Daylight & Sunlight Assessments of a large-scale residential development at a site located at Boherboy, Saggart, County Dublin.

Document 1 of 3

Applicant: **Kelland Homes Ltd & Aderrig 4 Residential Ltd**
Date: **11th December 2025**

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1. Introduction

Kelland Homes Ltd. and Aderrig 4 Residential Ltd. intend to apply for permission for a Large-scale Residential Development (LRD) at a site located at Boherboy, Saggart, County Dublin. To the immediate north of the site is the Carrigmore residential estate, to the west are agricultural lands and a single dwelling, to the east is the Corbally residential estate and Carrigmore Park while to the south is the Boherboy Road.

The development will consist of 611 no. dwellings, comprised of 306 no. 2, 3 & 4 bed, 2 & 3 storey, detached, semi-detached & terraced houses, 133 no. 1, 2 & 3 bed duplex units in 12 no. 2-3 storey blocks, and 172 no. 1, 2 & 3 bed apartments in 5 no. buildings ranging in height from 4-5 & 5 storeys. The proposed development also includes a 2-storey crèche (c.630m²).

Access to the development will by via one no. new vehicular access point from the Boherboy Road, along with vehicular, pedestrian and cyclist connections to adjoining developments at Corbally Heath and Corbally Glade to the east and Carrigmore Green to the north, and pedestrian/cyclist access into Carrigmore Park to the east.

The proposed development provides for (i) all associated site development works above and below ground, including surface water attenuation & an underground foul sewerage pumping station at the northern end of the site, (ii) public open spaces (c. 2.19Ha), (iii) communal open spaces (c. 4,337sq.m), (iv) hard & soft landscaping and boundary treatments, (v) surface car parking, (vi) bicycle parking, (vii) bin & bicycle storage, (viii) public lighting, and (ix), plant (M&E), utility services & ESB sub-stations, all on an overall application site area of c.18.7Hha. In accordance with the South Dublin County Development Plan (2022-2028), an area of c.1.03Ha within the site is reserved as a future school site.

1.1 Executive Summary

This report assesses the impact of the proposed development for Daylight and Sunlight on the neighbouring buildings and the quality of daylight and sunlight within the proposed development. This analysis is carried out based on the drawings of MCORM Architecture & Urban Design and Davey + Smyth Architects.

The report has been prepared by John Healy - Diploma Architectural Technology, M.Sc Environmental Design of Buildings, PG Dip Digital Media. John is a Director at Digital Dimensions for the last 25 Years.

John has been working as a Daylight and Sunlight consultant for the last 15 years following completion of a Masters of Science in Environmental Design of Buildings at Cardiff University. The Masters focused on passive design strategies including daylight and sunlight optimisation. John has worked on an extensive list of projects over the years varying in scale and location from restricted city sites to urban and rural projects throughout Ireland. Some previous work include;

- Oscar Traynor Wood; 850 unit housing and apartment development for Glenveagh Homes / Dublin City Council.
- Belcamp North Dublin; 2527 unit residential scheme for Gannon Homes.
- Taylor's Lane Apartment Development; 402 units apartment development for Shannon Homes.
- Social Housing Bundles (SHB) 4&5; 17 social housing sites for the NDFA.
- No.9 -12 Dawson Street: Extension to listed office block in Dublin for Oakmount.

1.2 Assessment of Potential Impact to Daylight and Sunlight Availability on Neighbouring Properties

1.2.1 Daylight to Neighbouring Properties

Analysis demonstrated in Section 3 shows that there will be a minor to negligible reduction in daylight in neighbouring properties. The proposed development meets the recommendations for daylight in the BRE guidelines BR209:2022 (third edition).

1.2.2 Sunlight to Neighbouring Properties

Analysis demonstrated in Section 4 shows that there will be a minor to negligible reduction in sunlight in neighbouring dwellings.
Analysis demonstrated in Section 5 shows that there will be a negligible reduction in sunlight in neighbouring amenity spaces.
The proposed development meets the recommendations for sunlight in the BRE guidelines BR209:2022 (third edition).

1.3 Assessment of the Quality of Daylight and Sunlight within the Proposed Development

The residential units were designed in line with the recommendations of the BRE guidelines (2022). A number of design iterations were conducted to improve the daylight and sunlight within the proposed development. The guidelines clearly state that the targets are recommendations only and flexibility is required when setting and interpreting the targets.

The BRE guidelines (2022) recommends assessment methods set out in BS EN 17037 for daylight provision. BS EN 17037 contains a National Annex which sets out minimum daylight levels to be achieved in the UK and channel Islands. Ireland has a similar latitude and climate to the UK. The UK annex to BS EN 17037 states that the target values set out in EN 17037 Table A1 may be hard to achieve in the UK, it sets alternative minimum values for rooms to dwellings. The minimum illuminance levels set out in BS EN17037:2018+A1:2021 are: Kitchens and living spaces containing a kitchen 200lux (1.3%DF). Living rooms 150lux (1%DF) and bedrooms 100lux (DF0.7%).

The levels set out in the UK annex are used in this assessment, as the primary results to be achieved, because these are referenced in the BRE guidelines (2022), as recommended by the local authority. The BRE guidelines (2022) deals with daylight and sunlight to neighbouring properties and defers to BS EN17037:2018+A1:2021 for daylight and sunlight within the proposed development and allows for a complete assessment of the proposed development and its surroundings. The BRE guidelines (2022) presents a discussion on aspects of daylight and sunlight and interpreting the results of these assessments.

IS EN17037:2018 does not set out any guidance for assessing the impact to daylight and sunlight from a proposed development on neighbouring buildings nor is there any Irish governmental guidance on interpreting results and percentages of units to achieve the target results in multi unit developments. IS EN17037:2018 does not set out room use specific targets but instead designates a Minimum and Target lux level to be achieved in all rooms regardless of use. The function of a room historically has been the key factor in informing the design of a building and the window sizes to allow adequate daylight levels for the task typical to that room to be achieved. The lack of variance in target levels for the tasks typical to a room can lead to substantially oversized windows in rooms with a lower requirement for daylight levels, for example bedrooms. The aim to achieve the minimum target lux level to all rooms in a multi unit residential building is not practical and could lead to overheating of units that have greater access to the sky and sunlight. This could also lead to higher energy usage due to oversized windows and a balance needs to be met.

The results for the Minimum and Target levels set out in Table A1 in IS EN17037:2018 are presented in the assessment as supplementary for completeness, however, conclusions can not be made due to lack of clear guidance on interpenetration of results.

1.3.1 Assessment of Daylight in Accordance with BR209:2022 and BS EN 17037:2018+A1:2021

100% of the Living, Dining, Kitchen and Bedroom spaces within the proposed development achieve the target values set out in BS EN 17037:2018+A1:2021 Table NA1. These are the minimum values, per specified use, to be achieved in habitable rooms and meets the recommendations of the BRE guidelines (2022).

1.3.2 Sunlight within the Proposed Development

This scheme is well designed for sunlight, 100% of the houses will achieve the minimum target sunlight hours to a habitable room. In the 305 apartment and duplex units, 96.7% (295 no.) have a habitable room which achieves the minimum recommended 1.5 direct sunlight hours. This is in line with the BRE guideline example where 4 in 5 achieves the target sunlight hours.

All proposed public and communal amenity spaces achieve sunlight levels that exceed 2 hours sunlight over 50% of the required amenity space on the 21st March.

The proposed development meets the recommendations for sunlight in the BRE guidelines BR209:2022 (third edition).

1.4 Supplementary Information - Assessment of Daylight in Accordance with IS EN 17037:2018

EN 17037:2018 sets out values for target illuminance, minimum target illuminance and fractions of reference plane to be achieved. The target and minimum target levels set out in EN17037:2018 are for any type of building; they do not take into account room use or make allowance for rooms that have a lesser requirement for daylight. The results of this assessment indicate a high level of daylight provision, with 98.0% of rooms achieving Minimum Illuminance and 92.8% achieving Target Illuminance. Appendix B identifies any rooms which do not achieve minimum illuminance or target illuminance levels.

To date there is no guidance from governmental bodies on the use or interpretation of IS EN 17037:2018. Apartment guidelines and local authorities guidelines refer to BR209 2022: “Site layout planning for daylight and sunlight” (third edition) which in turn references BS EN 17037. BS EN17037:2018+A1:2021 is the same as IS EN 17037:2018 with the addition of a National Annex (NA1) and the annex specifically refers to and sets room specific values for dwellings in the UK and Channel Islands. Therefore the assessment against IS EN 17037:2018 is included as supplementary information only, noting there are no room specific recommendations for daylight and because of this limitation, it is considered the recommendations made in the BRE guidelines (2022) are more appropriate.

1.5 Conclusions

Overall the design team worked in response to the context to ensure the proposed development performs with regards to achieving the best possible daylight and sunlight quality. All habitable rooms meet the minimum standard for daylight provision as per BS EN 17037:2018+A1:2021 as referred to in the BRE guidelines BR209:2022 (third edition).

In the assessment of daylight in accordance with IS EN 17037:2018, shown for supplementary information, the vast majority of habitable rooms achieve daylight provision as set out in IS EN 17037:2018

With regard to internal daylighting, Section 3.2 of the Urban Development and Building Heights: Guidelines for Planning Authorities (2018) states:

> *"Where a proposal may not be able to fully meet all the requirements of the daylight provisions above, this must be clearly identified and a rationale for any alternative, compensatory design solutions must be set out, in respect of which the planning authority or An Bord Pleanála should apply their discretion, having regard to local factors including specific site constraints and the balancing of that assessment against the desirability of achieving wider planning objectives. Such objectives might include securing comprehensive urban regeneration and or an effective urban design and streetscape solution."*

It is our opinion that all habitable rooms within the proposed development achieve the minimum target daylight levels set out in BS EN 17037:2018+A1:2021, as referred to in the BRE guidelines BR209:2022 (third edition) and no compensatory measures are required.

2. Methodology

2.1 Standards and Guidelines

Ministerial guidance is provided in Sustainable Residential Development and Compact Settlements: Guidelines for Planning Authorities (2024) Section 5.3.7(b).

> *"In cases where a technical assessment of daylight performance is considered by the planning authority to be necessary regard should be had to quantitative performance approaches to daylight provision outlined in guides like A New European Standard for Daylighting in Buildings IS EN17037:2018, UK National Annex BS EN17037:2019 and the associated BRE Guide 209 2022 Edition (June 2022), or any relevant future standards or guidance specific to the Irish context."*

The Daylight and Sunlight assessments included in this report demonstrates the level of compliance with these three documents:

- BR209:2022 Site Layout Planning for Daylight and Sunlight (third edition), also referred to as the BRE guidelines (2022).
- BS EN 17037:2018+A1:2021 Daylight in Buildings, also referred to as the UK Annex.
- IS EN 17037:2018 Daylight in Buildings.

2.2 BRE Guidance Document BR209:2022 Site Layout Planning for Daylight and Sunlight (third edition)

In its opening summary, the BRE guidelines (2022) states that the report *"is purely advisory and the numerical target values within it may be varied to meet the needs of the development and its location."* The recommendations of the BRE guidelines (2022) are not suitable for rigid application to all developments in all contexts. This is of particular importance in the context of national and local policies for the consolidation and densification of urban areas.

The BRE guidelines (2022) sets out the assessment metrics to be applied when assessing the potential impact of a development on the daylight and sunlight of neighbouring properties. This is broadly in line with the previous version of the BRE guidelines (2011). The metrics for assessing impact to neighbouring buildings for Daylight is the Vertical Sky Component (VSC) and Sunlight is the Annual Probable Sunlight Hours (APSH). Sunlight to neighbouring amenity space is assessed through the measurement of sunlight availability on the 21st March and the plotting of shadow diagrams.

When assessing the quality of interior spaces in proposed developments, the BRE guidelines (2022) Appendix C states; *"The guidance contained in this publication is intended to be used with BS EN 17037 and its UK National Annex."* The BRE guidelines (2022) also states in Section 1.7 that *"The guidance here is intended for use in the United Kingdom and in the Republic of Ireland, though recommendations in the Irish Standard IS EN 17037 may vary from those in BS EN17037."*

2.3 Daylight in Buildings EN 17037:2018

EN 17037 is a unified daylighting standard published by the European Committee for Standardization (CEN) in 2018. It is applicable across all countries within the EU including Ireland, with the Irish edition IS EN17037:2018. The standard is enacted in Britain under BS EN 17037:2018+A1:2021 with a UK National Annex for regional assessments. The daylight and sunlight assessment methods for internal daylight and sunlight provision are common to both the Irish Standard version and the UK version. The EN17037:2018 Standard deals exclusively with new developments and does not give guidance or metrics on loss of light or sunlight to existing properties.

The UK National Annex (NA) provides further recommendations for daylight provision in the UK and Channel Islands. The UK annex states that the daylight target levels in BS EN 17037:2018 Clause A.2 may be hard to achieve in buildings in the UK, in particular dwellings in urban areas with significant obstructions or tall trees outside. The UK annex sets out minimum daylight provision to be achieved in UK dwellings. Table NA.1 sets out room specific minimum values to be achieved in the UK and Channel Islands. All the rooms achieve the minimum DF factor levels set out in A1 for Bedrooms (DF0.7%), Living Rooms (1%DF) and Kitchens and Living Spaces containing a Kitchen(1.3%). The Daylight Factor percentage values are derived from minimum room specific illuminance levels set out in NA+1 and the Median External Diffuse Illuminance ($E_{v,d,med}$) for Dublin from Table A.3 EN17037:2018. The illuminance levels and corresponding DF% are given in Table 5 below.

