SHADOW DIAGRAM CERTIFICATION

NUMBER: SDC182301

DATE: 22.07.21

PROJECT: 5899 - Royal Far West
14-22 Wentworth & 19-21 South Steyne
Manly
NSW

CLIENT: Royal Far West
C/ - Murcutt Candalepas
309 Sussex St
SYDNEY NSW 2000 - Candalepas Assoc
309 Sussex St Sydney NSW

CERTIFICATION FOR :			
DA ☐ DA council application	**L&E** ☒ All Other Planning Documentation	**EXPERT** ☒ Expert Witness Statement	**CONSULTANT** Primary ☐ Other ☒
DOCUMENT CONTENTS:			
CERTIFICATE ☒ This Page		**Statement** ☒ ITEM 2	**Process** ☒ ITEM 3

I hereby certify that the shadow diagrams provided for this proposed design are accurate and in accordance with the following information.
This certification is applicable only to the shadow diagrams produced as listed below.

Deneb Design is able to confirm the accuracy of the Murcutt Candalepas shadow diagrams as per the following information.

CERTIFICATION DETAILS FOR SHADOW DIAGRAMS		
Project Details	5899 - Royal Far West 14-22 Wentworth & 19-21 South Steyne Manly. As detailed in DA Plans provided by Candalepas Assoc ,Architectural Plans - Murcutt Candalepas reference 5899 issue B, dated 14/07/21	
Applicable for Shadow Diagrams Numbered	SD 01 + (refer to separate A3 format Drawing set)	
Issue	Version 01(b) – 1823_SD_B_01	
Dated	22.7.2021	
ACCURACY DETAILS	**DATA**	**TOLERANCE**
Existing Building	3D SKP file Candalepas July 2021	+/- 150mm Replication of Survey data.
Neighbouring Buildings		
Topography and Site		
Proposed Design	Architectural Plans	+/- 150mm
RL critical heights	Architectural Plans & Survey	+/- 40mm
Shadow Cast per Component	3D Modelling Software (post June 2020 - Vray engine) (pre June 2020 – Mental Ray Engine)	+/- 120mm
PRECEDENCE RULE - DATA		
1. Survey (embedded) 2. Architectural Plans 3. Supplementary Documentation and Shadow Diagrams		

CERTIFIER SIGNED:

Cameron McFadzean

Certifier:
Cameron McFadzean
Registered Architect NSW 8750, BA (Architecture) B Architecture, AssessorABSA, AssocIES
Deneb Design

Certifier: Cameron McFadzean BA (architecture) B Architecture Assoc IES Illuminating Engineers Society (AustNZ)
| 1b Jendi Ave Bayview NSW 2104 | 02 9997 7480 | info@denebdesign.com.au | www.denebdesign.com.au

ITEM 1 CALCULATIONS – NOT REQUIRED

ITEM 2. VERIFICATION STATEMENT

Deneb Design has been commissioned to review the design data and provide a verification statement pertaining to the accuracy of the Shadow Diagrams provided in the Architectural Plan Set - Murcutt Candalepas reference 5899 issue B, dated 14/07/21.

Deneb Design has produced a set of independent Shadow Anaylsis diagrams based on 3D Data provided. This statement is supported by the A3 Format 182301_SD_B_01.pdf file which offers a visual comparision per time period for the comparision of Deneb Shadows vs Murcutt Candalepas Shadows.
The 3D Data has been cross checked against architectural plans for dimensional and orientation compliance.
The production process utilises a different daylight system and shadow analysis workflows that will be briefly discussed as they relate to the comparision of shadows cast.

Deneb Design can confirm the accuracy of the Murcutt Candalepas Shadow diagrams as being true and accurate within the tolerances of our analysis workflow – refer to Item 3 for further details. In particular Item 3.7 details the method of acquiring the shadow component onto a surface and this technique using real life simulation of shadows results in the difference of the shadow cast due to the effects of Penumbra (shadow edge blurriness). The technical difference results in the Deneb Design shadow consistently being calculated within the confines of the geometrically obtained reference shadow lines.

Deneb Design has been able to offer a reasonable understanding of the discrepancy of the Architectus Shadows compared to Murcutt Candalepas / Deneb Design calculations. This is most easily explained by the error of time zone – Daylight Savings Time, with a thorough review and proof provided on accompanying report – final page.

ITEM 3. PROCESS OF SHADOW DIAGRAM PRODUCTION – post June 2020 issue

A brief summation of the process of digital shadow production used by Deneb Design follows.

1. 3D Model created from information in typical order of precedence: (refer to specific documents for variation to this order of precedence).
- 1.1 Survey Plan –
- 1.2 Architectural Models (3D) and Elevations
- 1.3 Architectural Plans
- 1.4 Site Photos / Aerial images.

The accuracy of the translation of these data sources are provided in the certification document. Where accuracy and validity cannot be determined the tolerances are not stated. The tolerances stated are median figures gathered from self auditing process. It is not uncommon for different data sources to contain discrepancies, hence the precedence rule.

2. Sunlight System

Daylight system – a photometrical physically-based light source, based on IES standards (Illuminating Engineering Society) is positioned within the model using True North orientation (derived from Plans/Survey). Date and Time values are set, and these are processed internally by computer algorithms (MAX) to determine azimuth and altitude. The altitude and azimuth angles are available upon request. Pre June 2020 – Mental Ray raytracing engine is used. Post June 2020 – Vray Brute Force ray tracing engine is used.

3. Shadow Image

For each and every time slot a image is rendered using the 3D model and daylight system for every component of the shadow set. A single time slot may consist of several (typically 4) shadow types. Due to render resolution and edge bluriness, particularly in low light where the shadow cast becomes difficult to differentiate accuracy tolerance is determined as a percentage across the entire image. This is as low as 0.5%, however due to the number of passes and composition of the final shadow image this tolerance is indicated as a higher figure and shown in the certification document. Refer also to dynamic range and thresholds for more information. Typical image slots:
- 3.1 Neighboring structures and ground / terrain and other features.
- 3.2 Neighboring shadows cast
- 3.2 Existing Building (if present) and existing shadow cast
- 3.3 Proposed Building and proposed shadow cast
- 3.4 Other Stages or variations if required.

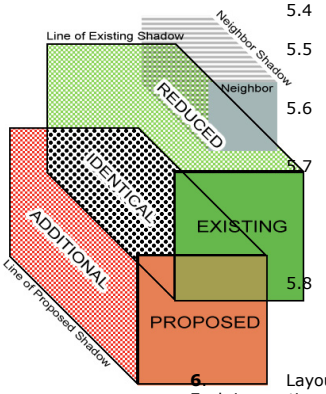
4. Composition

Composition is the ordering and opacity of the image slots. The rendered image slots are compositioned and coloured/separated to create a shadow diagram showing different shadowing of elements – self, existing, proposed, additional etc. This process is subject to human compositioning error only – ie it is either accurate or has an obvious error related to composition – Deneb Design work procedures determine a sequence of steps which has reduced this compositional error to nearly zero occurrence. This composition can include numerous options as per the clients direction. Algorithms are used to analyse the pixels of each render to determine shadow cast – refer to item 7. Scripts are used to automate the procedure of taking three common shadows – proposed, existing and neighbor, and translating these into more meaningful Reduced, Identical and Additional.

5. Shadow Types – Classifications

A typical shadow diagram has several different shadow types shown. Not all shadow diagrams have all of these types.

- 5.1 Existing Building and Shadow– The existing building is 3D modeled and the shadow that is cast is called the existing shadow. This existing shadow may also be divided into IDENTICAL and REDUCED Shadow types.
- 5.2 Proposed Building (Orange) and Shadow– The proposed building is modeled and typically shown in PLAN. The shadow cast from this proposed building is called the proposed shadow. This is typically not show by itself – and is divided into IDENTICAL and ADDITIONAL shadow types.
- 5.3 REDUCED Shadow (Green Dot) – The reduced shadow is determined by comparing the existing shadow and the proposed shadow. The proposed shadow is removed from the existing shadow, with any remaining existing shadow now called the reduced shadow. (function is: Existing – Proposed = Reduced Shadow)
- 5.4 IDENTICAL Shadow (Black Dot) - This is the shadow where the existing and proposed shadows coincide – ie the are both the same. (function is: Proposed = Existing)
- 5.5 ADDITIONAL Shadow – (Red Dot) - the additional shadow is determined by comparing the existing shadow and the proposed shadow. The existing shadow is removed from the proposed shadow, with any remaining proposed shadow now called the Additional Shadow. (function is: Proposed – Existing = Additional Shadow)
- 5.6 Neighbor Buildings – Where these are 3D all shadows will be cast across the 3D building. This is important where the shadow casts across a terrain and then travels up the wall. This will show the shadow terminating at the wall in PLAN. If sufficient shadow cast extends over the top of the wall then it will be shown on the roof (and be visible in PLAN).
- 5.7 NEIGHBOR Shadows (grey stripe)– these are shadows cast from neighbor buildings. For clarity of comparison these are shown in combination with all other shadows. Ie We show the existing &/or proposed shadow falling over the top of the neighbor shadow. This is important when considering solar access. Ie the neighbor shadow does not remove the overshadowing of either existing or proposed. This methodology has been brought about by the established "tradition" of not showing any neighbor shadows, and by the complication that not all neighbor buildings can be modeled if they are not on survey.
- 5.8 The methodology of classifying structures into existing, proposed is clearly defined by the architectural plans depicting the proposed works and existing conditions. Typically the survey is used for the existing conditions. The methodology of classifying structures into the neighbor category has some scope which is typically documented and detailed in the plans themselves. Generally most items not within the site boundary are treated as neighbor structures. Existing fences are typically treated as neighbor structures.

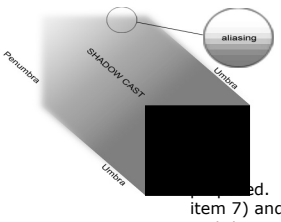


6. Layout

Each image time slot in composition becomes a single shadow image. These shadow images are positioned in page with time stamps and titles placed alongside. Deneb Design work procedure has a code checking system to assist in ensuring the correct shadow image is placed in the correct place on the page. This procedure is semi-automated and human error can occur. Self auditing has revealed a <1% occurrence.

