension, measured in a vertical section perpendicular to a main window wall of an existing building, from the centre of the lowest window, subtends an angle of more than 25° to the horizontal, then the diffuse daylighting of the existing building may be adversely affected. This will be the case if ...*
>
> - *the VSC measured at the centre of an existing main window is less than 27%, and less than 0.8 times its former value..."*

The BRE Guide states as follows (at paragraph 2.1.8) in relation to daylight access within new development:

> *"2.1.8 Daylight provision in new rooms may be checked using the average daylight factor (ADF). The ADF is a measure of the overall amount of daylight in a space... BS 8206-2 Code of practice for daylighting, recommends an ADF of 5% for a well daylit space and 2% for a partly daylit space. Below 2% the room will look dull and electric lighting is likely to be turned on. In housing BS 8206-2 also gives minimum value of ADF of 2% for kitchens, 1.5% for living rooms and 1% for bedrooms."*

The British Standard, BS 8206-2[2], goes on to state, at Section 5.6, that *"Where one room serves more than one purpose, the minimum average daylight factor should be that for the room type with the highest value. For example, in a space which combines a living room and a kitchen the minimum average daylight factor should be 2%."*

IS EN 17037: Daylight in Buildings states as follows:

> *"The daylight in an interior space depends, primarily, on the availability of natural light and, thereafter, the properties of the space and its surroundings. The standard proposes two methods to assess daylight provision in the interior: a calculation method based on daylight factor and cumulative daylight availability (method 1); or a calculation method based on the direct prediction of illuminance levels using hourly climate data (method 2).*
>
> *Both methods apply the annual occurrence of an absolute value for internal illuminance calculated from the availability of external horizontal illuminance as determined from climate data suitable for the site of evaluation.*
>
> *Calculation method 1 using daylight factors on a reference plane should achieve a target daylight factor (D_T) and/or a minimum target daylight factor (D_{TM}) across a fraction of the reference plane for at least half of the daylight hours, where D_T and D_{TM} are based on the provision of recommended target illuminance values, (E_T) and minimum target illuminance (E_{TM}), both in lx."*

Under a minimum scenario, *IS EN 17037: Daylight in Buildings* recommends a target illuminance of 300 lux across 50% of a reference plane (a horizontal plane 0.85 m above the ground within a studied room) and a minimum target illuminance of 100 lux across 95% of that reference plane (Table A.1 for vertical windows). Applying Method 1, this corresponds to a recommendation to achieve 2.0% daylight factor across 50% of the reference plane and 0.7% daylight factor across 95% of the reference plane (see Table A.3 for Ireland, Dublin).

The IS EN 17037 does not identify daylighting targets for specific room types. The National Annex attached to the *BS EN 17037: Daylight in Buildings* states as follows:

> *"The UK committee supports the recommendations for daylight in buildings given in BS EN 17037: 2018; however, it is the opinion of the UK committee that the recommendations for daylight provision in a space... may not be achievable for some buildings, particularly dwellings."*

The BS EN 17037 goes on to recommend that at least 50% of a horizontal reference plane (at 0.85 m) achieve the following target illuminances for each room type: 100 lux for bedrooms, 150 lux for living rooms and 200 lux for kitchens. For Belfast, this corresponds to a recommendation to achieve 0.7% daylight factor for bedrooms, 1.1% daylight factor for living rooms and 1.4% daylight factor for kitchens over 50% of the horizontal reference plane.

Assessment Methodology for Daylight Access
A three dimensional digital model of the proposed development and of existing buildings in the area was constructed by ARC Consultants based on drawings and three dimensional models supplied by the Design Team. Where survey data of surrounding context was not available, assumptions were made, with reference to on-site, satellite and aerial photography and to the online planning register, where relevant, in the creation of the three dimensional model. Existing and proposed landscaping was not included in this model.

In assessing the impact of the proposed development on existing buildings, ARC assessed the Vertical Sky Component of each window at a point at the centre of each window. In assessing daylight access within the proposed development, Average Daylight Factor and Daylight Factor was assessed on the working plane (i.e., at 850 mm). Having regard to the extreme variability in sky luminance over the course of any given day depending on weather conditions and the changing seasons, in order for daylight factor to be a meaningful and comparable measure of daylight access, it is necessary to assume a particular luminance distribution for the sky when calculating Average Daylight Factor. This daylight access analysis uses the Commission Internationale de l'Eclairage (CIE) Standard Overcast Sky Distribution model in its calculations, which is the standard sky most commonly used in daylight access analysis. This model assumes that sky luminance varies from horizon to zenith and is considered to correspond to an overcast day. As such, calculation of Average Daylight Factor in a room in circumstances where the sky luminance corresponds to the CIE Standard Overcast Sky Distribution could be considered to represent a worst case scenario. Unless specifically referenced, analysis of uniformity of daylight access within a room has not been carried out as part of this assessment.

In assessing daylight access within rooms within the proposed development, the following assumptions were made:

- Grid: 0.5 m x 0.5 m
- Internal floor reflectance: 30%
- Internal wall reflectance: 65%
- Internal ceiling reflectance: 80%
- External ground reflectance: 20%
- Glazing transmission: 70%
- Glazing maintenance factor: 90%
- Working plane height: 0.85 m

In applying the recommendations of the National Annex of BS EN 17037, the recommendations outlined in Table NA.5 - Supplement to Table A.3 for 10 UK and Channel Islands Locations for Belfast were applied. As Belfast is located at a more northerly latitude than Dublin, the recommendations for minimum daylight factors for Belfast are considered to be conservative and represent a worst case scenario.

2 It is noted that *BS 8206-2:2008: Lighting for buildings - Part 2: Code of practice for daylighting* was withdrawn. It is further noted that a new European Standard, adopted in Ireland as *IS EN 17037:2018 Daylight in Buildings*, has come into force. However, given that Irish statutory guidance specifically refers to the BS 8206-2:2008 and to the BRE Guide, but not to IS EN 17037:2018, and given that the methodologies and standards outlined in IS EN 17037:2018 are quite different to those cited in the guidance documents referenced in Irish statutory guidance, BS 8206:2008, as quoted in the BRE Guide, has been referenced in the preparation of this report.

Definition of Impacts on Daylight Access

The assessment of the impact of the proposed development on daylight access had regard to the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* prepared by the Environmental Protection Agency (Draft of 2017), and to Directive 2011/92/EU (as amended by Directive 2014/52/EU) on the assessment of the likely effects of certain public and private projects on the environment.