2.4 Daylight to Existing Buildings

BRE guidelines (2022) Section 2.2.2 sets out which rooms need to be assessed for daylight.

> *"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."*

A proposed development could potentially have a negative effect on the level of daylight that a neighbouring property receives, if the obstructing building is large in relation to its distance from the existing dwelling. BRE guidelines (2022) Section 2.2.4 states that *"Loss of light to existing windows need not be assessed if the distance of each part of the new development from the existing window is three or more times its height above the centre of the existing window.*" In this report, we refer to this as the 'zone of influence'.

BRE guidelines (2022) Section 2.2.23 states; *"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*."

If a window falls within a 45° angle both in plan and elevation with a new development in place, the window may be affected and should be assessed.

For loss of daylight the BRE guidelines (2022) recommends calculation of the Vertical Sky Component. VSC can be defined as the amount of skylight that falls on a vertical window. It is the ratio of direct sky illuminance falling on the outside window, to the simultaneous horizontal illuminance under an unobstructed sky. The standard CIE Overcast Sky is used and the ratio is usually expressed as a percentage. The maximum value is just under 40% for a completely unobstructed vertical wall. The Vertical Sky Component on a window is a good measure of the amount of daylight entering it.

The BRE guidelines (2022) recommend one of two criteria is met when assessing for the Vertical Sky Component;

a) Where the Vertical Sky Component at the centre of the existing window exceeds 27% with the new development in place then enough sky light should still be reached by the existing window.

b) Where the Vertical Sky Component with the new development in place is both less than 27% and less than 0.8 times its former value, then the area lit by the window is likely to appear more gloomy, and electric light will be needed more of the time.

The BRE guidelines (2022) state that if the VSC is:

- At least 27%, then conventional window design will usually give reasonable results;
- Between 15% and 27%, then special measures (larger windows, changes to room layout) are usually needed to provide adequate daylight;
- Between 5% and 15%, then it is very difficult to prove adequate daylight unless very large windows are used;
- Less than 5%, then it is often impossible to achieve reasonable daylight, even if the whole window wall is glazed

This report assesses the percentage of direct sky illuminance that falls on the centre point of neighbouring windows that could be affected by the proposed development through the Vertical Sky Component (VSC) as per the methodologies contained in the BRE guidelines (2022).

2.5 Sunlight to Existing Buildings

The BRE guidelines (2022) recommend assessing the main living rooms and conservatories if they have a window wall facing within 90° of due south. Kitchens and bedrooms are less important but care should be taken not to block too much sun. If the proposed development is fully north of the existing window then sunlight need not be assessed.

The Annual Probable Sunlight Hours (APSH) is used to assess the quantity of sunlight for a given location. This is the total amount of sunshine for a given location on an unobstructed horizontal surface taking cloud cover into account. Statistical data from the Irish Meteorological Service is used to assess the APSH and the Winter Probable Sunlight Hours (taken to fall between the 21st of September and the 21st of March).

Table 1 below shows the average sunlight hours for each month and the maximum possible without any cloud cover. This gives the factor of possible sunlight hours for each month.

Met Éireann Sunlight Hours Data Set 1991-2020													
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Average Sunlight Hours/ Day	1:54	2:54	3:42	5:24	6:24	6:00	5:17	5:00	4:24	3:24	2:24	1:42	
Average Sunlight Hours/ Month	58:54	81:12	114:42	162:00	198:24	180:00	163:47	155:00	132:00	105:24	72:00	52:42	1449.1
Total Available Sunlight Hours	252	265	358	412	483	485	496	451	375	320	250	236	4383
Probable Sunlight Hours Ratio	23.4%	30.6%	32.9%	39.3%	41.1%	37.1%	33.0%	34.4%	35.2%	32.9%	16.8%	22.3%	33.1%

Table 1: Average monthly sunlight hours recorded at Dublin Airport - Data set 1991-2020

The BRE guidelines (2022) recommend that the centre of a window or 1.6m above ground for a door be assessed and it should receive at least 25% of the APSH and it should receive at least 5% during the period of 21st September to 21st March. If the available APSH is less than this then it should not be reduced below 0.8 times its former value or noticeable loss of sunlight may occur.

2.6 Sunlight to Gardens and Open Spaces

For calculations of sunlight analysis it is general practice to use March 21st. The BRE guidelines (2022) Section 3.3.17 states:

> *"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. If a detailed calculation cannot be carried out, it is recommended that the centre of the area should receive at least two hours of sunlight on 21 March."*

2.7 BRE Guidelines (2022) Appendix G: Calculations of Trees & Hedges

Trees are not usually included in the assessments of impact on neighbouring properties, unless specified otherwise. In relation to the effects of trees and hedges the BRE guidelines (2022) Section G1.2 states;

> *"It is generally more difficult to calculate the effects of trees on daylight because of their irregular shape and because some light will generally penetrate through the crown. Where the effects of a new building on existing buildings nearby is being analysed, it is usual to ignore the effects of existing trees. This is because daylight is at its scarcest and most valuable in winter when most trees will not be in leaf."*

The BRE guidelines (2022) recommends that sometimes trees should be taken into account for the proposed development where the new development is proposed near large existing trees. This needs to be done by modelling a representative of the existing trees. Reflectance and transparency should be taken into account. Table G1 in BR209:2022 gives values for transparencies of tree crowns in summer and winter for deciduous trees, dense evergreen can be assessed as opaque. Table G2 gives general reflectance values for shades of trees.

2.8 BRE Guidelines (2022) Appendix H: Environmental Impact Assessment

The BRE guidelines sets out criteria for classification for assessment of impact where a new development affects a number of existing buildings or open spaces in relation to an Environmental Impact Assessment. The guide does not give a specific range or percentages but sets out parameters as set out below.

> *"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 limited area of open space lose light (within the guidelines), a classification of negligible impact is more appropriate. Where the loss of light is only just within the guidelines, and a larger number of windows or open space area are affected, a minor adverse impact would be more appropriate, especially if there is a particularly strong requirement for daylight and sunlight in the affected building or open space.*
>
> *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 sources 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, guideline should be applied.*
>
> *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, e.g. a living room in a dwelling or a children's playground.*
>
> *Beneficial impacts occur when there is a significant increase in the amount of skylight and sunlight reaching an existing building where it is required, or in the amount of sunlight reaching an open space.*
>
> *Beneficial impacts should be worked out using the same principles as adverse impacts. Thus a tiny increase in light would be classified as a negligible impact, not a minor beneficial impact."*

The BRE guidelines does not set out a specific value range for the different classification of impact level of Minor, Moderate and Major to each window. For the purpose of this report one of five classification levels will be applied:

Imperceptible:	There is no reduction in the VSC levels or where the levels are 95% of the existing value.
Negligible:	A reduction in the VSC level but it retains a VSC >27% or <27% but >80% of the existing value.
Minor reduction:	VSC below 27% but greater than 20%, or ratio greater than 65% of the existing value.
Moderate reduction:	VSC below 20% but greater than 10%, or ratio greater that 50% of the existing value.
Major reduction:	VSC below 10% or ratio less than 50% of the existing value.

A flexible approach should be taken when assessing the impact with daylight and sunlight being one of many factors that influence the environment when planning a new development. The evaluation of the impact should be considered in conjunction with other factors when determining the overall impact level to a property.

2.9 Assessment Model Parameters

The BRE guidelines (2022) recommends surface reflectances should represent real conditions and where reflectance values have not been measured or specified default values are set out in Table C4 of the guidance document. The surface reflectances have been specified and are set out in Table 2 below. This table also shows the input values for material used and additional assessment model input parameters.

Input Values for Assessment Model			
Surface Reflectance			
Element	Reflectance	Transmittance	Material Description
Internal walls	80%	0%	White Painted Walls
Internal ceiling	80%	0%	White Painted Ceiling
Floor - light wood	40%	0%	Light wood Flooring
External walls - proposed development	50%	0%	Brick
External walls - outside site	50%	0%	CIBSE
External ground	20%	0%	CIBSE
Glass		68%	Triple glazed clear glass
Maintenance Factor for Glass		Assessment Plane	
Suburban Vertical no overhang	0.96	Sensor Grid spacing	0.3m
Suburban Vertical sheltered by balcony or overhang	0.88	Sensor grid inset	0.35m
Framing Factor: Patio Doors	0.77	Minimum inset	0.3m
		Work plane offset	0.85m

Table 2: Surface reflectance parameters and input values for model calculations

2.10 Daylight in the Proposed Development.

The BRE guidelines (2022) Appendix C sets out interior daylight recommendations, it states; “BS EN 17037 supersedes BS8206 Part 2 ‘Code of practice for daylighting’ which contained a method of assessment based on Average Daylight Factor, which is now no longer recommended.”

BS EN 17037 sets out two methods for assessing daylight provision in proposed buildings. One method is called the **Illuminance method.** This is based on Target illuminances for daylight to be achieved across specified fractions of a reference plane at working plane height (0.85m) for half the daylight hours in a year. The Illuminance Method requires the use of a suitable weather file with local climate conditions and takes into account the orientation of the space.

The alternative method is called the **Daylight Factor Method.** This method is based on calculating the daylight factors achieved over specific fractions of a reference plane. The Daylight factor is the illuminance at a point on a reference plane in a space, divided by the illuminance on an unobstructed horizontal surface outdoors. This method uses an overcast sky for calculation and the assessment of the space is orientation independent. BS EN 17037 gives the Median External Diffuse Illuminance (Ev,d,med) for the capital cities throughout Europe to account for external local illuminance levels.

The UK committee formed the opinion that the Target Illuminance recommendations in Clause A.2 of BS EN 17037 may not be achievable for some buildings, particularly dwellings. The UK committee believes this could be the case for dwellings with basement rooms or those with significant external obstructions. In BS EN 17037:2018+A1:2021, the UK National Annex (NA) sets out additional minimum room specific Target Daylight Factor values for the UK. Clause NA.2 sets out illuminance values to be exceeded over at least 50% of the points on a reference plane 0.85m above the floor for at least half the daylight hours.

EN 17037:2018 sets out values for Minimum and Target levels to be achieved with a minimum, medium and high compliance level for each. The guideline recommends that the minimum level should be achieved for both target levels but it does not give guidance on the number of units or fraction within a multiple residential unit development that should achieve these values. Additionally it does not differentiate between room use and weighted targets for rooms which would have a lesser requirement. The UK annex sets out factors for UK specific settings where it is difficult to achieve natural daylighting.

The compliance calculation is based on an annual, climate-based simulation of interior illuminance distributions. The BRE guidelines (2022) refers to this method as the Illuminance Method. For each hour of the year, the percentage of the floor area achieving minimum and target illuminance thresholds are measured on a room-by-room basis. Two target types are set with the following criteria:

- Target Illuminance: 300 lux over 50% of floor area for at least 50% of daylight hours.
- Minimum Illuminance: 100 lux over 95% of floor area for at least 50% of daylight hours.

BS EN 17037 gives three levels of recommendation for daylight provision in an interior space: Minimum, Medium and High. The BRE guidelines (2022) Section C3 recommends for compliance with the standard, a space should achieve the Minimum level.

Daylight hours are defined as the 4380 hours with the most diffuse horizontal illuminance in the weather file. In addition to this baseline (Minimum) requirement, rooms can achieve Medium and High levels of compliance by meeting higher illuminance thresholds, as outlined in the table below:

Target Illuminance From Daylight Over At Least Half The Daylight Hours		
Level of recommendation	Target illuminance E_T(lx) for half of the assessment grid	Minimum illuminance E_{TM}(lx) for 95% of the assessment grid
Minimum	300 lux	100 lux
Medium	500 lux	300 lux
High	750 lux	500 lux

Table 3: IS / BS EN 17037:2018 Target Illuminance from Daylight over at least half the daylight hours.

Target Daylight Factor (D) for Dublin*		
Level of recommendation	Target daylight factor D for half of the assessment grid	Minimum daylight factor D for 95% of the assessment grid
Minimum	2%	0.7%
Medium	3.5%	2%
High	5%	3.5%

Table 4: IS / BS EN 17037:2018 Target Daylight Factor (D) for Dublin.

Target Minimum Daylight Factor (D) for Dublin* based on UK National Annex		
Room Type	Target illuminance E_T(lx) for half of the assessment grid	Target daylight factor D from Table A.3 EN17037 $E_{v,d,med}$ for Dublin -14,900
Bedroom	100 lux	0.7%
Living Room	150 lux	1%
Kitchen	200 lux	1.3%

* EN17037 uses the latitude of the capital city of each European country to set individual values for daylight and sunlight metrics for use in setting the target levels to be achieved in a particular country.

Table 5: BS EN 17037:2018+A1:2021 Target Illuminance levels and Daylight Factor (D) for Dublin.

2.11 Sunlight within Proposed Developments

The BRE guidelines (2022) Section 3.1.7 states:

> *"that for large residential developments the overall sunlight potential can be initially assessed by counting the number of windows facing south, east and west and the aim should be to minimise the number of living rooms facing solely north, north-east or north-west unless there is some compensating factor such as an appealing view to the north."*

In Section 3.1.8 the guideline acknowledges that it may not be possible to have every living room facing within 90° of south in large developments, however, it recommends maximising the number of units with a southerly aspect.

