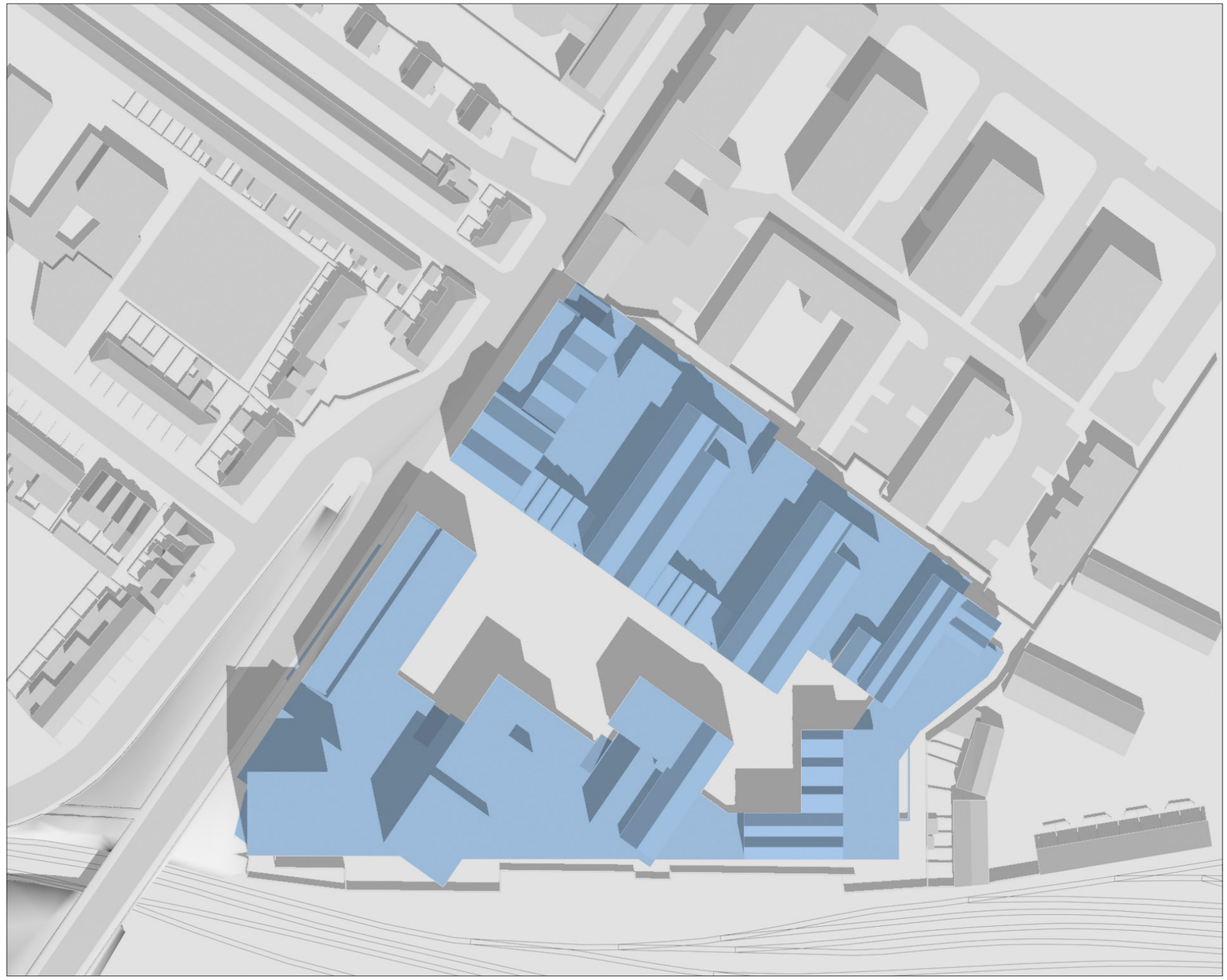

Sunlight and Daylight Access Analysis

of

the Proposed Development

on

Lands at East Road, Dublin 3

June 2019

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1.0 Introduction

ARC Architectural Consultants Ltd has been retained by the Applicant, Glenveagh Properties Limited, to prepare this Sunlight and Daylight Access Analysis of the proposed development on lands at East Road, Dublin 3.

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 large brownfield site to the north of the Dublin Port railway lane. It currently accommodates Hireco Park, which provides services related to articulated trailers, including hire of articulated trailers. The section of East Road opposing the application site and Church Road (which is accessed from East Road) is characterised by two storey terraced buildings largely in residential use. Lands to the north of the application site have been redeveloped with three to six storey commercial, residential and mixed use buildings. The three storey residential development at Teeling Way is located to the north of the application site. Two storey terraced houses at Merchant's Square are located to the east of the application site.

The wider context at the southern end of East Road is characterised by recent dense development of significant scale that has occurred as part of the regeneration of the Dublin Docklands area, including the Convention Centre Dublin at Spencer Dock and the Point Village complex at East Wall Road. With the exception of the new Central Bank development and the now under construction Dublin Landings scheme, much of the Docklands are to the south of the application site remains vacant or underused (e.g. accommodating low density warehousing) pending implementation of the SDZ Planning Scheme. However, it is notable that permission for significant development has recently been granted by Dublin City Council in respect of most of the undeveloped lands at the southern termination of City Blocks 2 and 3. It is also notable that high density development has occurred outside the boundary of the *North Lotts and Grand Canal Dock SDZ Planning Scheme*, including a residential development rising to a height of eleven storeys at the junction of East Road and Sheriff Street Upper.

Given the vacant character of the site and relatively large areas of low density development surrounding the site, the shadow environment of the existing site and of its immediate surroundings is inconsistent with what would normally be expected in the urban core or the industrial docklands area of a city.

1.2 Relevant Characteristics of the Proposed Development

The proposed development will comprise construction of a mixed use development set out in 9 no. blocks, ranging in height from 3 to 15 storeys to accommodate 554 no. apartments, enterprise space, retail units, foodhub/café/exhibition space, residential amenity, crèche and men's shed. The site will accommodate car parking spaces, bicycle parking, storage, services and plant areas. Landscaping will include a new central public space and residential podium courtyards.

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

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.

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."*

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

Given that the application site is now largely vacant, it is envisaged that shadows cast by the proposed development have the potential to result in a considerable change in the existing shadow environment of the surrounding area. Specifically, the proposed development has the potential to result in additional overshadowing of East Road and Church Road to the west during the mornings, Teeling Way to the north at various times of the day and Merchants Square to the east during the afternoons and evenings throughout the year. However, ARC's analysis indicates that the construction of the proposed development is unlikely to result in any undue adverse impacts on buildings and amenity areas on lands surrounding the application site within the meaning of the BRE Guide. ARC's analysis, therefore, indicates that the potential impact of shadows cast by the proposed development on lands to the west, north and east is likely to range from "imperceptible" to "moderate" over the course of the year. Under a

Figure 2.1: Indicative diagram showing location of sample rooms and windows assessed as part of this Sunlight and Daylight Access Analysis

worst-case scenario, the potential impact of shadows cast by the proposed development on East Road, Church Road, Teeling Way and Merchants Square is likely to be consistent with emerging trends for development in the area and is unlikely to result in any undue adverse impacts on sunlight access to existing buildings and amenity areas.

During the winter months, when the sun is low in the sky, shadows cast by the proposed development have the potential to extend some distance to the west, north and east. However, due to the density of the shadow environment at this time of the year, the construction of the proposed development is unlikely to result in a material change to the shadow environment of more distant lands to the north of the site. The potential impact of the proposed development on more distant lands to the west, north and east of the application site is, therefore, likely to range from none to "imperceptible" to "slight" for a short time during the winter months.

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 on 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 quantitative 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 Figure 2.1 above).

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). 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 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;

(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 shadow 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 with a reasonable expectation of sunlight[1] in buildings in residential use to the west, north and east of the site (i.e. low level windows at East Road, Church Road, Teeling Way and Merchants Square). Therefore, ARC identified a representative sample of windows at East Road, Church Road, Teeling Way and Merchants Square for detailed quantitative analysis. This sample is considered to constitute a worst case scenario.

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]

Table 2.1: Predicted impact of the proposed development on sunlight access to sample windows in existing buildings on lands surrounding the application site

Zone	Existing Probable Sunlight Hours Received			Proposed Probable Sunlight Hours Received		
	Annual	Summer*	Winter*	Annual	Summer*	Winter*
Zone a000 Teeling Way Floor 00	34%	30%	4%	34%	30%	4%
	BRE recommendation met: Predicted impact below BRE threshold for adverse impact. ARC's analysis predicts that there will be no change in sunlight access to this window after the construction of the proposed development.					
Zone a002 Teeling Way Floor 02	60%	42%	18%	53%	42%	11%
	BRE recommendation met: Predicted impact below BRE threshold for adverse impact. ARC's analysis predicts that this window will continue to receive a level of sunlight in excess of the BRE recommendation of 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development.					
Zone b000 Teeling Way Floor 00	26%	21%	5%	25%	21%	4%
	BRE recommendation met: Predicted impact below BRE threshold for adverse impact. ARC's analysis predicts that this window will not experience a reduction of greater than 4% of annual probable sunlight hours over the course of the year after the construction of the proposed development.					
Zone b002 Teeling Way Floor 02	33%	24%	9%	33%	24%	9%
	BRE recommendation met: Predicted impact below BRE threshold for adverse impact. ARC's analysis predicts that there will be no change in sunlight access to this window after the construction of the proposed development.					
Zone 21 Church Road Floor 00	68%	47%	21%	51%	33%	18%
	BRE recommendation met: Predicted impact below BRE threshold for adverse impact. ARC's analysis predicts that this window will continue to receive a level of sunlight in excess of the BRE recommendation of 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development.					
Zone 13 Church Road Floor 00	69%	47%	22%	51%	36%	15%
	BRE recommendation met: Predicted impact below BRE threshold for adverse impact. ARC's analysis predicts that this window will continue to receive a level of sunlight in excess of the BRE recommendation of 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development.					

1 The BRE Guide does not identify a need to undertake detailed quantitative assessment of the impact of new development on existing buildings, which do not face within 90° of due south (i.e. such as No. 40 Merchants Square) and does not set out a recommended level of sunlight access for such windows. Given this, the below analysis focuses on windows facing within 90° of due south.

Zone	Existing Probable Sunlight Hours Received			Proposed Probable Sunlight Hours Received		
	Annual	Summer*	Winter*	Annual	Summer*	Winter*
Zone 08 Church Road Floor 00	61%	47%	14%	42%	37%	5%
	BRE recommendation met: Predicted impact below BRE threshold for adverse impact. ARC's analysis predicts that this window will continue to receive a level of sunlight in excess of the BRE recommendation of 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development.					
Zone 06 Church Road Floor 00	68%	47%	21%	48%	37%	11%
	BRE recommendation met: Predicted impact below BRE threshold for adverse impact. ARC's analysis predicts that this window will continue to receive a level of sunlight in excess of the BRE recommendation of 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development.					
Zone 04 Church Road Floor 00	69%	46%	23%	50%	38%	12%
	BRE recommendation met: Predicted impact below BRE threshold for adverse impact. ARC's analysis predicts that this window will continue to receive a level of sunlight in excess of the BRE recommendation of 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development.					
Zone 86 East Road Floor 00	64%	42%	22%	37%	31%	6%
	BRE recommendation met: Predicted impact below BRE threshold for adverse impact. ARC's analysis predicts that this window will continue to receive a level of sunlight in excess of the BRE recommendation of 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development.					
Zone 36 Merchants Square Floor 00	35%	27%	8%	32%	24%	8%
	BRE recommendation met: Predicted impact below BRE threshold for adverse impact. ARC's analysis predicts that this window will continue to receive a level of sunlight in excess of the BRE recommendation of 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development.					