7. Shadow Parts and edge accuracy.

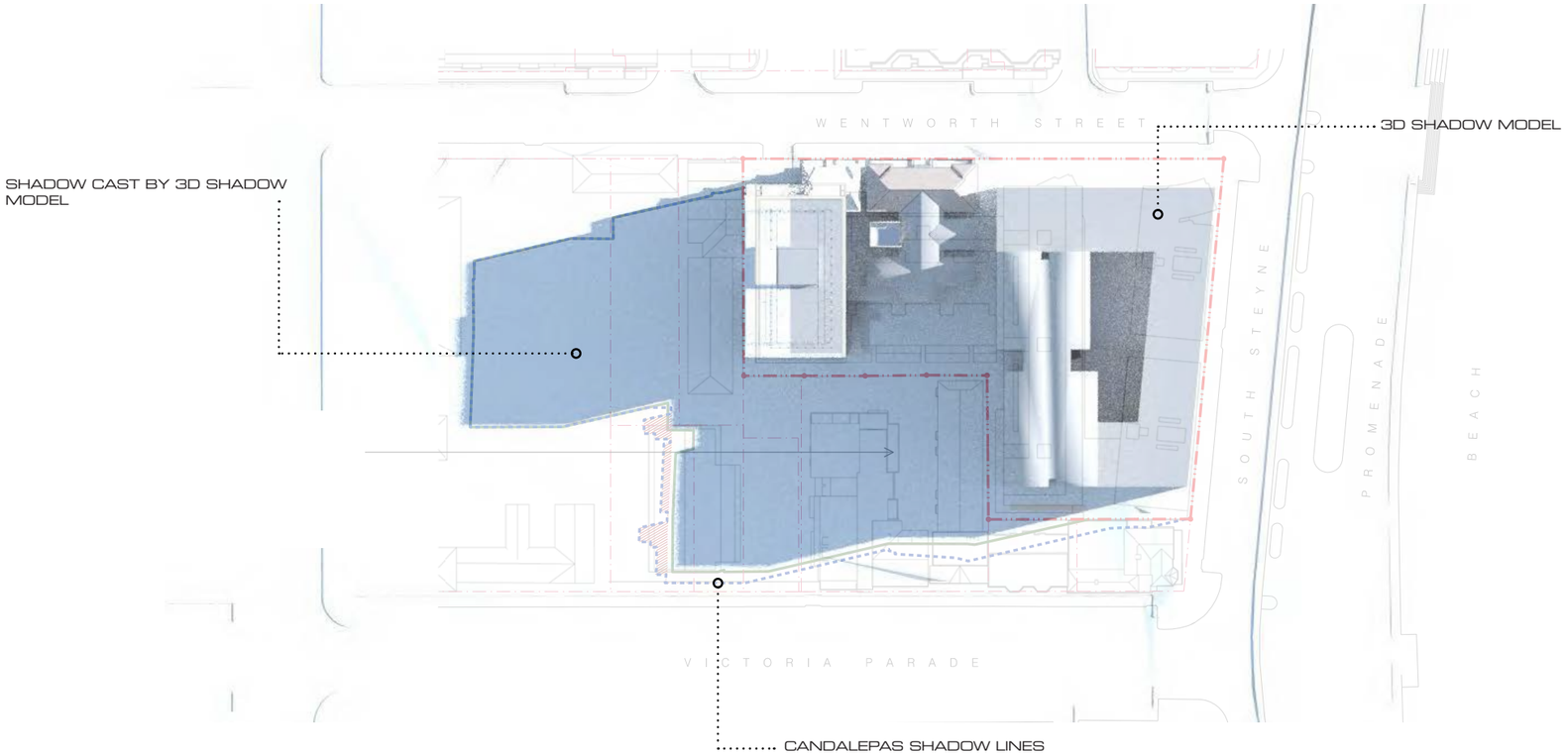
The daylight system used in the production of the shadows produces photo-real shadows that have a Umbra (dark part) and a Penumbra (gradient from dark to light). This is most obvious in low sun angles, where the shadows are long. As the length of the shadow increases the edge of it becomes "blurry". An algorithm analysis each render for the dynamic range to determine where to classify the shadow – ie it determines a threshold value for the greyscale shadow cast. The notion of dynamic range is important to this algorithm for instance in low light (low sun and terrain sloping away from the light) the dynamic range (difference between black and white) in the render is small – thereby reducing the ability to accurately classify the shadow cast. Pre June2020 – Mental Ray raytracing engine . Post June 2020 – Vray brute force engine – which enables more control of these elements for sharper edge definition when required.



Solar Calculations

8.1 Methodology and accuracy - Where provided the solar calculations provide numerical areas to various shadow areas – ie existing and proposed. Reference to the definitions in this document is required. The areas are calculated by an algorithm analyzing the shadow area (refer to item 7) and returning a pixel count. This pixel count is then scaled to appropriate unit conversion (typically m2). Due to the item 7 consideration and the scaling effect a tolerance expressed as a % of total image is given. A manual system of translating the area values into a presentation table is used and subject to human error. Several formulas are used within the table to express comparative analysis (% change etc) and these are also subject to human error.

CERTIFIED SHADOW DIAGRAM



NOTES

1. Trees omitted from calculations
2. Neighbouring buildings omitted from calculations
3. True north used as solar north.
4. Terrain is approximate outside of the site
5. Winter solstice - 21 June
6. Equinox - 22 March / September
7. Mid Summer 21 December
8. Time Zone - AEST unless noted (Aust. Eastern Standard Time - AEST)

DATA SOURCE (in order of precedence)

- Architectural Plans - Murcutt Candalepas reference 5899 issue B, dated 14/07/21
- 3D SKP file Candalepas July 2021
- Times are as noted on drawings

CERTIFIED SHADOW DIAGRAM
No : SDC182301
Refer to attached Certificate.

Certifier:
C McFadzean
B Arch BA (Arch) IES ABSA AAAI

Member of IES
(The Illuminating Engineers Society of Australia)

NORTH

LEGEND

- APPROVED PART 3A ON GROUND SHADOW OUTLINE
- PROPOSED DEVELOPMENT ON GROUND SHADOW OUTLINE
- ON GROUND SHADOW CAST BY MASSING ABOVE THE PART 3A HEIGHT PLANE

HOW TO READ GUIDE

TITLE
SHADOW DIAGRAMS ANALYSIS PLAN

PROJECT
Royal Far West 14-22 Wentworth St & 19-21 South Steyne, Manly

DESIGNER
Murcutt Candalepas

CLIENT
Royal Far West

DENEB DESIGN
3D SHADOW DIAGRAMS
VISUALISATION + ANALYSIS
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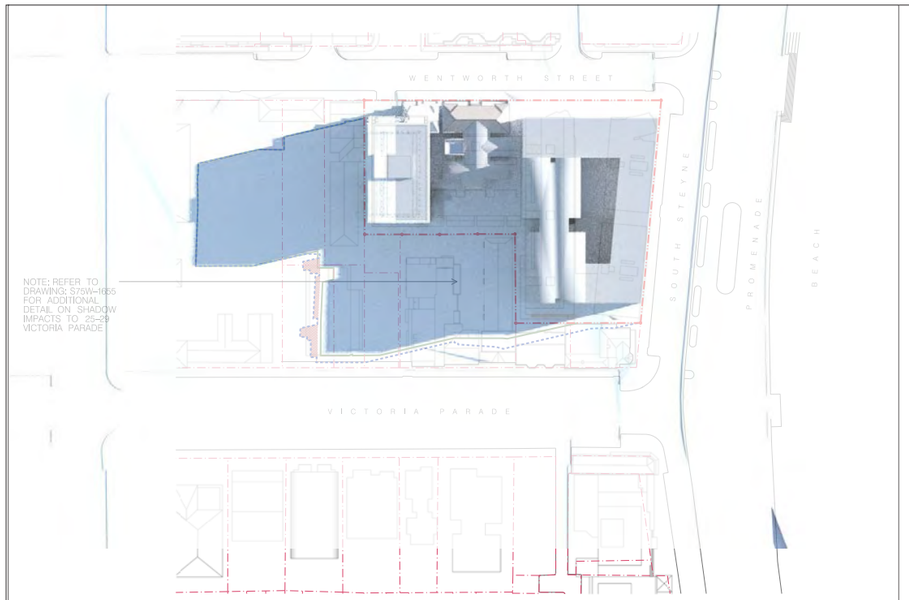

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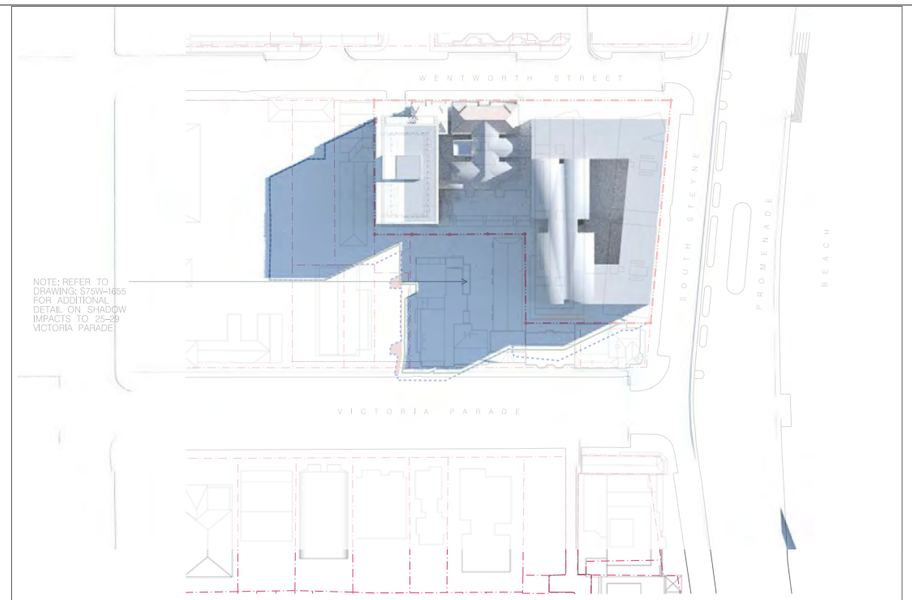