The BRE guidelines (2022) Section 3.1.10 recommends that BS EN 17037 should be used to assess for interior access to direct sunlight. BS EN 17037 Table A.6 sets recommendations for access to sunlight and notes three levels of achievement; Minimum, Medium and High. In dwellings at least one habitable room, preferably a living room, should achieve the Minimum of 1.5 direct hours on a specified date between 1st February and 21st March, with a cloudless sky. This assessment uses the 21st March. The guidelines recommend a time step of 5 minutes or less for the assessment interval. The Minimum level to achieve is 1.5, the Medium level is 3 hours and the High level is 4 hours direct sunlight.

3. Daylight in Neighbouring Buildings

3.1 Site Overview

The location is a greenfield site in Boherboy, Saggart, County Dublin. The site rises from Carrigmore Avenue at the north to Boherboy Road to the south. Existing green corridors, along some of the existing boundary lines are being retained, which will reduce any perceptible impact on daylight and sunlight of existing properties.

Figure 1: Indicative view of the site, taken from Google Maps.
Please refer to architectural drawings for statutory boundaries.

3.2 Preliminary Assessment of Neighbouring Dwellings

The BRE guidelines BR209:2022 (third edition) recommend that loss of light to existing windows need not be assessed if the distance of each part of the new development from the existing window is three or more times its height above the centre of the existing window. This area referred to as the zone of influence is plotted in Figure 2 in yellow. The areas where the zone of influence is close to residential properties are examined in detail below.

Figure 2: Proposed site plan showing the zone of influence from the proposed building and direction of the window wall of neighbouring residential properties.

3.3 Preliminary Assessment of Neighbouring Dwellings (continued)

The zone of influence, three times the height of the proposed development is indicated in Figure 2 for the proposed units closest to the boundary. For the majority of the site it does not extend to any neighbouring residential structure. The zone of influence extends to a residential structure at the south eastern boundary with the houses on Corbally Glade. The area is looked at closer in Figure 3 below.

In this area the existing dwelling are subject to sectional analysis. Section planes perpendicular to the window wall of the adjacent properties facing the proposed development are indicated in blue. The planes at locations A & B extend and if they intersect the proposed development, they are plotted in Figure 4 below.

The BRE guidelines also states that if part of a new building measured in a vertical section perpendicular to the main window wall of an existing building, from the centre of the lowest window, subtends an angle of more than 25º to the horizontal, then the diffuse light of the existing building may be adversely affected. If a window falls within a 45° angle both in plan and elevation with a new development in place then the window may be affected and should be assessed.

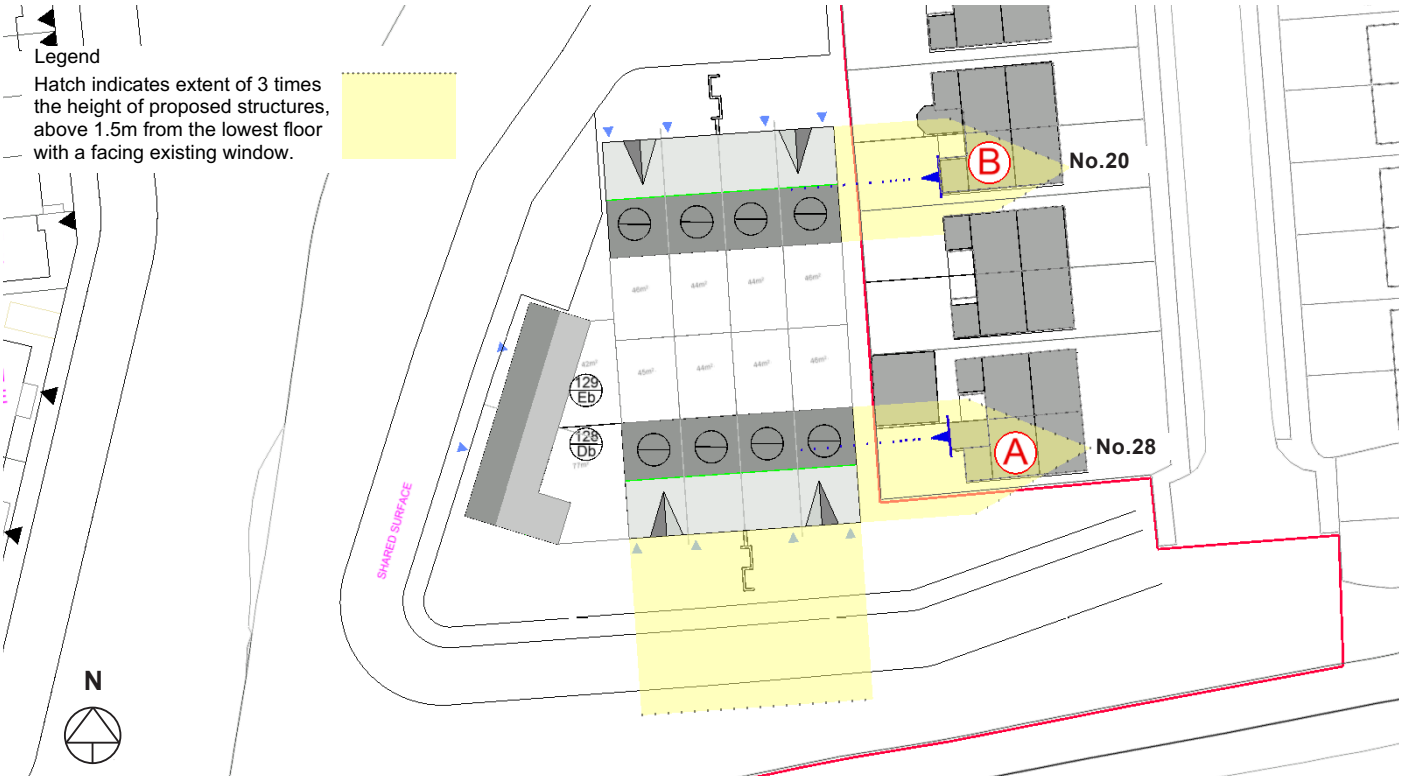
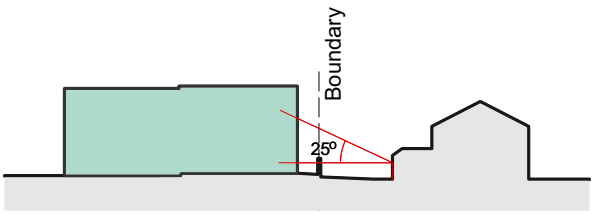
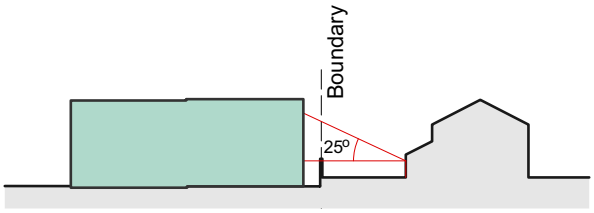


Figure 3: Detail Area 1 - Partial site plan showing the zone of influence from the proposed building and direction of the window wall in neighbouring residential properties in Corbally Glade



Section through window wall at location A



Section through window wall at location B

Figure 4: Sections perpendicular to window wall at locations indicated in Figure 3

3.3 Comment on Preliminary Assessment

Location A; Fig 4 - No.28 Corbally Glade. The section plane perpendicular to the window wall on the lowest residential floor indicates the 25º line would be subtended by the proposed development. This house will be assessed in detail for daylight and sunlight in Section 3.4.

Location B Fig 4; - No.20 Corbally Glade. The section plane perpendicular to the window wall on the lowest residential floor indicates the 25º line would be subtended by the proposed development. This house will be assessed in detail for daylight and sunlight in Section 3.4.

3.4 Detailed Assessment to Neighbouring Buildings

The BRE guidelines BR209:2022 (third edition) recommend assessing the Vertical Sky Component (VSC) to neighbouring properties, where the layouts are not known. Annual Probable Sunlight Hours (APSH) will also be assessed, where that is relevant.

The BRE guidelines recommends that if a window retains a VSC in excess of 27% with the proposed development in place then it will still receive enough daylight. If the existing VSC is below 27% or is reduced below 27% and below 0.8 times its former value then the diffuse light maybe adversely affected.

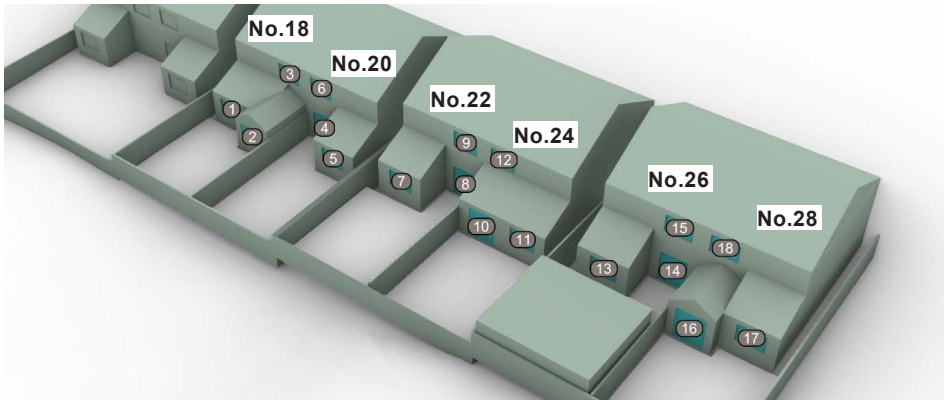


Figure 5: Corbally Glade - View of model locating VSC test points

Vertical Sky Component						
Location	Window ID	Vertical Sky Component Recommended Value > 27%		Ratio: Proposal to Existing Recommended > 80%	Meets criteria if >27% VSC or <27% but >80% existing value	Comment
		Existing %	Proposed %			
18 Corbally Glade	1	35.3	31.7	89.8%	Y	Negligible
	2	36.2	31.0	85.6%	Y	Negligible
	3	38.2	35.6	93.1%	Y	Negligible
20 Corbally Glade	4	24.4	20.2	82.6%	Y	Negligible
	5	34.6	27.6	79.8%	Y	Negligible
	6	38.2	35.0	91.8%	Y	Negligible
22 Corbally Glade	7	36.8	30.5	82.8%	Y	Negligible
	8	23.3	21.9	94.0%	Y	Negligible
	9	38.2	35.2	92.1%	Y	Negligible
24 Corbally Glade	10	32.6	30.2	92.8%	Y	Negligible
	11	33.0	30.3	91.9%	Y	Negligible
	12	38.2	35.1	91.7%	Y	Negligible
26 Corbally Glade	13	25.7	24.7	96.2%	Y	Negligible
	14	21.6	19.5	90.7%	Y	Negligible
	15	38.1	34.8	91.3%	Y	Negligible
28 Corbally Glade	16	31.3	22.5	71.9%	N	Minor Reduction
	17	35.4	27.2	76.9%	Y	Negligible
	18	38.2	34.6	90.4%	Y	Negligible

Table 6: Vertical Sky Component to Corbally Glade

3.5 Conclusion of Potential Impact to Existing Windows

There is a reduction below 27% VSC and 80% of the existing value to Window ID.16 a rear ground floor extension. The window will still retain a high VSC level and any potential impact will be minor. All the remaining windows retain a VSC in excess of 27% or are not reduced below 80% of the existing VSC value. Any reduction in daylight from the proposed development will be negligible to minor and meets the recommendations of the BRE guidelines BR209:2022 (third edition).

4. Sunlight in Neighbouring Buildings

4.1 Sunlight in Neighbouring Dwellings (Annual Probable Sunlight Hours)

The BRE guidelines BR209:2022 (third edition) recommends assessing window walls for the APSH that face within 90º of due south. The guidelines state that;

> *" In housing the main requirement for sunlight is living rooms, where it is valued at any time of day, but especially in the afternoon. Sunlight is also required in conservatories. It is viewed as less important in bedrooms and in kitchens, where people prefer it in the morning rather than the afternoon."*

For a proposed development to have a noticeable impact on the annual Probable Sunlight Hours the value need to be reduced below the recommended 25% annual or 5% in the winter period from September to March. If the value is either below this to begin with or is reduced below this then it should not be reduced below 0.8 times its former value.

The BRE guidelines states that obstruction to sunlight may become an issues if

- Some part of a new development is situated within 90° of due south of a main window wall of an existing building

- 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.

The windows are identified in the preliminary assessment, in Corbally Glade, that face within 90° of due south are assessed regardless of use. These are shown in Figure 6 and the results are set out in Table 7 below.

