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ST LEONARDS COMMONS

OVERSHADOWING ANALYSIS TO SUPPORT A DEVELOPMENT APPLICATION AT
29-57 CHRISTIE STREET ST LEONARDS

INTENT

The following study seeks to generate an envelope and massing for a development application at 29-57 Christie Street St Leonards for a new commercial development. The specific planning controls which are relevant to this study are the St Leonards Crows Nest 2036 Draft Plan and the Lane Cove Development Control Plan Part D 1.10 . The solar access controls in the St Leonards Crows Nest 2036 Draft Plan protect three hours of sunlight for residential areas while the final plan only protects two. This study has used the draft controls which are more conservative and ensure greater solar amenity. A comparison with the final plan controls is included.

The results of this study define a building envelope for this development. As the design progressed, this envelope was found to produce some spatial and aesthetically inappropriate results. A methodology was found to resolve these issues by infilling some parts of the proposed building form. These infills were further studied to understand their shadow impact. The results demonstrated that the impact was negligible with most increases being within a margin of tolerance. As such, these modifications were adopted into the development application proposal.

METHODOLOGY

The study uses a 3D model of St Leonards from 2015 at Level of Detail (LOD) 3 provided by AAM Pty Ltd accurate to 0.3m. Other buildings built since then such as the Mirvac Development St Leonards Square have been modelled as massings from existing drawings. The study uses the parametric modelling software Grasshopper and the sunlighting analysis plugin Ladybug. Although the scripts and modelling has been checked in-house for quality assurance, the accuracy of the study is dependent upon the accuracy of the 3D model input and the Ladybug software.

VEGETATION

The area of study has high levels of tree coverage and vegetation which would realistically cause overshadowing onto the park and residential areas. For the purpose of this study, trees and vegetation have NOT been accounted for. The results of this study therefore are more conservative than real life conditions.

ISSUE	A
DATE	29/09/2020
PREPARED BY	MA
CHECK	QY, JF

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AMENDMENTS

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PROJECT
29-57 CHRISTIE STREET
COMMERCIAL DEVELOPMENT
29-57 CHRISTIE STREET, ST LEONARDS NSW 2065

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ANALYSIS CONDUCTED USING MORE
CONSERVATIVE DRAFT CONTROLS
PROVIDE GREATER SOLAR ACCESS

ST LEONARDS CROWS NEST 2036 DRAFT PLAN

BUILT FORM ACTIONS AND RECOMMENDATIONS

Amend planning controls to introduce solar height planes to prevent additional overshadowing of specific areas in winter at the times stipulated below:

Newlands Park 10:00am - 3:00pm

Residential Areas 9:00am - 3:00pm for at least 3 hours

ST LEONARDS CROWS NEST 2036 PLAN

BUILT FORM ACTIONS AND RECOMMENDATIONS

Amend planning controls to introduce solar height planes to prevent additional overshadowing of specific areas in winter at the times stipulated below:

Newlands Park 10:00am - 3:00pm

Residential Areas 9:00am - 3:00pm for at least 2 hours

FINAL PLAN PROTECTS 2 HOURS NOT 3

LANE COVE DCP CONTROLS

D - COMMERCIAL DEVELOPMENT AND MIXED USE

1.10 SOLAR ACCESS

Objectives

The objective for solar access is:

- 1. To provide reasonable solar access to habitable rooms and recreational areas of new and existing developments

Provisions

These provisions apply to proposed developments and any residential development beyond the site:

a)Commercial and mixed use developments are not to reduce sunlight to dwellings in the adjacent or same zone below a minimum of 3 hours sunlight on a portion of the windows of the habitable rooms between 9am and 3pm on 21 June.

b) Where adjacent dwellings and their open space already receive less than the standard hours of sun, new development should seek to maintain this solar access where practicable.

c) Habitable rooms in at least 70% of dwellings in high density residential developments, should receive a minimum of three hours direct sunlight between 9am and 3pm on 21st June, in total between any portion of these rooms. In dense urban areas a minimum of 2 hours may be acceptable. A reasonable proportion of both the common and private open space in those sites is also to receive sunlight during that period, according to the circumstances of the sites.

d) The number of single-aspect dwellings with a southerly aspect (SW-SE) should be limited to a maximum of 10% of total dwellings within a high density residential development. Developments varying from the minimum standard due to site constraints and orientation must demonstrate how energy efficiency is addressed.

e) Council may accept a reduction in solar access for the subject site and adjacent development if the topography and lot orientation (as distinct from a preferred design) are such that the standard is considered unreasonable.

Shadow diagrams are required with the development application to show solar access and the extent of overshadowing.

NOTE

Residential areas south of 29-57 Christie Street, located within the North Sydney LGA, sit directly south of the highly built up St Leonards CBD. For this reason, many of the residential lots already do not receive 3 hours of sunlight. For the purpose of this development, "reasonable solar access to habitable rooms and recreational areas of new and existing developments" will be provided by ensuring that all private open spaces and windows receive at least 2 hours of sunlight from 21 March until 21 September and where they do not already, solar access will be reduced no further.

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AREA OF STUDY



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METHOD TO DETERMINE COMPLYING ENVELOPE

STEP 1

PARK
OVERSHADOWING

RESIDENTIAL AREAS
OVERSHADOWING

1) Set time for which no additional overshadowing should occur on the park.

2) Extrude the outline of the park, subtracting existing shadows at the solar vector for that time for every day of the year of the study period.

3) Delete these extrusions from an envelope created by extruding the site boundary directly upwards.

4) The resulting envelope is one that does not cause additional overshadowing from the specified time for the study period.

5) Use the resultant envelope from the RE1 study to identify zones that will have an impact from the cast sun shadow from 9:00am-3:00pm JUN 21

6) Cast the building envelope shadow over the residential facade to identify the affected residential lots.

7) Isolate the impacted facades that receive less than 3 hours of direct sunlight. The detailed process is as follows:

(a) calculate the existing context Shadow from 9:00am-3:00pm.

(b) quantify how many hours of direct sunlight per day each portion of the residential building gets currently.

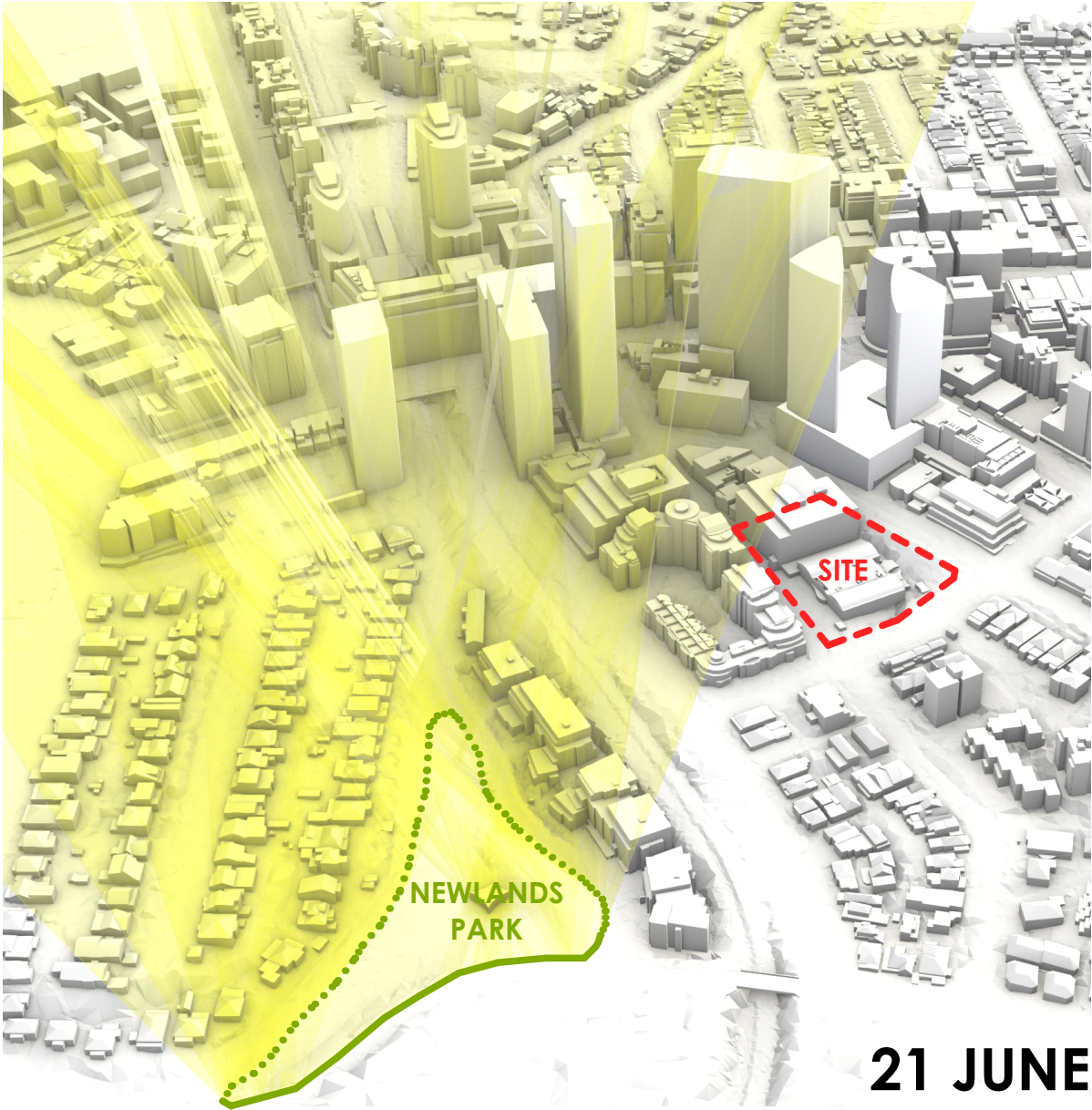
(c) quantify how many hours of direct sunlight per day each portion of the residential building gets with the new massing in place.