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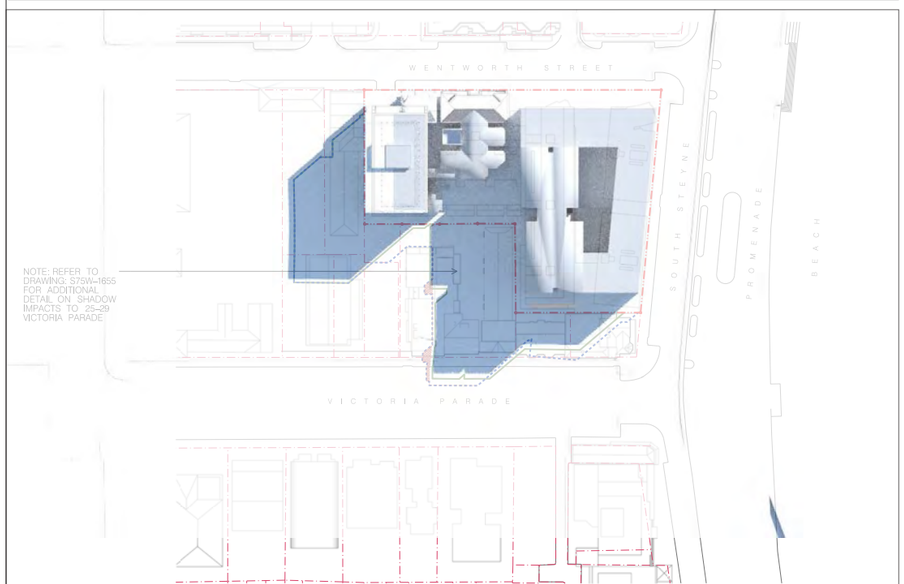

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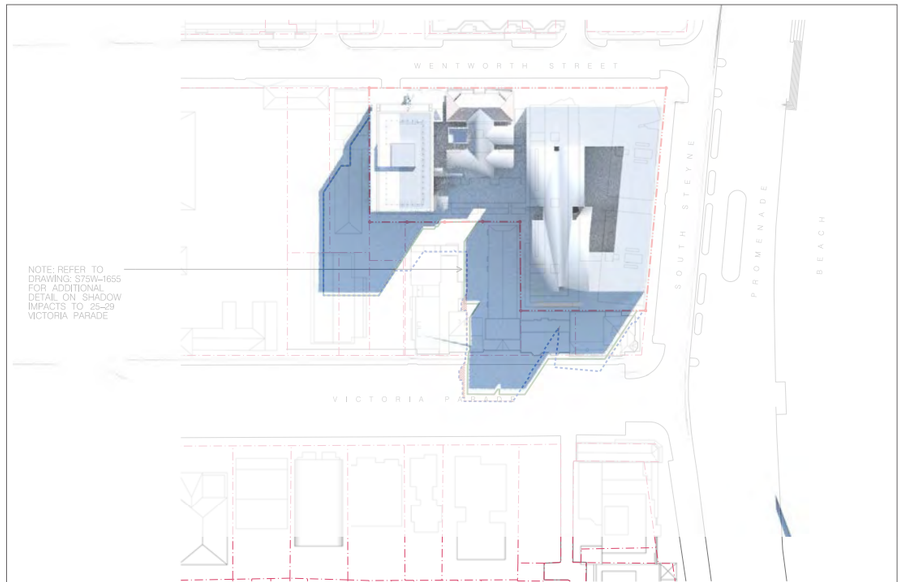

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CERTIFIED SHADOW DIAGRAM
No : SDC182301
Refer to attached Certificate.

Certifier:
C McFadzean
B Arch BA (Arch) IES ABSA AAAI

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NORTH

LEGEND

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3A DESIGN
WINTER SOLSTICE
21 JUNE

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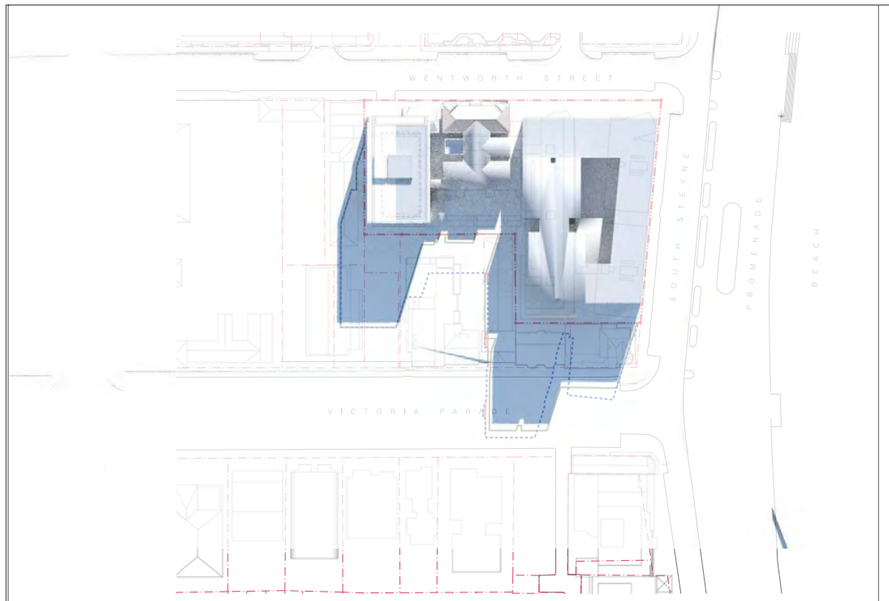

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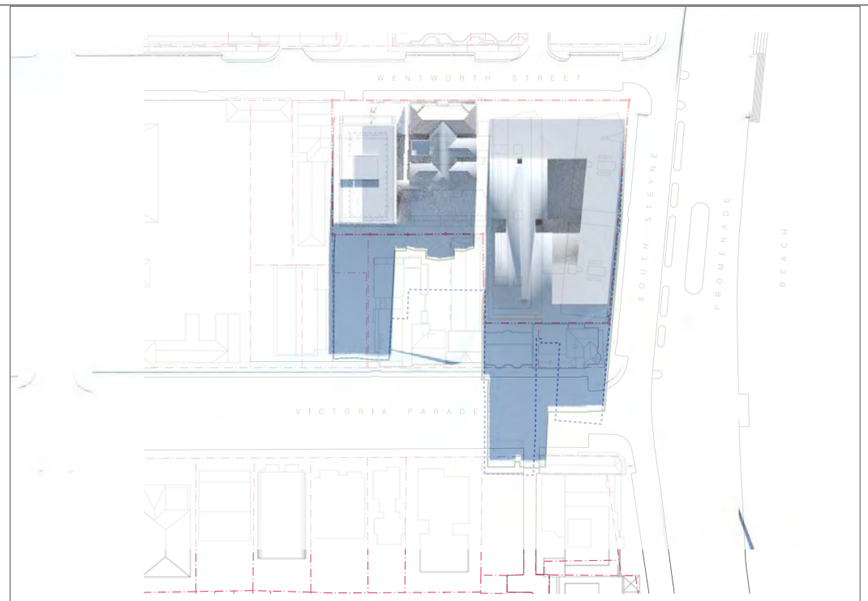

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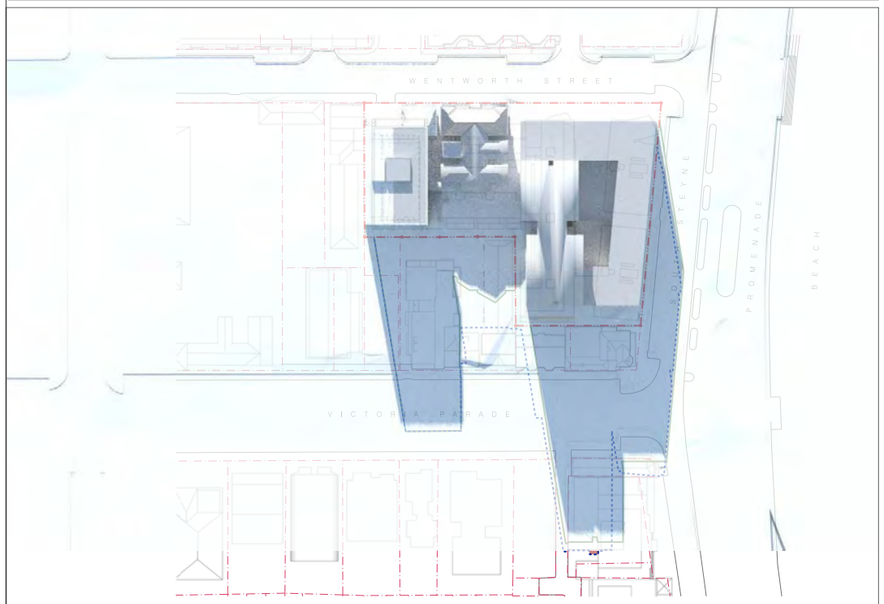

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LEGE

CERTIFIED SHADOW DIAGRAM
No : SDC182301
Refer to attached Certificate.