In assessing whether a predicted effect of the proposal on daylight access is likely to be "imperceptible", "not significant", "slight", "moderate", "significant", "very significant" or "profound" within the meaning of the EPA's *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*, ARC referred to Appendix I of the BRE Guide sets out advice on environment impact assessment. It states:

> *I4 The assessment of impact will depend on a combination of factors, and there is no simple rule of thumb that can be applied.*
>
> *I5 Where the loss of skylight or sunlight fully meets the guidelines in this book, the impact is assessed as negligible or minor adverse. Where the loss of light is well within the guidelines, or only a small number of windows or a limited area of open space lose light (within the guidelines), a classification of negligible impact is more appropriate, especially if there is a particularly strong requirement for daylight and sunlight in the affected building or open space.*
>
> *I6 Where the loss of skylight or sunlight does not meet the guidelines in this book, the impact is assessed as minor, moderate or major adverse. Factors tending towards a minor adverse impact include:*
> - *only a small number of windows or limited area of open space are affected*
> - *the loss of light is only marginally outside the guidelines*
> - *an affected room has other source of skylight or sunlight*
> - *the affected building or open space only has a low level requirement for skylight or sunlight*
> - *there are particular reasons why an alternative, less stringent, guidelines should be applied (see Appendix F).*
>
> *I7 Factors tending towards a major adverse impact include:*
> - *a large number of windows or large area of open space are affected*
> - *the loss of light is substantially outside the guidelines*
> - *all the windows in a particular property are affected*
> - *the affected indoor or outdoor spaces have a particularly strong requirement for skylight or sunlight, eg a living room in a dwelling or a children's playground.*

Having considered the factors outlined in Appendix I of the BRE Guide, ARC's assessment classifies the impact of the proposed development on daylight access within existing buildings with reference to the list of definitions set out at Table 3.3: Descriptions of Effects contained in the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* prepared by the Environmental Protection Agency. The definitions from the EPA document are in italics, while some comment is also given below on what ARC considers these definitions might imply in the case of daylight access (e.g. having regard to Appendix I of the BRE Guide). Please note that, for the purpose of this report, the word "effect" is taken to have the same meaning as the word "impact".

- ***Imperceptible:*** *An effect capable of measurement but without significant consequences.* The definition implies that the development would cause a change in the daylight received at a location, capable of measurement, but not noticeable to the casual observer. If the development caused no change in daylight access, there could be no effect. Examples of "imperceptible" impacts on daylight access would include:
  (a) a scenario where the proposed development is predicted to reduce the Vertical Sky Component received by a sample window, but the sample window will continue to receive the relevant recommended level of Vertical Sky Component after the construction of the proposed development; and
  (b) a scenario where the proposed development is predicted to reduce the Vertical Sky Component to not less than 0.8 times its former value (i.e. the BRE Guide threshold for an adverse impact).

- ***Not Significant:*** *An effect which causes noticeable2 changes in the character of the environment but without significant consequences* (the footnote "2" to the word *"noticeable"* is: *"for the purposes of planning consent procedures"*). The definition implies that the development would cause a change in the daylight received at a location, which is capable of measurement and capable of being noticed by an observer who is taking an active interest in the extent to which the proposal might affect daylight access.

- ***Slight:*** *An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.* For this definition to apply, the amount of daylight received at a location would be changed by the construction of the development to an extent that is both capable of measurement and is noticeable to a minor degree. However, the daylight environment within an existing building should remain largely unchanged. An example of a "slight" impact would be a scenario where, although the impact of the proposed development is not predicted to reduce the amount of daylight received by a sample window to less than 0.8 times its former value, the amount of light received by the sample window is predicted to fall below a key recommended level, whether that is the BRE Guide recommended target value or an alternative target value. A further example of a "slight" impact would be where, although the construction of the proposed development is predicted to reduce the amount of light received to a level below the BRE Guide threshold for an adverse impact, the predicted reduction is just outside that BRE Guide threshold (e.g. the amount of daylight received by a sample window or sunlight received by a sample window or garden falls to not less than 0.7 times its existing value*). A "slight" impact could also occur where there is a more considerable reduction in daylight or sunlight by a sample window within an existing building, but only a small number of windows within that property are affected to that extent.

- ***Moderate:*** *An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.* In this case, a development must bring about a change in the daylight environment within an existing building; and this change must be consistent with a pattern of change that is already occurring or is likely to occur. A moderate effect would occur where other developments were bringing about changes in daylight access of similar extent in the area. A "moderate" impact might also be considered to occur where the level of daylight received by a sample window falls below the BRE Guide recommended level and to between 0.5 and 0.7 times its existing value, subject to consideration of other factors*.

- ***Significant:*** *An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.* The definition implies that the existence of the development would change the extent of daylight access in a manner that is not *"consistent with existing and emerging baseline trends"*. For example, a development resulting in a *"significant"* diminution of daylight access would reduce daylight to the extent that minimum standards for daylighting are not met and artificial lighting is required for part of the day. A "significant" impact could occur where the predicted reduction in daylight access is greater than what is envisaged to occur if the application site were developed in line with existing and emerging baseline trends. Subject to consideration of other factors, a "significant" impact could occur where daylight access to the sample window falls to between 0.25 and 0.5 times its former value*.

- ***Very Significant:*** *An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.* The definition implies that the existence of the development would change the extent of daylight access to a considerable degree and in a manner that is not *"consistent with existing and emerging baseline trends"*. For example, a *"very significant"* effect would occur where a development would result in daylight received in a room falling well below the minimum standards for daylighting and where artificial lighting would be required in that room as the principal source of lighting all the time. A "very significant" impact could occur where the predicted reduction in daylight access is considerably greater than what is envisaged to occur if the application site were developed in line with existing and emerging baseline trends. Subject to consideration of other factors, a "very significant" impact could occur where daylight access to the sample window or sunlight access to the sample window or garden falls to between 0.01 and 0.25 times its former value*.

- ***Profound:*** *An effect which obliterates sensitive characteristics.* Examples of development resulting in a ***"profound"*** effect on daylight access would include facilitating daylight access to a room in an existing building where the existing room has none (e.g. as a result of the demolition of a building) or by removal of all access to daylight within an existing building.

* Please note that, while this section sets out indicative quantitative ranges that could apply to each type of impact, this assessment considers a range of factors (such as relevant target values, the use of the affected building, the number of rooms affected within the building, etc) in classifying impacts.

In relation to daylight access, it is conceivable that a development could result in positive effects, but this implies that a development would involve a reduction of the size or scale of built form (e.g. such as the demolition of a building, which might result in an increase in daylight access). Though that is possible, it is usually unlikely as most development involves the construction of new obstructions to daylight access.