(d) isolate the areas that are impacted by the nominal massing and receive less than 3 hours of direct sunlight, then find their specific overshadowing times to use as the reverse projections.

8) Reverse project the impacted areas, cutting out from the nominal building mass.

9) Create massing to fit within envelope

The adopted controls derived from the St Leonards Crows Nest Master Plan says that "new development in the area does not produce any additional overshadowing of nominated places during specified hours in mid-winter." For Newlands Park, the specified hours are 10:00am until 3:00pm.



METHOD TO DETERMINE COMPLYING ENVELOPE

STEP 2

- PARK
OVERSHADOWING

1) Set time for which no additional overshadowing should occur on the park.
2) Extrude the outline of the park, subtracting existing shadows at the solar vector for that time for every day of the year of the study period.
3) Delete these extrusions from an envelope created by extruding the site boundary directly upwards.
4) The resulting envelope is one that does not cause additional overshadowing from the specified time for the study period.
- RESIDENTIAL AREAS
OVERSHADOWING

5) Use the resultant envelope from the RE1 study to identify zones that will have an impact from the cast sun shadow from 9:00am-3:00pm JUN 21
6) Cast the building envelope shadow over the residential facade to identify the affected residential lots.
7) Isolate the impacted facades that receive less than 3 hours of direct sunlight. The detailed process is as follows:
 (a) calculate the existing context Shadow from 9:00am-3:00pm.
 (b) quantify how many hours of direct sunlight per day each portion of the residential building gets currently.
 (c) quantify how many hours of direct sunlight per day each portion of the residential building gets with the new massing in place.
 (d) isolate the areas that impacted by the nonimal massing and receive less than 3 hours of direct sunlight, then find their specific overshadowing times to use as the reverse projections.
8) Reverse project the impacted areas, cutting out from the nominal building mass.
9) Create massing to fit within envelope

For June 21, the existing shadows cast onto the park from 10:00am until 3:00pm are generated from a 3D model of the surrounding area. These are then subtracted from the outline of the park to reveal those areas of the park getting sunlight already. This shape is then extruded back at the solar vector for that time. Any built form within this would cast additional shadow onto the park on June 21 from 10:00am until 3:00pm. The amalgamation of these form a large fan.

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METHOD TO DETERMINE COMPLYING ENVELOPE

STEP 3

- PARK
OVERSHADOWING

1) Set time for which no additional overshadowing should occur on the park.
2) Extrude the outline of the park, subtracting existing shadows at the solar vector for that time for every day of the year of the study period.
3) Delete these extrusions from an envelope created by extruding the site boundary directly upwards.
4) The resulting envelope is one that does not cause additional overshadowing from the specified time for the study period.
- RESIDENTIAL AREAS
OVERSHADOWING

5) Use the resultant envelope from the RE1 study to identify zones that will have an impact from the cast sun shadow from 9:00am-3:00pm JUN 21
6) Cast the building envelope shadow over the residential facade to identify the affected residential lots.
7) Isolate the impacted facades that receive less than 3 hours of direct sunlight. The detailed process is as follows:
 (a) calculate the existing context Shadow from 9:00am-3:00pm.
 (b) quantify how many hours of direct sunlight per day each portion of the residential building gets currently.
 (c) quantify how many hours of direct sunlight per day each portion of the residential building gets with the new massing in place.
 (d) isolate the areas that impacted by the nominal massing and receive less than 3 hours of direct sunlight, then find their specific overshadowing times to use as the reverse projections.
8) Reverse project the impacted areas, cutting out from the nominal building mass.
9) Create massing to fit within envelope



This envelope is the volume in which a building can be built which will not cause additional overshadowing on the park from 10:00am until 3:00pm. The size of this will change according to the study times and study periods.

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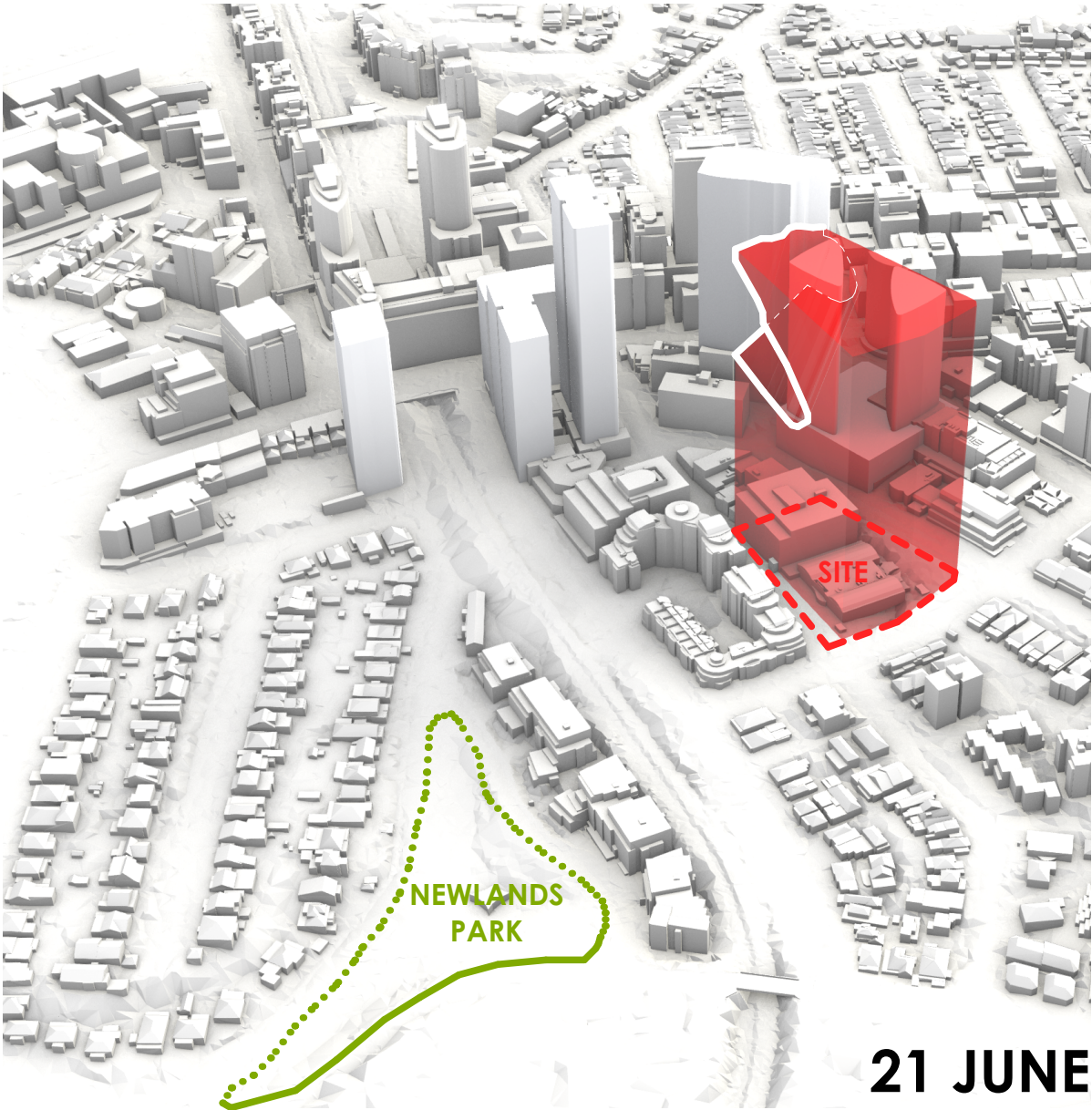
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METHOD TO DETERMINE COMPLYING ENVELOPE

STEP 4

- PARK
OVERSHADOWING

1) Set time for which no additional overshadowing should occur on the park.