* 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.

ARC's analysis indicates that the impact of the proposed development on sample studied windows with a reasonable expectation of sunlight on lands surrounding the application site is unlikely to be of a level, which would suggest that *"sunlighting of the existing dwelling may be adversely affected"* (i.e. the three criteria set out in the BRE Guide will not be met in the case of the sample windows with a reasonable expectation of sunlight). The impact of shadows cast by the proposed development on the sample studied windows in buildings in proximity to the application site is, therefore, predicted to range from "imperceptible" to "slight".

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

Insofar as amenity spaces / gardens are concerned, 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 21 March notwithstanding the construction of a proposed development, loss of sunlight as a result of additional overshadowing is not likely to be noticed.

There are few existing amenity spaces (e.g. rear gardens or communal open spaces serving residential development) sufficiently close to the application site that the potential for impacts due to overshadowing might arise. For the purposes of this analysis, ARC identified the communal open space associated with Teeling Way to the north of the application site and two rear gardens at Merchants Square adjoining the eastern boundary of the site as sample zones for detailed quantitative analysis.

Table 2.2 sets out the likely proportion of these gardens/amenity areas in sunlight before and after the construction of the proposed development throughout the day on 21st March. As set out in Table 2.2, ARC's analysis indicates that the proposed development will result in little or no additional overshadowing of the gardens and amenity areas on lands in the vicinity of the application site on 21st March.

Table 2.2: Impact of the proposed development on sunlight access to sample neighbouring gardens and amenity areas

Time	Teeling Way Communal Area Percentage hours in sunlight		36 Merchant Square Rear Garden Percentage hours in sunlight		40 Merchant Square Rear Garden Percentage hours in sunlight	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
10:00	2%	2%	0%	0%	0%	0%
10:30	20%	20%	7%	7%	0%	0%
11:00	38%	36%	9%	9%	3%	3%
11:30	47%	36%	12%	12%	10%	10%
12:00	66%	64%	19%	19%	30%	30%
12:30	70%	67%	21%	21%	32%	32%
13:00	82%	76%	25%	25%	30%	30%
13:30	87%	81%	26%	26%	28%	28%
14:00	83%	57%	10%	10%	19%	19%
14:30	83%	27%	13%	13%	19%	19%
15:00	73%	0%	1%	1%	6%	6%
15:30	64%	0%	0%	0%	0%	0%
16:00	57%	9%	0%	0%	0%	0%
16:30	36%	6%	0%	0%	0%	0%
17:00	17%	0%	0%	0%	0%	0%

As illustrated above, ARC's analysis indicates that the impact of the proposed development on the amenity area serving the Teeling Way development to the north of the northern boundary of the site and the sample gardens at Merchants Square to the east of the application site is unlikely to be of a level, which would suggest that sunlighting of the existing amenity area may be adversely affected within the meaning of the BRE Guide.

Specifically, while the proposed development is predicted to overshadow the amenity area at Teeling Way during the afternoons of 21st March, the amenity area will continue to receive at least two hours of sunshine over half its area after the construction of the proposed development. Having regard to the pattern of development of lands to the north of the application site and the wider pattern of development within the Dublin Docklands area, ARC's analysis indicates that the impact of shadows cast by the proposed development on lands to the north is likely to be consistent with emerging trends for development in the area and, therefore, "moderate" in extent during the spring and autumn months. It should be noted that shadows cast by the proposed development are likely to result in only "imperceptible" impacts on the Teeling Way amenity space during the summer months, when the space is most likely to be used.

To the east, the proposed development is not predicted to result in any change to the shadow environment of the sample rear gardens at Merchants Square 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

The impact of the proposed development on daylight access within existing buildings is likely to be most significant in the case of existing buildings at close proximity with windows directly opposing the application site. Specifically, development on the application site is likely to result in a reduction in daylight access to rooms in buildings opposing the application site at Church Road, East Road, Teeling Way and Merchants Square, as would be expected where the major redevelopment of a largely vacant, brownfield site takes place. The impact of the proposed development on daylight access to existing residences in proximity to the application site is predicted to range from "imperceptible" to "slight" to "moderate".

Having regard to the pattern of development in the area and to statutory planning policy for densification for the urban area, under a worst case scenario, the impact of the proposed development on existing buildings in proximity to the application site is likely to considered to be consistent with an emerging pattern of medium to high density development in the area and, therefore, "moderate" in extent.

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 Figure 2.1 above). However, by way of example in order to illustrate briefly the findings outlined in the overview section, ARC conducted quantitative 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 Figure 2.1 above).

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). 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 shadow environment, ARC considered two factors:

(i) ***the use of receptors (i.e. buildings) surrounding the application site***: buildings in residential use (and, particularly, habitable rooms within residences) would be considered to be sensitive to changes in the shadow environment;

(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 (i.e. low level rooms East Road, Church Road, Teeling Way and Merchants Square). Therefore, ARC identified a representative sample of rooms and windows at East Road, Church Road, Teeling Way and Merchants Square for detailed quantitative analysis. This sample is considered to constitute a worst case scenario.

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 in two different ways as described in Sections 3.2.1 and 3.2.2 below. The results of ARC's analysis are presented in Table 3.1, with commentary on the results of the analysis set out in Section 3.2.3.

3.2.1 Vertical Sky Component

ARC measured Vertical Sky Component to sample windows in existing buildings (i) before the construction of the proposed development; and (ii) after the construction of the proposed development. The impact of the proposed development on daylight access within existing and permitted buildings was measured with regard to Vertical Sky Component having regard to the BRE Guide, which states as follows: *"In assessing the loss of light to an existing building, the VSC is generally recommended as the appropriate parameter to use."*

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..."*

Adherence to the recommendations of the BRE Guide with regard to achieving a Vertical Sky Component of 27% has been shown to lead to densities of development, which would be very considerably too low to be sustainable and would be inconsistent with the local, regional and national statutory planning policy. The BRE Guide acknowledges this. At Appendix F: Setting Alternative Target Values for Skylight and Sunlight Access, it states: *"Sections 2.1, 2.2 and 2.3 give numerical target values in assessing how much light from the sky is blocked by obstructing buildings. These values are purely advisory and different targets may be used based on the special requirements of the proposed development or its location... Whatever the targets chosen for a particular development, it is important that they should be self-consistent. Table F1 can be used to ensure this."* In order to determine what would be an appropriate target value for skylight in the urban context of East Road, ARC had regard to statutory planning policy.

The Urban Development and Building Heights Guidelines for Planning Authorities (December 2018) provide that : "these guidelines require that the scope to consider general building heights of at least three to four storeys, coupled with appropriate density, in locations outside what would be defined as city and town centre areas, and which would include suburban areas, must be supported in principle at development plan and development management levels". These Guidelines go on to suggest that "it would be appropriate to support the consideration of building heights of at least 6 storeys at street level" in city centre areas. The Design Manual for Urban Roads and Streets (DMURS) recommends a strong sense of enclosure in large centres (i.e. a building height to street width ratio of between 1:1 and 1:2). A 12.5 m wide distance (e.g. 3 m wide footpath + 3.25 m lane + 3.25 m lane + 3 m wide footpath) between opposing four storey residential blocks (approximate height of 12 m) would represent an approximate building height to street width ratio of 1:1. Therefore, given that the Urban Development and Building Height Guidelines would seem to suggest building heights of at least four to six storeys for areas like East Road and having regard to the recommendations of DMURS with regard to achieving a sense of enclosure, it was considered appropriate for the purposes of this assessment to determine an alternative target value on the basis of a building height to street width ratio of 1:1. Table F1 of the BRE Guide suggests that a building height to street width ratio of 1:1 corresponds to a Vertical Sky Component of 16%.

The results of ARC's analysis are set out in Table 3.1 below, together with a short comment on each result.

3.2.2 Average Daylight Factor

While BRE Guide discusses the use of Vertical Sky Component in assessing impact on daylight access, it is notable that, while the relevant British Standard, BS 8206-2:2008: Lighting for buildings - Part 2: Code of practice for daylighting makes reference to the fact that the BRE Guide recommends the use of Vertical Sky Component in assessment of the impact on existing buildings, the British Standard stops short of making the same recommendation. To the contrary, the British Standard states: *"The vertical sky component is* ***one of the factors*** *on which the average daylight factor in an existing interior depends."* (Emphasis added.)

Vertical Sky Component refers to the amount of light from the sky falling directly at a particular point on a vertical surface such as a window or wall. Average Daylight Factor takes into account daylight coming from the sky, externally reflected light and internally reflected light. Given this, it is considered that Average Daylight Factor provides a more comprehensive picture of daylight access within existing buildings and the extent to which new development will change the daylight environment within those existing buildings.

BS 8206-2:2008: Lighting for buildings - Part 2: Code of practice for daylighting states as follows at Section 5.5: Average daylight factor:

> *"The average daylight factor is used as the measure of general illumination from skylight. It is considered good practice to ensure that rooms in dwellings and in most other buildings have a predominantly daylit appearance. In order to achieve this the average daylight factor should be at least 2%."*

In terms of assessing the impact of development on daylight access in an existing room, the British Standard suggests that, where a room has an ADF of 5%, a reduction in daylight access of between 15% and 8% is likely to be noticed - the room *"would be likely to appear more gloomy, and electric lighting would be needed for more of the time"*. In other words, where daylight access is reduced to between 0.85 times and 0.92 times its former value, the occupant of that residence is likely to notice the change. What this is saying is that, in some cases (the details of which are not explained in the British Standard), a reduction in ADF to anything less than 0.92 times the former light levels will be noticeable. In other cases (again not explained), light levels will have to fall to 0.85 times their former value before the change is noticed. Therefore, in all cases where a room has an ADF of 5%, anything greater than a 15% drop in daylight levels (or a drop to 0.85 times its former value) will be noticed. A general rule of thumb is that if daylight access was reduced by one fifth (or a drop to 0.8 times its former value), the occupants will be likely to notice.

For the purpose of this analysis, assumptions were made as to the use of the studied rooms within existing buildings, the size and layout of the interior of the rooms, the colour schemes used in the decoration of the walls, floor and ceiling of the room and the type of glazing used in the window opes. As such, the rooms in existing buildings adjoining the application site analysed as part of this analysis must be considered to be notional. While it was necessary, in undertaking the analysis, to make assumptions regarding the parameters of chosen sample rooms, comparative analysis of daylight access within assumed rooms is instructive as to the likely extent of change in the daylight environment in existing buildings in proximity to the application site.

3.2.3 Summary Findings

As set out in Table 3.1 on the following page, ARC's analysis indicated that:

- All sample studied windows neighbouring residences will continue to achieve in excess of the alternative target value of 16% Vertical Sky Component after the construction of the proposed development. Where sample zones were found to receive a VSC of less than 16% at present (e.g. Zones b000 and b002 at Teeling Way and the zones studied at Nos. 36 and 40 Merchants Square), ARC's analysis indicated that the impact of the proposed development to these windows would not fall within adverse ranges (i.e. the Vertical Sky Component of studied windows is not predicted to fall to less than 0.8 times its former value).
- The proposed development will have little or no impact on Average Daylight Factor in notional sample studied rooms. The proposed development is not predicted to reduce the Average Daylight Factor in any notional sample studied room below 0.8 times its former value. Where the impact of the proposed development is likely to fall within noticeable ranges, the proposed development is not predicted to affect the sensitivities of the daylight environment within the studied room.