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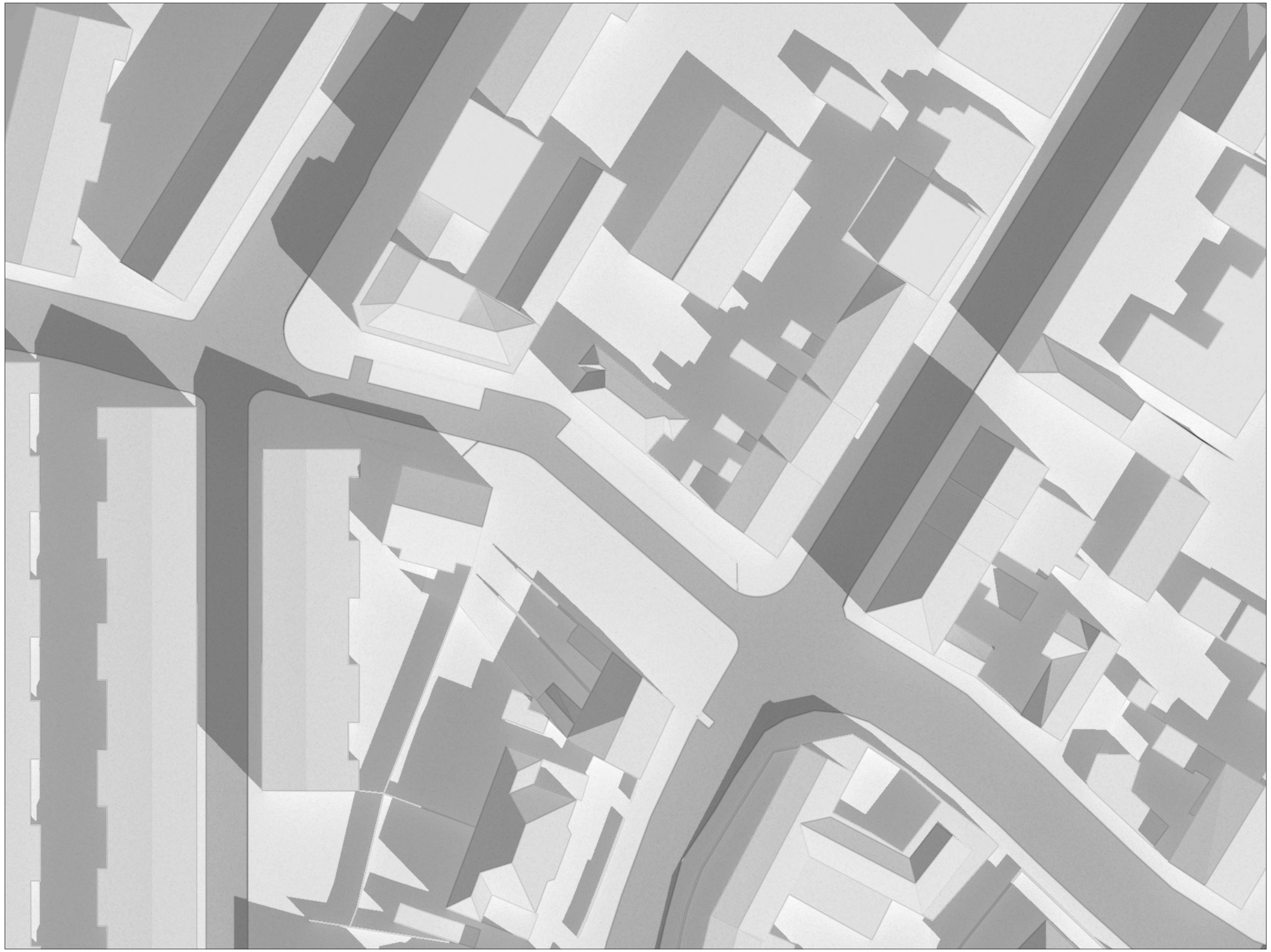

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SHADOW STUDY
27 PATRICK STREET, DUN LAOGHAIRE, CO. DUBLIN
JULY 2022

DATE : MARCH 21ST - EQUINOX
SUNRISE : 6.25 AM
SUNSET : 6.40 PM

TIME :
10.00 AM

PROPOSED
DEVELOPMENT

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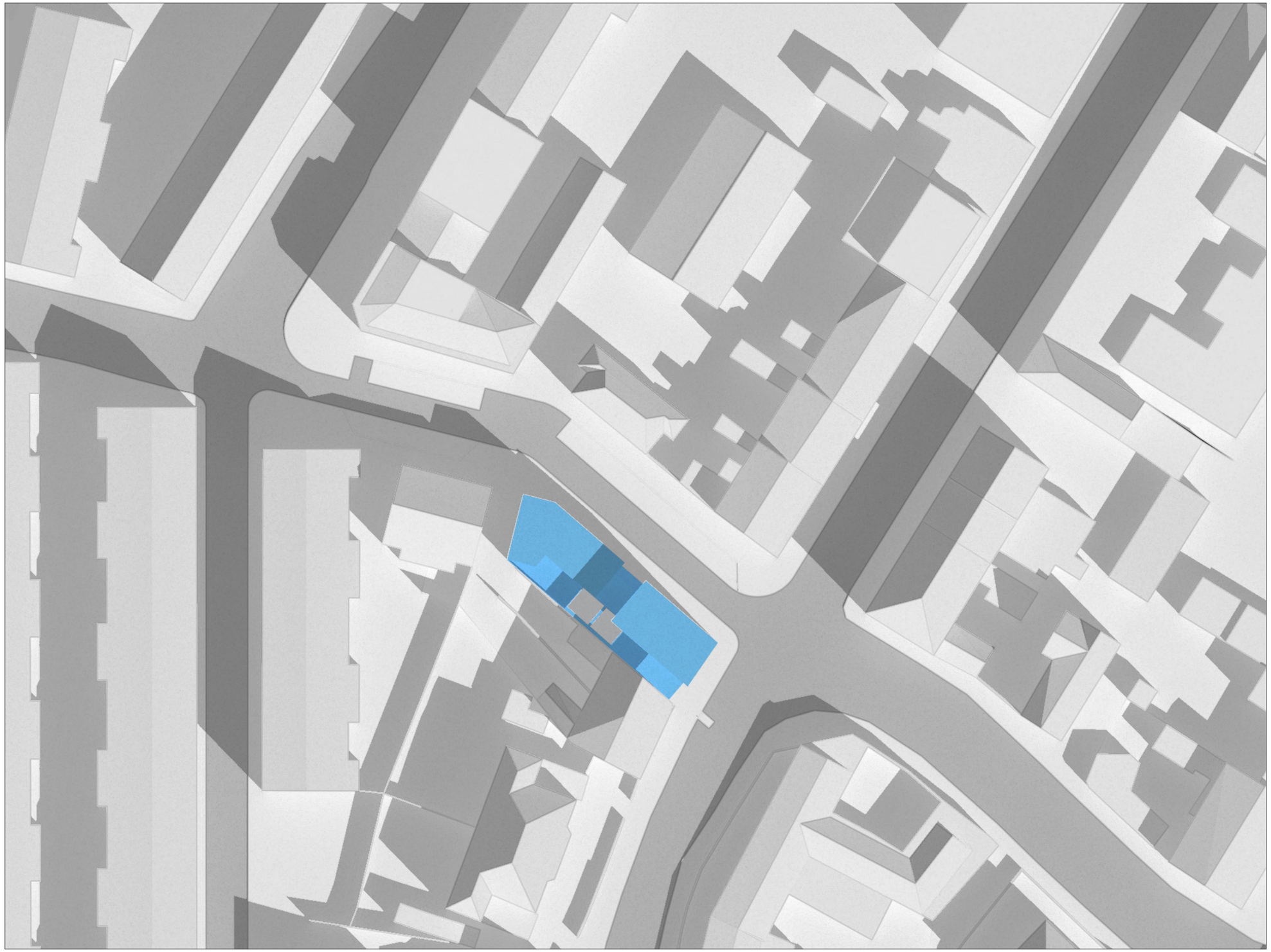

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27 PATRICK STREET, DUN LAOGHAIRE, CO. DUBLIN
JULY 2022

DATE : MARCH 21ST - EQUINOX
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TIME :
10.00 AM