2) Extrude the outline of the park, subtracting existing shadows at the solar vector for that time for every day of the year of the study period.

3) Delete these extrusions from an envelope created by extruding the site boundary directly upwards.

4) The resulting envelope is one that does not cause additional overshadowing from the specified time for the study period.
- RESIDENTIAL AREAS
OVERSHADOWING

5) Use the resultant envelope from the RE1 study to identify zones that will have an impact from the cast sun shadow from 9:00am-3:00pm JUN 21

6) Cast the building envelope shadow over the residential facade to identify the affected residential lots.

7) Isolate the impacted facades that receive less than 3 hours of direct sunlight. The detailed process is as follows:

(a) calculate the existing context Shadow from 9:00am-3:00pm.

(b) quantify how many hours of direct sunlight per day each portion of the residential building gets currently.

(c) quantify how many hours of direct sunlight per day each portion of the residential building gets with the new massing in place.

(d) isolate the areas that are impacted by the nominal massing and receive less than 3 hours of direct sunlight, then find their specific overshadowing times to use as the reverse projections.

8) Reverse project the impacted areas, cutting out from the nominal building mass.

9) Create massing to fit within envelope

The site boundary is then extruded directly upwards to test if the site intersects with the no additional overshadowing fan. The extrusions from the park are then deleted from this to generate the no additional overshadowing envelope.

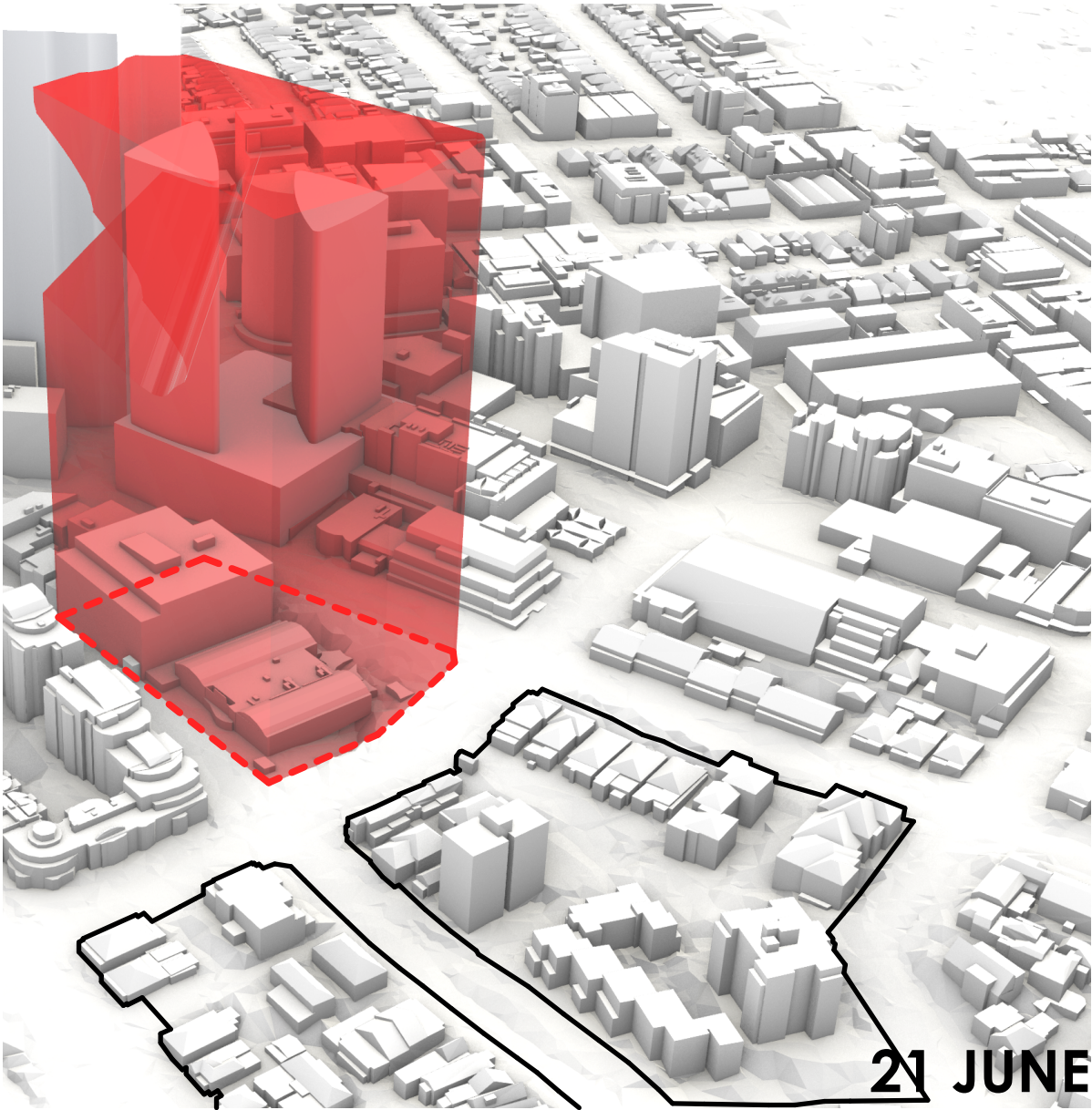
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METHOD TO DETERMINE COMPLYING ENVELOPE

STEP 5

- PARK
OVERSHADOWING

1) Set time for which no additional overshadowing should occur on the park.

2) Extrude the outline of the park, subtracting existing shadows at the solar vector for that time for every day of the year of the study period.

3) Delete these extrusions from an envelope created by extruding the site boundary directly upwards.

4) The resulting envelope is one that does not cause additional overshadowing from the specified time for the study period.
- RESIDENTIAL AREAS
OVERSHADOWING

5) Use the resultant envelope from the RE1 study to identify zones that will have an impact from the cast sun shadow from 9:00am-3:00pm JUN 21

6) Cast the building envelope shadow over the residential facade to identify the affected residential lots.

7) Isolate the impacted facades that receive less than 3 hours of direct sunlight. The detailed process is as follows:

(a) calculate the existing context Shadow from 9:00am-3:00pm.

(b) quantify how many hours of direct sunlight per day each portion of the residential building gets currently.

(c) quantify how many hours of direct sunlight per day each portion of the residential building gets with the new massing in place.

(d) isolate the areas that are impacted by the nominal massing and receive less than 3 hours of direct sunlight, then find their specific overshadowing times to use as the reverse projections.

8) Reverse project the impacted areas, cutting out from the nominal building mass.

9) Create massing to fit within envelope

From this envelope, we identify which residential areas will be affected. This study will look to ensure that all residential facades receive at least three hours of sunlight or if they currently receive less than three hours of sunlight, are not reduced further.