Given this, ARC's analysis indicates that, under a worst case scenario, the impact of the proposed development on daylight access to the sample zones at East Road, Church Road, Teeling Way and Merchants Square is predicted to be consistent with emerging trends for development or "moderate" in extent.

Table 3.1: Predicted impact of the proposed development on daylight access to sample rooms in buildings in proximity to the application site

Sample Room	Vertical Sky Component			Average Daylight Factor		
	Existing Vertical Sky Component	Proposed Vertical Sky Component	Comment	Existing Average Daylight Factor	Proposed Average Daylight Factor	Change
Zone a000 Teeling Way Floor 00	20.70%	20.60%	Vertical Sky Component is predicted to remain above 16% after the construction of the proposed development.	2.60%	2.44%	Average Daylight Factor is predicted to decrease to 0.94 times its former value.
Zone a002 Teeling Way Floor 02	32.40%	29.10%	Vertical Sky Component is predicted to remain above 16% after the construction of the proposed development.	0.96%	0.96%	No change.
Zone b000 Teeling Way Floor 00	10.00%	9.10%	Vertical Sky Component is predicted to decrease to 0.91 times its former value (i.e. not less than 0.8 times its former value) and so the impact of the proposed development is below the threshold for adverse impact.	2.44%	2.44%	No change.
Zone b002 Teeling Way Floor 02	14.20%	13.00%	Vertical Sky Component is predicted to decrease to 0.92 times its former value (i.e. not less than 0.8 times its former value) and so the impact of the proposed development is below the threshold for adverse impact.	2.52%	2.50%	Daylight levels are predicted to decrease to 0.99 times their former value.
Zone 21 Church Road Floor 00	32.20%	24.80%	Vertical Sky Component is predicted to remain above 16% after the construction of the proposed development.	3.63%	3.22%	Daylight levels are predicted to decrease to 0.89 times their former value.
Zone 13 Church Road Floor 00	34.70%	24.10%	Vertical Sky Component is predicted to remain above 16% after the construction of the proposed development.	3.86%	3.50%	Average Daylight Factor is predicted to decrease to 0.91 times its former value.
Zone 08 Church Road Floor 00	35.20%	23.40%	Vertical Sky Component is predicted to remain above 16% after the construction of the proposed development.	3.92%	3.33%	Average Daylight Factor is predicted to decrease to 0.85 times its former value.
Zone 06 Church Road Floor 00	37.10%	25.00%	Vertical Sky Component is predicted to remain above 16% after the construction of the proposed development.	2.30%	1.91%	Average Daylight Factor is predicted to decrease to 0.83 times its former value.
Zone 04 Church Road Floor 00	36.20%	24.60%	Vertical Sky Component is predicted to remain above 16% after the construction of the proposed development.	2.30%	1.98%	Average Daylight Factor is predicted to decrease to 0.86 times its former value.
Zone 86 East Road Floor 00	35.50%	19.00%	Vertical Sky Component is predicted to remain above 16% after the construction of the proposed development.	2.66%	2.19%	Average Daylight Factor is predicted to decrease to 0.82 times its former value.
Zone 40 Merchants Square Floor 00	25.30%	19.30%	Vertical Sky Component is predicted to remain above 16% after the construction of the proposed development.	4.48%	4.00%	Average Daylight Factor is predicted to decrease to 0.89 times its former value.
Zone 36 Merchants Square Floor 00	24.20%	21.10%	Vertical Sky Component is predicted to remain above 16% after the construction of the proposed development.	3.65%	3.47%	Average Daylight Factor is predicted to decrease to 0.95 times its former value.

4.0 Assessment of Daylight Access within the Proposed Development

BS 8206-2:2008: Lighting for buildings - Part 2: Code of practice for daylighting states as follows at Section 5.5: Average daylight factor:

> *"The average daylight factor is used as the measure of general illumination from skylight. It is considered good practice to ensure that rooms in dwellings and in most other buildings have a predominantly daylit appearance. In order to achieve this the average daylight factor should be at least 2%."*

The British Standard goes on to recommend a minimum of 1% Average Daylight Factor for bedrooms; 1.5% Average Daylight Factor for living rooms and 2% Average Daylight Factor for kitchens. These minimum recommendations are also set out at Section 2.1.8 of the BRE Guide.

As part of this *Sunlight and Daylight Access Analysis,* ARC undertook an assessment of the likely daylight access within the proposed residential units. A representative sample of rooms within the proposed development was studied at the lowest level of accommodation given that daylight access to lower levels will be the most obstructed in terms of daylight access so issues in respect of daylight access are most likely to occur at the lowest levels of accommodation. An emphasis was placed on analysis of rooms likely to receive lower levels of daylight (e.g. rooms with the potential to receive lower levels of daylight access due to their location within the proposed development and/or due to their layout and fenestration).

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 Figure 4.1 above. For more detail on the methodology used in assessing daylight access, please refer to the Technical Appendix of this Report. The results of ARC's analysis of likely daylight access within the proposed development are set out in Table 4.1 below:

Figure 4.1: Indicative diagram showing location of sample rooms and amenity areas assessed as part of this Sunlight and Daylight Access Analysis

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

Location	Floor	Room Type	Predicted Average Daylight Factor
Block A1 Z1	Floor 01	Living / kitchen / dining room	4.35%
Block A1 Z2	Floor 01	Living / kitchen / dining room	3.20%
Block A1 Z3	Floor 01	Living / kitchen / dining room	1.55%
Block A1 Z4	Floor 01	Living / kitchen / dining room	4.19%
Block A2 Z1	Floor 01	Bedroom	3.29%
Block A2 Z2	Floor 01	Living / kitchen / dining room	2.76%
Block A2 Z3	Floor 01	Living / kitchen / dining room	4.30%
Block A3 Z1	Floor 01	Bedroom	3.65%
Block A3 Z2	Floor 01	Living / kitchen / dining room	1.70%
Block B1 Z1	Floor 01	Living / kitchen / dining room	1.66%
Block B2 Z1	Floor 01	Living / kitchen / dining room	1.71%
Block B2 Z2	Floor 01	Living / kitchen / dining room	3.22%
Block C1 Z1	Floor 01	Living / kitchen / dining room	3.02%
Block C1 Z2	Floor 01	Living / kitchen / dining room	4.75%
Block C2 Z1	Floor 01	Living / kitchen / dining room	1.79%
Block C2 Z2	Floor 01	Living / kitchen / dining room	1.54%
Block D1 Z1	Floor 01	Living / kitchen / dining room	1.93%
Block D1 Z2	Floor 01	Living / kitchen / dining room	1.85%
Block D1 Z3	Floor 01	Living / kitchen / dining room	2.66%
Block D2 Z1	Floor 01	Living / kitchen / dining room	4.40%
Block D2 Z2	Floor 01	Living / kitchen / dining room	1.58%

The British Standard outlines a number of recommendations for daylight access within proposed development (1% Average Daylight Factor for bedrooms; 1.5% Average Daylight Factor for living rooms; 2% Average Daylight Factor for kitchens), although the British Standard recommends caution in applying the recommendations contained therein as part of the planning process. It states: *"The aim of the standard is to give guidance to architects, engineers, builders and others who carry out lighting design. It is recognized that lighting is only one of many matters that influence fenestration. These include other aspects of environmental performance (such as noise, thermal equilibrium and the control of energy use) fire hazards, constructional requirements, the external appearance and the surroundings of the site. The best design for a building does not necessarily incorporate the ideal solution for any individual function. For this reason, careful judgement needs to be exercised when using the criteria given in the standard for other purposes, particularly town planning control."* [Emphasis added.]

For the purpose of this report, ARC made reference to the British Standard recommendation of 1% Average Daylight Factor for bedrooms when assessing proposed bedrooms and to the British Standard recommendation of 1.5% Average Daylight Factor for living rooms when assessing proposed living / kitchen / dining rooms[2]. ARC's analysis indicates that all sample habitable rooms within the proposed development are likely to achieve Average Daylight Factors considerably in excess of the relevant minimum levels recommended by the British Standard (1% Average Daylight Factor for bedrooms; 1.5% Average Daylight Factor for living rooms).

5.0 Assessment of Sunlight Access within Residential Communal Open Spaces proposed as part of the Proposed Development

Appendix 1 of the *Sustainable Urban Housing: Design Standards for New Apartments Guidelines for Planning Authorities* sets out the requirements for quantum of communal amenity space associated with developments of new apartments. The Apartment Guidelines do not prescribe requirements on the issue of sunlight access to proposed open spaces and does require that planning authorities have regard to quantitative performance approaches to sunlight provision in amenity spaces set out in the Building Research Establishment's *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide). However, notwithstanding this, ARC referenced Section 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 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 at the equinox.

The subject application proposes a split level public open space and 4 no. communal spaces available to the residents of the proposed development (i.e. Areas 1, 2, 3 and 5 as indicated at Figure 4.1). Having regard to Section 3 of the BRE Guide, ARC undertook detailed quantitative analysis of the proportion of the amenity spaces in sunlight on 21st March and the results of this analysis are set out in Table 4.1. In the interests of completeness, Table 5.1 also shows the proportion of the communal open spaces in sunlight on 21st June.

As set out in Table 5.1 below, it is unlikely that more than half of Areas 1, 2 and 3 will receive sunlight for at least two hours on the 21st March. Achieving a level of sunlight access to all proposed communal open spaces within a medium to high density development in an urban location presents challenges. While courtyards would seem to present an ideal solution in terms of providing essential passive surveillance and a sense of enclosure, at Irish latitudes, an open space surrounded on all sides by structures can be overshadowed over much of its area for much of the year. Every effort has been made by the design team to ensure that communal open spaces receive good sunlight insofar as is possible. For example, Section 3.3.6 of the BRE Guide states *"Poor sunlighting of outdoor spaces only occurs with certain forms of layout. If a long face of a building faces close to due north then there will be an area adjoining the building which is permanently in shade at the equinox (and hence all winter). Areas slightly further from such a building face will only receive sunlight for a limited time at the beginning or end of the day. Areas of this sort also occur if buildings form an enclosed or partly enclosed space which is blocked off from the southern half of the sky... It is often possible to redesign the layout so as to minimise these areas, either by reorienting buildings or by opening up gaps to the south in courtyards."* Given this, considerable testing of a variety of layout options was carried out over the course of the design stage to determine the best approach for sunlight access to the proposed communal open spaces between blocks. In addition to this, the southern end of Areas 1, 2, 3 and also Area 5 to the south has been opened up and the height of any structures at the southern ends of these spaces limited to maximise sunlight access. This has ensured that Area 5 will receive a level of sunlight access in excess of that recommended by the BRE Guide for amenity spaces. All communal residential open spaces (i.e. Areas 1, 2, 3 and 5) will receive some for most of the day on the 21st March. It is also noted that all communal open spaces will receive sunlight over a large proportion (i.e. more than 50%) of their respective areas for a considerable period of time on 21st June, the summer months being the time when open spaces are most likely to be used.