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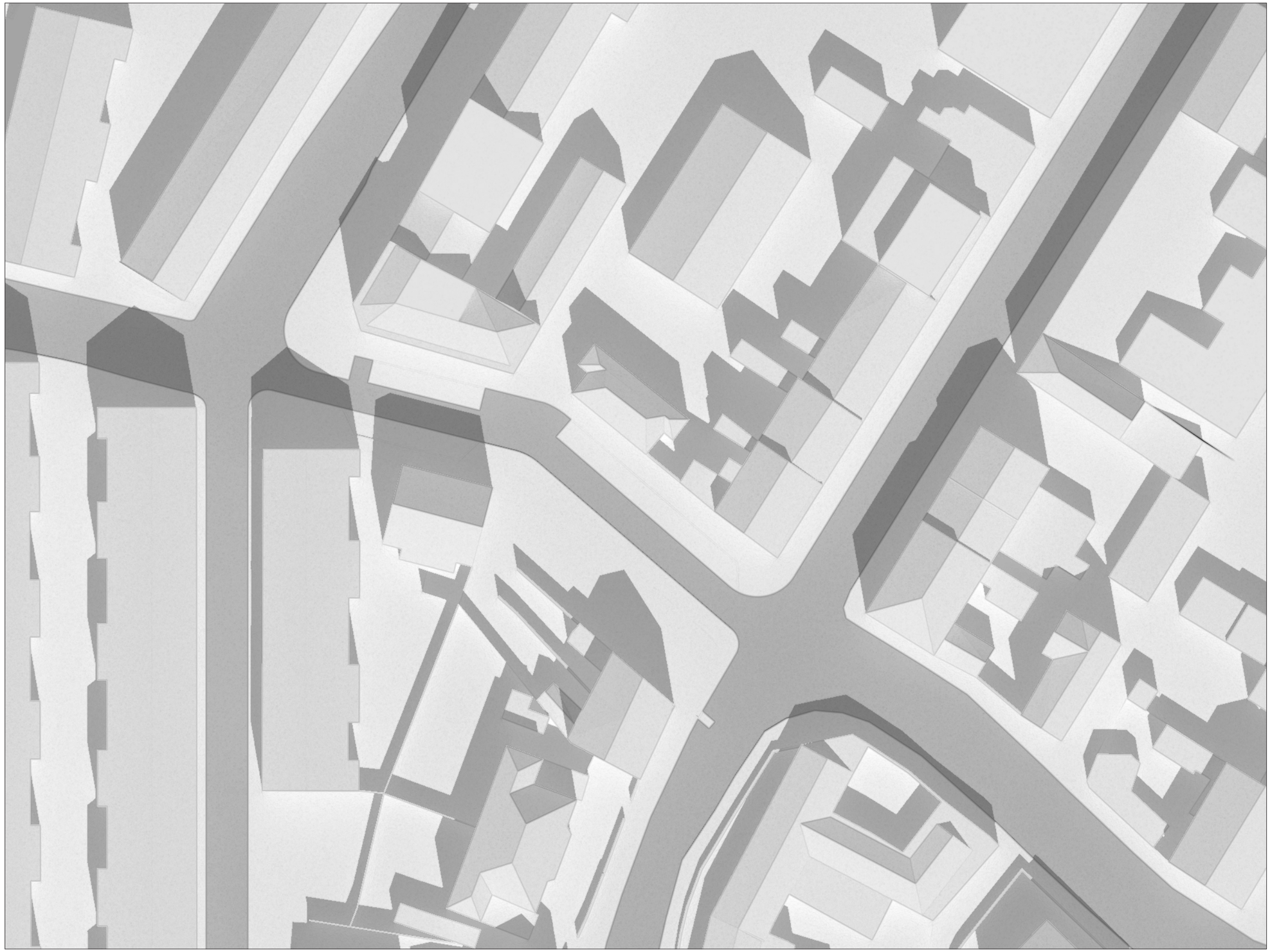

SHADOW STUDY
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JULY 2022

DATE : MARCH 21ST - EQUINOX
SUNRISE : 6.25 AM
SUNSET : 6.40 PM

TIME :
12.00 PM

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JULY 2022

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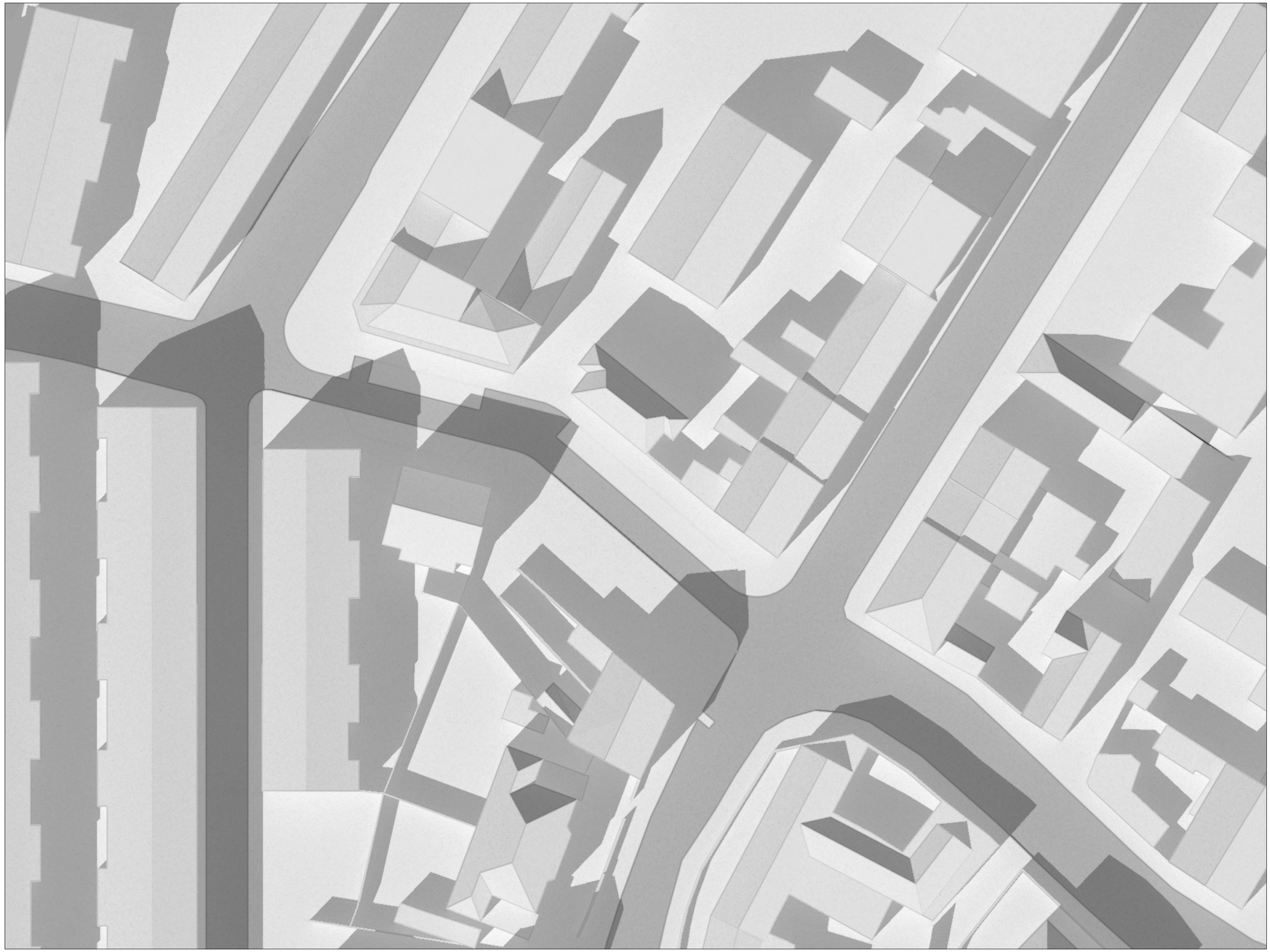