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STEP 5

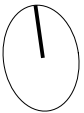
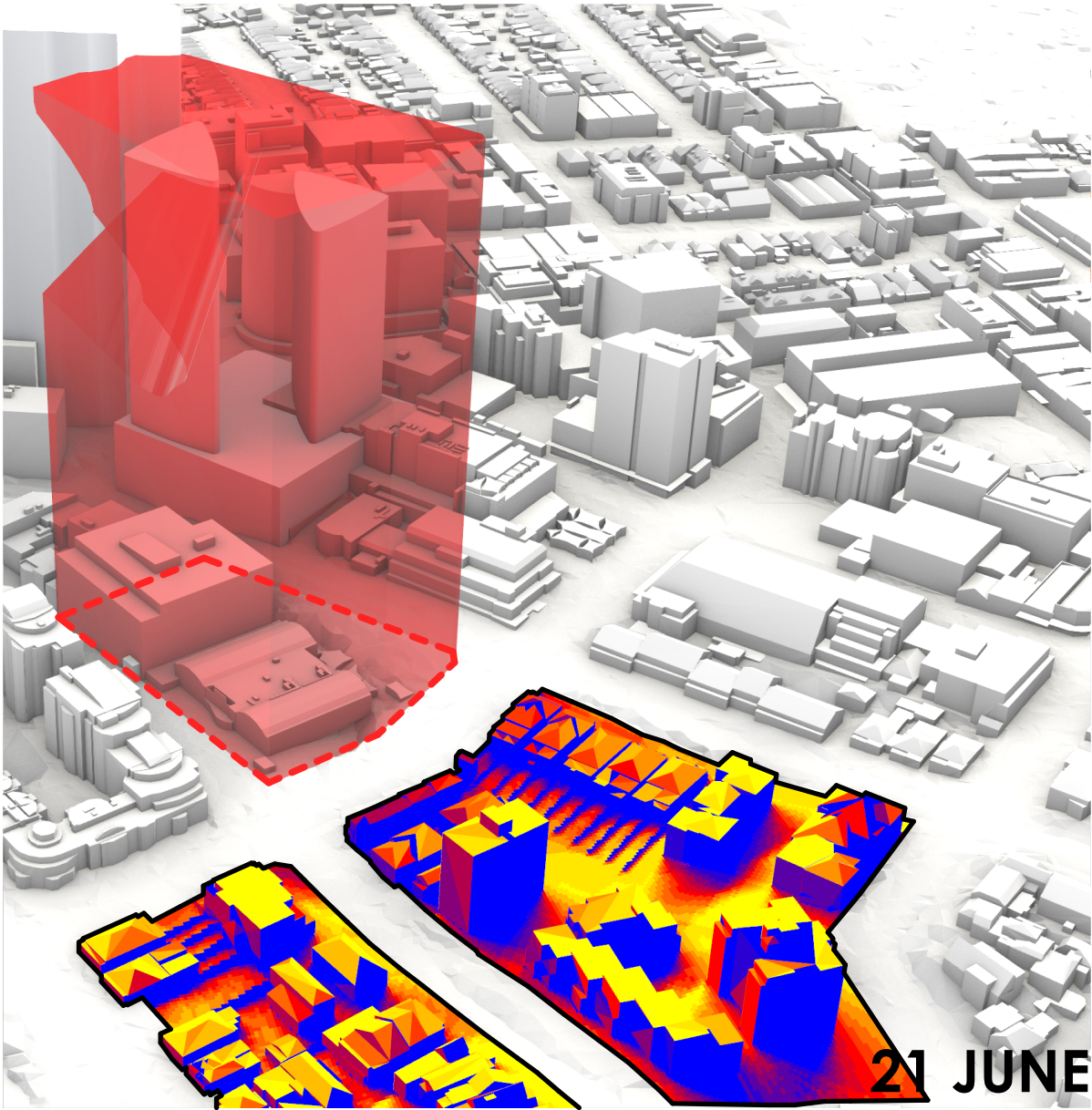
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METHOD TO DETERMINE COMPLYING ENVELOPE

STEP 6

- PARK
OVERSHADOWING

RESIDENTIAL AREAS
OVERSHADOWING
- 1) Set time for which no additional overshadowing should occur on the park.
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 - 6) Cast the building envelope shadow over the residential facade to identify the affected residential lots.**
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 - (d) isolate the areas that are impacted by the nominal massing and receive less than 2 hours of direct sunlight, then find their specific overshadowing times to use as the reverse projections.
 - 8) Reverse project the impacted areas, cutting out from the nominal building mass.
 - 9) Create massing to fit within envelope

The diagram to the left shows the amount of sunlight received for specific 1m x 1m grid points within the test area with blue being the least and yellow the most. This diagram shows the results for 21 June. Note ONLY FACADES OF RESIDENTIAL BUILDINGS ARE CONSIDERED FOR THIS STUDY.

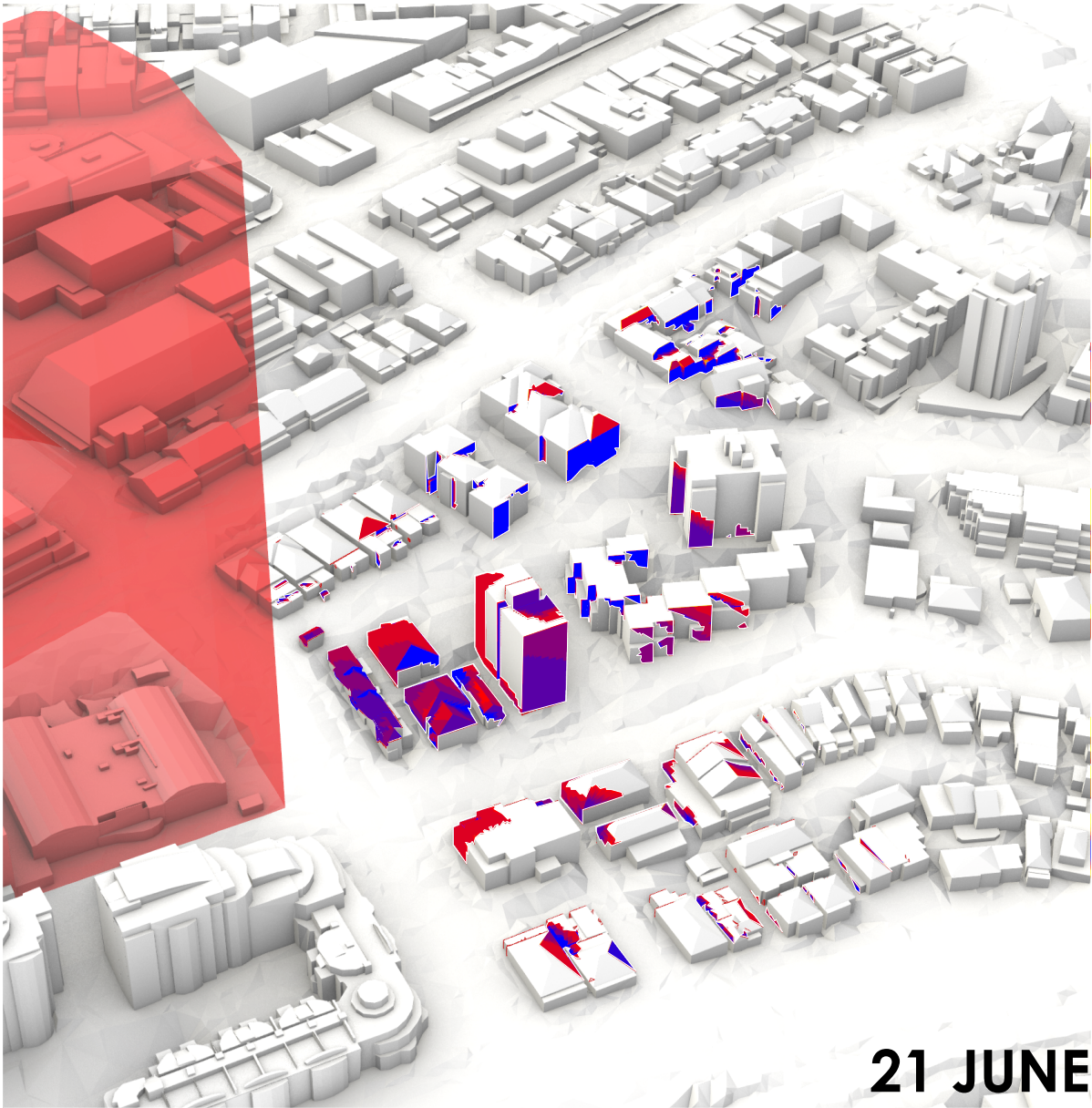
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METHOD TO DETERMINE COMPLYING ENVELOPE

STEP 7A-C

- PARK
OVERSHADOWING

RESIDENTIAL AREAS
OVERSHADOWING
- 1) Set time for which no additional overshadowing should occur on the park.

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(b) quantify how many hours of direct sunlight per day each portion of the residential building gets currently.

(c) quantify how many hours of direct sunlight per day each portion of the residential building gets withthe new massing in place.

(d) isolate the areas thats impacted by the nonimal massing and receive less than 3 hours of direct sunlight, then find their specific overshadowing times to use as the reverse projections.

8) Reverse project the impacted areas, cutting out from the nominal building mass.

9) Create massing to fit within envelope

Calculate the hours of sunlight received without the initial envelope in place. Calculate the hours of sunlight received with the initial envelope in place. From this, we identify the areas that are; **a) affected by the new envelope** and; **b) now receive less than three hours of sunlight**. These are the areas for which our proposal cannot cause additional excessive overshadowing.