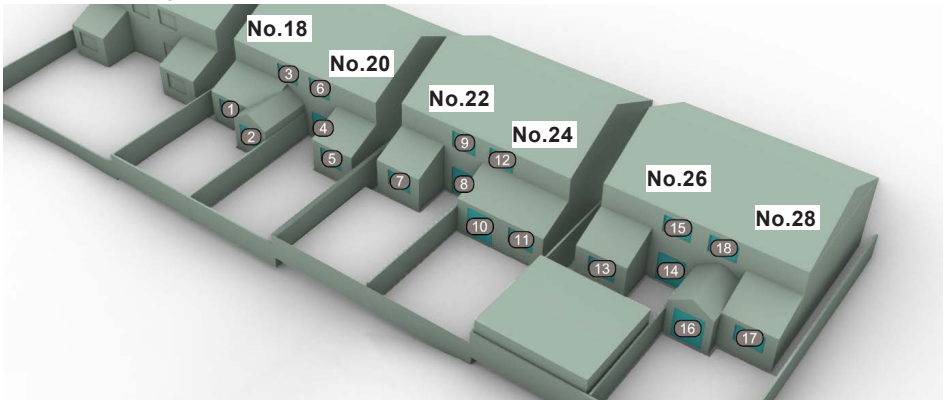


Figure 6: Corbally Glade - View of model locating APSH test points

Annual Probable Sunlight Hours

Location ID	APSH >25% Target			Sept 21 - Mar 21 WPSH >5% Target			Meets Criteria of >25% APSH and >5% WPSH Or <25% or <5% WPSH But Retains >80% Existing Value	
	Existing	Proposed	Ratio	Existing	Proposed	Ratio		
	% of APSH	% of APSH	If less than 25% APSH Target >80%	% WPSH	% WPSH	If less than 5% WPSH Target >80%	APSH	WPSH
1	42.0%	33.4%	79.6%	9.8%	3.0%	30.1%	Y	N
2	42.9%	35.3%	82.3%	10.2%	6.5%	63.9%	Y	Y
3	53.0%	45.9%	86.7%	17.7%	12.4%	69.9%	Y	Y
4	23.1%	16.7%	72.2%	2.1%	0.2%	9.3%	N	N
5	39.7%	25.7%	64.8%	7.3%	5.7%	77.7%	Y	Y
6	53.0%	44.4%	83.8%	17.7%	12.0%	67.7%	Y	Y
7	50.3%	34.8%	69.2%	16.4%	9.6%	58.8%	Y	Y
8	24.8%	21.5%	86.7%	1.1%	0.9%	81.8%	Y	Y
9	53.0%	43.3%	81.8%	17.7%	12.7%	71.7%	Y	Y
10	37.7%	33.4%	88.6%	8.4%	5.9%	70.7%	Y	Y
11	36.6%	32.0%	87.3%	4.7%	4.0%	83.5%	Y	Y
12	52.9%	42.9%	81.1%	17.6%	12.0%	68.2%	Y	Y
13	27.9%	27.3%	97.7%	8.2%	7.9%	96.9%	Y	Y
14	21.6%	18.7%	86.6%	0.0%	0.0%	0.0%	Y	Y
15	53.1%	45.8%	86.3%	17.8%	13.7%	76.8%	Y	Y
16	43.9%	27.7%	63.1%	15.2%	12.3%	81.0%	Y	Y
17	48.7%	34.8%	71.6%	16.2%	14.6%	90.3%	Y	Y
18	53.2%	46.4%	87.4%	17.8%	15.6%	87.3%	Y	Y

Table 7: Annual Probable Sunlight Hours To Neighbouring Buildings in Corbally Glade

4.2 Conclusion on Annual Probable Sunlight Hours (APSH)

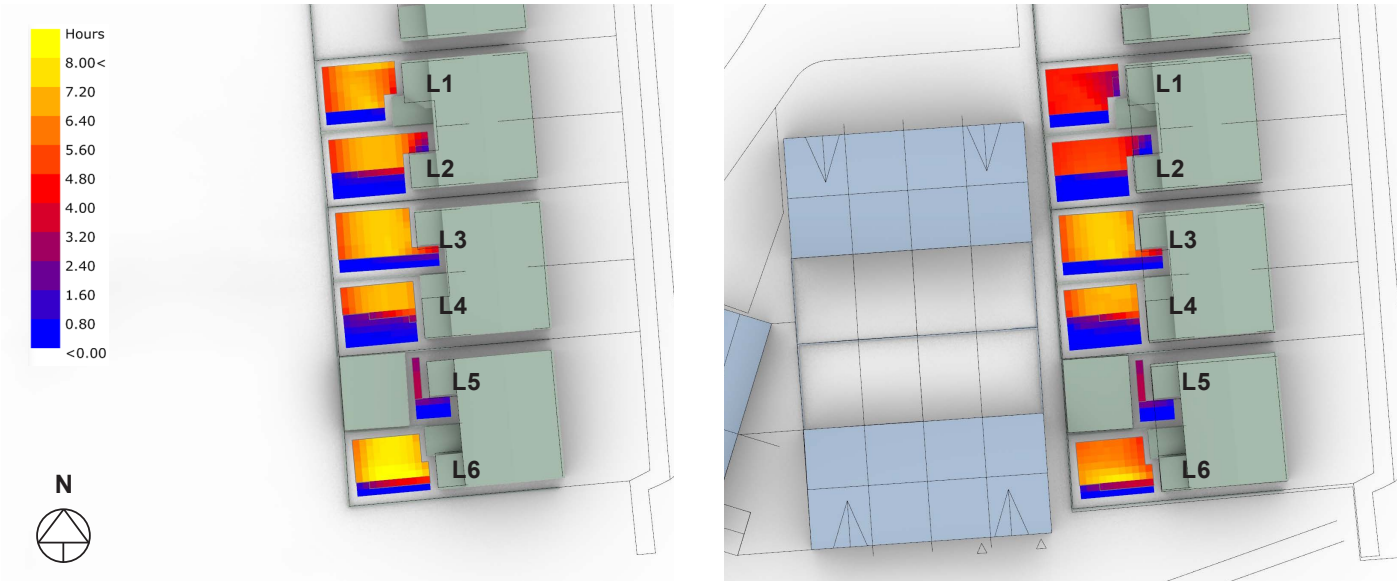
The majority of the windows exceed the target values set out for annual and winter probable sunlight hours. A minor impact on sunlight is noted to windows ID.1 & ID.4. Both of these dwellings have other windows where target values for sunlight are achieved. Any reduction in sunlight from the proposed development will be negligible to minor and meets the recommendations of the BRE guidelines BR209:2022 (third edition).

5. Sunlight to Amenity in Neighbouring Properties

The BRE guidelines BR209:2022 (third edition) indicates that for an amenity area to have good quality sunlight throughout the year, 50% of the space should receive in excess of 2 hours sunlight on the 21st March. It also states that front gardens need not be assessed for sunlight. Amenity spaces which are entirely south of the proposed development will not perceive any reduction in sunlight. The amenity space is assessed for the amount of direct sunlight received by the space in 5 minute intervals between 8am and 6pm on the 21st March over an analysis grid with a 300mm grid size and the average is calculated.

5.1 Amenity Space to Neighbouring Properties in Corbally Glade

The neighbouring amenity spaces were assessed for a potential impact on their sun on the ground. Existing and proposed generated analysis are shown in Figure 7, the results are shown in Table 8 below.



Existing **Proposed**

Figure 7: Existing & Proposed radiation map of amenity areas, showing available sunlight on 21st March. The scale represents the sunlight received from 0 - 8 hours.

Sunlight on the Ground - Neighbouring Properties					
No.		% Area receiving 2 hours sunlight on 21st March		Ratio	Meets criteria of >50% area Or if <50% then target >80% existing value
	Location	Existing	Proposed	Proposed: Existing	
L1	No.18 Corbally Glade	80.2%	76.9%	95.9%	Meets Criteria
L2	No.20 Corbally Glade	64.8%	54.0%	83.3%	Meets Criteria
L3	No.22 Corbally Glade	72.9%	72.9%	100.0%	Meets Criteria
L4	No.24 Corbally Glade	52.5%	50.5%	96.2%	Meets Criteria
L5	No.26 Corbally Glade	28.5%	28.5%	100.0%	Meets Criteria
L6	No.28 Corbally Glade	84.5%	83.3%	98.6%	Meets Criteria

Table 8: Calculation of Sun on the Ground to Neighbouring Amenity Areas

5.2 Conclusion

All the private amenity space to the surrounding properties were assessed for sunlight in accordance with the recommendations set out in BR209:2022. On the 21st March, all the amenity spaces will retain 2 hours sunlight over 50% of the area or will not be reduced below 80% of the existing levels. The proposed development meets the recommendations for sunlight in the BRE guidelines BR209:2022 (third edition).

6. Daylight within the Proposed Development

All habitable rooms within the apartment and duplex units were assessed for daylight provision by illuminance method. The Illuminance method assesses the daylight levels over at least 50% daylight hours in the year and uses a weather file data set. These methods take into account the orientation of the space. They provide an accurate representation of the daylight provision to a specific room in the context of the proposed environment.

Compliance is demonstrated by a calculation of Daylight Provision with the illuminance method under BS EN 17037:2018+A1:2021. A summary of the results are presented in Table 9 below and a complete set of room results are shown in Appendix A.

For supplementary information, an assessment of Daylight Provision with the illuminance method under IS /BS EN 17037:2018 is undertaken. A summary of the results are presented in Table 10 below and a complete set of room results are shown in Appendix B.

6.1 Assessment for Daylight Provision BS EN 17037:2018+A1:2021

The UK National Annex (A1) contains minimum room specific target values for dwellings in the UK. Ireland has a similar latitude and climate to the UK. The minimum illuminance levels are kitchens and living spaces containing a kitchen 200lux, living rooms 150lux and bedrooms 100lux. It is recommended that these target illuminance values are exceeded over at least 50% of the points on a reference plane 0.85m above the floor, for at least half of the daylight hours.

The UK committee supports the recommendations of EN17037:2018 but considers the target daylight levels may be hard to achieve in UK dwellings, in particular in urban areas and areas with mature trees. The Target and Minimum levels set out in IS / BS EN17037:2018 does not take into account room use or make allowance for room that have a lesser requirement for daylight.

Minimum daylight provision UK NA.1 - BS EN 17037:2018+A1:2021					
Apartments and Duplex Units	Room Use	Number of rooms	Target illuminance ET(lx) for half of the assessment grid	Number of rooms to achieve target Lux over 50% of the assessment grid	Percentage of rooms achieving Target
	LKD	306	200	306	100.0%
	Liv	40	150	40	100.0%
	Bedrooms	630	100	630	100.0%
	Study	20	150	20	100.0%
Total		996		996	100.0%

Table 9: Summary of room for Target Illuminance compliance with BS EN 17037:2018+A1:2021. Individual room results can be viewed in Appendix A.

6.2 Conclusion

BR209:2022 recommends assessment methods set out in BS EN 17037 for daylight provision. 100% of the Living, Dining, Kitchen and Bedroom spaces achieve the target values set out in BS EN 17037:2018+A1:2021 section NA1. These are the minimum values, per specified use, to be achieved in habitable rooms.

6.3 Supplementary Information - Assessment for Daylight Provision IS / BS EN 17037:2018

A summary of Minimum and Target Illuminance levels under IS EN 17037:2018 Annex A Table A1 are set out in the table below.

Daylight provision Illuminance Method IS EN 17037:2018						
Apartments and Duplex Units		Below Target	Minimum	Medium	High	Percentage of rooms achieving Target
Overall total	Target Illuminance	7.2%	34.9%	31.7%	26.1%	92.8%
	Minimum Illuminance	2.0%	35.3%	36.3%	26.3%	98.0%

Table 10: Percentage of rooms at each level to IS/BS EN 17037:2018. Individual room results can be viewed in Appendix B.

The results indicate a high level of daylight provision, with 98% of habitable rooms in the apartment and duplex units achieving Minimum Illuminance and 92.8% achieving Target Illuminance. The rooms will be bright and pleasant spaces.

The recommendations for Daylight provision in Table A1 are not specific for dwellings and do not make allowance for room use. BS EN 17037:2018+A1:2021 address this with the National Annex NA.1 which sets out room specific targets for dwellings and compliance for this is presented in Section 6.2.

7. Sunlight within the Proposed Development

7.1 Sunlight Hours

The BRE guidelines BR209:2022 (third edition) and BS EN 17037:2018+A1:2021 set out recommendations for sunlight hours to be achieved. It states that; *"For dwellings, at least one habitable room, preferably a main living room, should meet at least the minimum criterion."* The guidelines recommend the sunlight hours should be assessed preferably on the 21st March over the course of the day. The guidelines set three levels of achievement. Minimum 1.5h, Medium 3h and High 4h. The guideline does not set the percentage of units that need the achieve the recommendations but they do give an example of a well designed floor layout in the figure below where 4 out of 5 units in an apartment building would achieve the target sunlight.

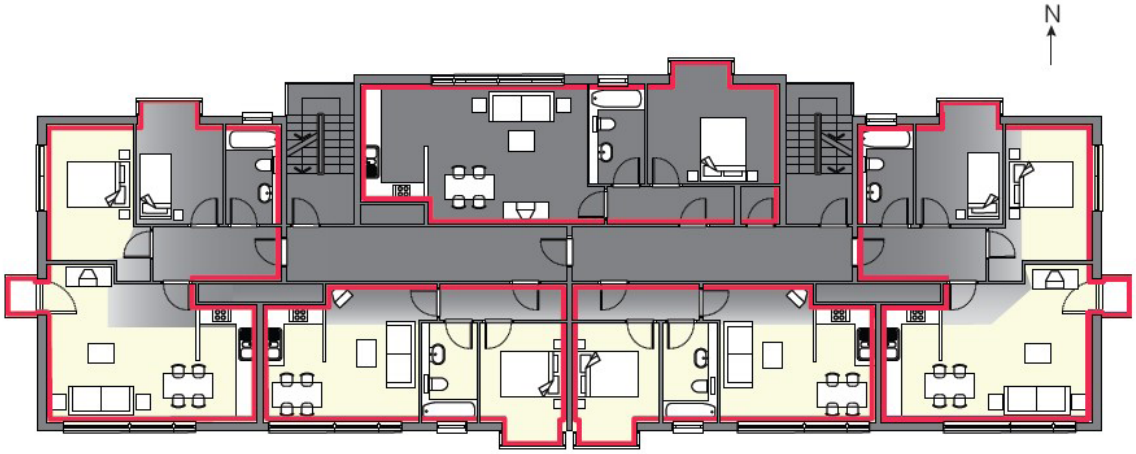


Figure 26: Careful layout design means that four out of the five flats shown have a south-facing living room

Figure 8: Extract from BR209:2022 Section 3 Sun-lighting: Diagram indicating sample floor plan to maximise units with a main living space facing south.