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JULY 2022

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3.00 PM

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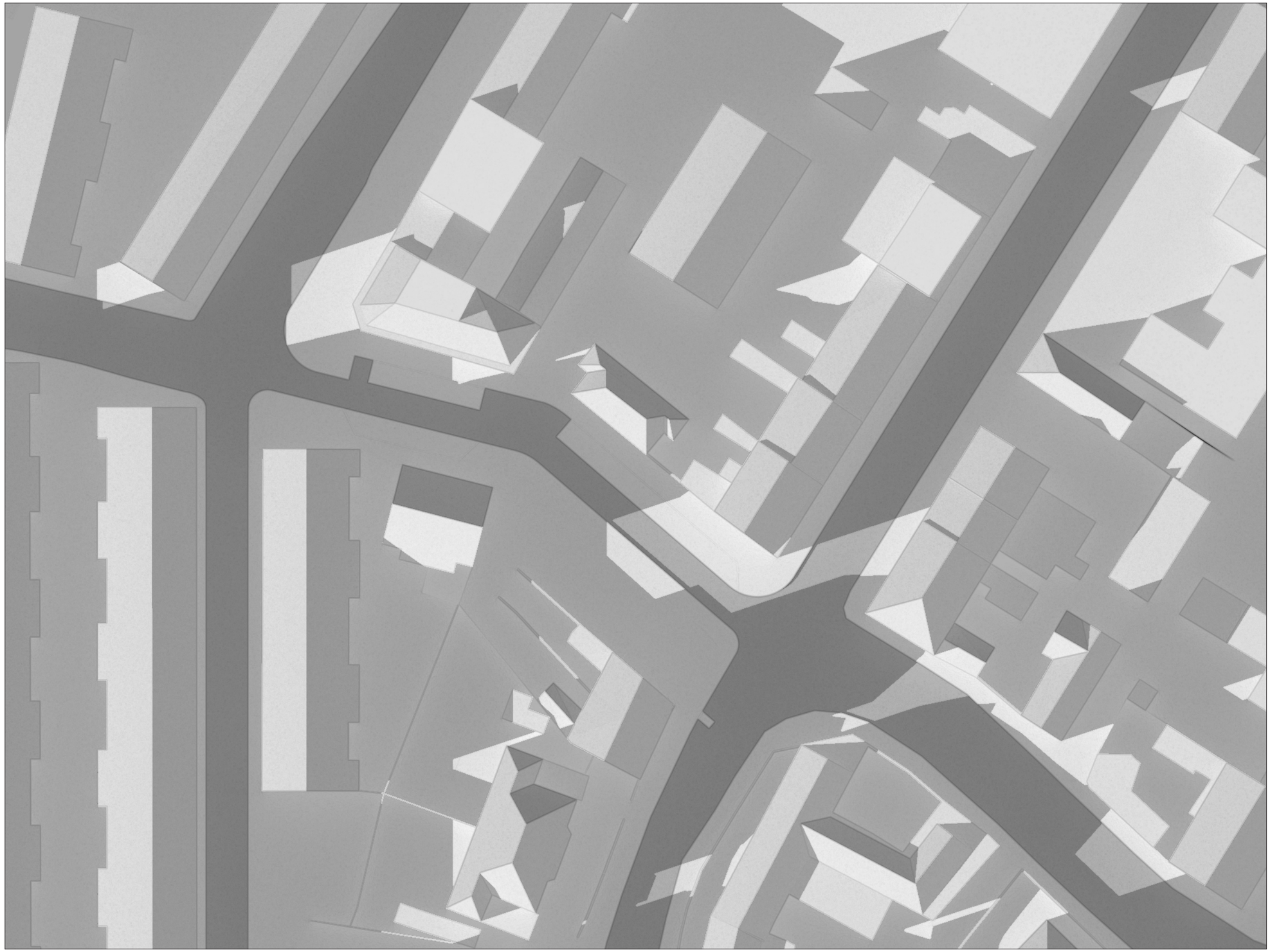

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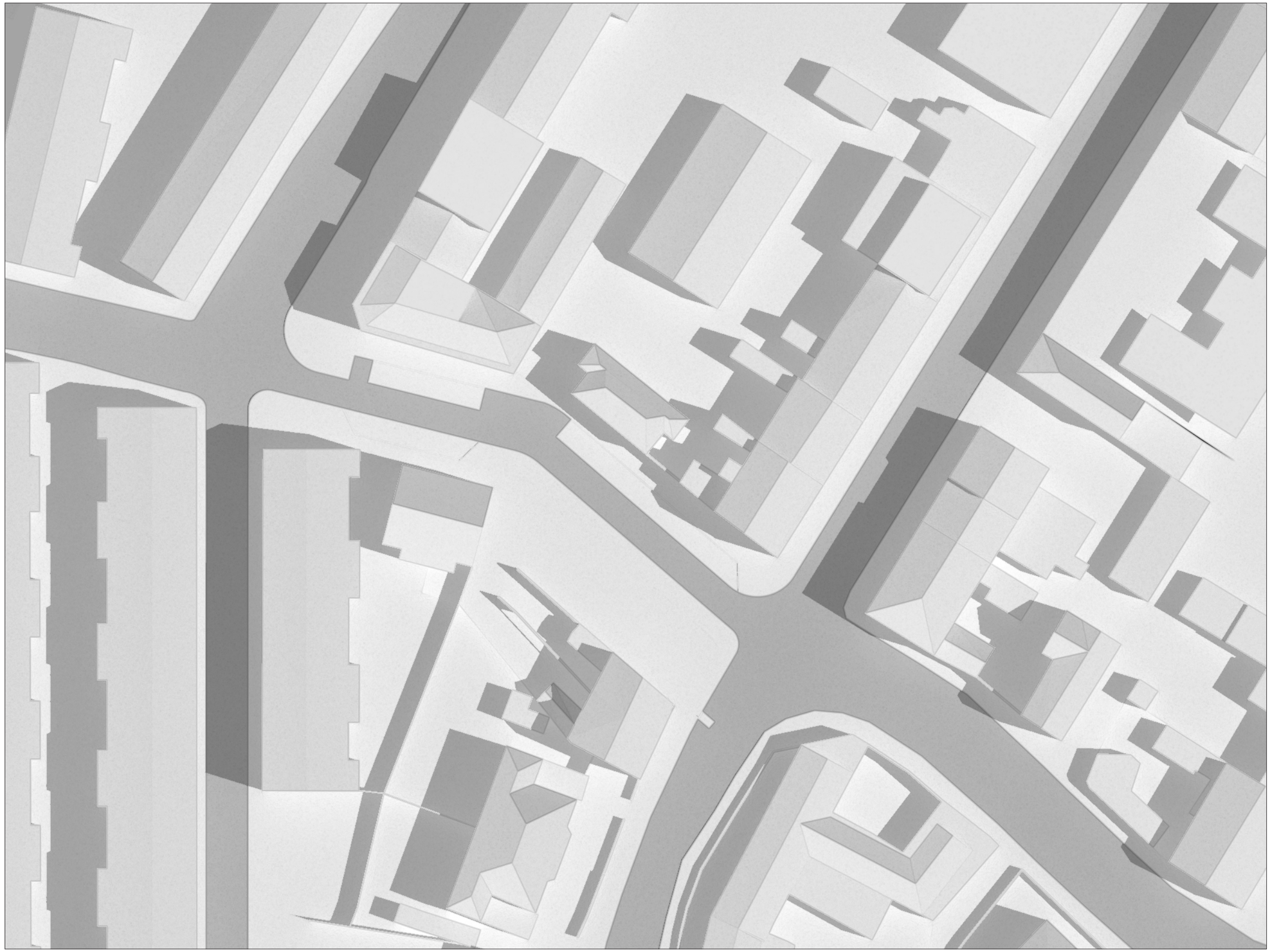