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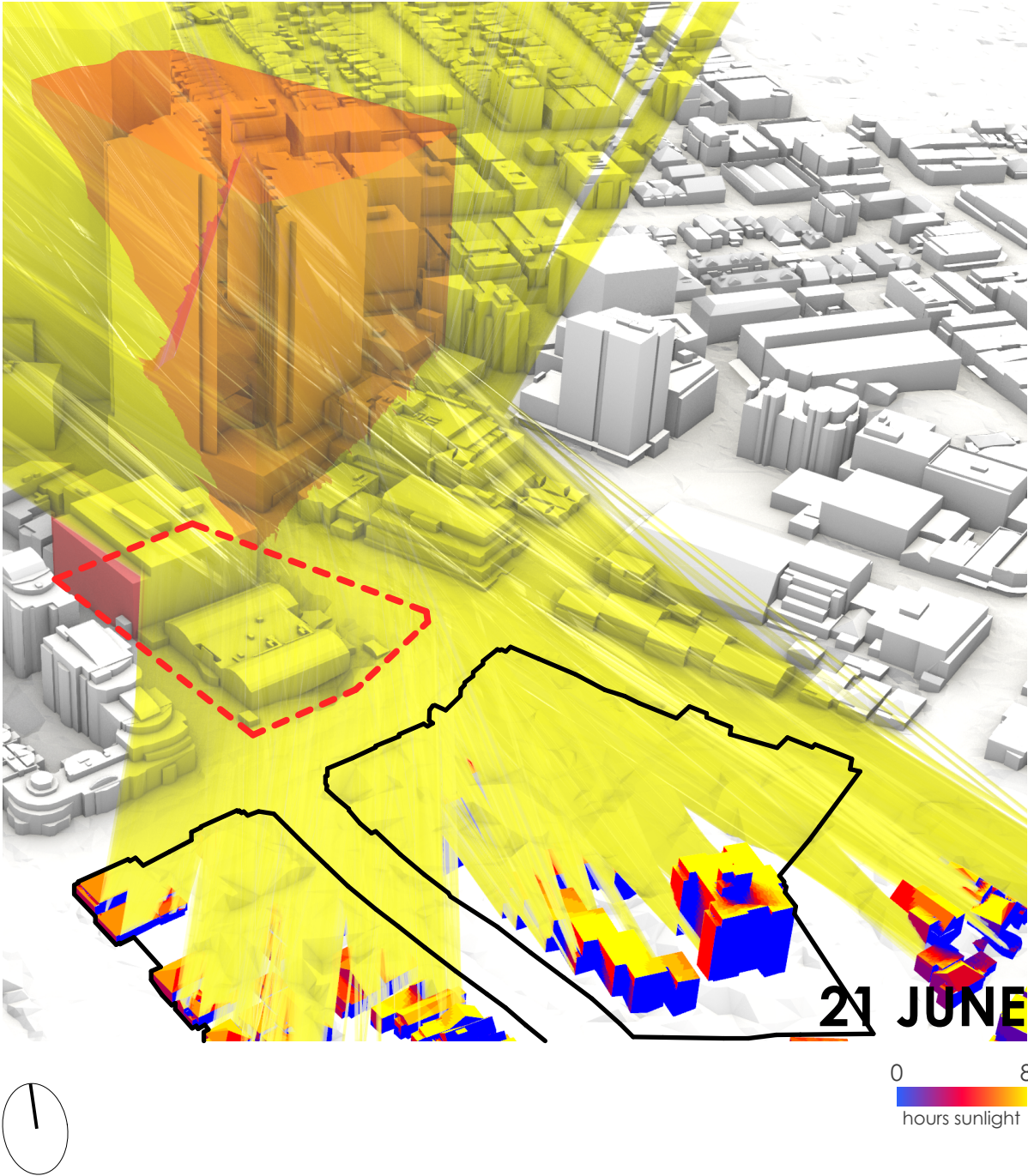
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METHOD TO DETERMINE COMPLYING ENVELOPE

STEP 7D

- PARK OVERSHADOWING
- RESIDENTIAL AREAS OVERSHADOWING
- 1) Set time for which no additional overshadowing should occur on the park.
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 - (d) isolate the areas that impacted by the nonimal massing and receive less than 2 hours of direct sunlight, then find their specific overshadowing times to use as the reverse projections.
 - 8) Reverse project the impacted areas, cutting out from the nominal building mass.
 - 9) Create massing to fit within envelope

Identify the times at which these additional overshadowing (to less than 3 hours) occurs. These correspond to the vectors in the reverse extrusions.

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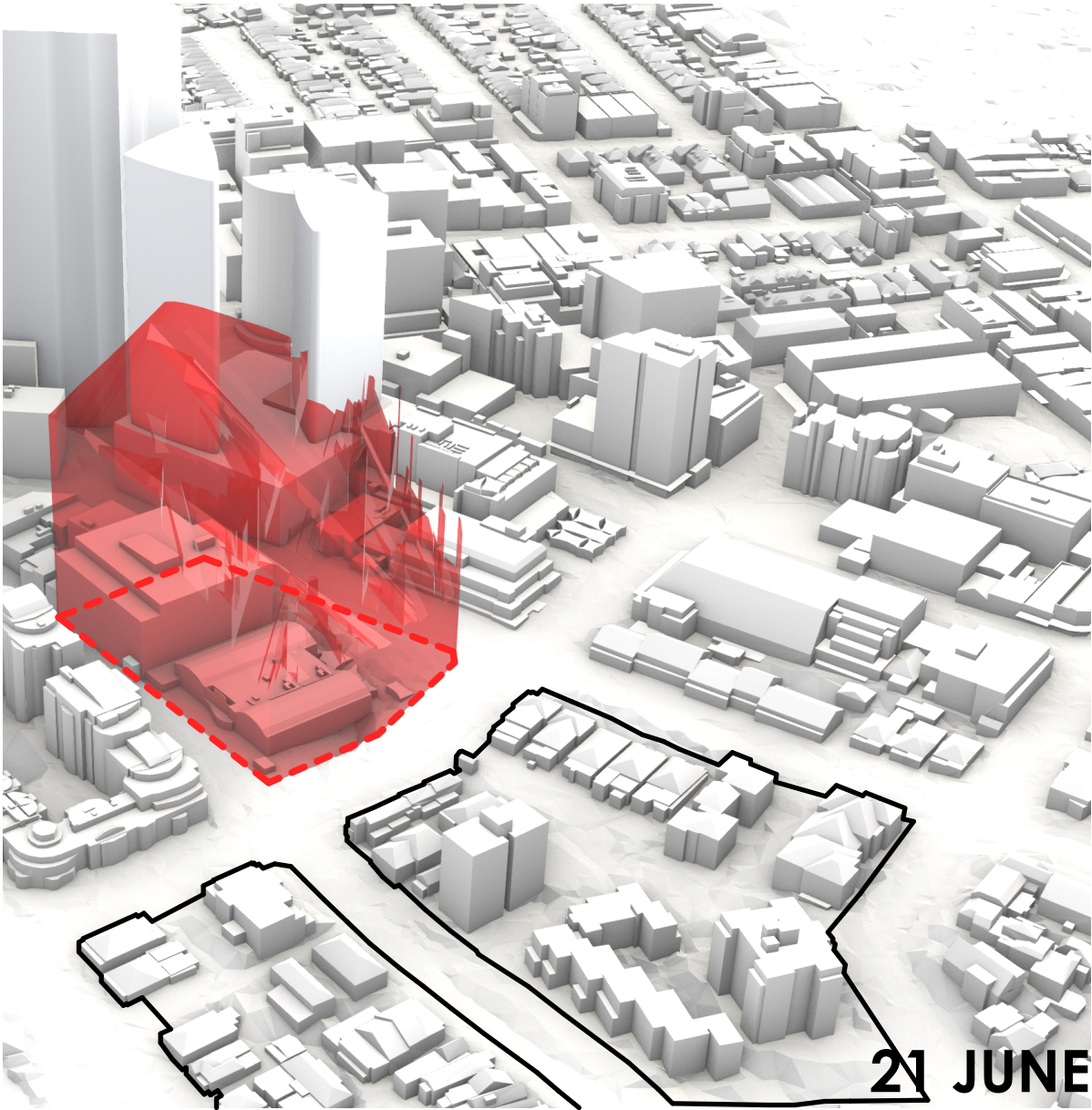
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METHOD TO DETERMINE COMPLYING ENVELOPE

STEP 8

- PARK
OVERSHADOWING

RESIDENTIAL AREAS
OVERSHADOWING
- 1) Set time for which no additional overshadowing should occur on the park.
 - 2) Extrude the outline of the park, subtracting existing shadows at the solar vector for that time for every day of the year of the study period.
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 - (d) isolate the areas that are impacted by the nominal massing and receive less than 2 hours of direct sunlight, then find their specific overshadowing times to use as the reverse projections.
 - 8) Reverse project the impacted areas, cutting out from the nominal building mass.
 - 9) Create massing to fit within envelope

For the study date of June 21, take the reverse projections and subtract them from the initial envelope. This forms the new envelope for which **any building built within it will not cause any of the areas receiving more than three hours of sunlight to receive less than three or any of the areas receiving less than three hours of sunlight to receive any less.**