Certifier:
C McFadzean
B Arch BA (Arch) IES ABSA AAAI

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NORTH

LEGEND

- APPROVED PART 3A ON GROUND SHADOW OUTLINE
- PROPOSED DEVELOPMENT ON GROUND SHADOW OUTLINE
- ON GROUND SHADOW CAST BY MASSING ABOVE THE PART 3A HEIGHT PLANE

3A DESIGN
WINTER SOLSTICE
21 JUNE

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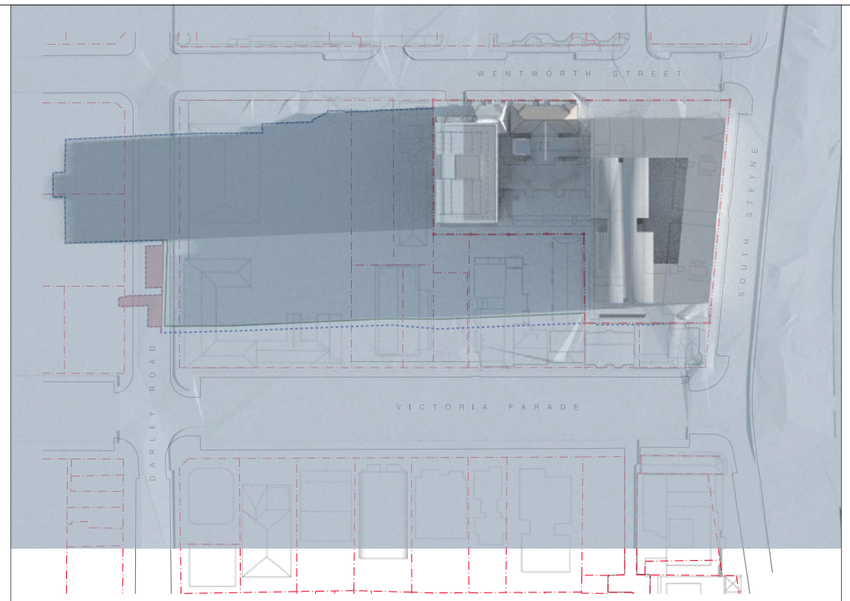

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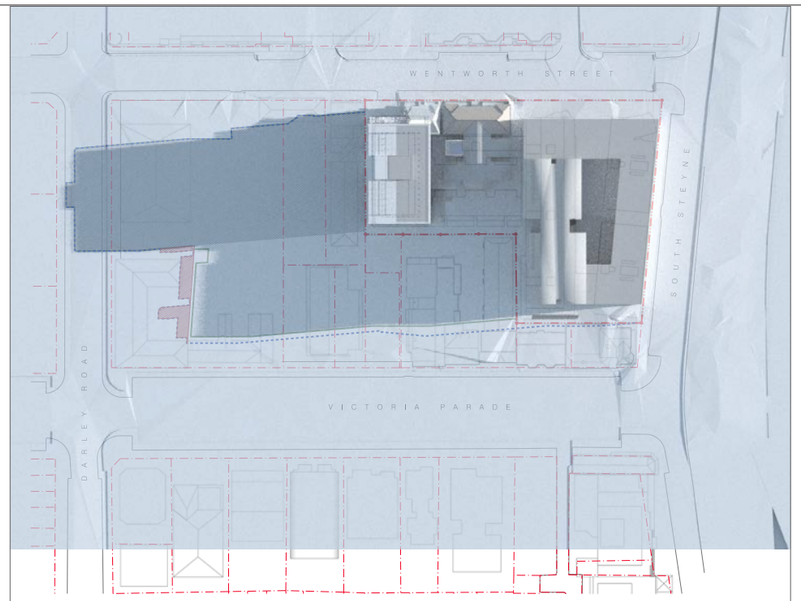

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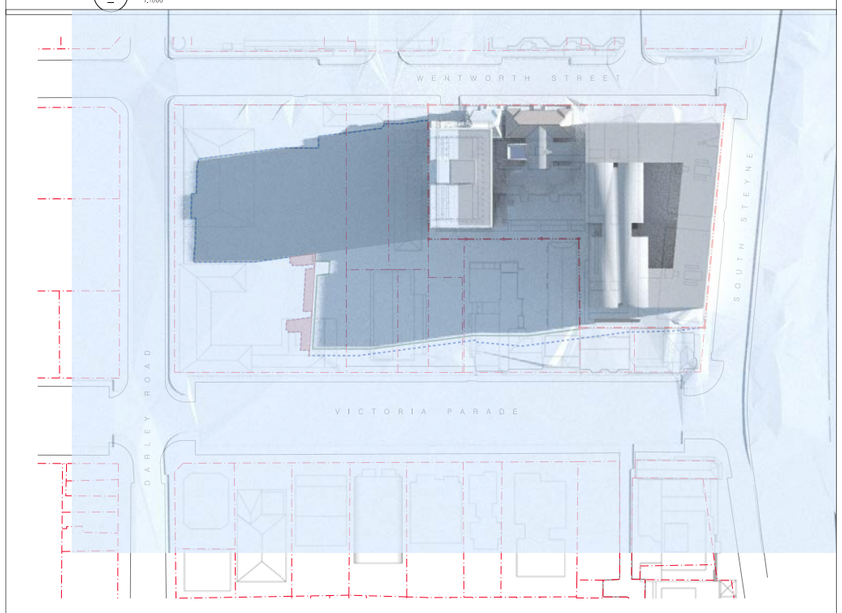

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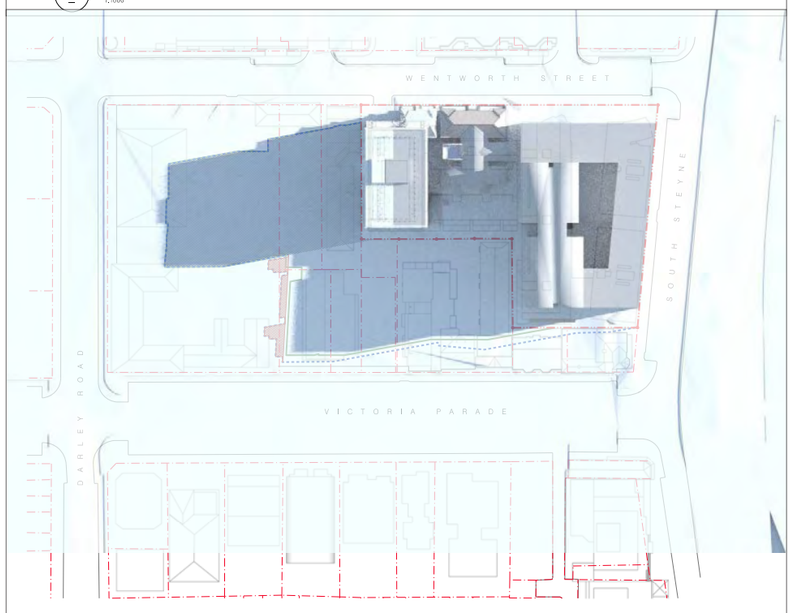

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CERTIFIED SHADOW DIAGRAM
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Certifier:
C McFadzean
B Arch BA (Arch) IES ABSA AAAI

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NORTH

LEGEND

APPROVED PART 3A ON GROUND SHADOW OUTLINE

PROPOSED DEVELOPMENT ON GROUND SHADOW OUTLINE

ON GROUND SHADOW CAST BY MASSING ABOVE THE PART 3A HEIGHT PLANE

3A DESIGN
WINTER SOLSTICE
21 JUNE

TITLE
SHADOW DIAGRAMS ANALYSIS PLAN

PROJECT
Royal Far West 14-22 Wentworth St & 19-21 South Steyne, Manly

DESIGNER
Murcutt Candalepas

CLIENT
Royal Far West

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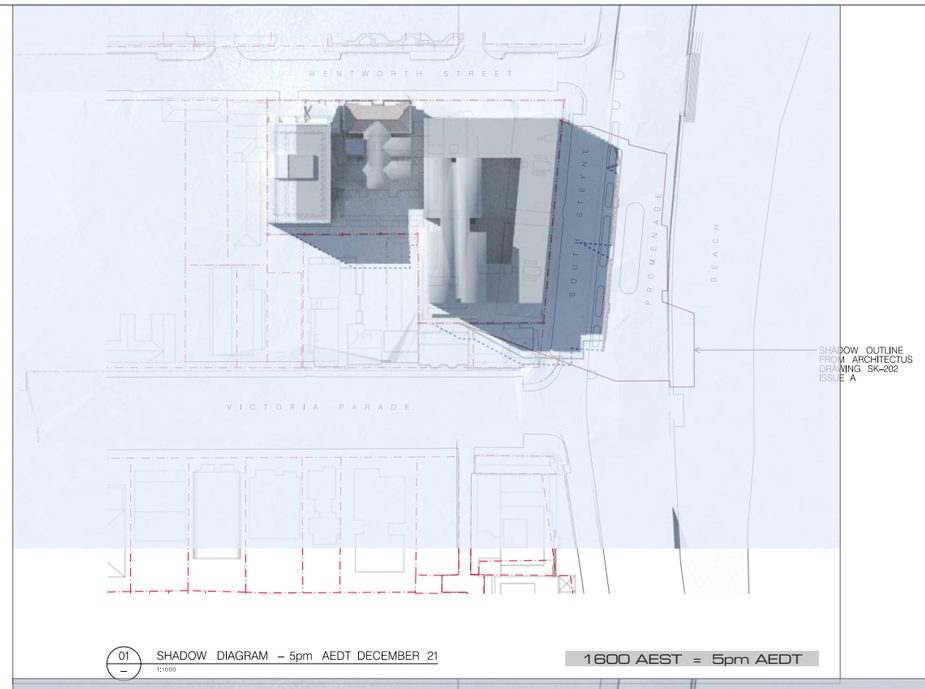