All the houses have a window wall within 90° due south. 100% of the houses will achieve the minimum target sunlight hours to a habitable room.

The apartments and duplex units are assessed for sunlight, in accordance with BS EN 17037:2018+A1:2021. In dual aspect units the southerly facing rooms have been selected for assessment. Preference is given to living spaces, however the recommendations of the BRE guidelines are met if minimum sunlight hours are achieved in any habitable room within a dwelling.

Detailed results are presented in Appendix C. It indicates if the relevant habitable room has a south facing window and shows the number of hours it receives sunlight, on the 21st March. A summary of these results are displayed in the table below.

Sunlight Hours Summary Table									
Apartment & Duplex Units	Total Units	Habitable room with a window within 90° south		Below recommendation <1.5 hours	Minimum >1.5 hours	Medium >3 Hours	High >4 Hours	Number meets criteria	Ratio meets criteria
		No.	Ratio						
Habitable Rm	305	233	76.4%	10	54	40	201	295	96.7%

Table 11: Summary of Results of Assessment of Sunlight Hours

7.2 Comment on EN 17037 Sunlight Hours

The BRE Guidelines recommend maximising the amount of units that have a window within 90° due south but does not have set targets. The guidelines acknowledge that for large developments with site constraints its not possible to achieve south facing windows to all main living spaces and that achieving sunlight hours in another habitable room meets the criteria. In this development with 305 no. units 76.4% (233 no.) have window to a habitable room which faces within 90° south.

Windows with an aspect of greater than 90° due south, to the north west or north east, will still receive sunlight, but it is likely to be lesser amounts especially in the winter period. In this development with 305 no. units 96.7% (295 no.) have a habitable room which achieves the minimum recommended 1.5 direct sunlight hours.

7.3 Conclusion

This scheme is well designed for sunlight, 100% of the houses will achieve the minimum target sunlight hours to a habitable room. In the 305 apartment and duplex units, 96.7% (295 no.) have a habitable room which achieves the minimum recommended 1.5 direct sunlight hours. This is in line with the BRE guideline example where 4 in 5 achieves the target sunlight hours.

8. Sunlight to Amenity within the Proposed Development

The BRE guidelines BR209:2022 (third edition) indicate that for an amenity area to have good quality sunlight throughout the year, 50% of the ground, should receive in excess of 2 hours sunlight on the 21st of March. It also states that front gardens need not be assessed for sunlight.

8.1 Sunlight to Amenity within the Proposed Development

The amenity areas within this proposal have been assessed with a calculation of Sun on the Ground on the 21st March. Generated analysis is shown in Figure 9 and the results are set out in Table 12 below.

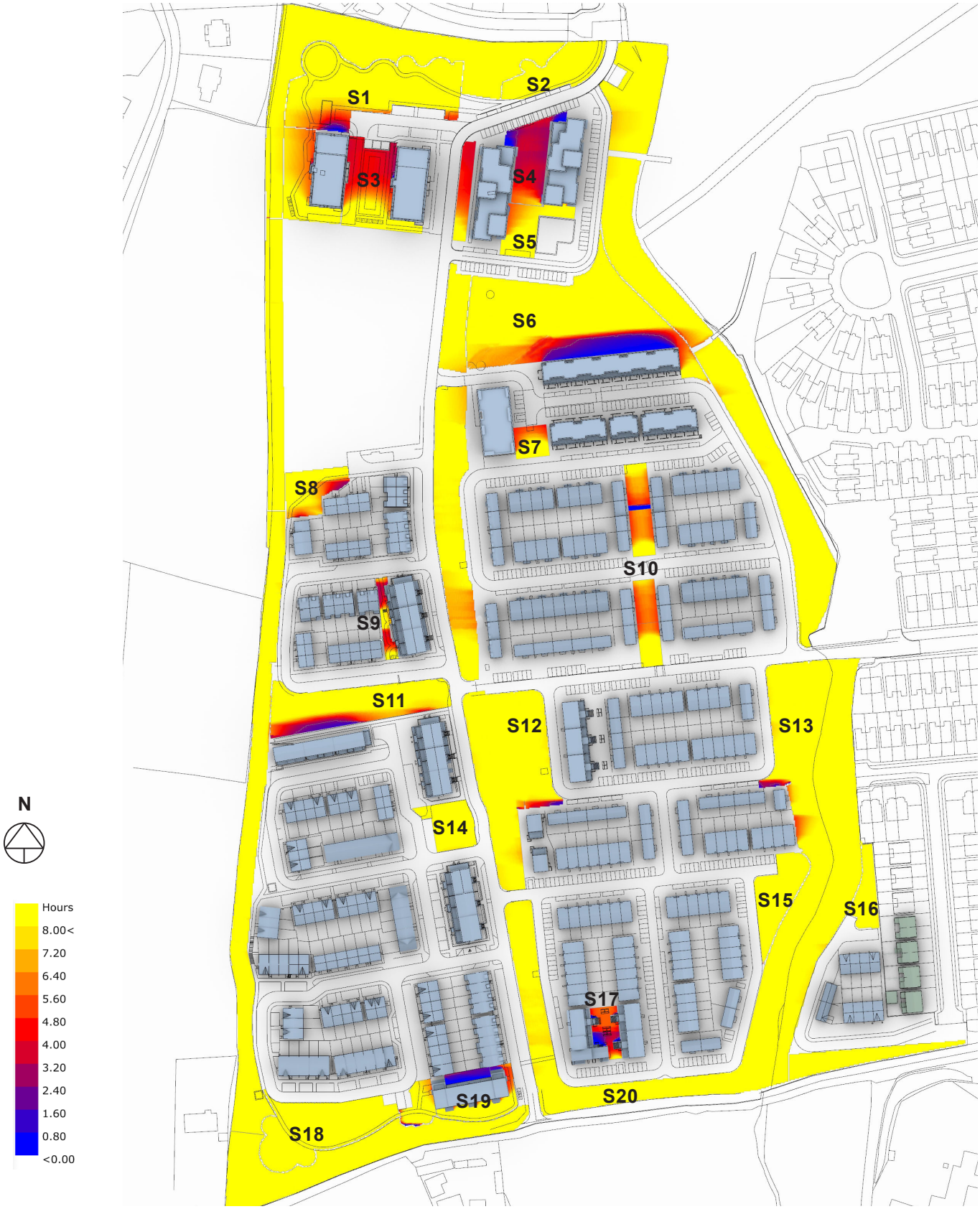


Figure 9: Radiation map of amenity within the proposed development, showing available sunlight on 21st March. The scale represents the sunlight received from 0 - 8 hours.

Sunlight on the Ground - Public & Communal Amenity			
ID No.	Details	% Area receiving 2 hours sunlight on 21st March	Meets criteria if >50% area receiving 2 hours sunlight on 21st March
S1	POS	100.0%	Y
S2	POS	100.0%	Y
S3	COS	99.7%	Y
S4	COS	89.4%	Y
S5	POS	99.1%	Y
S6	POS	71.9%	Y
S7	COS	100.0%	Y
S8	POS	100.0%	Y
S9	COS	99.0%	Y
S10	POS	100.0%	Y
S11	POS	100.0%	Y
S12	POS	100.0%	Y
S13	POS	100.0%	Y
S14	POS	100.0%	Y
S15	POS	100.0%	Y
S16	POS	100.0%	Y
S17	COS	80.1%	Y
S18	POS	100.0%	Y
S19	COS	73.1%	Y
S20	POS	100.0%	Y

Table 12: Calculation of Sun on the Ground to Amenity Areas within the Proposed Development

8.2 Conclusion

All the public and communal amenity spaces are well oriented for sunlight. All achieve 2 hours sunlight on the 21st March over in excess of 50% of the area. The proposed development meets the recommendations for sunlight in the BRE guidelines BR209:2022 (third edition).

9. Shadow Study

9.1 BRE Guidance on Shadow Studies

The BRE guidelines recommend using the March Equinox due the equal length of the day and night time. It states:

> *"If a space is used all year round, the equinox (21 March) is the best date for which to prepare shadow plots as it gives an average level of shadowing. Lengths of shadows at the autumn equinox (21 September) will be the same as those for 21 March, so a separate set of plots for September is not required."*

June 21st and December 21st are provided below for information but it should be noted that the summer solstice is the best case scenario with shadows at their shortest. The summer solstice diagrams are included here with the Daylight Saving Time (UTC+1) applied. In Winter even low buildings will cast long shadows, when sun barely rises above an altitude of 10° during the course of the day. It is common for large areas of the ground to be in shadow throughout the day, especially in a built-up area. The guidelines recommend that sunlight at an altitude of 10° or less does not count. Below are the times for the Equinox and Solstice, when the sun is above 10° altitude, rounded to the nearest half hour.

Equinox: between 8:30 and 17:30
Summer Solstice: Between 6:30 and 20:00
Winter Solstice: Between 10:30 and 14:00

Section 9.2 shows the existing and proposed shadow diagrams for the Equinox on the 21st March at 2 hourly intervals during the day between 09:00 and 17:00.
Section 9.3 shows the existing and proposed shadow diagrams for the Summer Solstice on the 21st June at 2 hourly intervals during the day between 09:00 and 19:00.
Section 9.4 shows the existing and proposed shadow diagrams for the Winter Solstice on the 21st December at 2 hourly intervals during the day between 09:00 and 15:00.

The site is a greenfield site, there is no shadow cast from any structures in the existing condition. Shadow diagrams are a visual aid to understand where possible shading may occur. The use of shadow diagrams as an assessment method should be taken over the course of the day and not a specific time due to the transient nature of the sun and the shade caused by obstructions.