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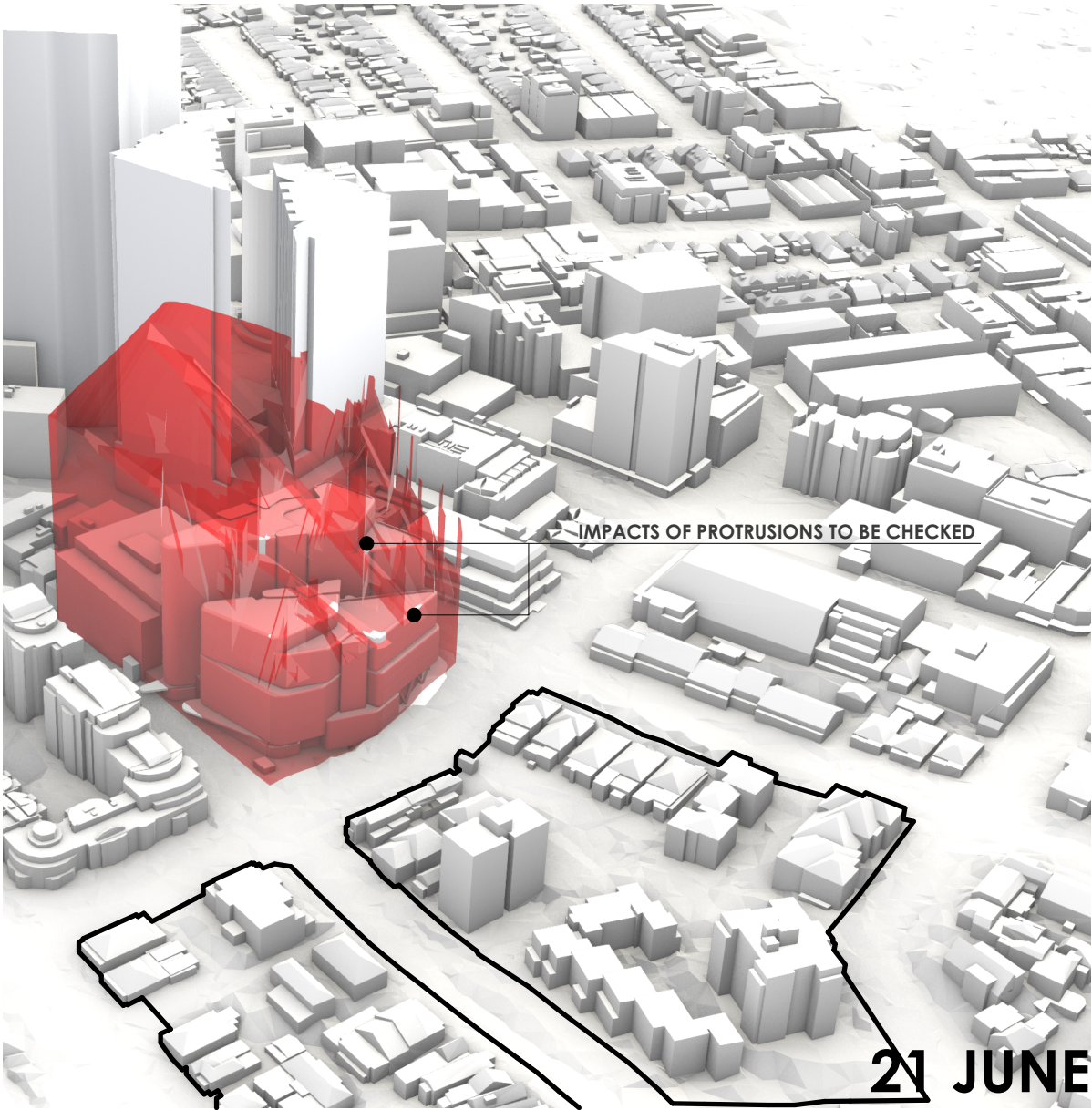
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METHOD TO DETERMINE COMPLYING ENVELOPE

STEP 9

- PARK
OVERSHADOWING

RESIDENTIAL AREAS
OVERSHADOWING
- 1) Set time for which no additional overshadowing should occur on the park.
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 - 3) Delete these extrusions from an envelope created by extruding the site boundary directly upwards.
 - 4) The resulting envelope is one that does not cause additional overshadowing from the specified time for the study period.
 - 5) Use the resultant envelope from the RE1 study to identify zones that will have an impact from the cast sun shadow from 9:00am-3:00pm JUN 21
 - 6) Cast the building envelope shadow over the residential facade to identify the affected residential lots.
 - 7) Isolate the impacted facades that receive less than 3 hours of direct sunlight. The detailed process is as follows:
 - (a) calculate the existing context Shadow from 9:00am-3:00pm.
 - (b) quantify how many hours of direct sunlight per day each portion of the residential building gets currently.
 - (c) quantify how many hours of direct sunlight per day each portion of the residential building gets with the new massing in place.
 - (d) isolate the areas that are impacted by the nominal massing and receive less than 2 hours of direct sunlight, then find their specific overshadowing times to use as the reverse projections.
 - 8) Reverse project the impacted areas, cutting out from the nominal building mass.
 - 9) Create massing to fit within envelope

A massing has been generated which predominantly fits within this envelope. Attempts to fit wholly within the envelope generate an awkward and undesirable tiered form. The next part of the study will test the impact of these extrusions outside the envelope.

SUMMARY

This process above creates an envelope for the site governed by controls related to overshadowing to the park and adjacent residential areas. The massing generated complies with controls relevant now but any change to them will result in a different envelope. The ambiguities of the overshadowing controls related to residential areas in the St Leonards Crows Nest 2036 Plan are noted.