2 The British Standard states *"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%."* However, given that the kitchen area in most of the studied apartments appears to be intended to be functionally separate to the living area (i.e. is shown as surrounded by cabinets on three sides on the plans of the many of the apartments; is shown on to the rear of deep plan single aspect rooms), it was considered to assess the sample studied rooms against the recommendation of 1.5% Average Daylight Factor for living rooms. However, please note that, notwithstanding whether kitchens are intended to be functionally separate, the full area of combined living / kitchen / dining rooms was analysed for the purposes of Table 3.1. Sample studied rooms were analysed as empty rooms (i.e. excluding any furniture or partitions).

Table 5.1: Approximate proportion of proposed open spaces within the application site in sunshine on 21st March*

Time	Area 1	Area 2	Area 3	Public Open Space	Area 5
21st March - Percentage of each area in sunlight					
10:00	9%	4%	10%	37%	28%
10:30	14%	4%	12%	36%	31%
11:00	5%	0%	11%	38%	38%
11:30	2%	0%	14%	45%	43%
12:00	9%	5%	25%	59%	56%
12:30	20%	11%	30%	61%	64%
13:00	32%	20%	37%	66%	76%
13:30	41%	30%	43%	69%	82%
14:00	52%	41%	52%	64%	71%
14:30	61%	51%	64%	61%	55%
15:00	43%	32%	51%	45%	42%
15:30	14%	17%	4%	25%	21%
16:00	10%	14%	1%	17%	13%
16:30	0%	2%	0%	12%	11%
17:00	0%	0%	0%	6%	8%
21st June - Percentage of each area in sunlight					
10:00	31%	21%	21%	63%	19%
10:30	44%	25%	25%	72%	27%
11:00	56%	38%	38%	75%	39%
11:30	60%	37%	37%	75%	46%
12:00	57%	37%	37%	75%	60%
12:30	65%	49%	49%	81%	79%
13:00	71%	63%	63%	80%	83%
13:30	76%	73%	73%	83%	75%
14:00	73%	79%	79%	84%	58%
14:30	67%	73%	73%	74%	21%
15:00	57%	57%	57%	61%	14%
15:30	33%	37%	37%	48%	8%
16:00	27%	29%	29%	48%	8%
16:30	15%	14%	14%	37%	5%
17:00	4%	4%	4%	26%	2%

* Please note that the public open space is taken as rough areas and do not include landscaping or boundary treatments (such as boundary walls).

ARC's analysis indicates that the proposed public open space included as part of the proposed development is likely to be able to receive a level of sunlight access in excess of that recommended by the BRE Guide on 21st March. The proposed communal open space will, therefore, appear adequately sunlit throughout the year within the meaning of the BRE Guide. More than this, the proposed communal open space will receive some sunlight access throughout the day and throughout the year, including at mid winter. Therefore, in simple terms, ARC's analysis indicated that there will always be somewhere within the proposed development where residents can go to sit and enjoy the sunshine on a sunny day.

Technical Appendix

Explanatory Note

To date, it is understood that no standards or guidance documents (statutory or otherwise) on the subject of sunlight access to buildings or open spaces or daylight access to buildings have been prepared or published in Ireland. In the absence of guidance on the matter of sunlight and daylight access tailored to Irish climatic conditions, Irish practitioners tend to refer to the relevant *British Standard, BS 8206-2:2008: Lighting for buildings - Part 2: Code of practice for daylighting*. The standards for daylight and sunlight access in buildings (and the methodologies for assessment of same) suggested in the British Standard have been referenced in this Sunlight and Daylight Access Analysis.

The *Dublin City Development Plan 2016-2022* states as follows in relation to residential development: *"Development shall be guided by the principles of Site Layout Planning for Daylight and Sunlight, A guide to good practice (Building Research Establishment Report, 2011)."* While the subject application does not propose residential development, the contents of 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 have also been considered in the preparation of the report in the interests of completeness.

Neither the British Standard nor the BRE Guide set out rigid standards or limits. The BRE Guide 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.]

That the recommendations of the BRE Guide are not suitable for rigid application to all developments in all contexts is of particular importance in the context of national and local policies for the consolidation and densification of urban areas or when assessing applications for highly constrained sites (e.g. lands in close proximity or immediately to the south of residential lands).

The purpose of this report is to provide a general indication of daylight performance and sunlight access before and after the construction of 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. 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.

Sunlight Access to Buildings and Open Spaces

Context under Technical and Guidance Documents

The relevant *British Standard, BS 8206-2:2008: Lighting for buildings - Part 2: Code of practice for daylighting*, recommends, at Section 5.3: Sunlight Duration, the following test for the assessment of sunlight access to residential accommodation: *"Interiors in which the occupants have a reasonable expectation of direct sunlight should receive at least 25% of probable sunlight hours... At least 5% of probable sunlight hours should be received during the winter months, between 21 September and 21 March. Sunlight is taken to enter an interior when it reaches one or more window reference points." "Probable sunlight hours"* is described by the British Standard as meaning the *"long-term average of the total number of hours during the year in which direct sunlight reaches the unobstructed ground."* Using data available from Met Eireann, the Irish Meteorological Service, ARC has determined that where a window is capable of receiving three hours of sunlight at the equinox, the tests set out in the British Standard will usually be met.

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 at the equinox. 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 and three dimensional models supplied by the Design Team; and with reference to Dublin City Council's online planning register, on-site, satellite and aerial photography. 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.

In determining whether or not to include existing and proposed substantial trees in the three dimensional model, ARC made reference to the BRE Guide (as updated in 2011), which states 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, ARC did not show the shadows cast by trees on the shadow study diagrams.

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 and existing buildings to be retained on the application site are 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 (i.e. Dublin) 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 impacts on sunlight access had regard to the *Guidelines on the Information to be Contained in Environmental Impact Statements* prepared by the Environmental Protection Agency (2002), and to Directive 2011/92/EU (as amended) on the assessment of the likely effects of certain public and private projects on the environment.

The list of definitions given below is taken from *Section 5: Glossary of Impacts* contained in the *Guidelines on the Information to be Contained in Environmental Impact Statements* prepared by the Environmental Protection Agency. Some comment is also given below on what these definitions might imply in the case of impact on sunlight access. The definitions from the EPA document are in italics.

Imperceptible Impact: *An impact capable of measurement but without noticeable consequences.* The definition implies that the development would cause a change in the sunlight received at a location, capable of measurement, but not noticeable. If the development caused no change in sunlight access, there could be no impact.

Slight Impact: *An impact 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.

Moderate Impact: *An impact that alters the character of the environment in a manner that is consistent with emerging 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 taking place. This impact would occur where other developments were bringing about changes in sunlight access in the area.

Significant Impact: *An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.* This impact would occur where the development overshadows a location to the effect that there is a significant change in the amount of direct sunlight received at that location.

Profound Impact: *An impact which obliterates sensitive characteristics.* In terms of sunlight access, a development must cast shadows over a location, where sunlight access was previously enjoyed, to the extent that all access to sunlight is removed.

The range of possible impacts listed above deal largely with the extent of impact; and the extent of the impact of a development is usually proportional to the extent to which that development is large in scale and/or height and its proximity to the location. This proportionality may be modified by the extent to which the development is seen as culturally or socially acceptable, and on the interaction between the proposed development, the character of the existing shadow environment and the land use pattern of the receiving environment.

Daylight Access to Buildings

Context under Technical and Guidance Documents

BS 8206-2:2008: Lighting for buildings - Part 2: Code of practice for daylighting states as follows at Section 8.2.1: Loss of Daylight to Existing Buildings:

> *"The BRE Report sets out two guidelines regarding the vertical sky component.*
>
> *a) If the vertical sky component at the centre of the existing window would exceed 27% with the new development in place, then enough skylight would still be reaching the existing window.*
>
> *b) If the vertical sky component with the new development in place would be both less than 27% and less than 0.8 times its former value, then the area lit by the window would be likely to appear more gloomy, and electric lighting would be needed for more of the time."*

BS 8206-2:2008: Lighting for buildings - Part 2: Code of practice for daylighting states as follows at Section 5.5: Average daylight factor:

> *"The average daylight factor is used as the measure of general illumination from skylight. It is considered good practice to ensure that rooms in dwellings and in most other buildings have a predominantly daylit appearance. In order to achieve this the average daylight factor should be at least 2%.*
>
> *If the average daylight factor in a space is at least 5% then electric lighting is not normally needed during the daytime, provided the uniformity is satisfactory … If the average daylight factor in a space is between 2% and 5% supplementary electric lighting is usually required."*

The British Standard goes on to recommend a minimum of 1% Average Daylight Factor for bedrooms; 1.5% Average Daylight Factor for living rooms and 2% Average Daylight Factor for kitchens.

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; and with reference to Dublin City Council's online planning register, on-site, satellite and aerial photography. In assessing the impact of the proposed development on existing buildings, assumptions were made as to the use of the existing rooms, the size and layout of the interior of the rooms (informed, where possible, by drawings available on the Dublin City Council online planning register), the colour schemes (e.g. materials, reflectances, etc) used in the decoration of the walls, floor and ceiling of the room and the type of glazing used in the window opes. In all cases, rooms are assessed as excluding furniture and window treatments (e.g. curtains, blinds). Assumptions are also made as to the materials and reflectances of external surfaces.

Daylight levels were assessed on the working plane (i.e., at work top level). The results of the analysis describe daylight access in terms of Average Daylight Factor (ADF), which expresses average daylight illuminance as a percentage of unobstructed outdoor illuminance. The factors considered in calculating Average Daylight Factor on the working plane include the light coming from the sky (i.e., the sky component), the light reflected from surfaces outside the room directly to the point being considered (i.e., the externally reflected component) and the light reflected from surfaces inside the room (i.e., the internally reflected component).

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.

Definition of Impacts on Daylight Access

The assessment of impacts on daylight access had regard to the *Guidelines on the Information to be Contained in Environmental Impact Statements* prepared by the Environmental Protection Agency (2002), and to Directive 2011/92/EU (as amended) on the assessment of the likely effects of certain public and private projects on the environment.

The list of definitions given below is taken from *Section 5: Glossary of Impacts* contained in the *Guidelines on the Information to be Contained in Environmental Impact Statements* prepared by the Environmental Protection Agency. Some comment is also given below on what these definitions might imply in the case of impact on daylight access. The definitions from the EPA document are in italics.

Imperceptible Impact: *An impact capable of measurement but without noticeable consequences.* The definition implies that the development would cause a change in the daylight received at a location, capable of measurement, but not noticeable. If the development caused no reduction in daylight access, there could be no impact.

Slight Impact: *An impact 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 development to an extent that is both capable of measurement and is noticeable. Published guidance on daylight access suggests that a reduction in the amount of daylight received in a room only becomes noticeable if the average daylight factor in the room is reduced by one fifth.

Moderate Impact: *An impact that alters the character of the environment in a manner that is consistent with emerging trends.* This would occur where there is a noticeable reduction in daylight received in a room and where this reduction is ongoing because of development already taking place in the area.

Significant Impact: *An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.* In terms of daylight access, a development, to have a significant impact, must result in a diminution of daylight access to the extent that minimum standards for daylighting are not met and artificial lighting is required for part of the day.

Profound Impact: *An impact which obliterates sensitive characteristics.* A profound impact would occur where a development would result in daylight received in a room falling well below the minimum standard for average daylight factor and where artificial lighting would be required in that room as the principal source of lighting all the time.