9.2 Shadow Casting diagrams March Equinox

Figure 10: Shadow diagrams 21 March 09:00 UTC

9.2 Shadow Casting diagrams March Equinox

Figure 11: Shadow diagrams 21 March 09:00 UTC

Figure 12: Shadow diagrams 21 March 11:00 UTC

Figure 13: Shadow diagrams 21 March 11:00 UTC

Figure 14: Shadow diagrams 21 March 13:00 UTC

Figure 15: Shadow diagrams 21 March 13:00 UTC

Figure 16: Shadow diagrams 21 March 15:00 UTC

Figure 17: Shadow diagrams 21 March 15:00 UTC

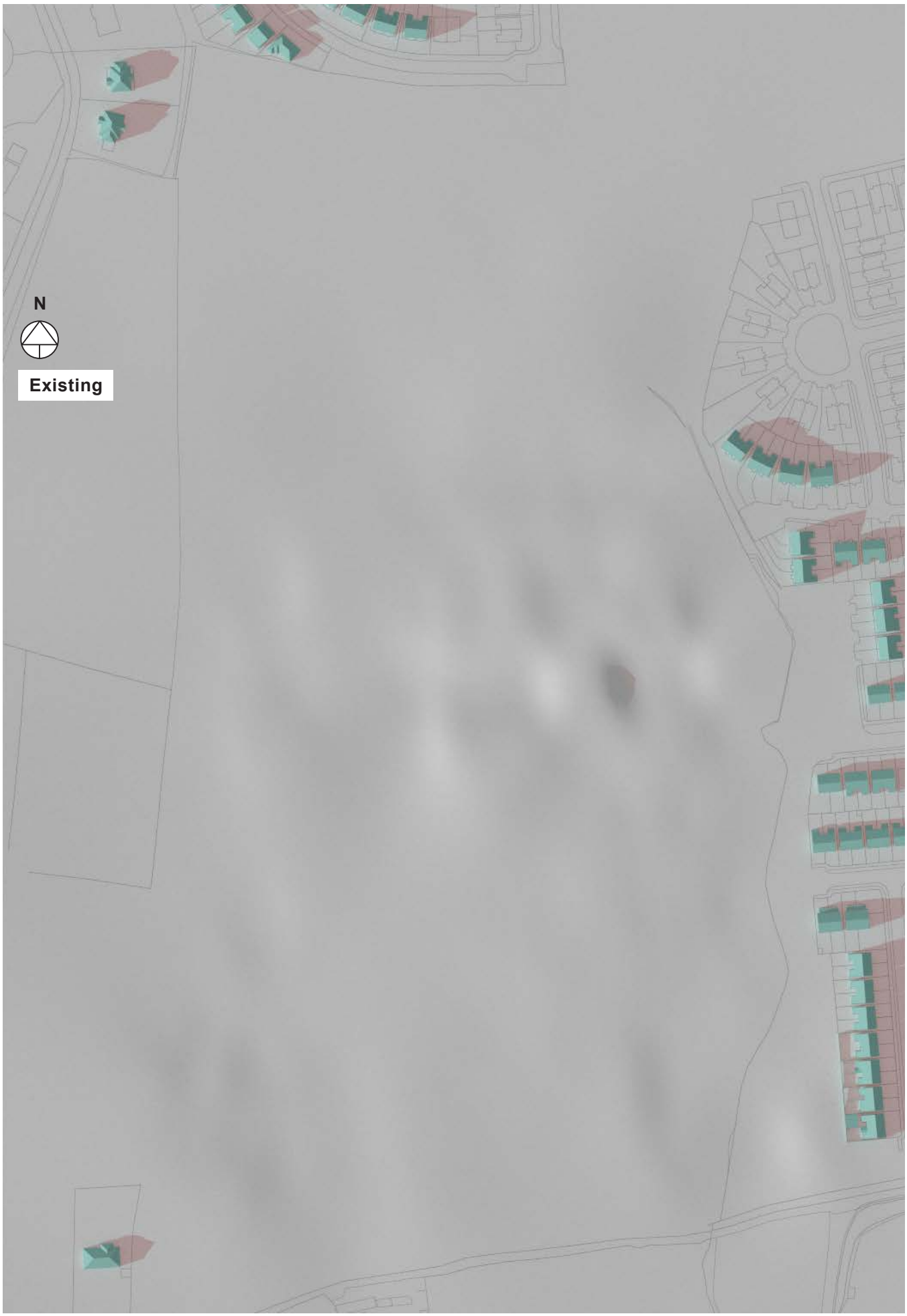


Figure 18: Shadow diagrams 21 March 17:00 UTC

Figure 19: Shadow diagrams 21 March 17:00 UTC

9.3 Shadow Casting diagrams June Solstice

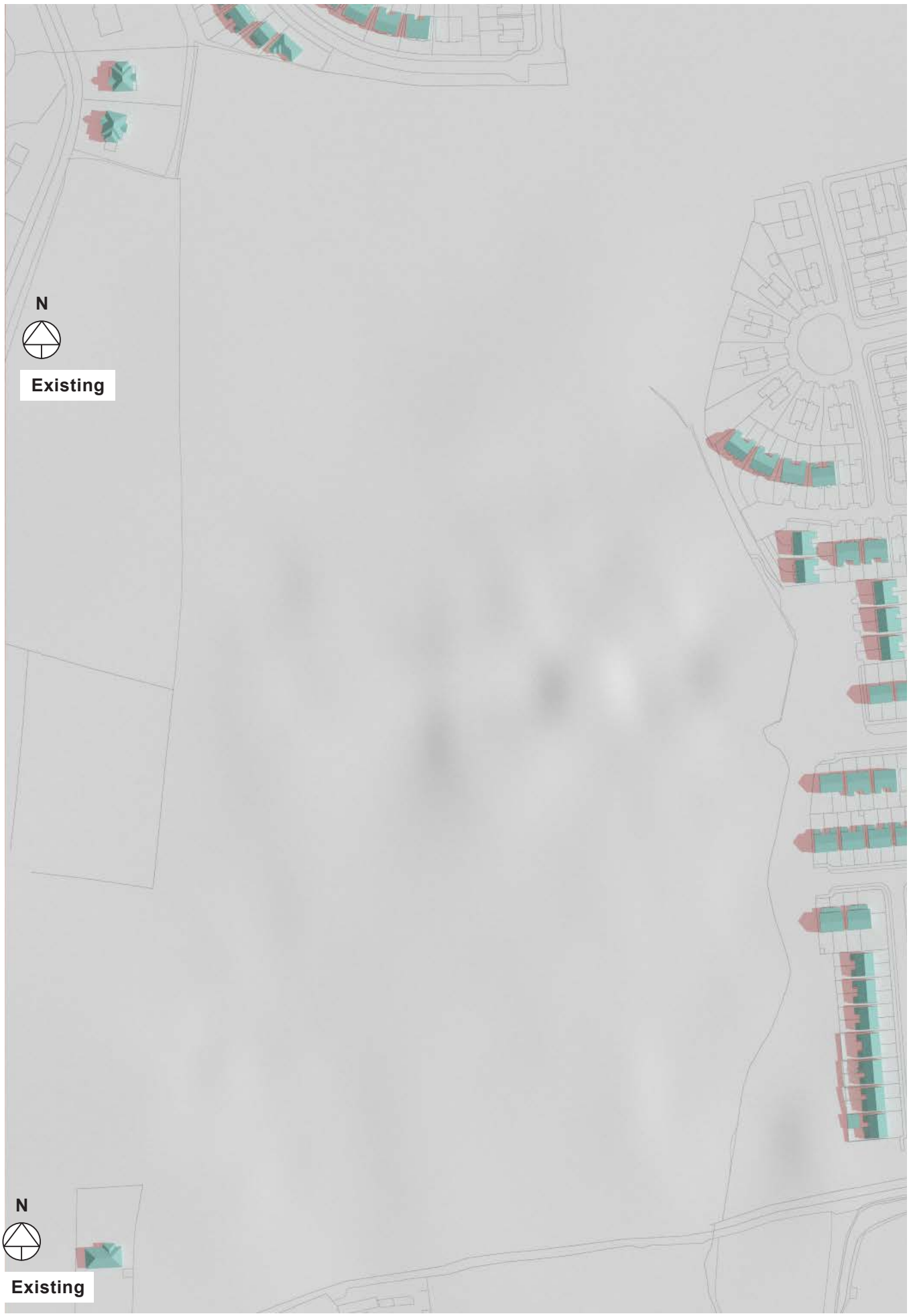


Figure 20: Shadow diagrams 21 June 09.00 UTC +1