01 – SHADOW DIAGRAM – 5pm AEDT DECEMBER 21
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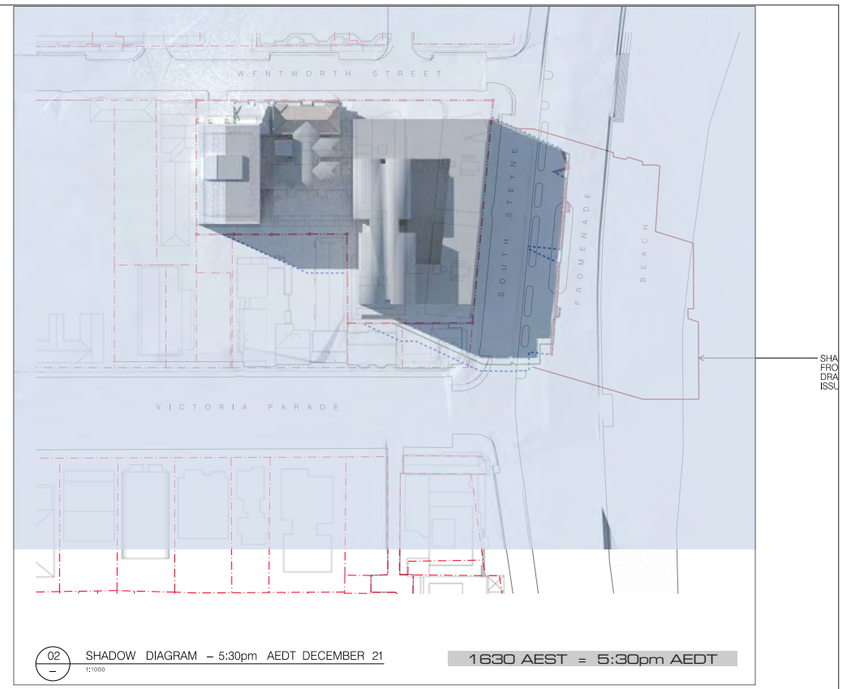
1600 AEST = 5pm AEDT



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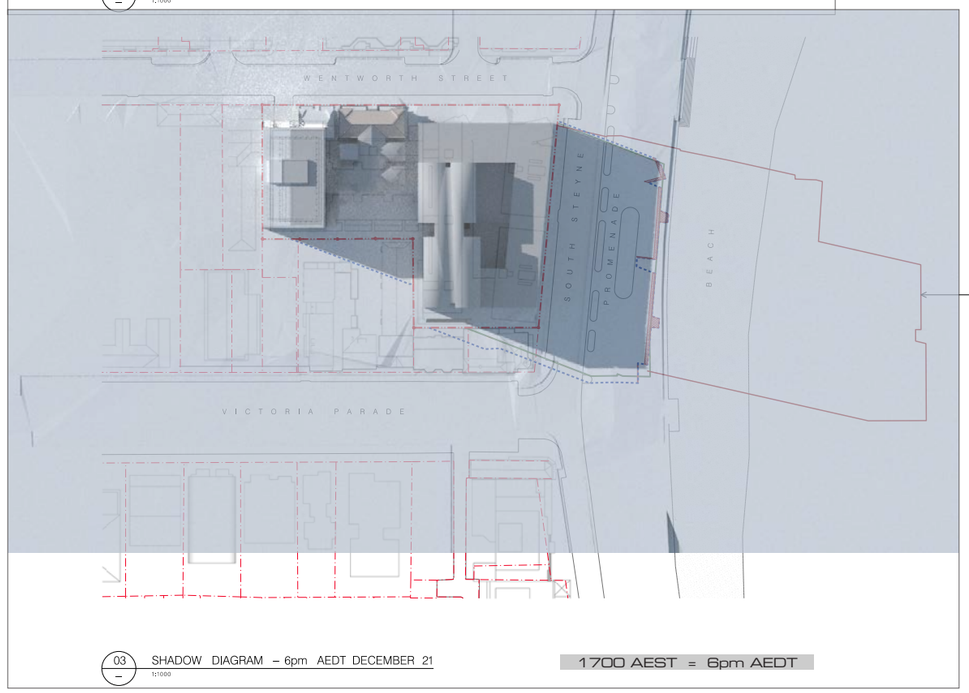

03 – SHADOW DIAGRAM – 6pm AEDT DECEMBER 21
1:1000

1700 AEST = 6pm AEDT

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3A DESIGN
SUMMER SOLSTICE
21 DECEMBER

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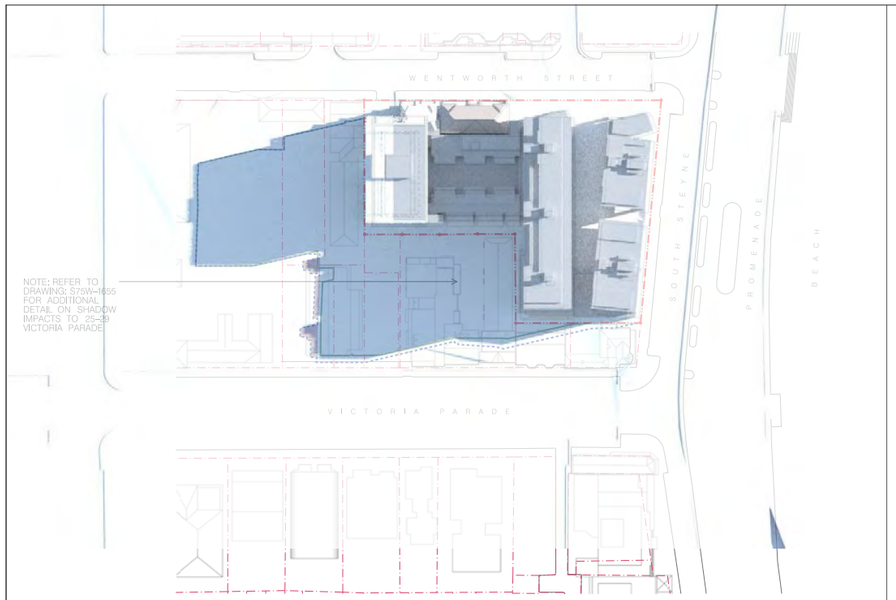

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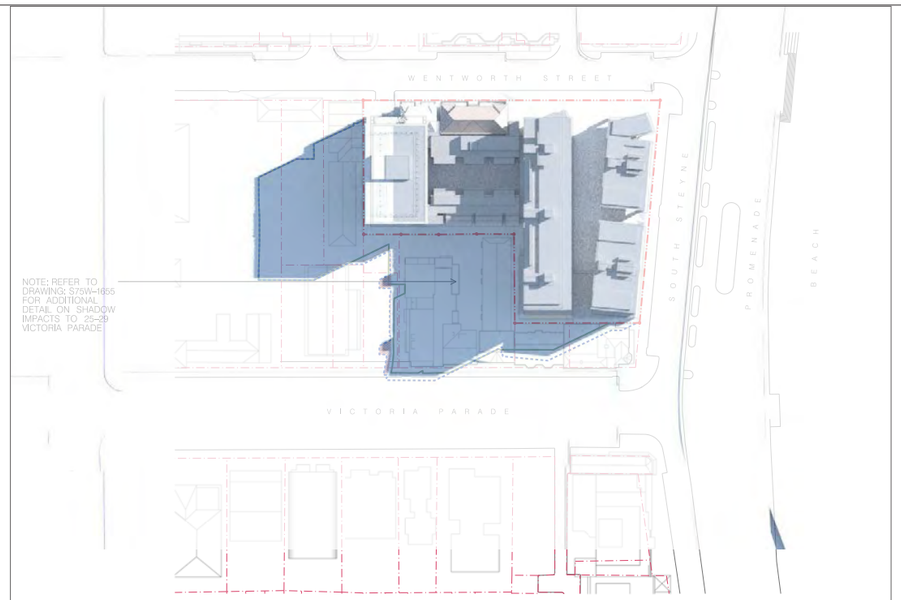

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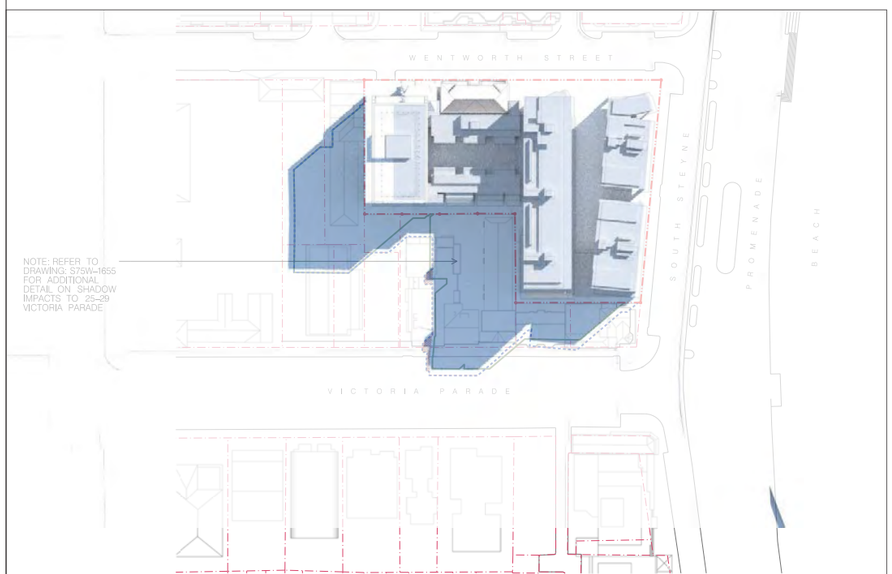

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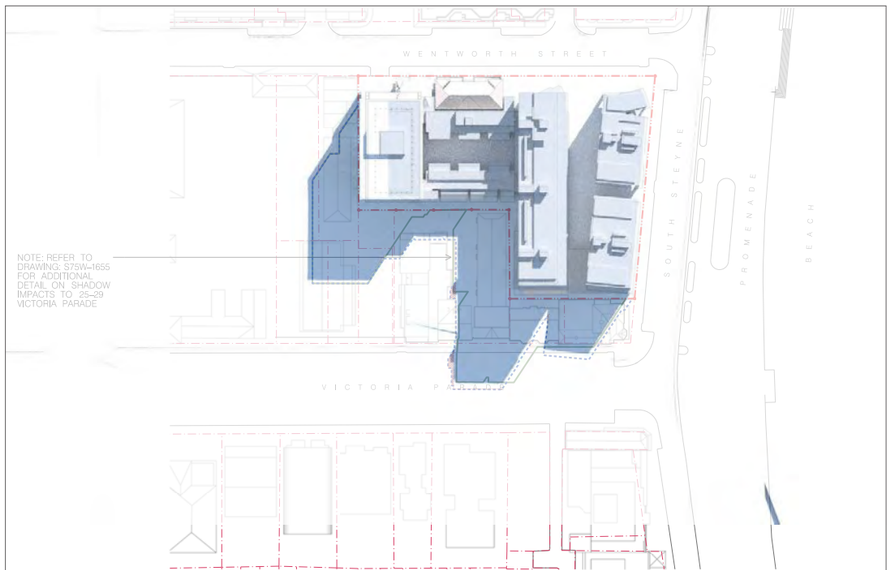

04 – SHADOW DIAGRAM – 12pm JUNE 21
1:1000

LEGEND

CERTIFIED SHADOW DIAGRAM
No : SDC182301
Refer to attached Certificate.