OSI Licence No.AR 0087019

N

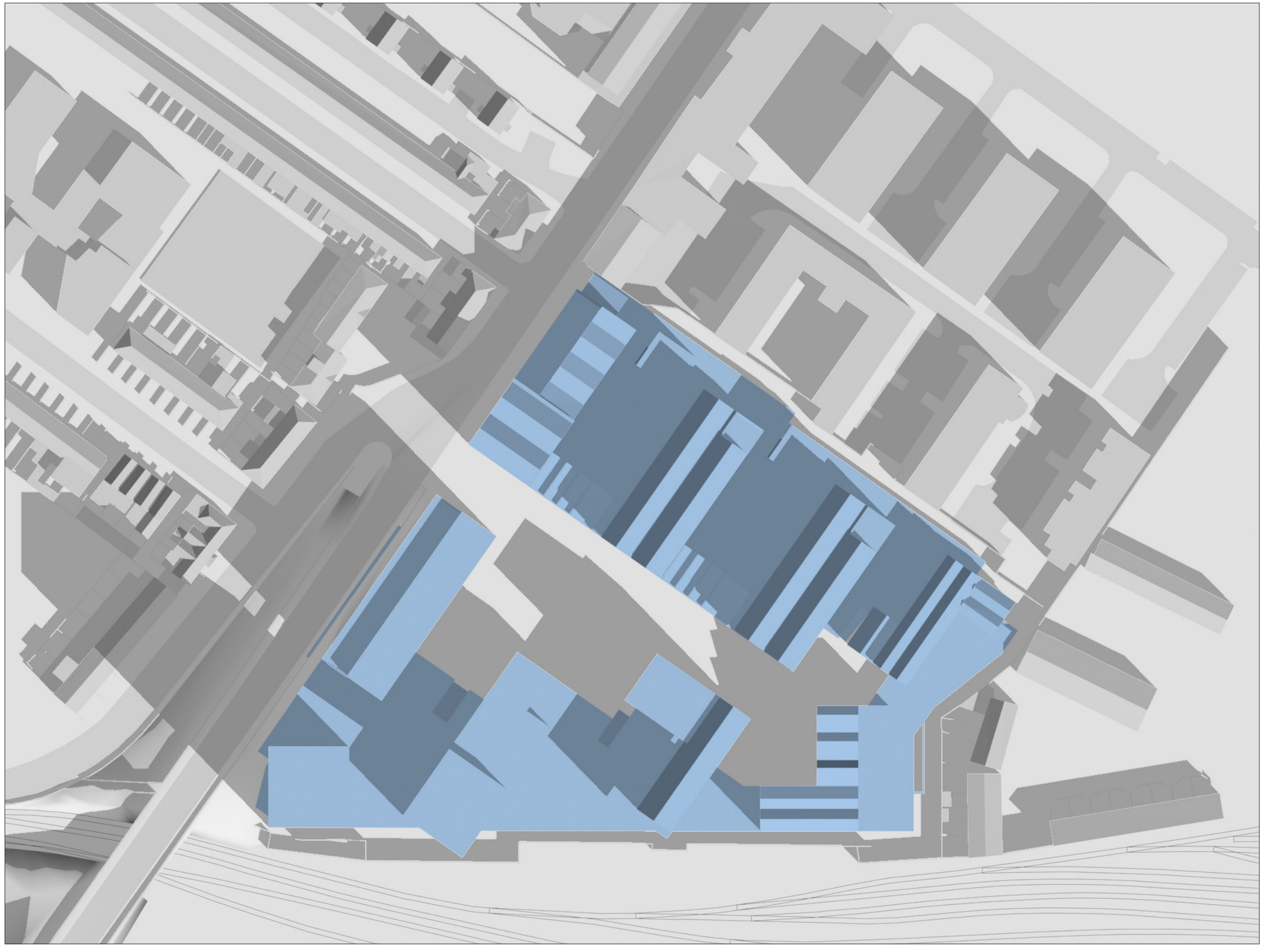
SHADOW STUDY
LANDS AT EAST ROAD, DUBLIN 3
JUNE 2019

DATE : MARCH 21ST - EQUINOX
SUNRISE : 6.26 AM
SUNSET : 6.39 PM

TIME :
10.00 AM

PROPOSED
DEVELOPMENT

OSI Licence No.AR 0087019



N

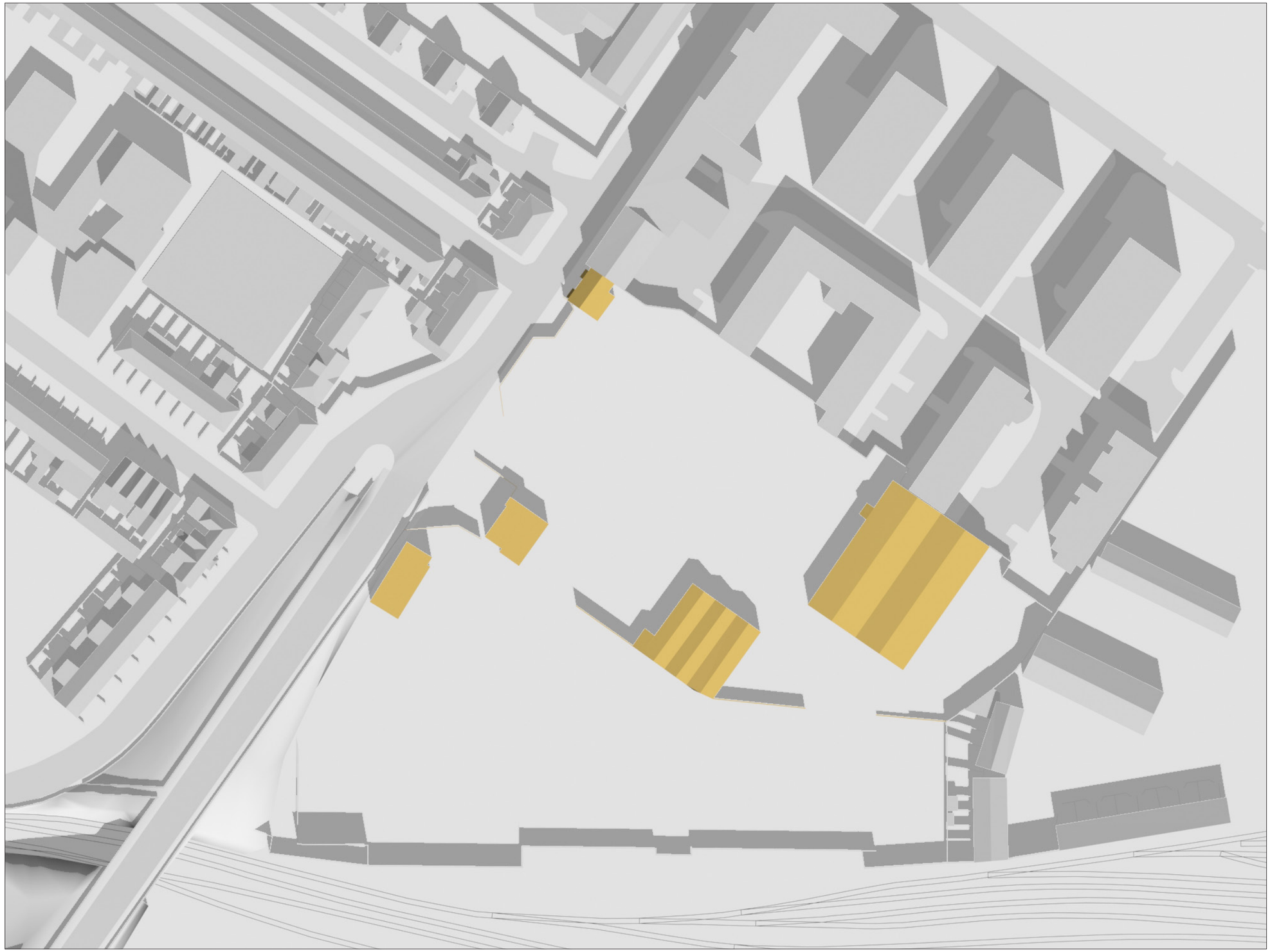
SHADOW STUDY
LANDS AT EAST ROAD, DUBLIN 3
JUNE 2019