9.3 Shadow Casting diagrams June Solstice

Figure 21: Shadow diagrams 21 June 09.00 UTC +1

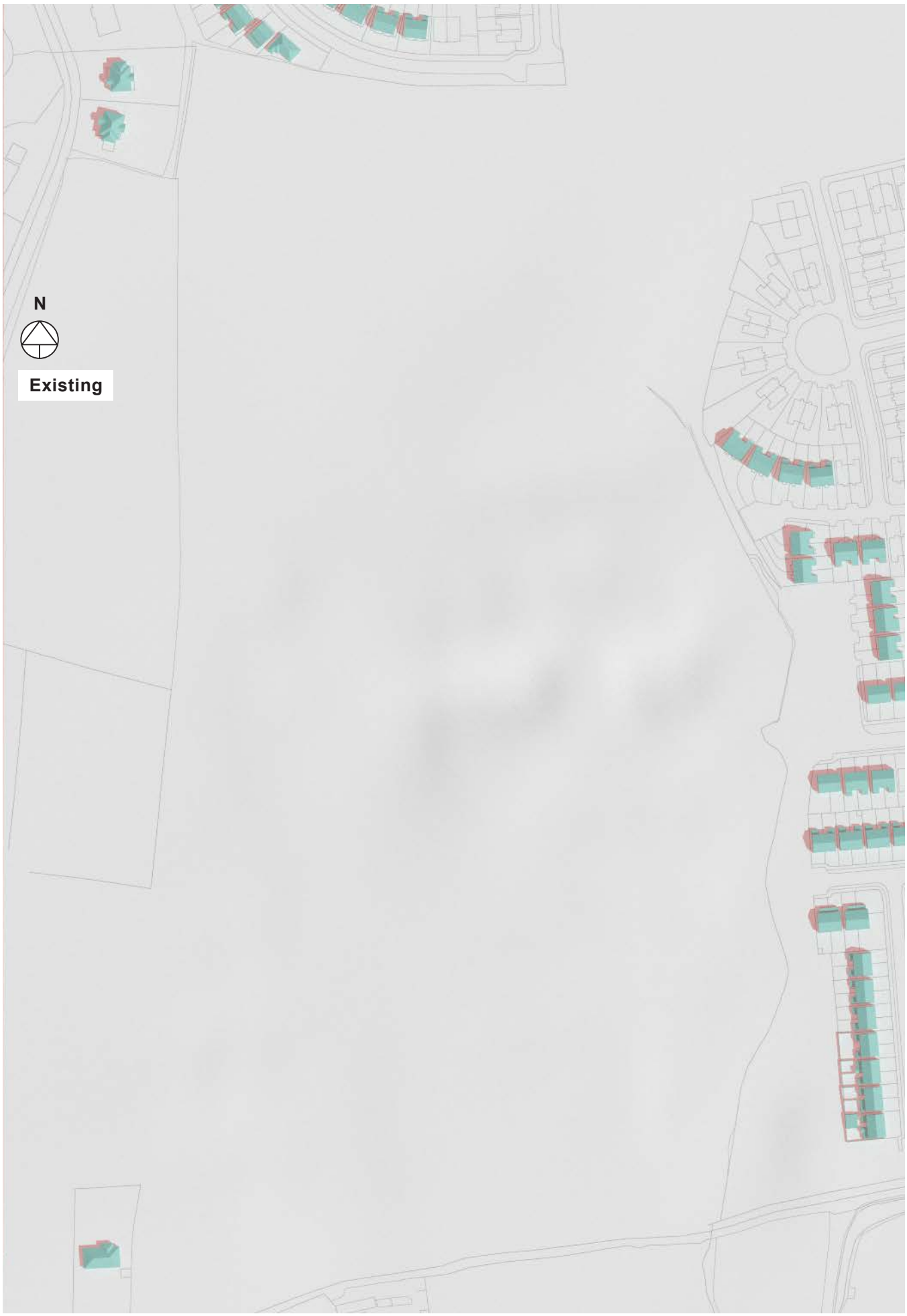


Figure 22: Shadow diagrams 21 June 11:00 UTC +1

Figure 23: Shadow diagrams 21 June 11:00 UTC +1

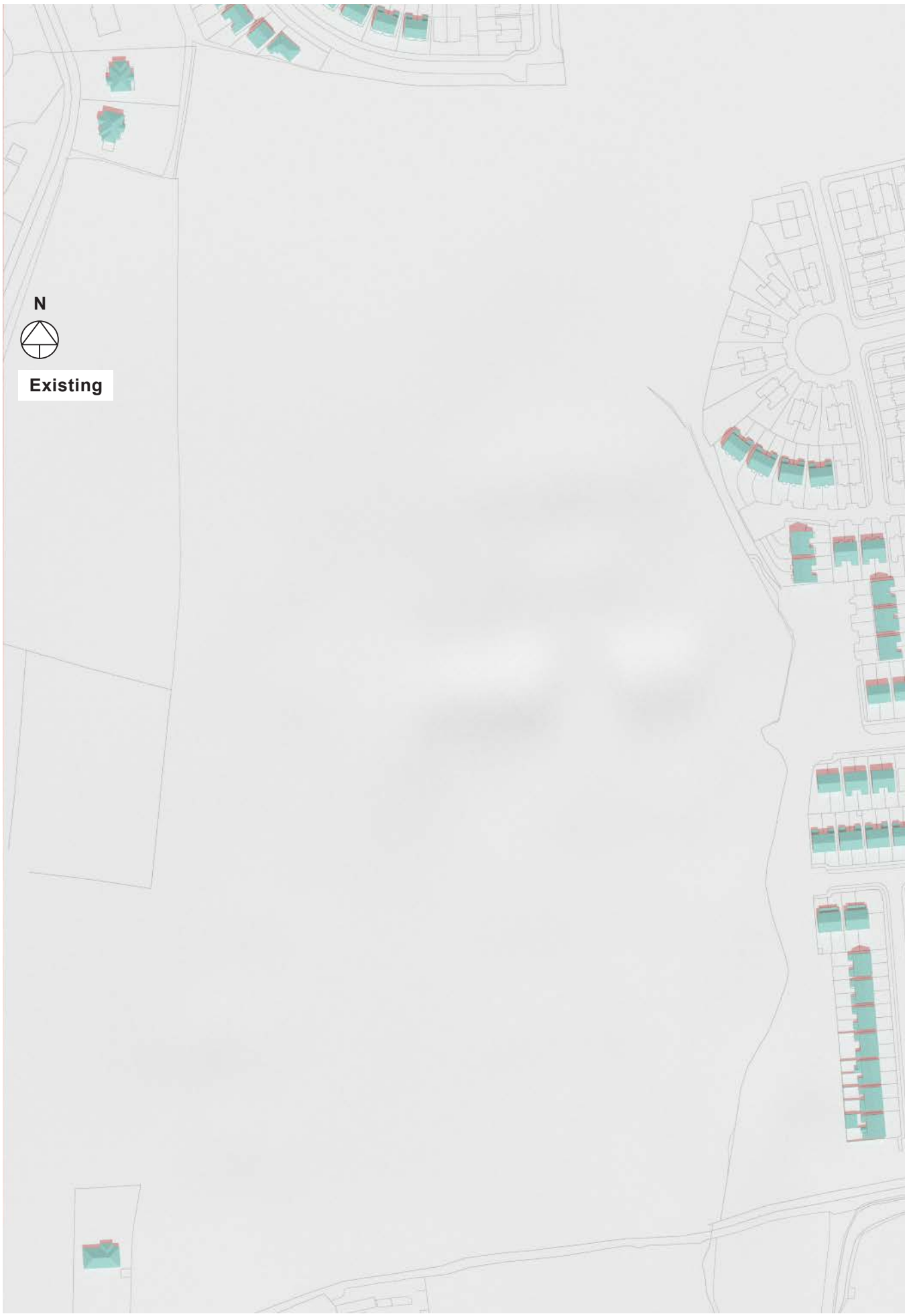


Figure 24: Shadow diagrams 21 June 13:00 UTC +1

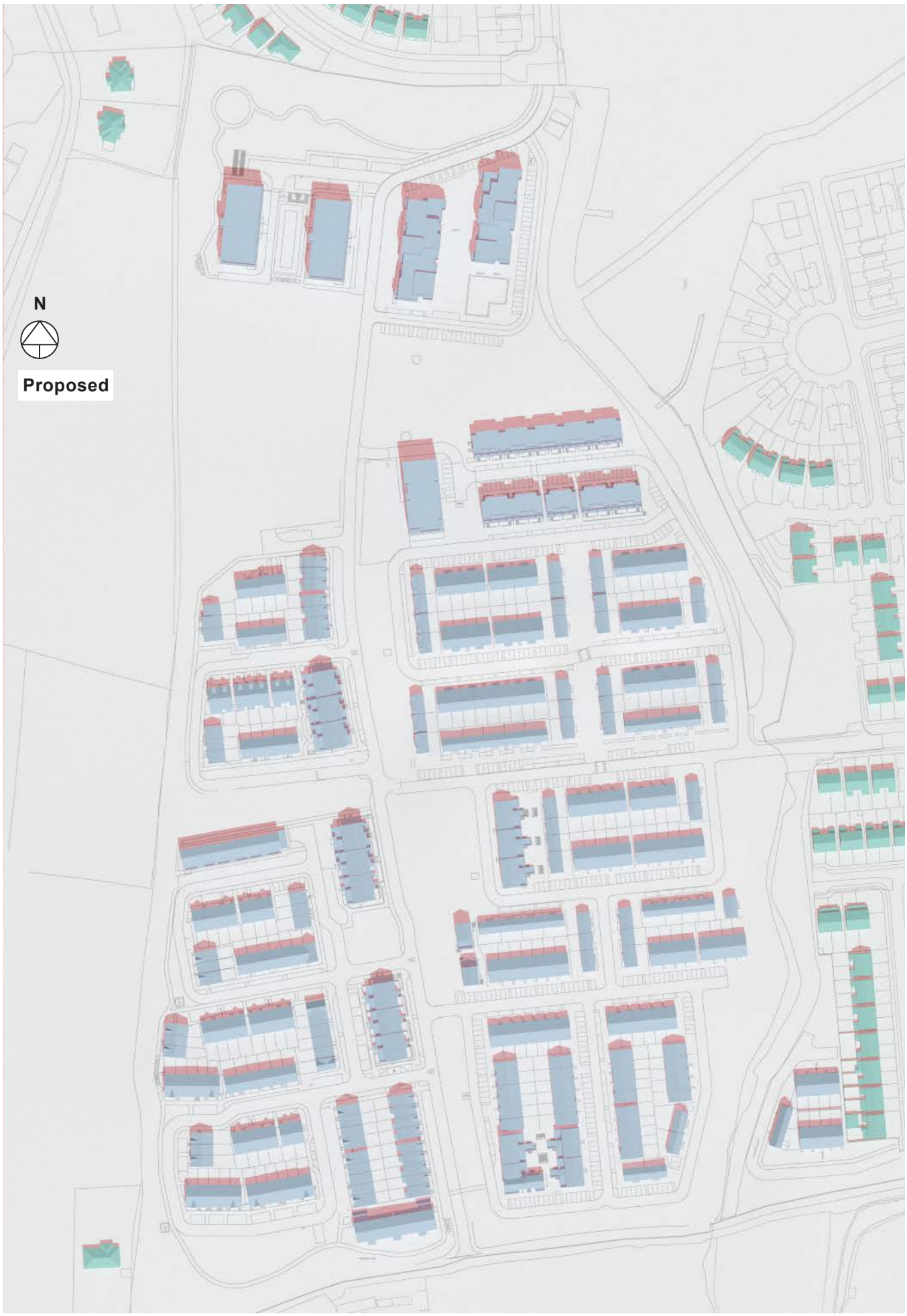


Figure 25: Shadow diagrams 21 June 13:00 UTC +1

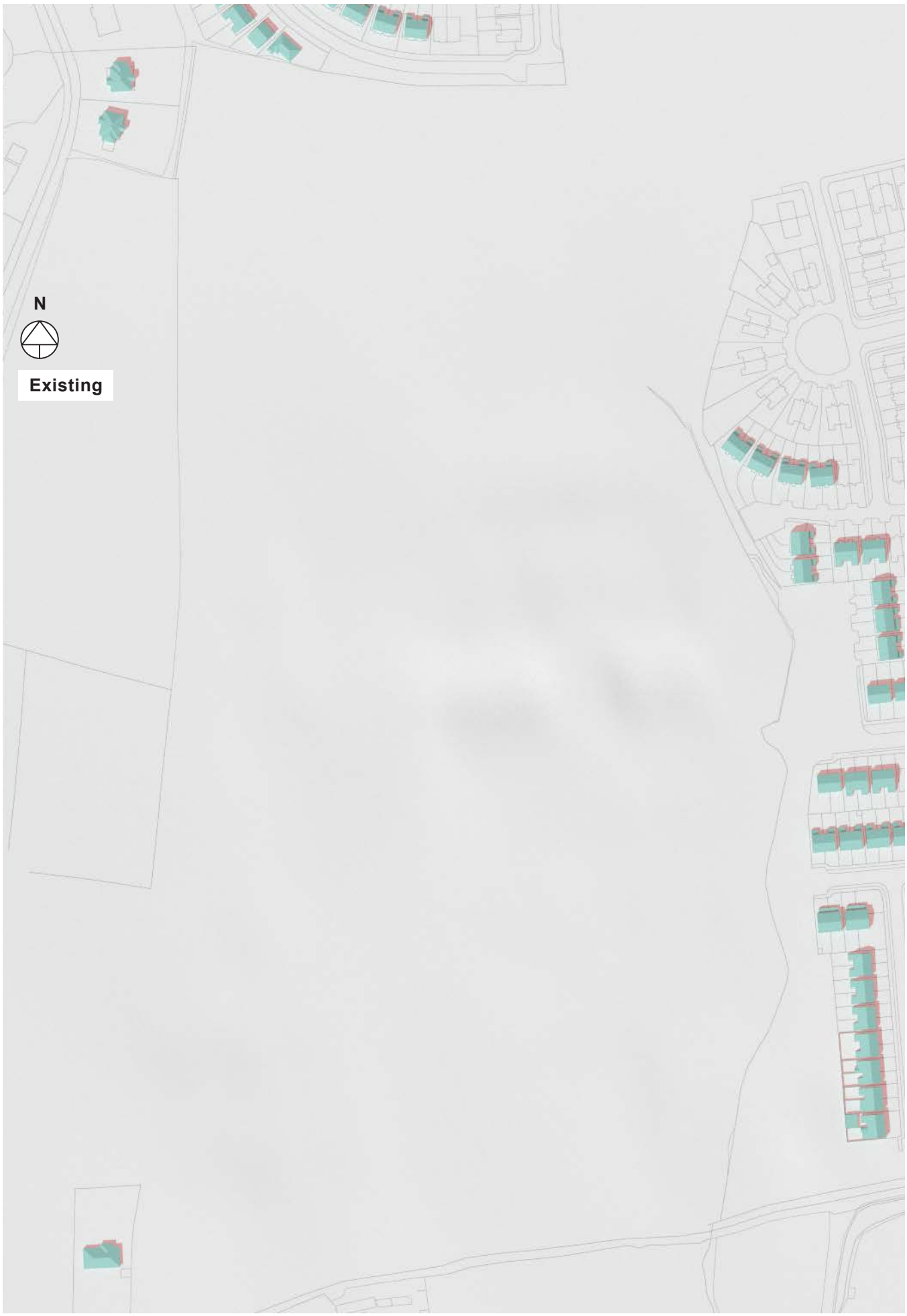


Figure 26: Shadow diagrams 21 June 15:00 UTC +1

Figure 27: Shadow diagrams 21 June 15:00 UTC +1

Figure 28: Shadow diagrams 21 June 17:00 UTC +1

Figure 29: Shadow diagrams 21 June 17:00 UTC +1

Figure 30: Shadow diagrams 21 June 19:00 UTC +1