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JULY 2022

DATE : JUNE 21ST - SUMMER SOLSTICE
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SUNSET : 9.56 PM

TIME :
9.00 AM

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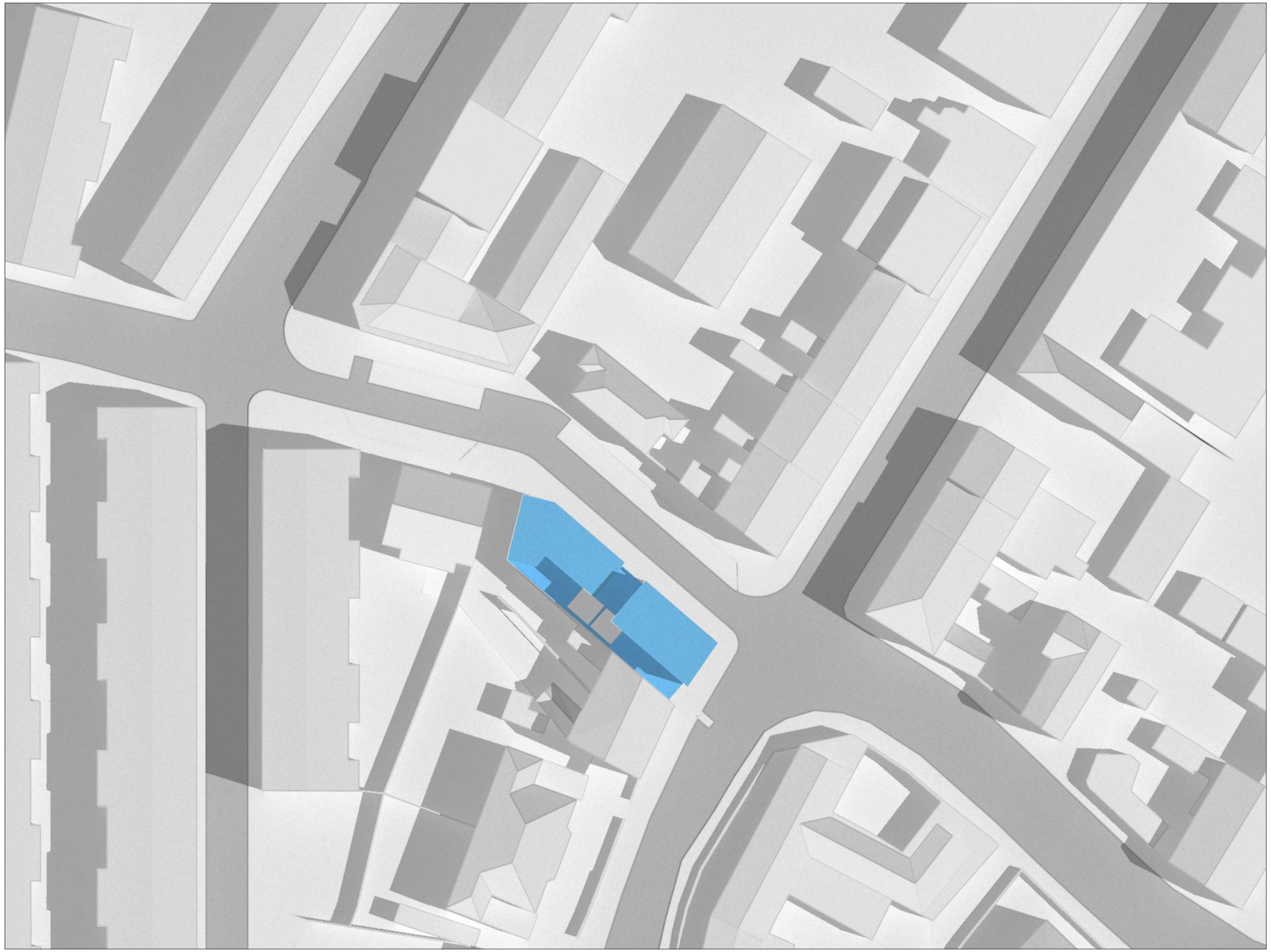