DATE : MARCH 21ST - EQUINOX
SUNRISE : 6.26 AM
SUNSET : 6.39 PM

TIME :
10.00 AM

RECEIVING
ENVIRONMENT

OSI Licence No.AR 0087019



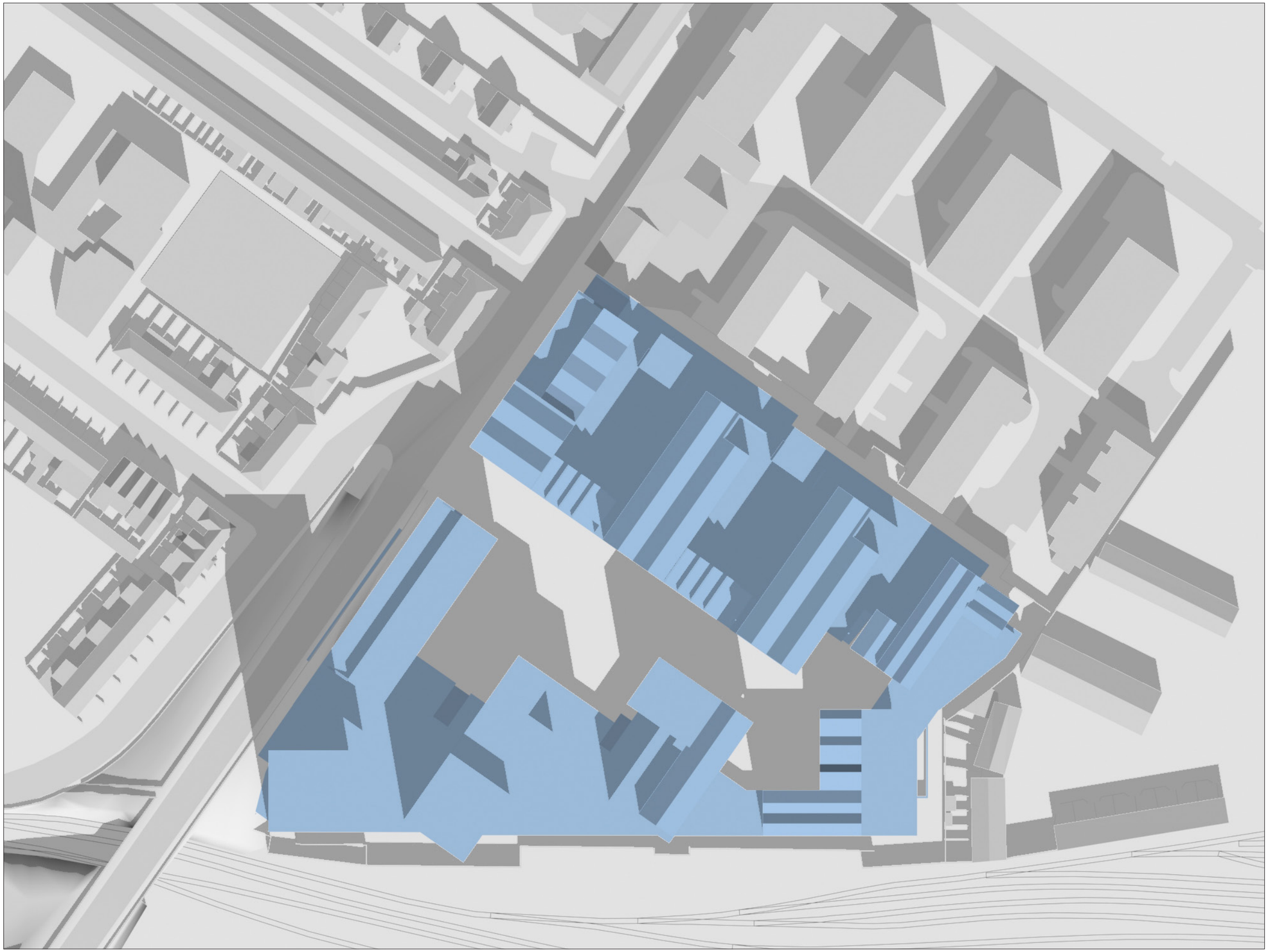
N

SHADOW STUDY
LANDS AT EAST ROAD, DUBLIN 3
JUNE 2019

DATE : MARCH 21ST - EQUINOX
SUNRISE : 6.26 AM
SUNSET : 6.39 PM

TIME :
12.00 PM

PROPOSED
DEVELOPMENT



OSI Licence No. AR 0087019

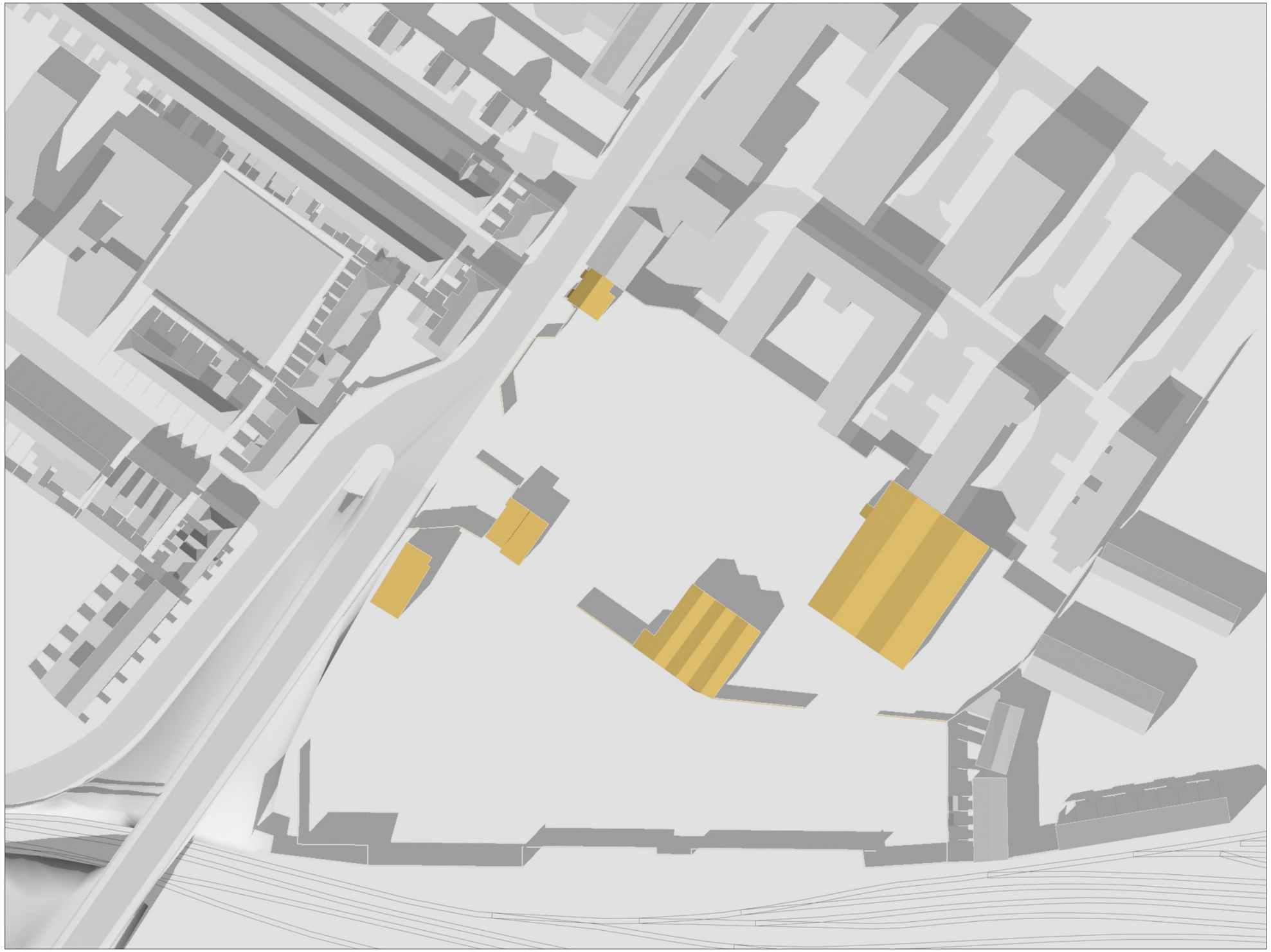
N

SHADOW STUDY
LANDS AT EAST ROAD, DUBLIN 3
JUNE 2019

DATE : MARCH 21ST - EQUINOX
SUNRISE : 6.26 AM
SUNSET : 6.39 PM

TIME :
12.00 PM

OSI Licence No.AR 0087019



N

SHADOW STUDY
LANDS AT EAST ROAD, DUBLIN 3
JUNE 2019

DATE : MARCH 21ST - EQUINOX
SUNRISE : 6.26 AM
SUNSET : 6.39 PM

TIME :
3.00 PM

PROPOSED
DEVELOPMENT

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SHADOW STUDY

LANDS AT EAST ROAD, DUBLIN 3

JUNE 2019

DATE : MARCH 21ST - EQUINOX

SUNRISE : 6.26 AM

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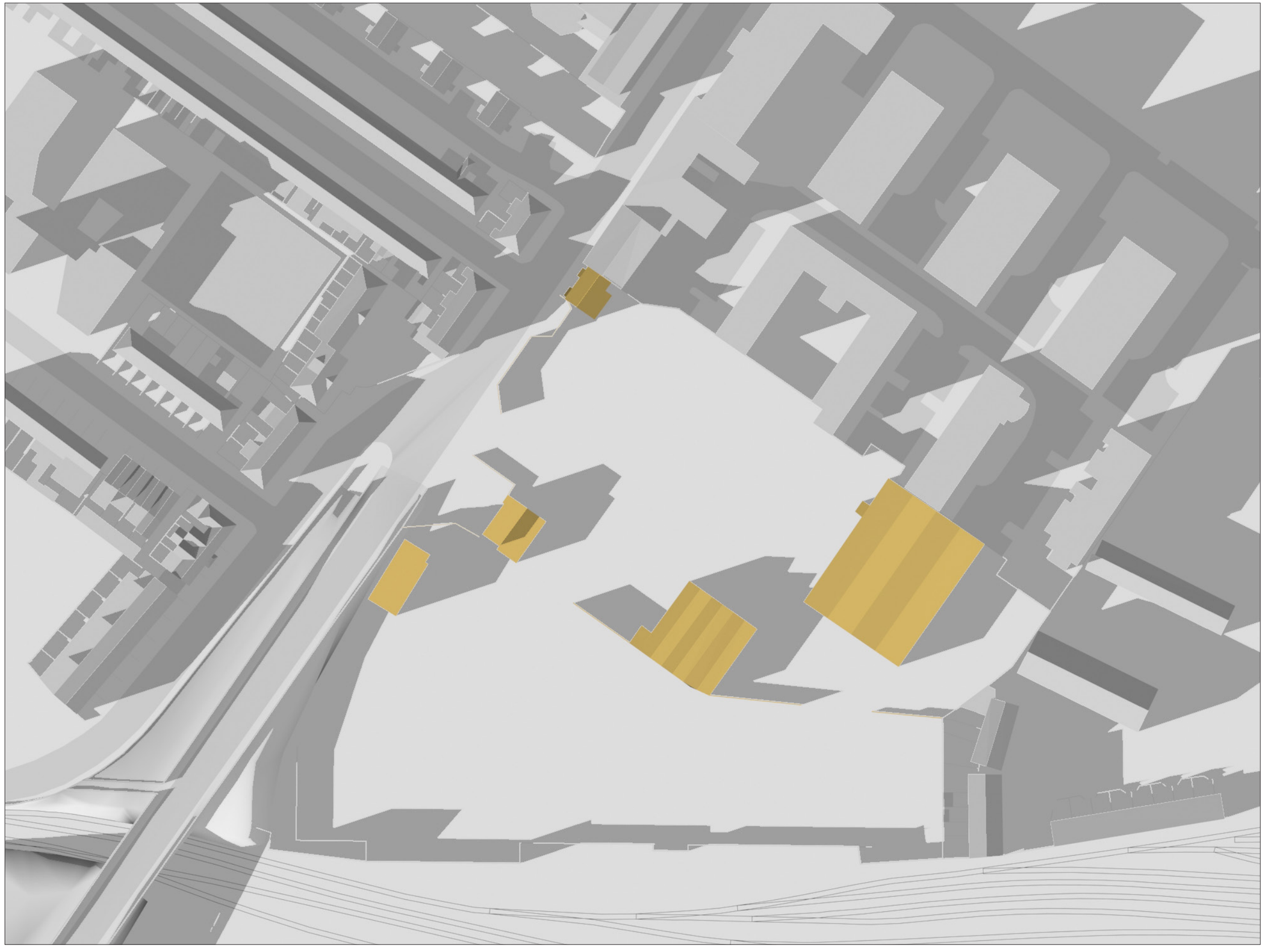


N

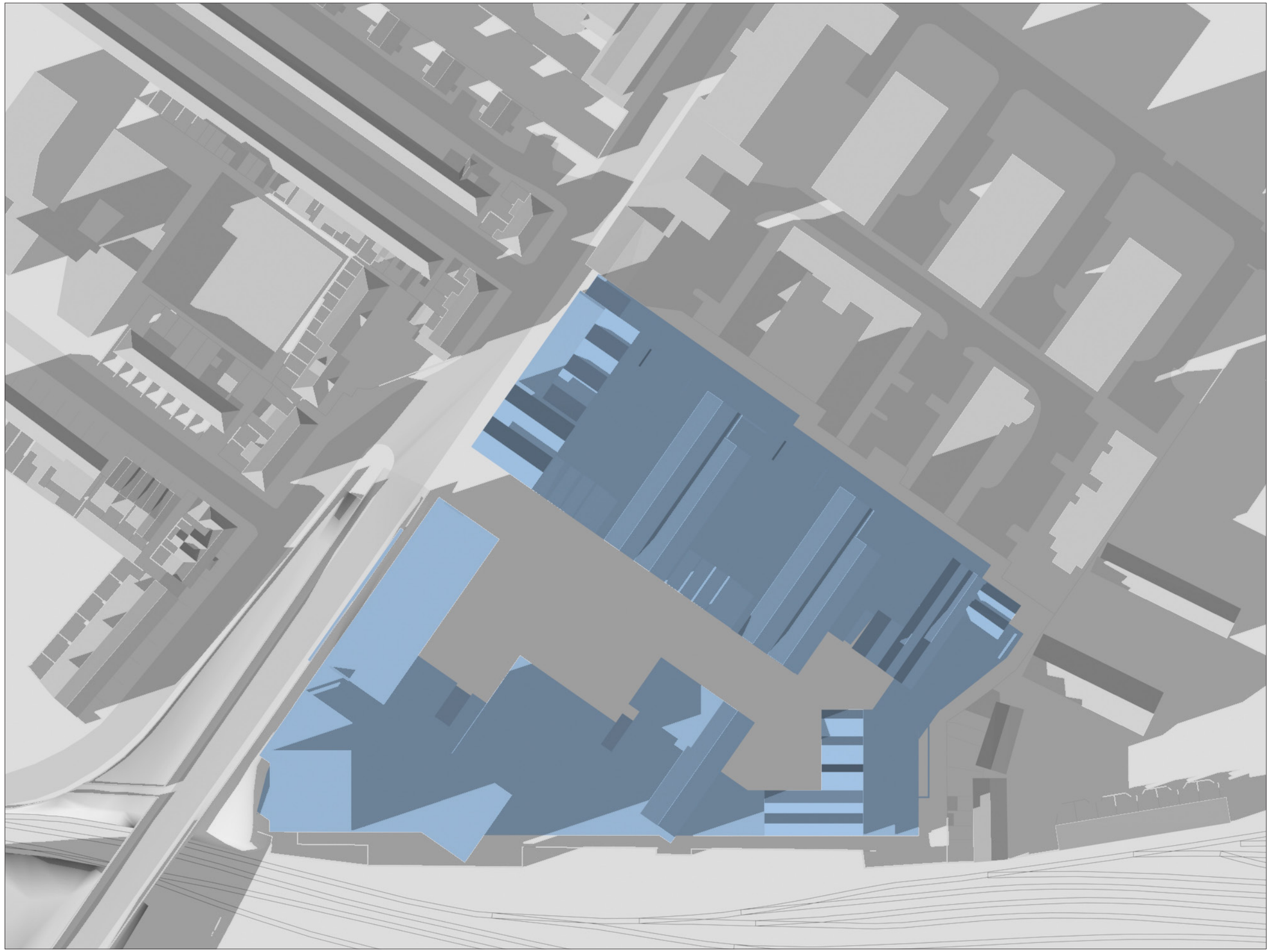
SHADOW STUDY
LANDS AT EAST ROAD, DUBLIN 3
JUNE 2019