AMENDMENTS

REV.	DATE	DESCRIPTION
A	09/05/2020	PRED ISSUE
B	31/07/2020	DRAFT DA ISSUE
C	04/09/2020	DA ISSUE

CHK
JF
JF

PROJECT
29-57 CHRISTIE STREET
COMMERCIAL DEVELOPMENT
29-57 CHRISTIE STREET, ST LEONARDS NSW 2065

FOR

Arrow
CAPITAL PARTNERS

STARWOOD
CAPITAL GROUP

DRAWING
OVERSHADOWING
STEP 9

PRINT DATE
29/09/2020

PROJECT NO.
21811
STATUS
DA

DRAWING NO.
OS 13

ISSUE
C

METHOD

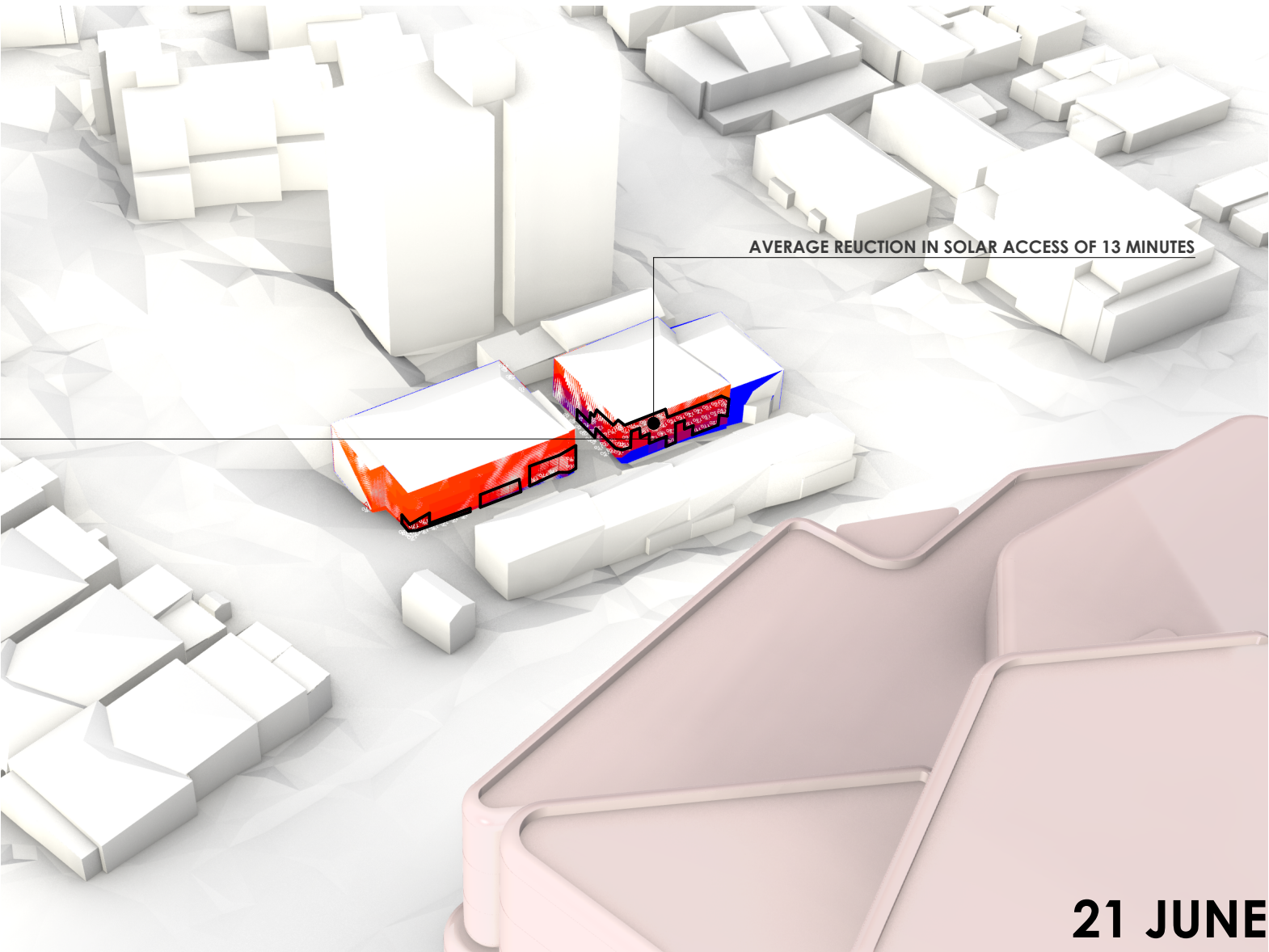
STEP 10 - PROTRUSION OVERSHADOWING

- 1-4) Park Overshadowing
- 5-9) Residential Areas Overshadowing
- 10) Test impact of protrusions through solar envelope

We now identify **the facades which do not receive the three hours sunlight and have been reduced by the protrusions from the solar envelope**. These are all located on 23-25 Christie Street.

The amount of sunlight received before the development and the amount of sunlight received after the development is quantified on a 1m x 1m grid.

Where facades do not receive the three hours they are not below 2 or the reduction is at most 15 minutes. The average reduction in solar access is 13 minutes. This is deemed to be a reasonable outcome.



AMENDMENTS		
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PROJECT
29-57 CHRISTIE STREET
COMMERCIAL DEVELOPMENT
29-57 CHRISTIE STREET, ST LEONARDS NSW 2065

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OVERSHADOWING	29/09/2020	21811	OS 14	C
STEP 10 INFILL OVERSHADOWING		STATUS		
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COMPARISON - DRAFT AND FINAL

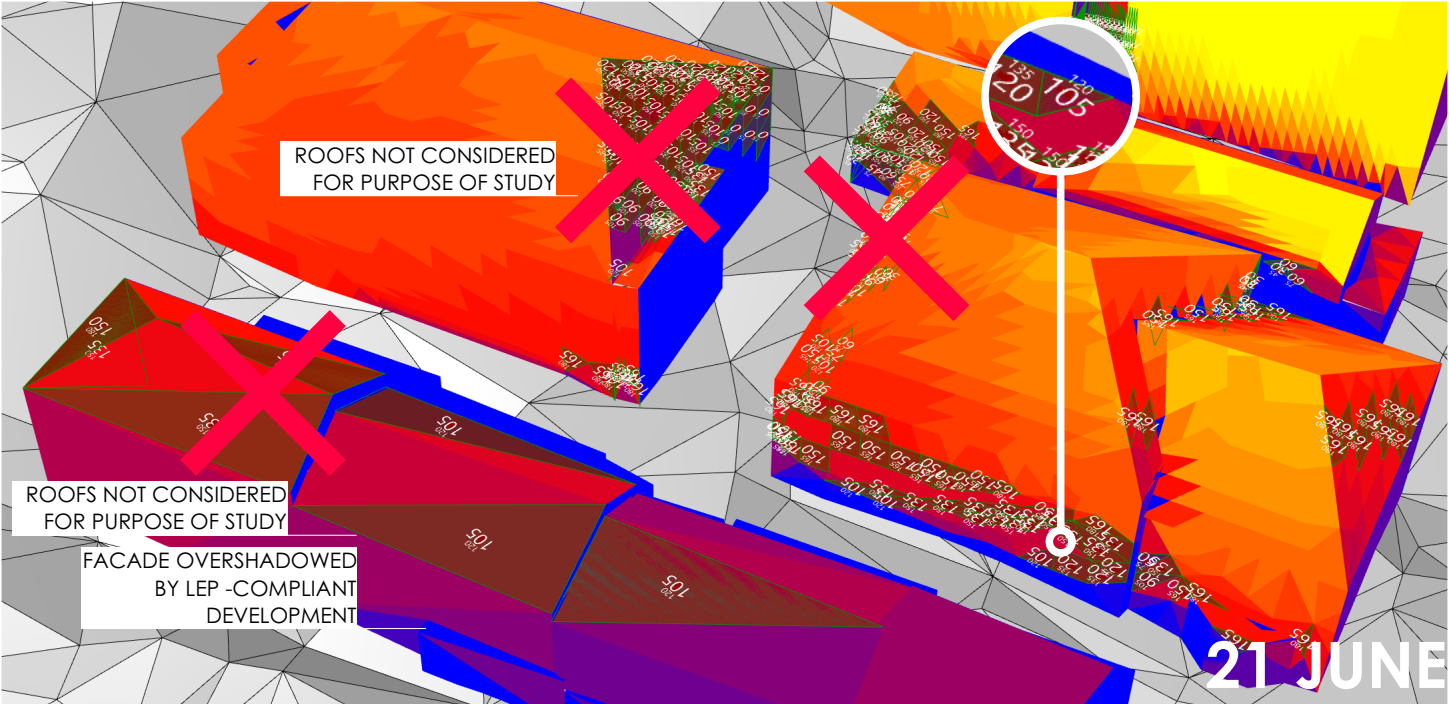
ST LEONARDS CROWS NEST 2036 DRAFT PLAN ANALYSIS

This study was conducted with the goal of ensuring three hours of sunlight to facades within the residential areas south of the site. This specifically tested the crevice zones as defined previously. This was according to the controls set by the St Leonards Crows Nest 2036 Draft Plan.

The small areas of the facades which were reduced below the three hours sunlight are shown to the right, measured to the square metre. These were then examined and quantified in detail. The overwhelming majority of these areas received at least two hours of sunlight and where they did not, the reduction was not more than 15 minutes.

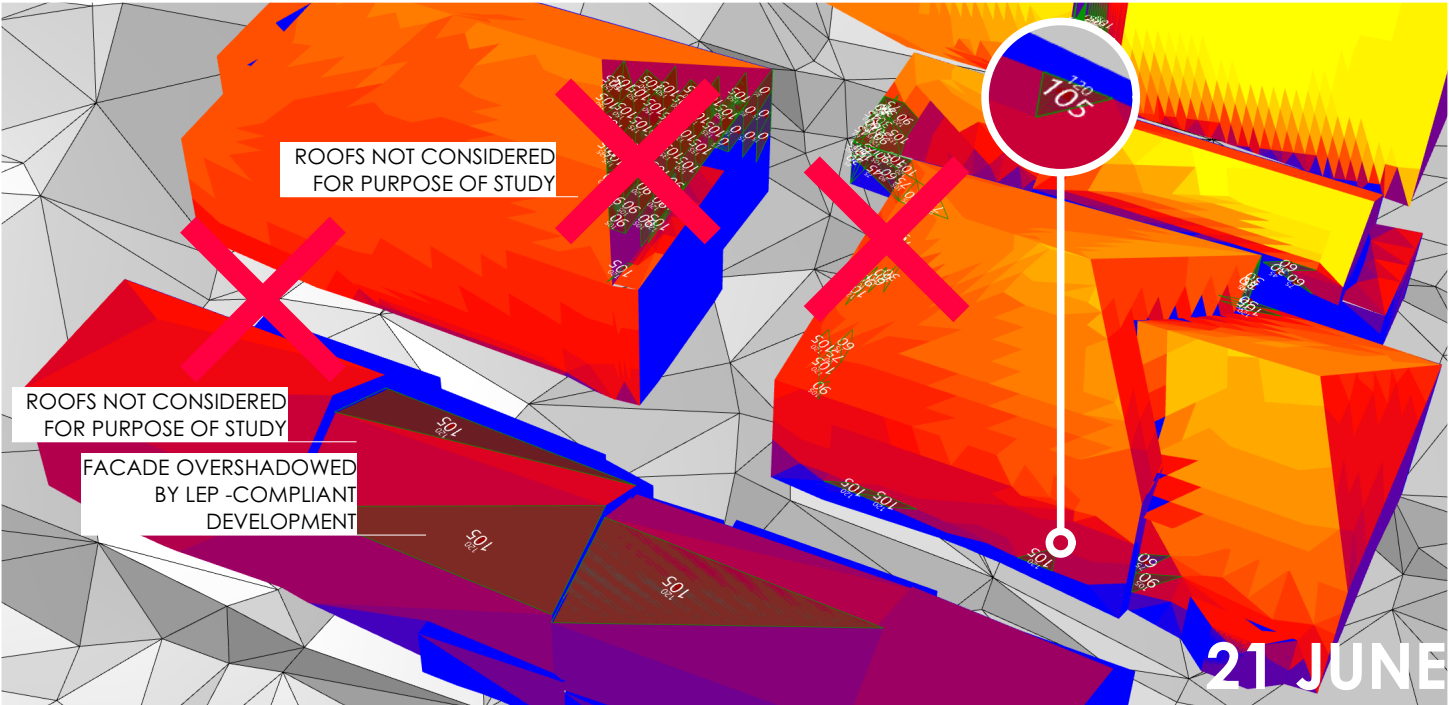
On average the areas which did not receive three hours of sunlight only had their existing sunlight reduced by thirteen minutes.