Figure 31: Shadow diagrams 21 June 19:00 UTC +1

9.4 Shadow Casting diagrams December Solstice

Figure 32: Shadow diagrams 21 December 09:00 UTC

9.4 Shadow Casting diagrams December Solstice

Figure 33: Shadow diagrams 21 December 09:00 UTC

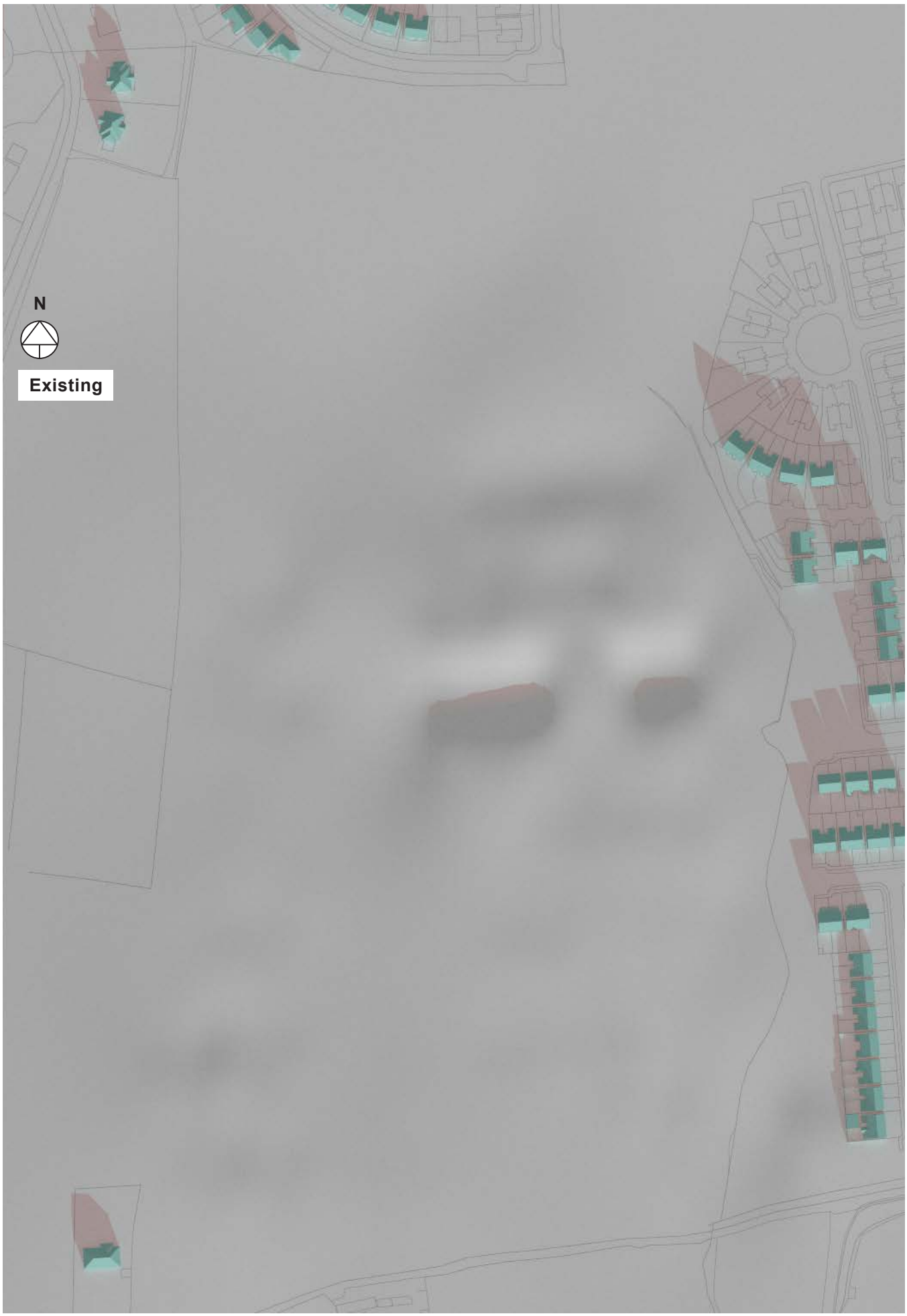


Figure 34: Shadow diagrams 21 December 11:00 UTC

Figure 35: Shadow diagrams 21 December 11:00 UTC

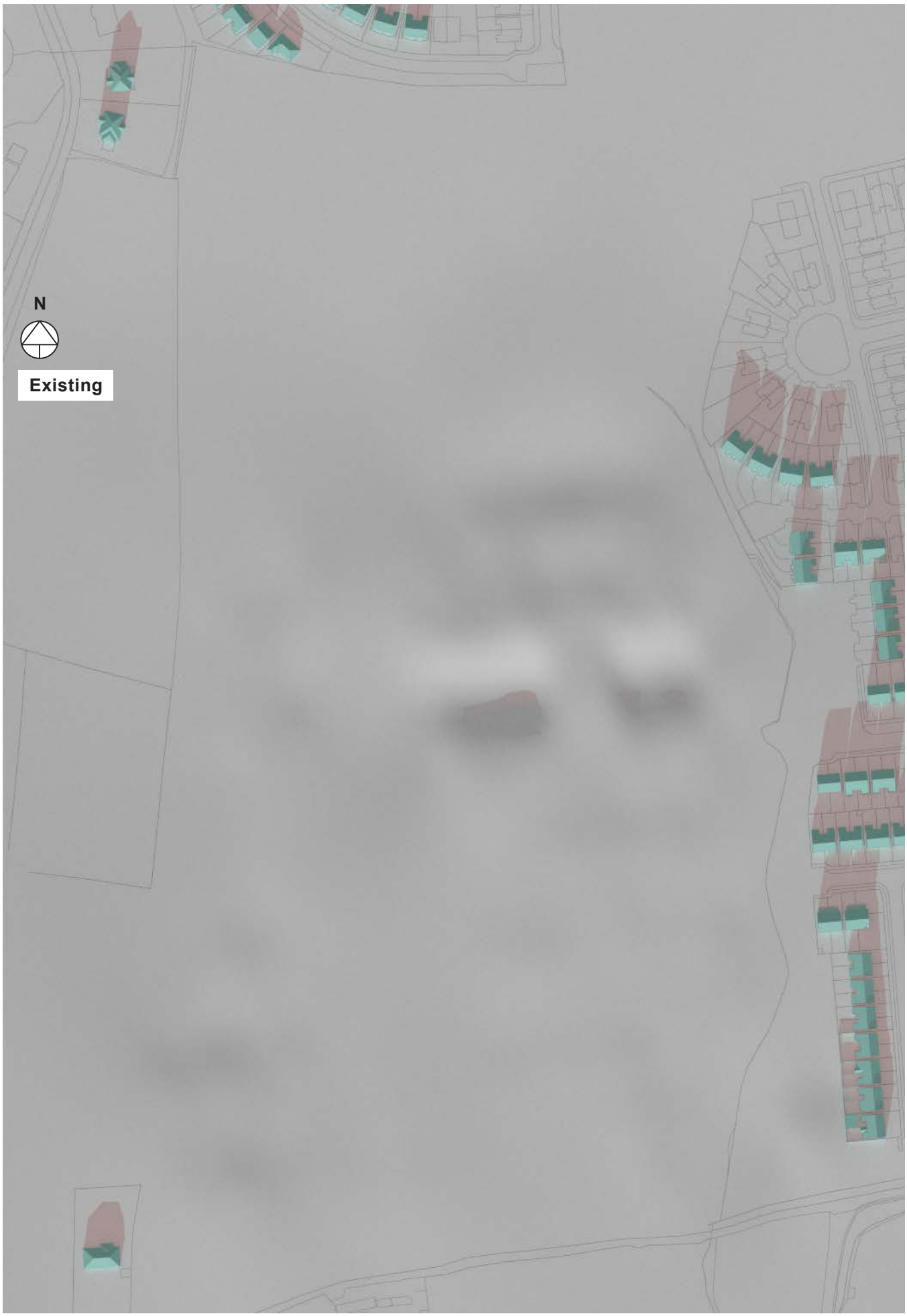


Figure 36: Shadow diagrams 21 December 13:00 UTC

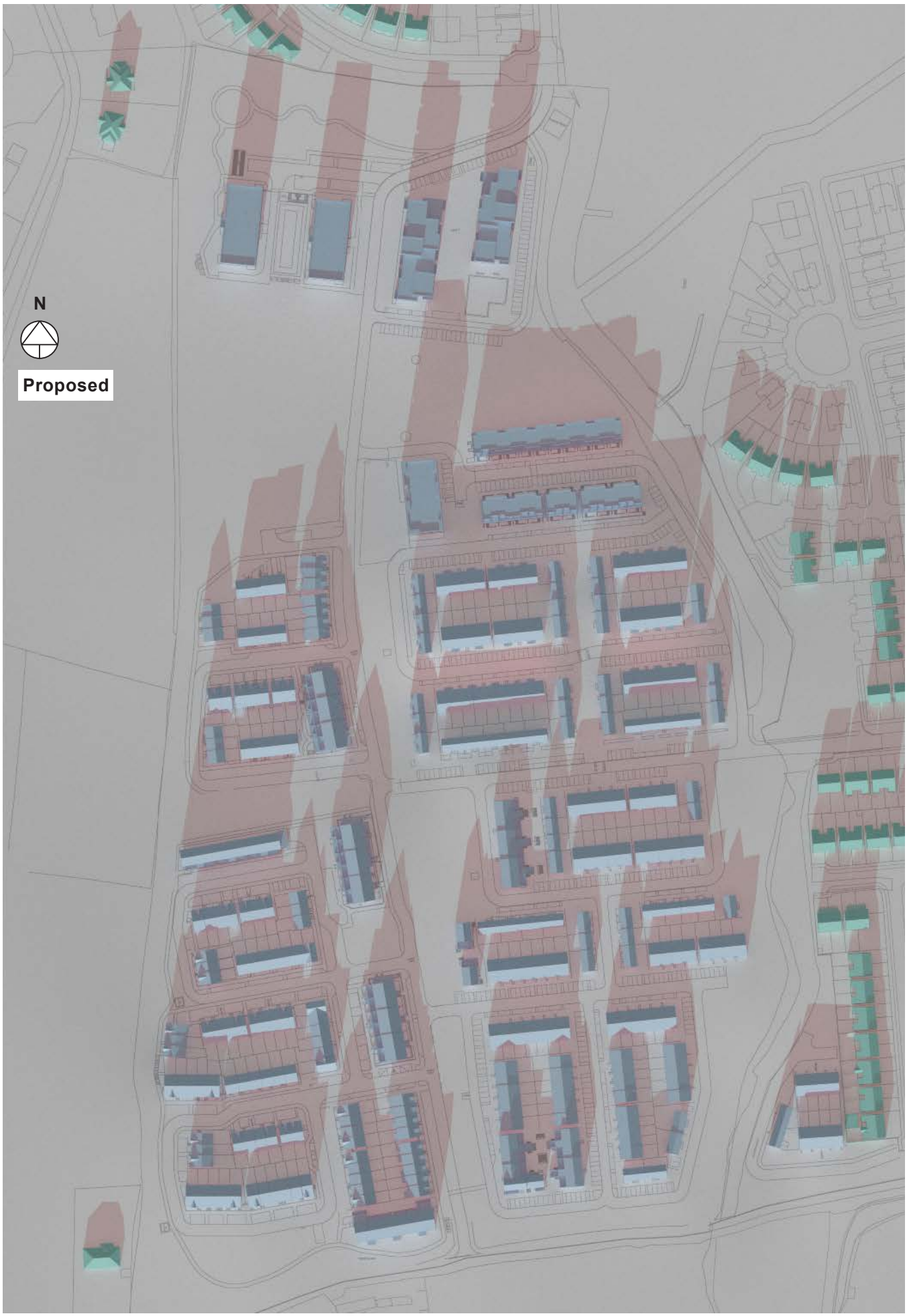


Figure 37: Shadow diagrams 21 December 13:00 UTC

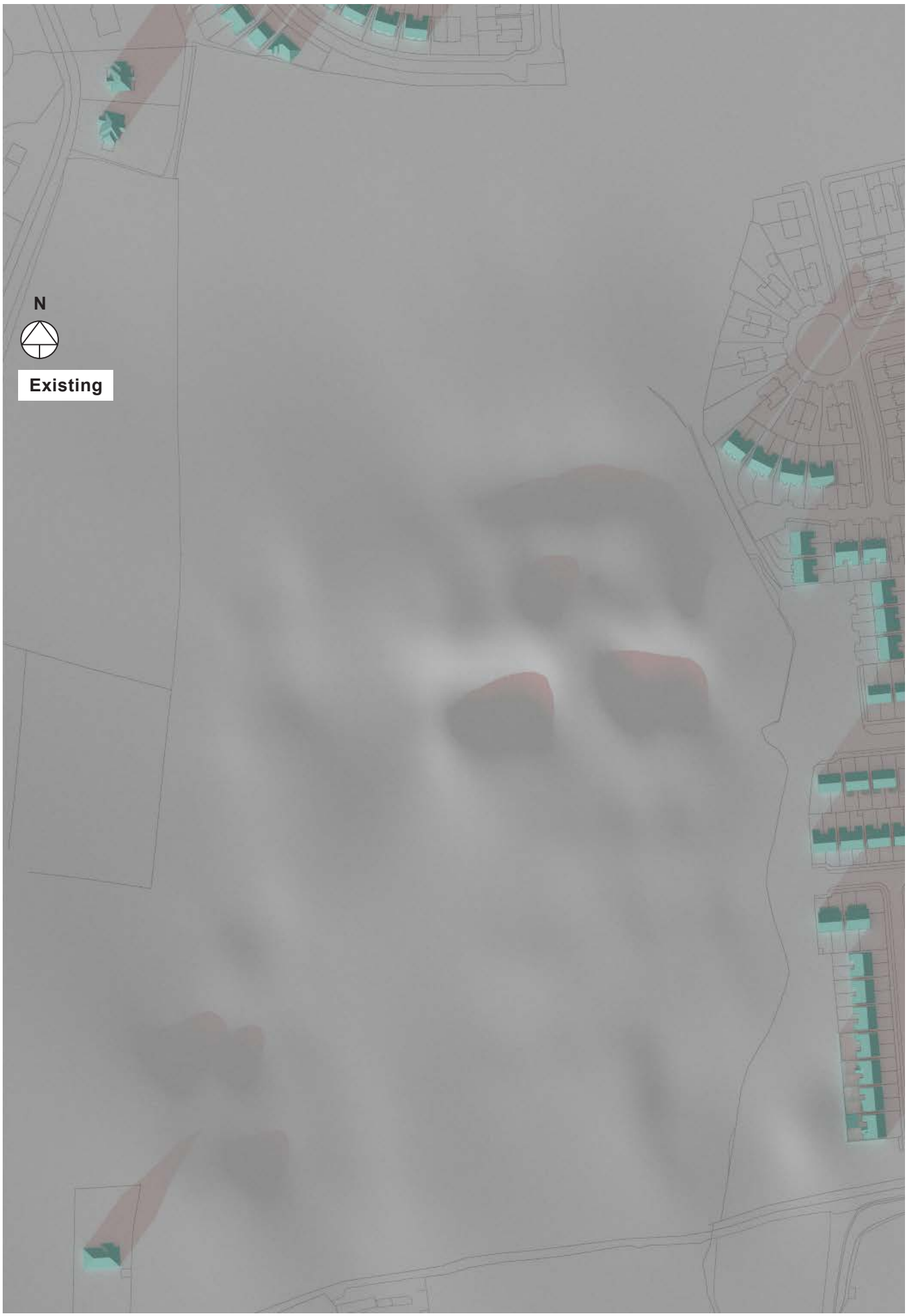


Figure 38: Shadow diagrams 21 December 15:00 UTC

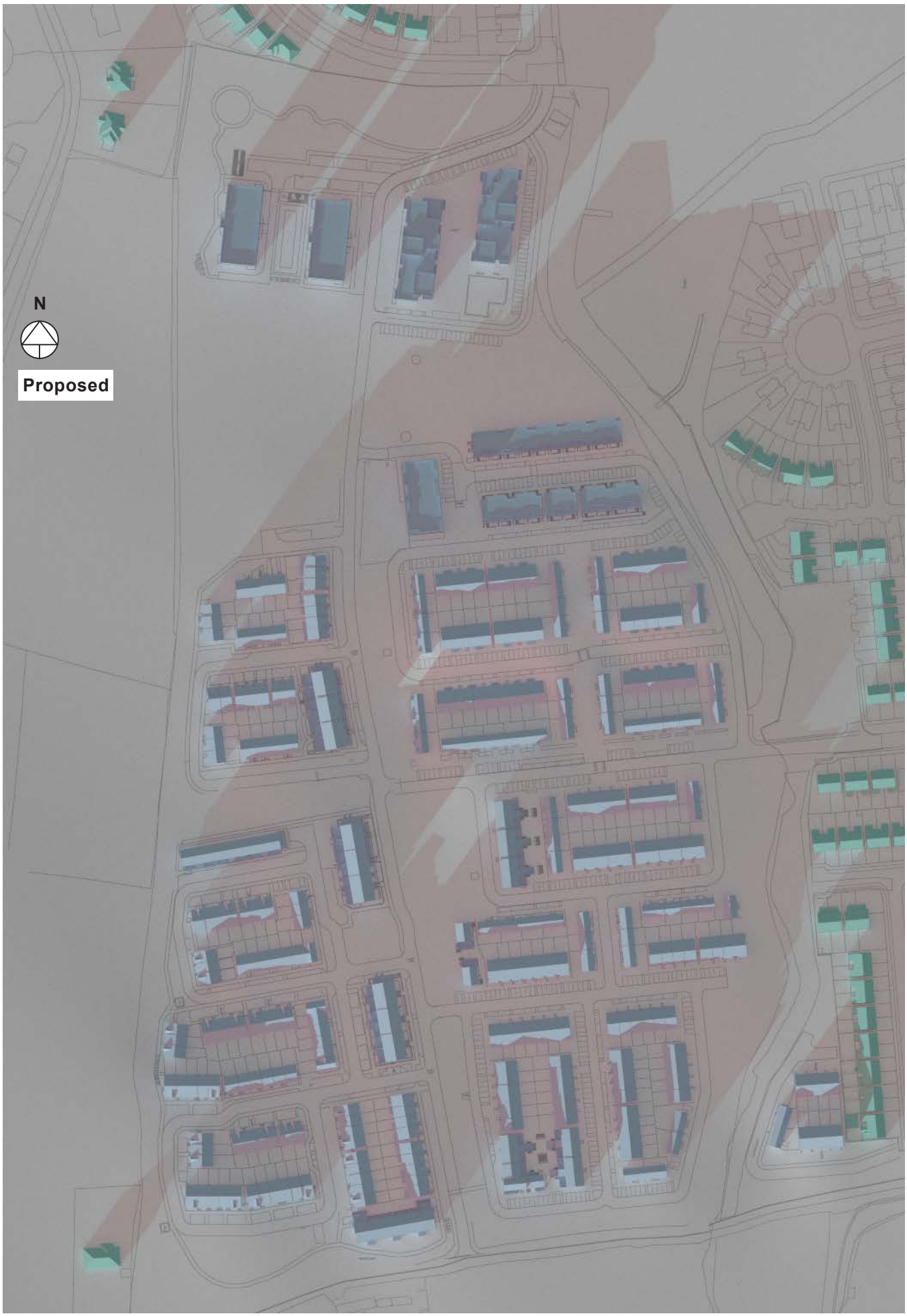


Figure 39: Shadow diagrams 21 December 15:00 UTC