DATE : MARCH 21ST - EQUINOX
SUNRISE : 6.26 AM
SUNSET : 6.39 PM

TIME :
5.00 PM

PROPOSED
DEVELOPMENT

OSI Licence No.AR 0087019



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SUNSET : 6.39 PM

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5.00 PM

OSI Licence No.AR 0087019

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SHADOW STUDY
LANDS AT EAST ROAD, DUBLIN 3
JUNE 2019

DATE : JUNE 21ST - SUMMER SOLSTICE
SUNRISE : 4.56 AM
SUNSET : 9.56 PM

TIME :
9.00 AM

PROPOSED
DEVELOPMENT

OSI Licence No.AR 0087019

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SHADOW STUDY
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JUNE 2019

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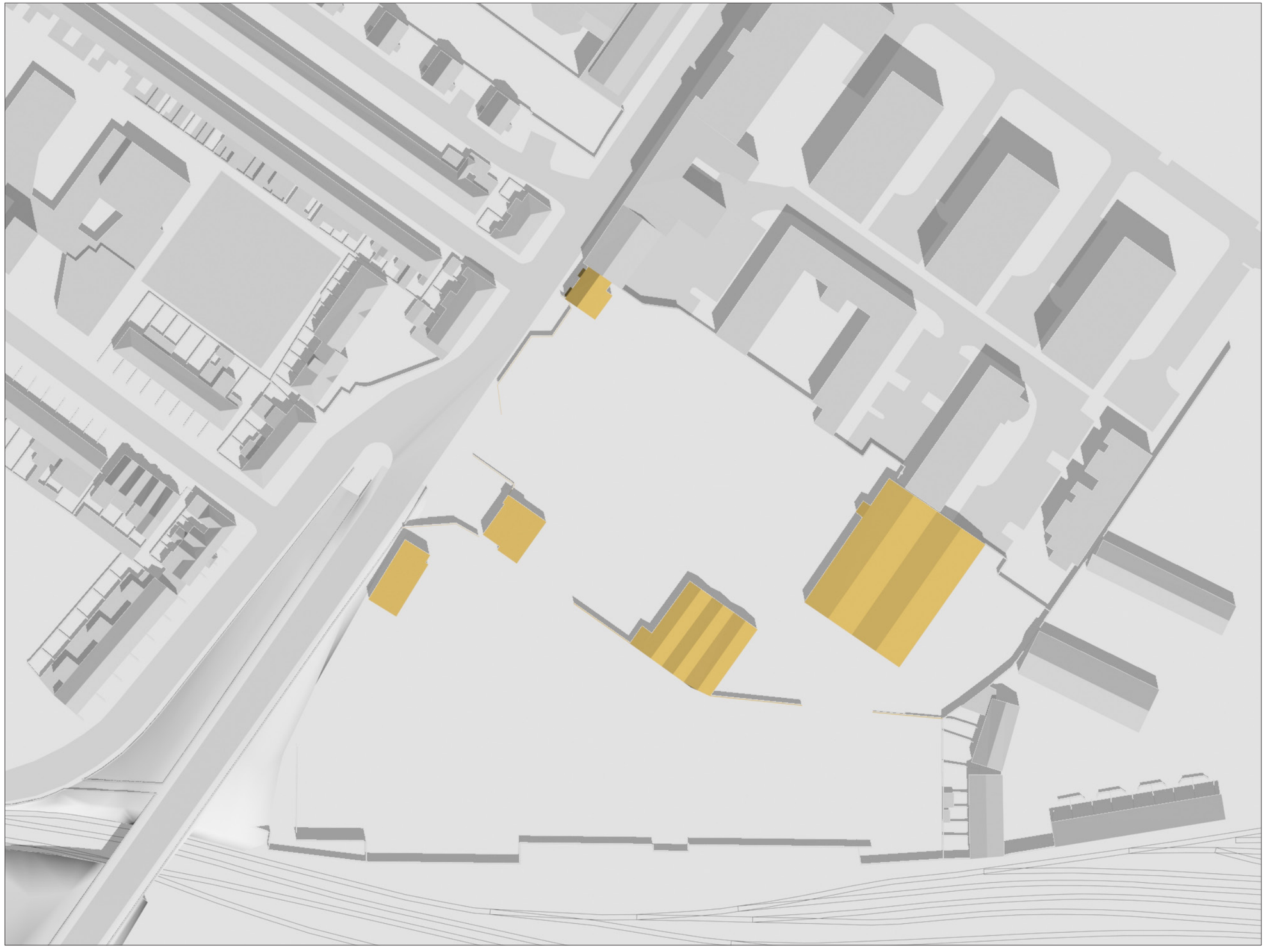
SUNSET : 9.56 PM

TIME :
9.00 AM

OSI Licence No.AR 0087019



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PROPOSED
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SHADOW STUDY

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JUNE 2019

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SUNRISE : 4.56 AM

SUNSET : 9.56 PM

TIME :

12.00 PM

RECEIVING
ENVIRONMENT

OSI Licence No. AR 0087019

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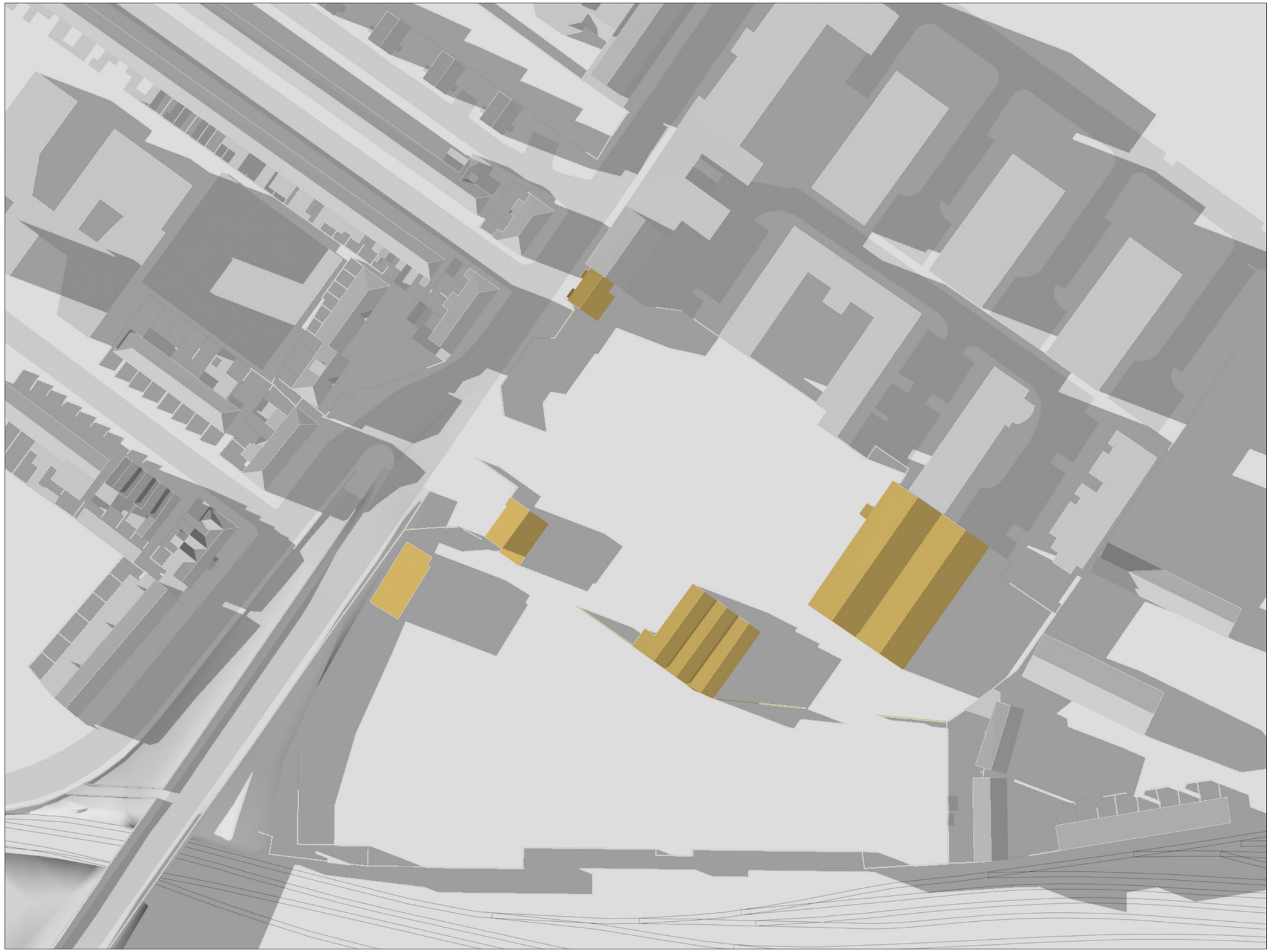