Certifier:
C McFadzean
B Arch BA (Arch) IES ABSA AAAI

Member of IES
(The Illuminating Engineers Society of Australia)

NORTH

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- ON GROUND SHADOW CAST BY MASSING ABOVE THE PART 3A HEIGHT PLANE

Murcutt Candalepas Massing Design
WINTER SOLSTICE
21 JUNE

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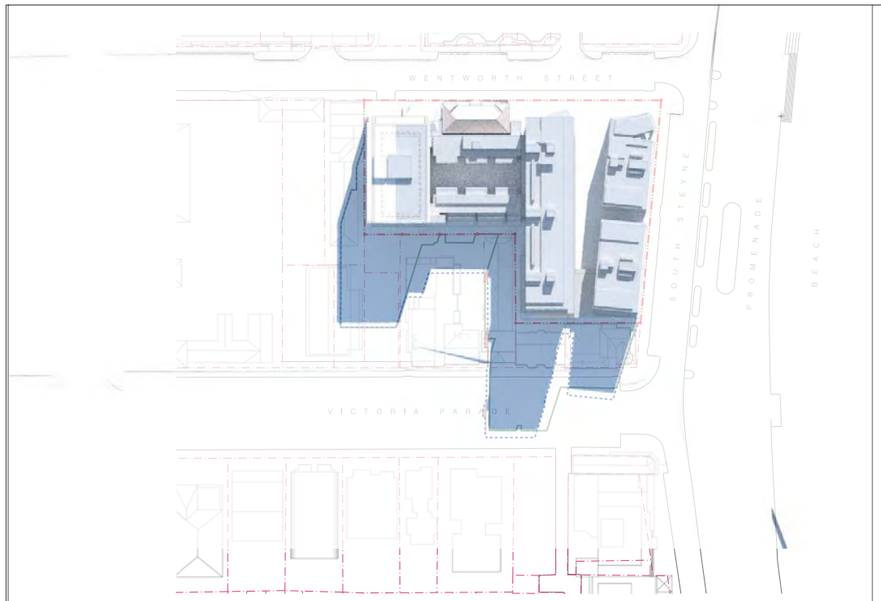
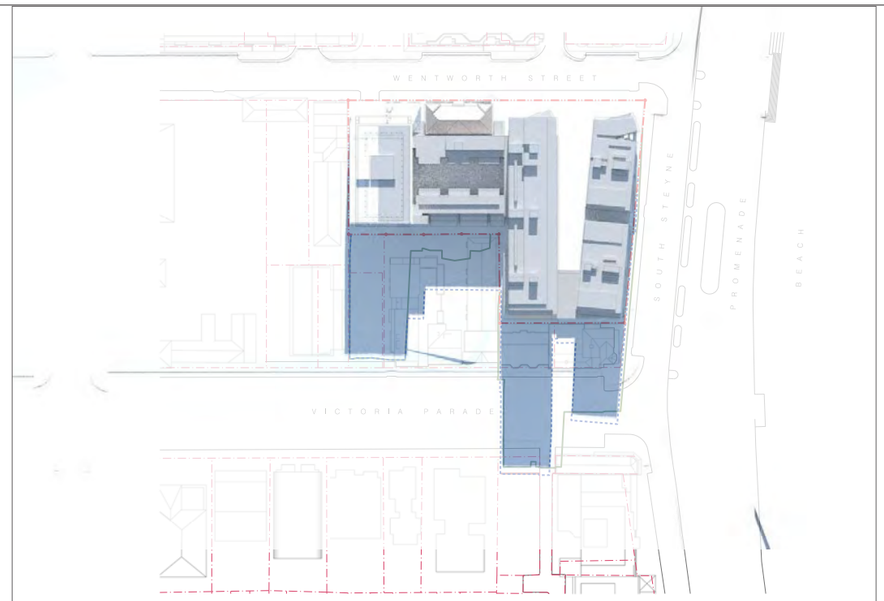
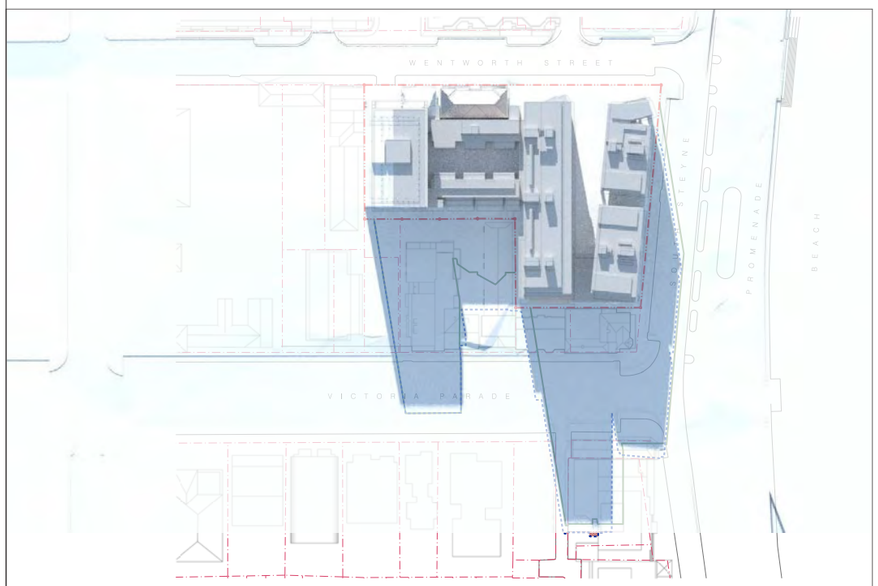
SCALE	:	(A3)
DATE	:	22.07.21
VERSION	:	01
REF	:	1823



01 – SHADOW DIAGRAM – 1pm JUNE 21
1:1000



02 – SHADOW DIAGRAM – 2pm JUNE 21
1:1000



03 – SHADOW DIAGRAM – 3pm JUNE 21
1:1000

LEGE

CERTIFIED SHADOW DIAGRAM
No : SDC182301
Refer to attached Certificate.

Certifier:
C McFadzean
B Arch BA (Arch) IES ABSA AAAI

Member of IES
(The Illuminating Engineers Society of Australia)

NORTH

LEGEND

- APPROVED PART 3A ON GROUND SHADOW OUTLINE
- PROPOSED DEVELOPMENT ON GROUND SHADOW OUTLINE
- ON GROUND SHADOW CAST BY MASSING ABOVE THE PART 3A HEIGHT PLANE

Murcutt Candalepas Massing Design
WINTER SOLSTICE
21 JUNE

TITLE
SHADOW DIAGRAMS
ANALYSIS PLAN

PROJECT
Royal Far West 14-22
Wentworth St & 19-21 South
Steyne, Manly

DESIGNER
Murcutt Candalepas

CLIENT
Royal Far West

DENEB DESIGN
3D SHADOW DIAGRAMS
VISUALISATION + ANALYSIS
02 9997 7480
info@denebdesign.com.au | denebdesign.com.au