These reductions are theoretical only as the dense mature site plantings cover ALL over these affected zones in shadow.



Screenshot from solar analysis study on adjacent residential blocks showing areas not receiving at least 3 hours of sunlight at 21 June as a result of facade smoothing over the solar crevices.

ST LEONARDS CROWS NEST 2036 PLAN ANALYSIS



Screenshot from solar analysis study on adjacent residential blocks showing areas not receiving at least 2 hours of sunlight at 21 June as a result of facade smoothing over the solar crevices.

If the study is conducted aiming for at least two hours of sunlight as required by the final St Leonards Crows Nest 2036 Plan, we can see the areas which do not receive the two hours as shown to the right. We are also able to quantify these reductions and we can see that there are very few of them and the impacts are once again minimal and in non usable locations.

AMENDMENTS		
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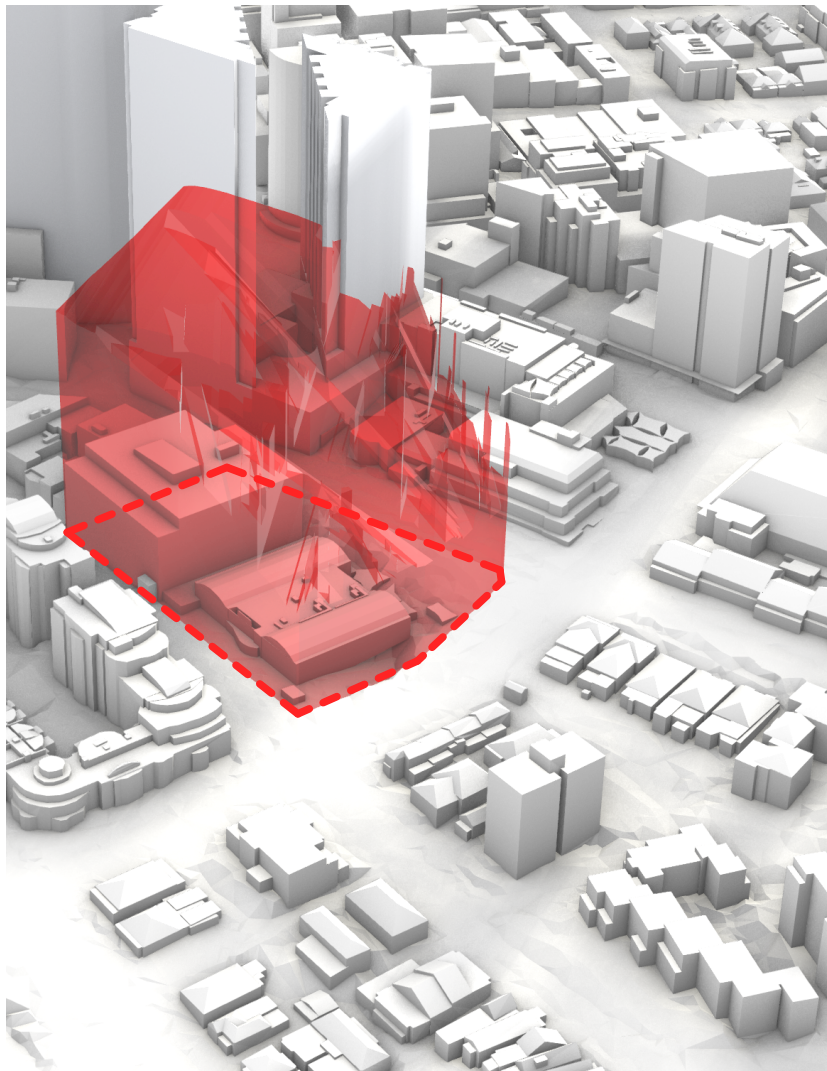
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COMMERCIAL DEVELOPMENT
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STEPS 1-9

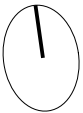


COMPLIANT ENVELOPE

An envelope has been generated to comply with the adopted controls from the St Leonards Crows Nest 2036 Draft Plan to protect solar access to Newlands Park and residential areas. A scheme within this envelope was deemed spatially and aesthetically inappropriate.

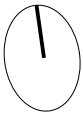
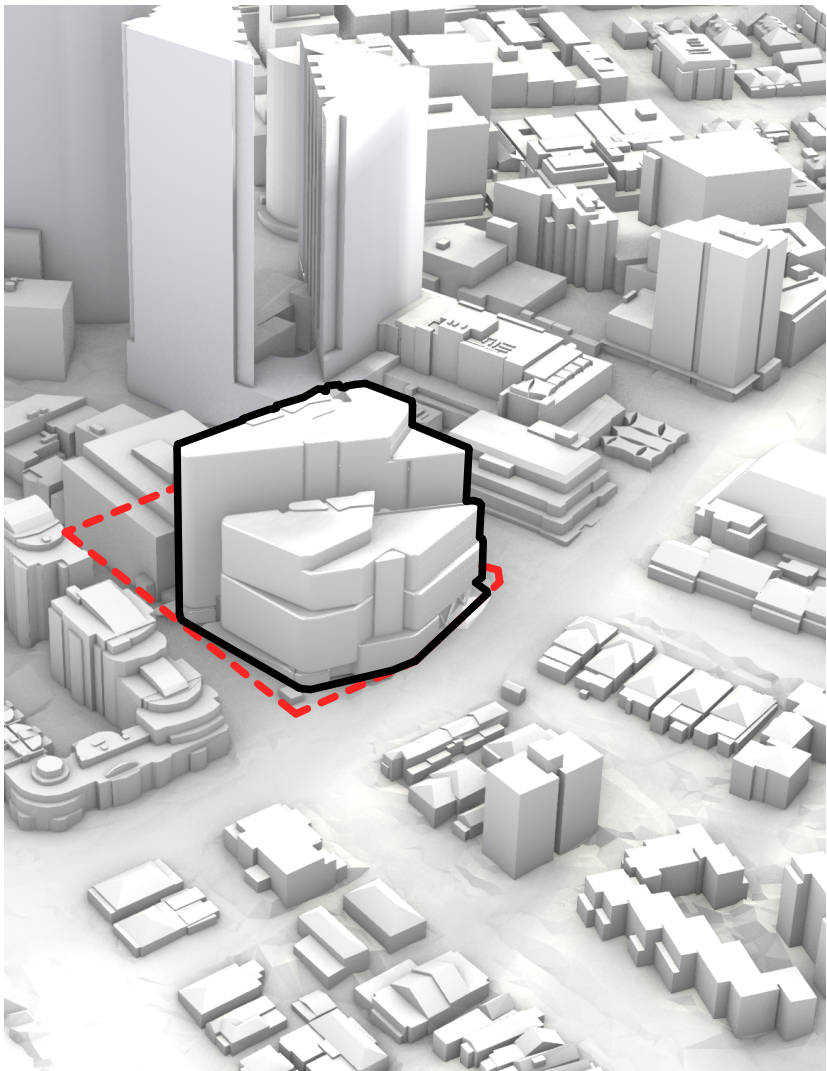


STEP 10



IMPACT OF ALTERED SCHEME

Minor changes were made to the form of the scheme which put some areas outside the generated envelope. The overshadowing impacts of these areas was tested and was deemed reasonable as it was limited to a small number of areas causing an average reduction in sunlight of 13 minutes.



ADOPTED SCHEME FOR DEVELOPMENT APPLICATION

This massing has been used for the development application scheme. There is no additional overshadowing to Newlands Park and the vast majority of residential areas impacted by the development receive at least 3 hours of sunlight on the 21 June.

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PROJECT
29-57 CHRISTIE STREET
COMMERCIAL DEVELOPMENT
29-57 CHRISTIE STREET, ST LEONARDS NSW 2065

FOR

Arrow
CAPITAL PARTNERS

STARWOOD
CAPITAL GROUP

DRAWING
OVERSHADOWING
SUMMARY

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OS 16

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