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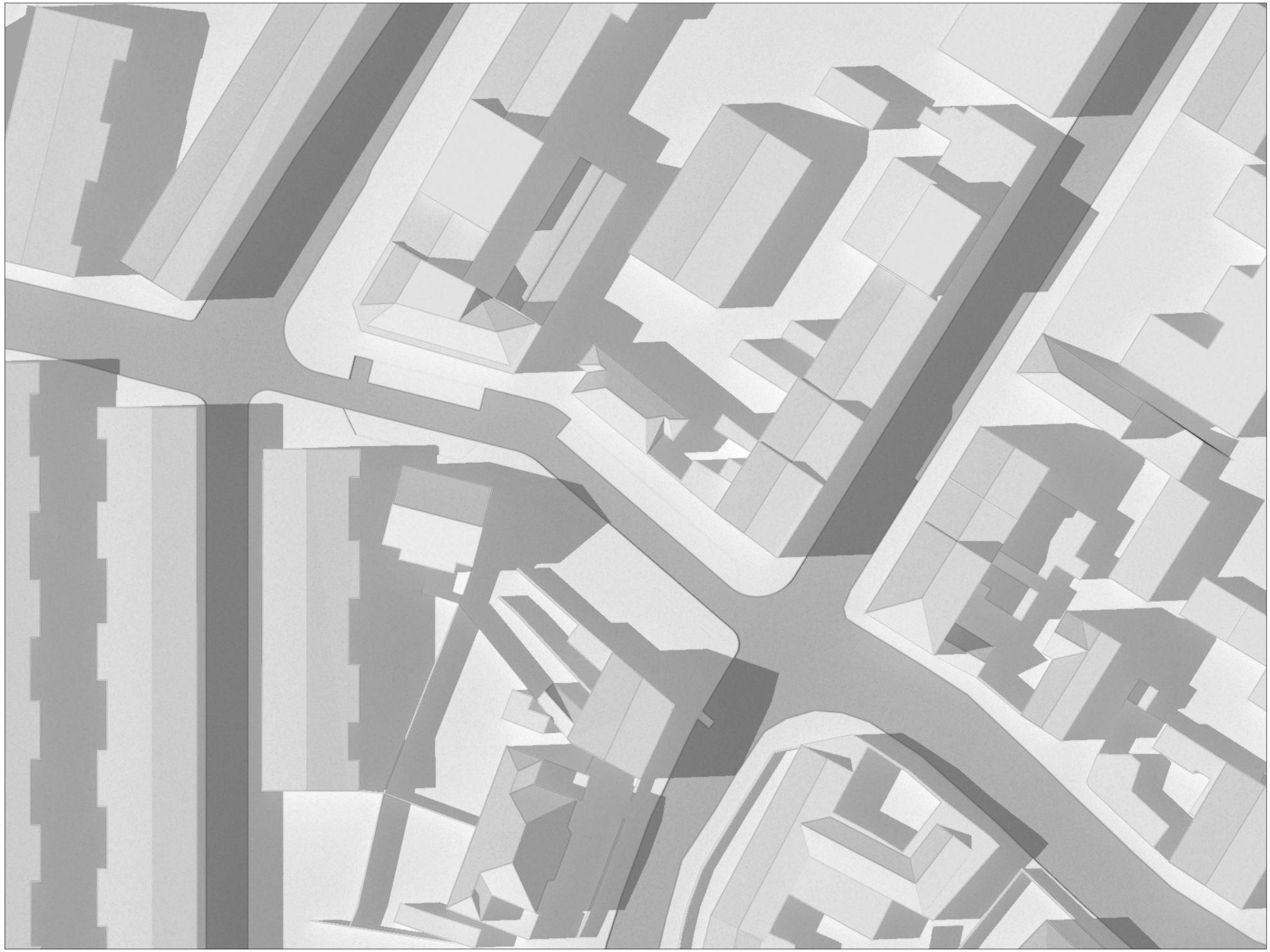

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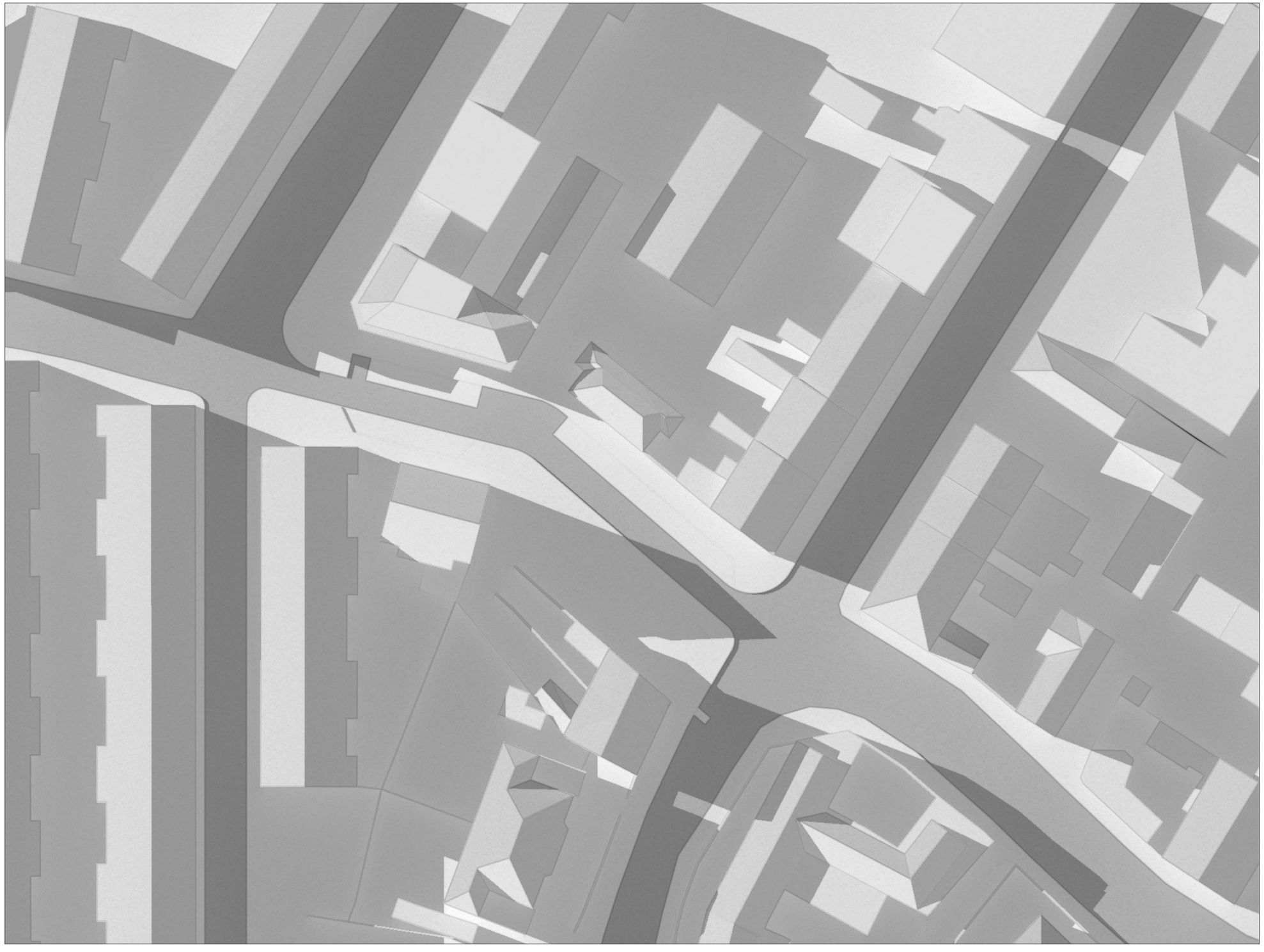

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JULY 2022

DATE : DECEMBER 21ST - WINTER SOLSTICE
SUNRISE : 8.38 AM
SUNSET : 4.08 PM

TIME :
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SHADOW STUDY
27 PATRICK STREET, DUN LAOGHAIRE, CO. DUBLIN
JULY 2022