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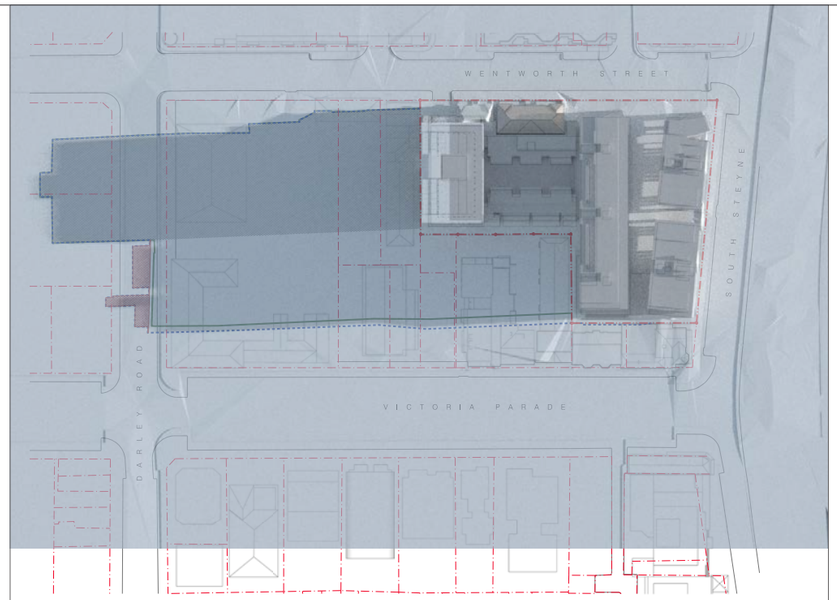
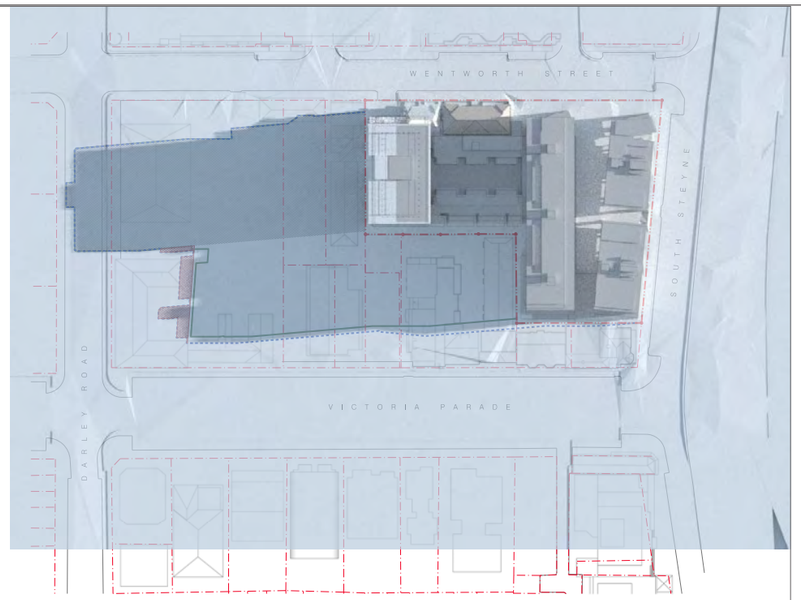
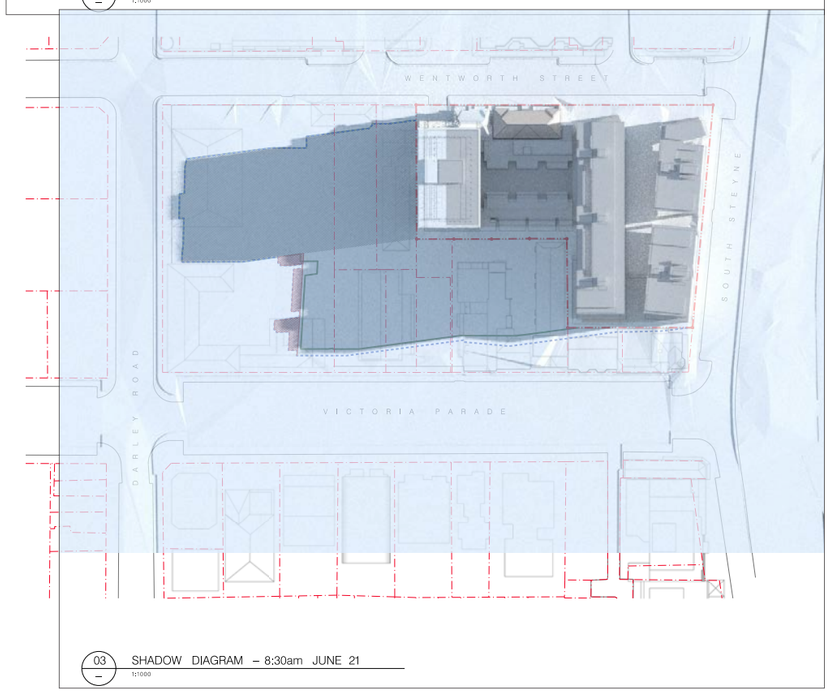


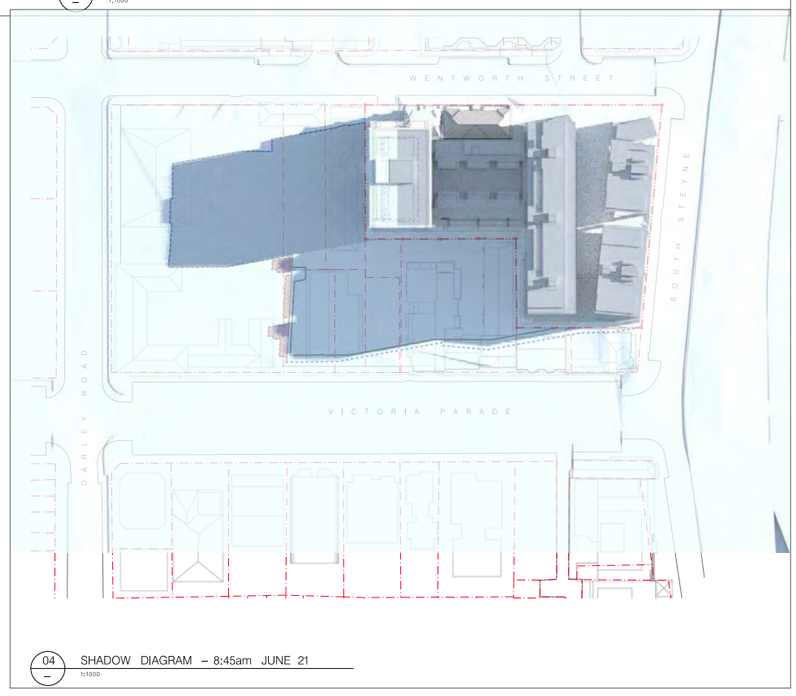
01 – SHADOW DIAGRAM – 8am JUNE 21
1:1000



02 – SHADOW DIAGRAM – 8:15am JUNE 21
1:1000



03 – SHADOW DIAGRAM – 8:30am JUNE 21
1:1000



04 – SHADOW DIAGRAM – 8:45am JUNE 21
1:1000

CERTIFIED SHADOW DIAGRAM
No : SDC182301
Refer to attached Certificate.

Certifier:
C McFadzean
B Arch BA (Arch) IES ABSA AAAI

Member of IES
(The Illuminating Engineers Society of Australia)

NORTH

LEGEND

- APPROVED PART 3A ON GROUND SHADOW OUTLINE
- PROPOSED DEVELOPMENT ON GROUND SHADOW OUTLINE
- ON GROUND SHADOW CAST BY MASSING ABOVE THE PART 3A HEIGHT PLANE

Murcutt Candalepas Massing Design
WINTER SOLSTICE
21 JUNE

TITLE
SHADOW DIAGRAMS ANALYSIS PLAN

PROJECT
Royal Far West 14-22 Wentworth St & 19-21 South Steyne, Manly

DESIGNER
Murcutt Candalepas

CLIENT
Royal Far West

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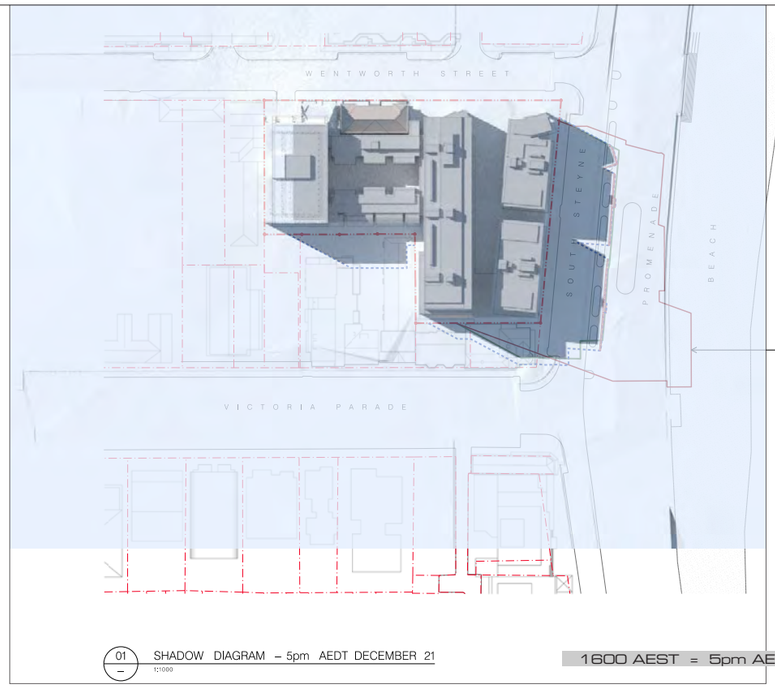
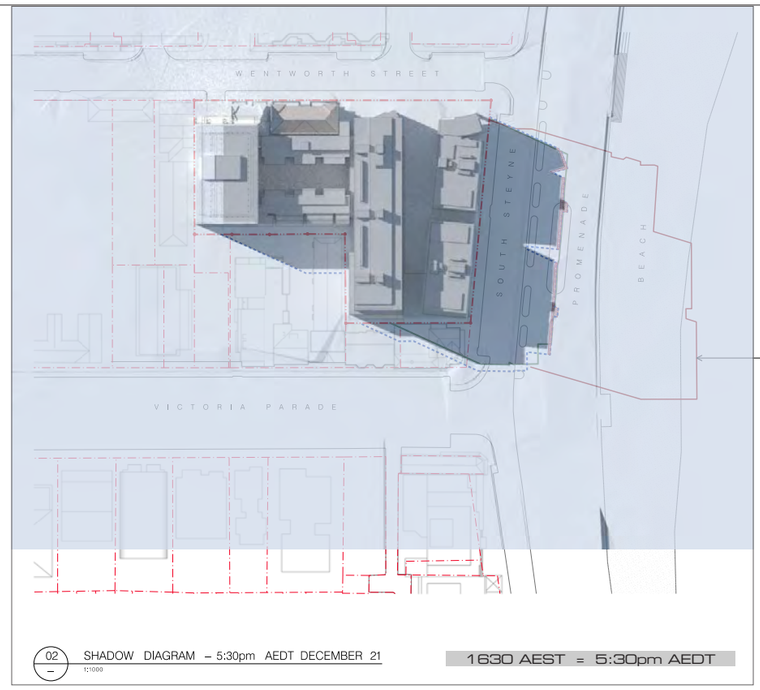