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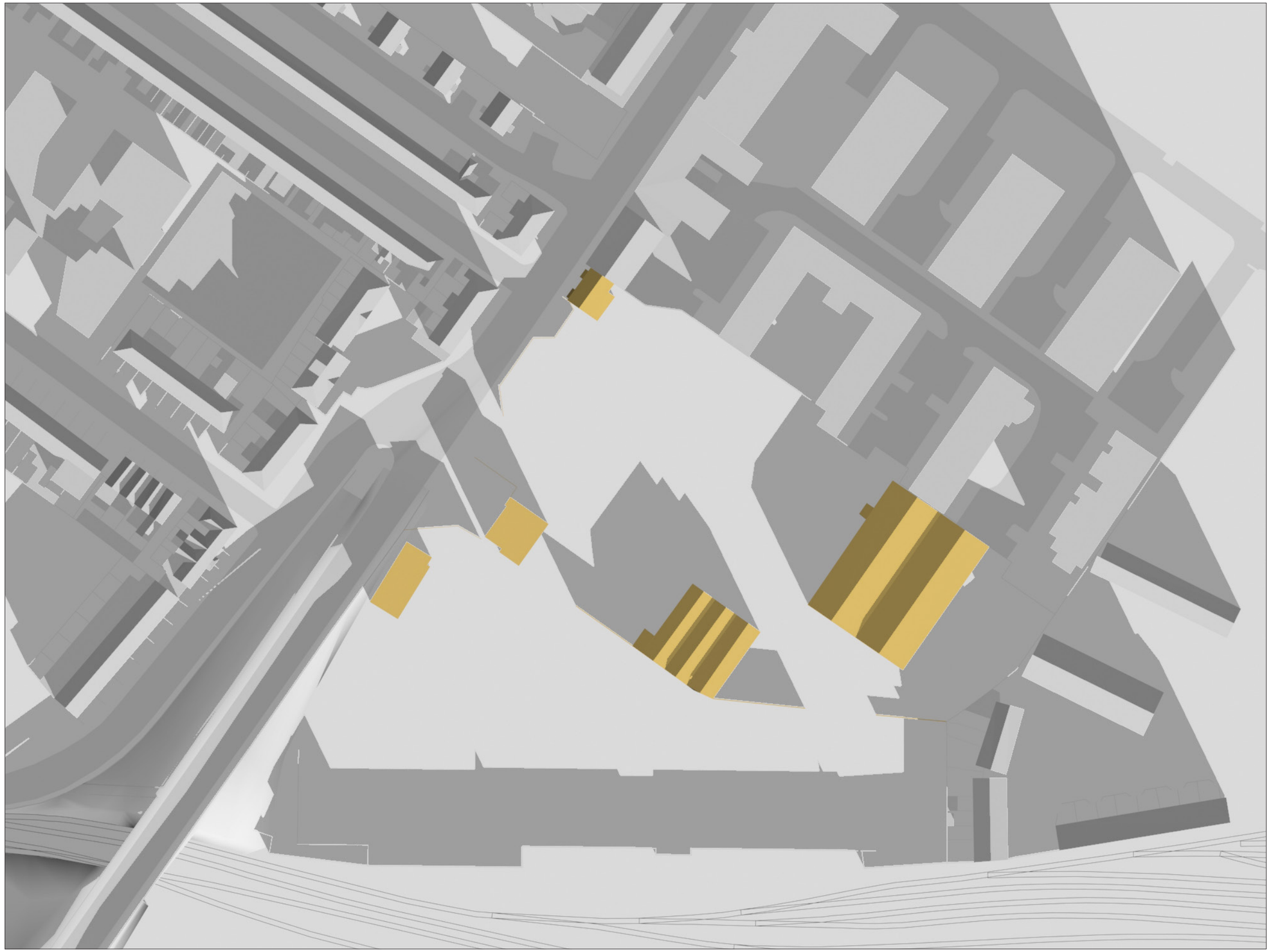

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SHADOW STUDY
LANDS AT EAST ROAD, DUBLIN 3
JUNE 2019

DATE : DECEMBER 21ST - WINTER SOLSTICE
SUNRISE : 8.37 AM
SUNSET : 4.07 PM

TIME :
10.30 AM

PROPOSED
DEVELOPMENT

OSI Licence No.AR 0087019

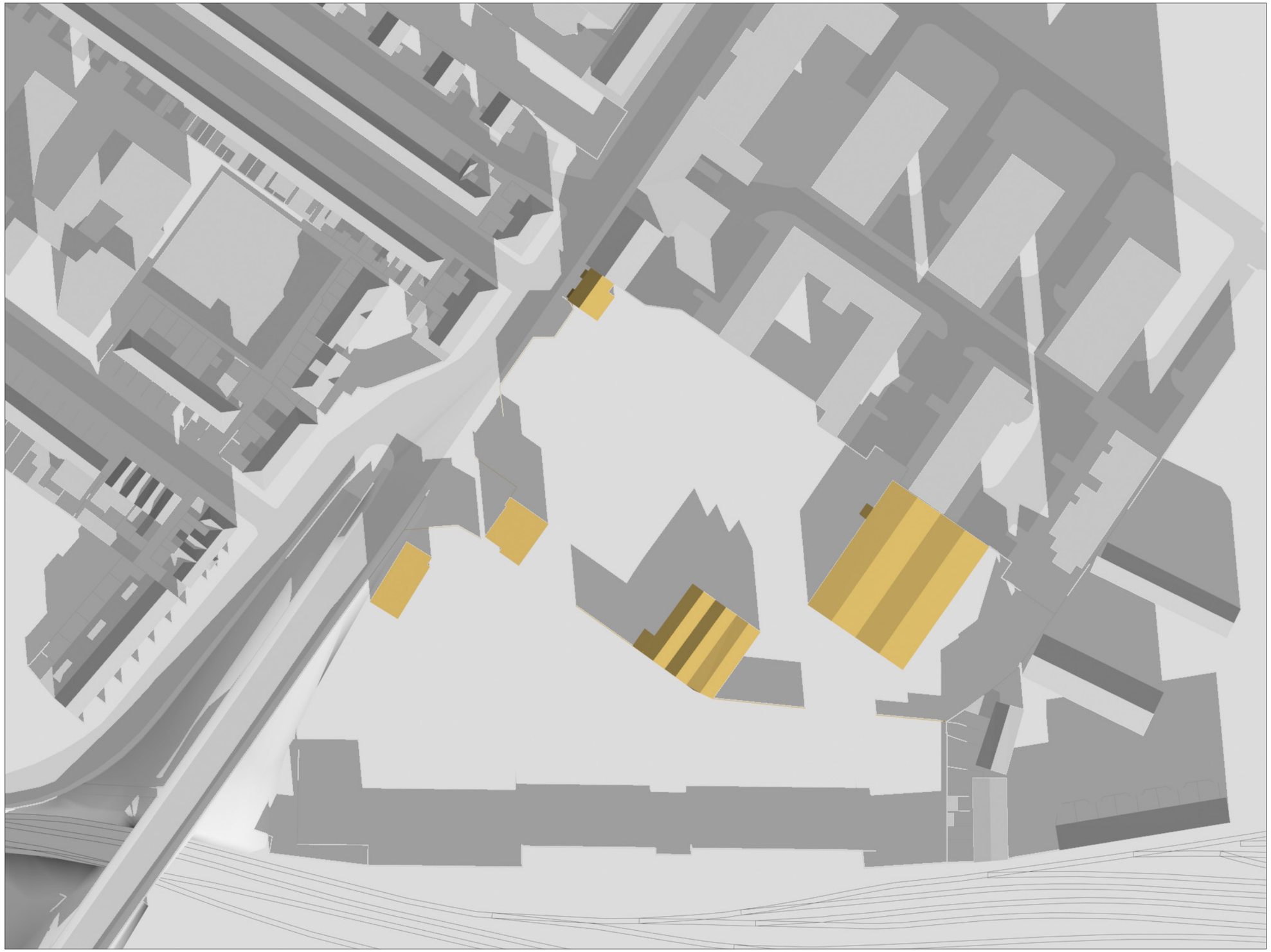
N

SHADOW STUDY
LANDS AT EAST ROAD, DUBLIN 3
JUNE 2019

DATE : DECEMBER 21ST - WINTER SOLSTICE
SUNRISE : 8.37 AM
SUNSET : 4.07 PM

TIME :
10.30 AM

OSI Licence No.AR 0087019



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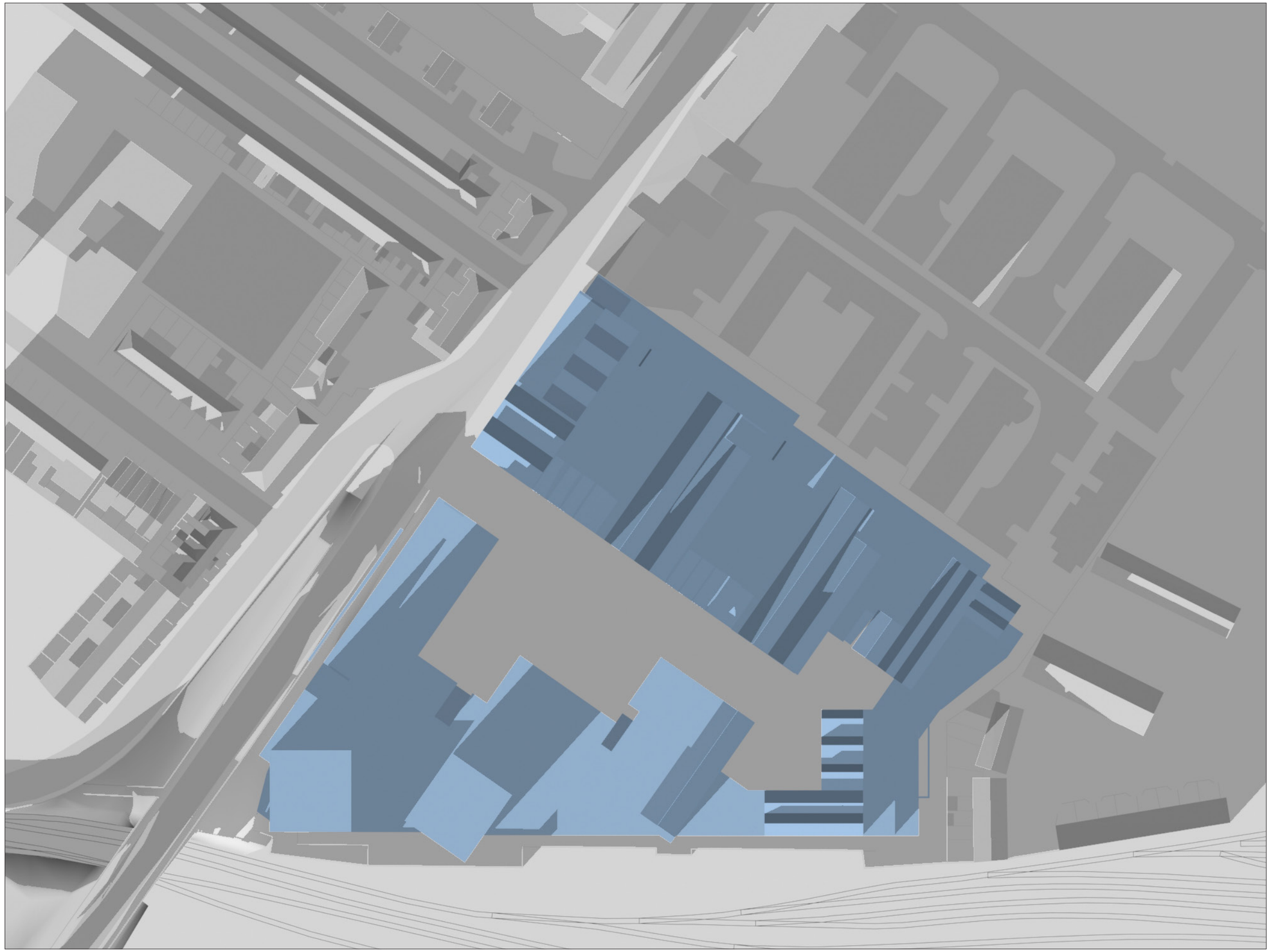

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