DATE : DECEMBER 21ST - WINTER SOLSTICE
SUNRISE : 8.38 AM
SUNSET : 4.08 PM

TIME :
10.30 AM

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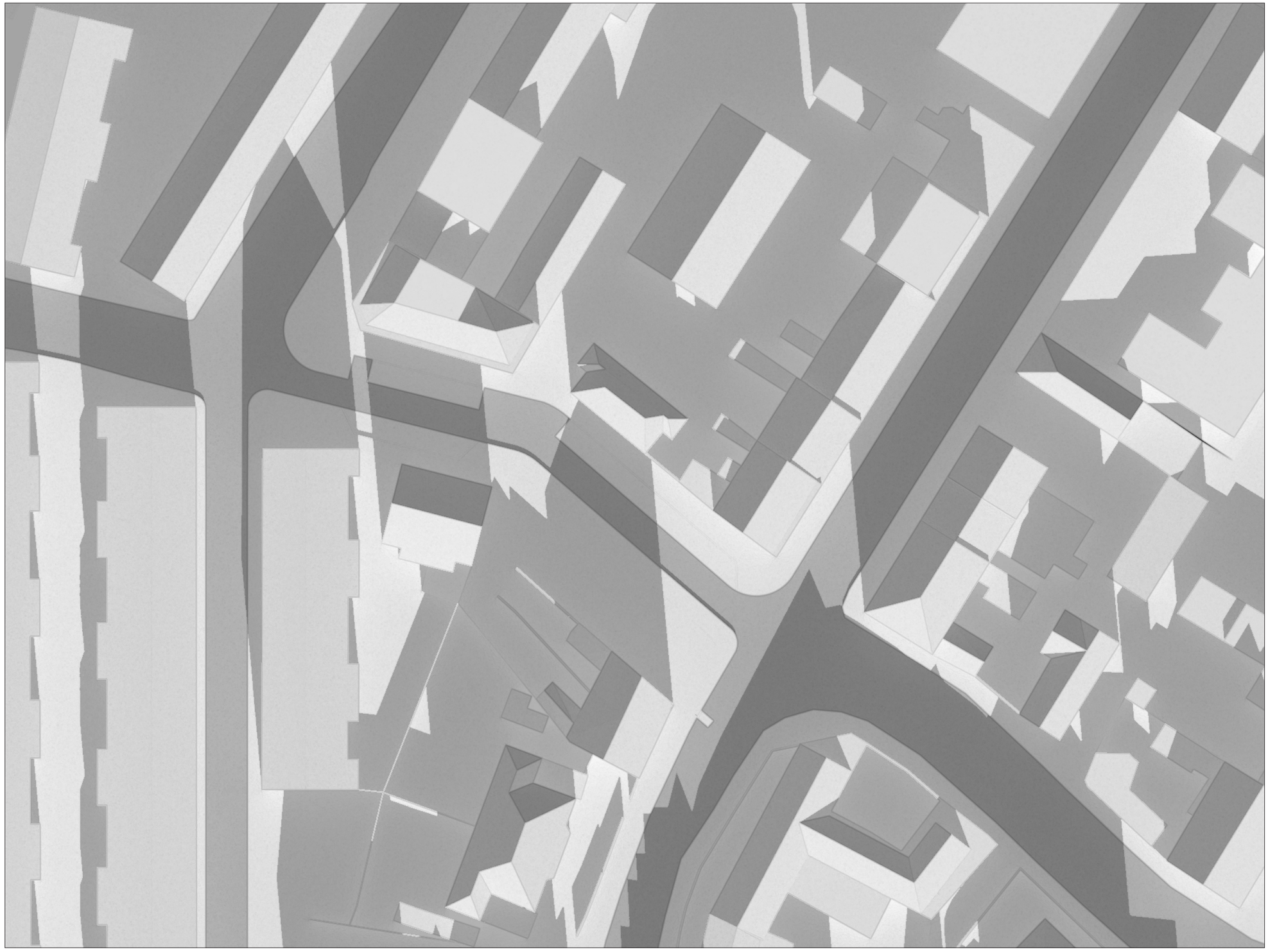

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TIME :
12.00 PM

PROPOSED
DEVELOPMENT

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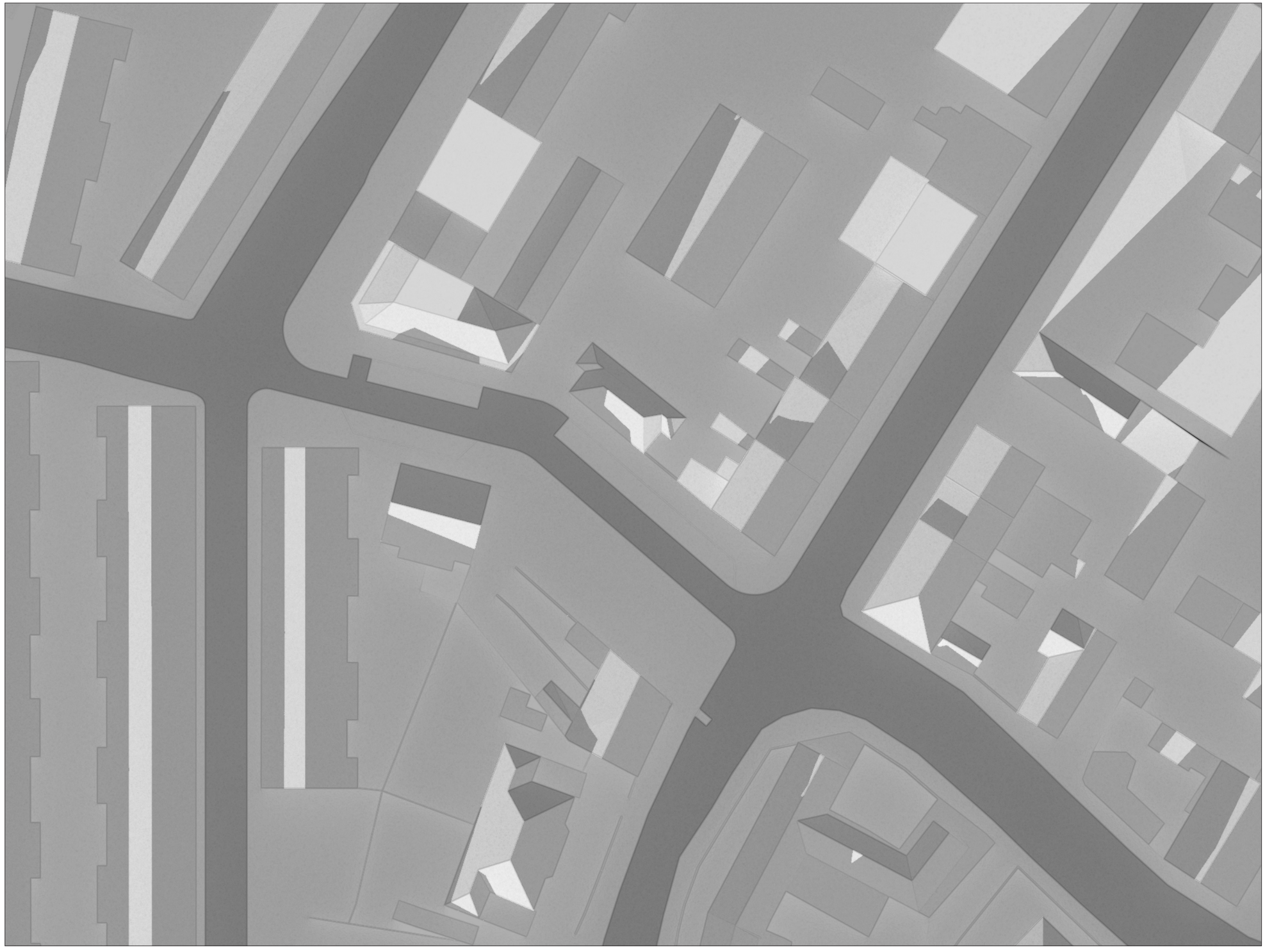

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