SHADOW OUTLINE FROM ARCHITECTUS DRAWING SK-202 ISSUE A

01 – SHADOW DIAGRAM – 5pm AEDT DECEMBER 21
1:1000

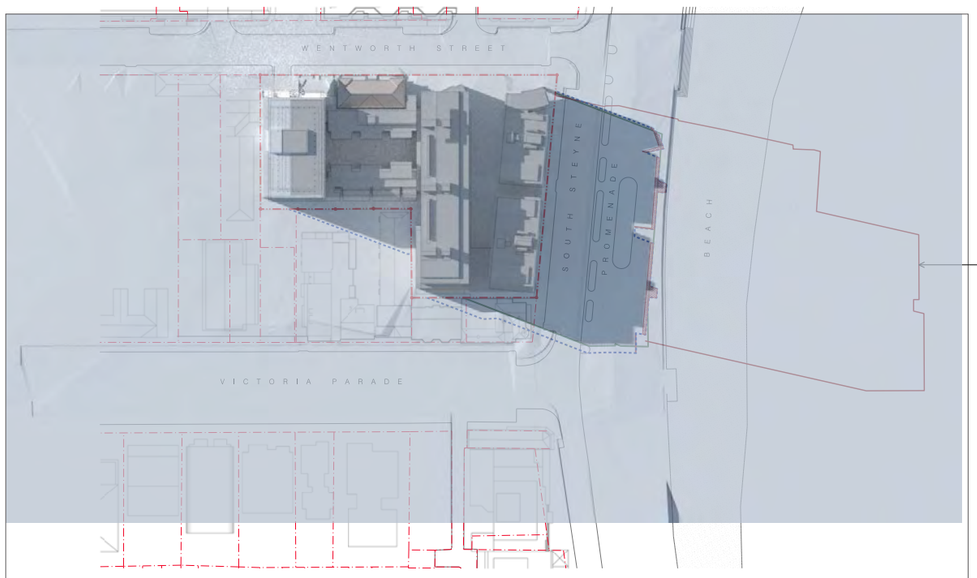
1600 AEST = 5pm AEDT



SHA
FRO
DRA
ISSU

02 – SHADOW DIAGRAM – 5:30pm AEDT DECEMBER 21
1:1000

1630 AEST = 5:30pm AEDT



SHADOW OUTLINE FROM ARCHITECTUS DRAWING SK-204 ISSUE A

03 – SHADOW DIAGRAM – 6pm AEDT DECEMBER 21
1:1000

1700 AEST = 6pm AEDT

LEGE

CERTIFIED SHADOW DIAGRAM
No : SDC182301
Refer to attached Certificate.

Certifier:
C McFadzean
B Arch BA (Arch) IES ABSA AAAI

Member of IES
(The Illuminating Engineers Society of Australia)

NORTH

LEGEND

- APPROVED PART 3A ON GROUND SHADOW OUTLINE
- PROPOSED DEVELOPMENT ON GROUND SHADOW OUTLINE
- ON GROUND SHADOW CAST BY MASSING ABOVE THE PART 3A HEIGHT PLANE

Murcutt Candalepas Massing Design
WINTER SOLSTICE
21 JUNE

TITLE
SHADOW DIAGRAMS ANALYSIS PLAN

PROJECT
Royal Far West 14-22 Wentworth St & 19-21 South Steyne, Manly

DESIGNER
Murcutt Candalepas

CLIENT
Royal Far West

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PAGE	:	SD 09
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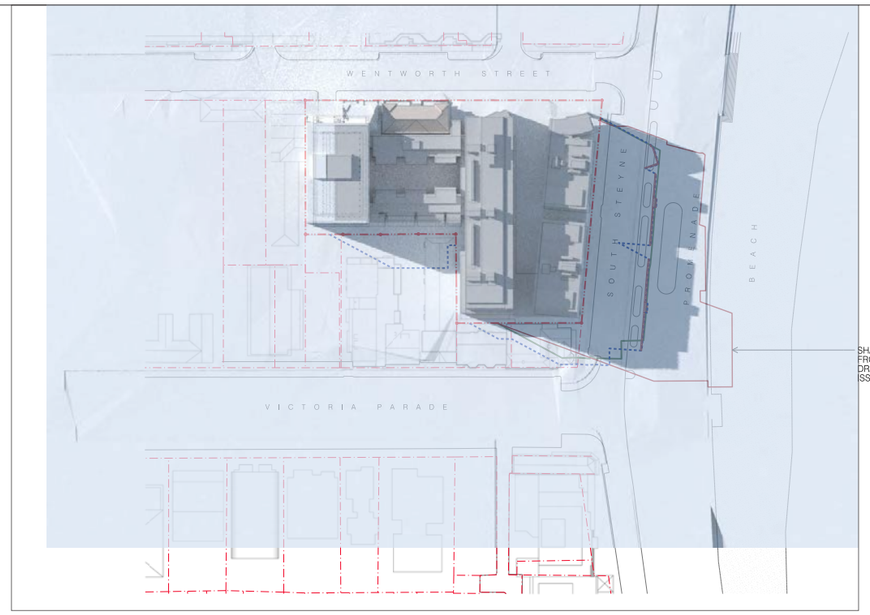
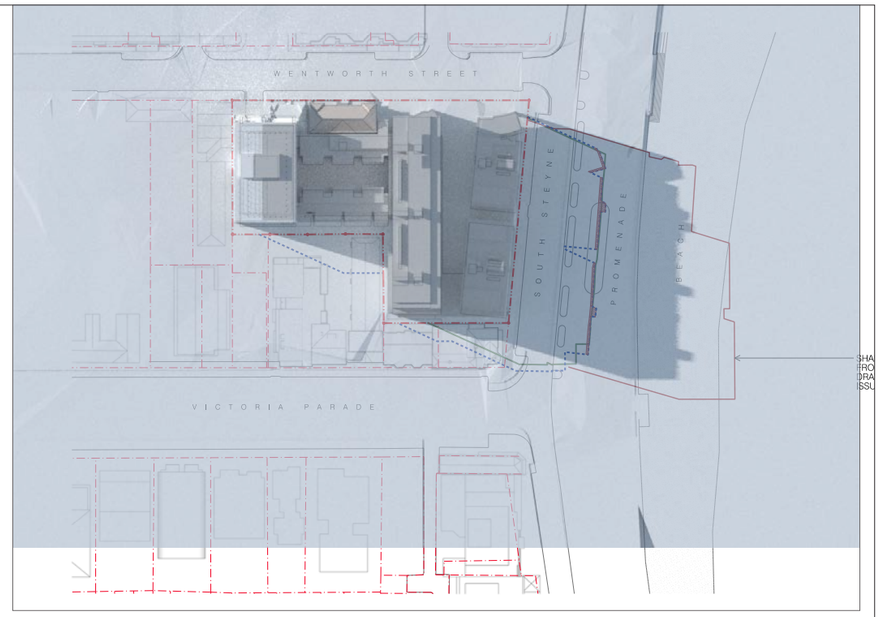
ARCHITECTUS REFERENCE



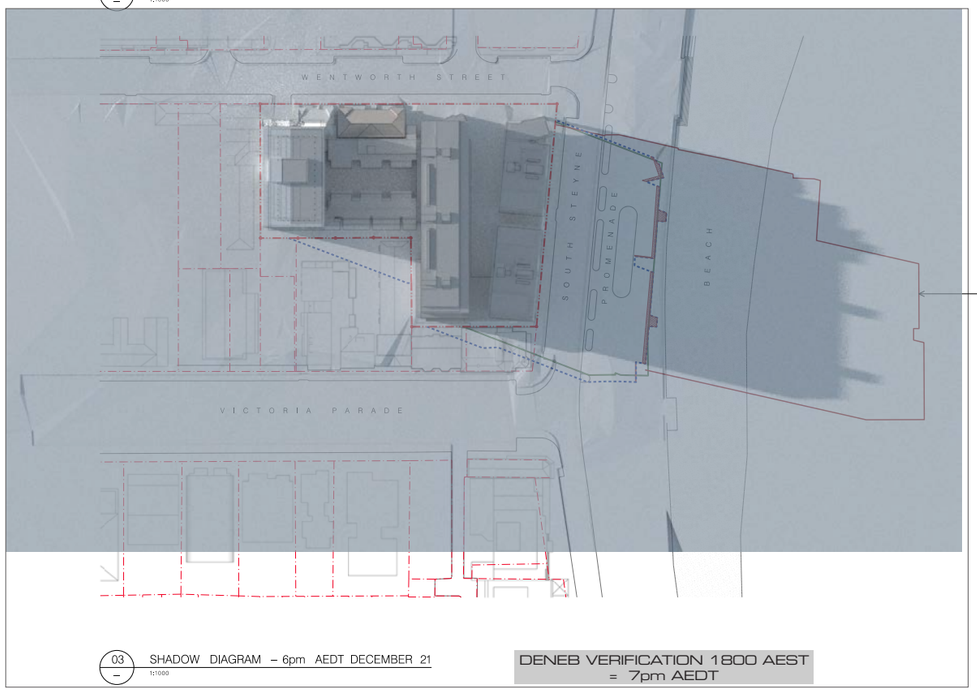
DENEB VERIFICATION 1700 AEST
= 6pm AEDT

01 – SHADOW DIAGRAM – 5pm AEDT DECEMBER 21
1:1000



DENEB VERIFICATION 1730 AEST
= 6:30pm AEDT

02 – SHADOW DIAGRAM – 5:30pm AEDT DECEMBER 21
1:1000



DENEB VERIFICATION 1800 AEST
= 7pm AEDT

03 – SHADOW DIAGRAM – 6pm AEDT DECEMBER 21
1:1000

NOTE; TIMING DISCREPANCY

Deneb verification is in AEST, Murcutt Candalepas line work is in AEDT.
It has been assumed that the Architectus reference line work is in AEST not AEDT. Therefore the Architectus shadow line is produced by sunlight at 6, 6:30 and 7pm AEDT which is the same as 5, 5:30 and 6pm AEST.

CERTIFIED SHADOW DIAGRAM
No : SDC182301
Refer to attached Certificate.

Certifier:
C McFadzean
B Arch BA (Arch) IES ABSA AAAI

Member of IES
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NORTH

LEGEND

- APPROVED PART 3A ON GROUND SHADOW OUTLINE
- PROPOSED DEVELOPMENT ON GROUND SHADOW OUTLINE
- SHADOW OUTLINE BASED ON ARCHITECTUS DRAWINGS SK-202,SK-203 & SK-204 (ALL ISSUE A), INCLUDED IN PAC REPORT ISSUED 18.04.13.
- ON GROUND SHADOW CAST BY MASSING ABOVE THE PART 3A HEIGHT PLANE

Murcutt Candalepas Massing Design
MID SUMMER
21 DECEMBER

TITLE
SHADOW DIAGRAMS ANALYSIS PLAN

PROJECT
Royal Far West 14-22 Wentworth St & 19-21 South Steyne, Manly

DESIGNER
Murcutt Candalepas

CLIENT
Royal Far West

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