



## SHADOW DIAGRAM CERTIFICATION

**NUMBER:** SDC166101  
**DATE:** 18.12.19  
**PROJECT:** 21 Tasman Street Dee Why 2099



**Client Details:**

-  
Tom Sawyer Building  
78 Cassia Street  
Dee Why NSW 2099

P 0411023143

CERTIFICATION FOR :			
<b>DA</b> <input checked="" type="checkbox"/> DA council application	<b>L&amp;E</b> <input type="checkbox"/> All Other Planning Documentation	<b>EXPERT</b> <input type="checkbox"/> Expert Witness Review / Statement	<b>CONSULTANT</b> Primary <input checked="" type="checkbox"/> Other <input type="checkbox"/>
DOCUMENT CONTENTS:			
<b>CERTIFICATE</b> <input checked="" type="checkbox"/> This Page	<b>Calculations</b> <input type="checkbox"/> ITEM 1	<b>Statement</b> <input type="checkbox"/> ITEM 2	<b>Process</b> <input checked="" type="checkbox"/> ITEM 3

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

CERTIFICATION DETAILS FOR SHADOW DIAGRAMS		
Project Details	21 Tasman Street Dee Why. As detailed in DA Plans provided by Tom Sawyer Building ,Deneb Design Architecture Ref. Dec 2019 DAO1	
Applicable for Shadow Diagrams Numbered	SD 01 +	
Issue	Version 01	
Dated	18.12.2019	
ACCURACY DETAILS	DATA	TOLERANCE
Existing Building	Survcorp ref 3545 dated 9.04.2019	+/- 150mm Replication of Survey data.
Neighbouring Buildings		
Topography and Site		
Proposed Design	Architectural Plans	+/- 150mm
RL critical heights	Architectural Plans & Survey	+/- 50mm
Shadow Cast per Component	3D Modelling Software	+/- 150mm
Comparative Shadow Analysis per time	3D Model & Post Processing	5% tolerance in total image
PRECEDENCE RULE - DATA		
1. Survey 2. Architectural Plans 3. Aerial Photography		

CERTIFIER SIGNED:

Cameron McFadzean

Certifier:

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

## ITEM 1 and 2 not required

## ITEM 3. PROCESS OF SHADOW DIAGRAM PRODUCTION

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 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.

### 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 blurriness, 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 analysis 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

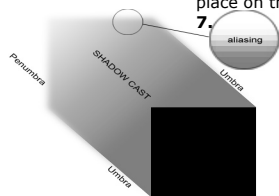
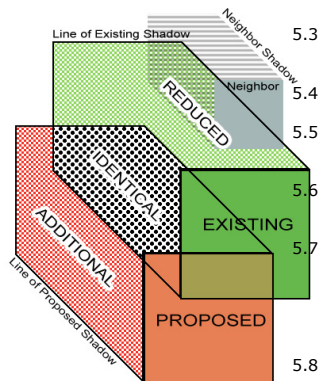
Each image time slot in composition becomes a single shadow image. These shadow images are positioned in page with time stamps and titles placed alongside. Deneb Design work procedure has a code checking system to assist in ensuring the correct shadow image is placed in the correct place on the page. This procedure is semi-automated and human error can occur. Self auditing has revealed a 0% occurrence.

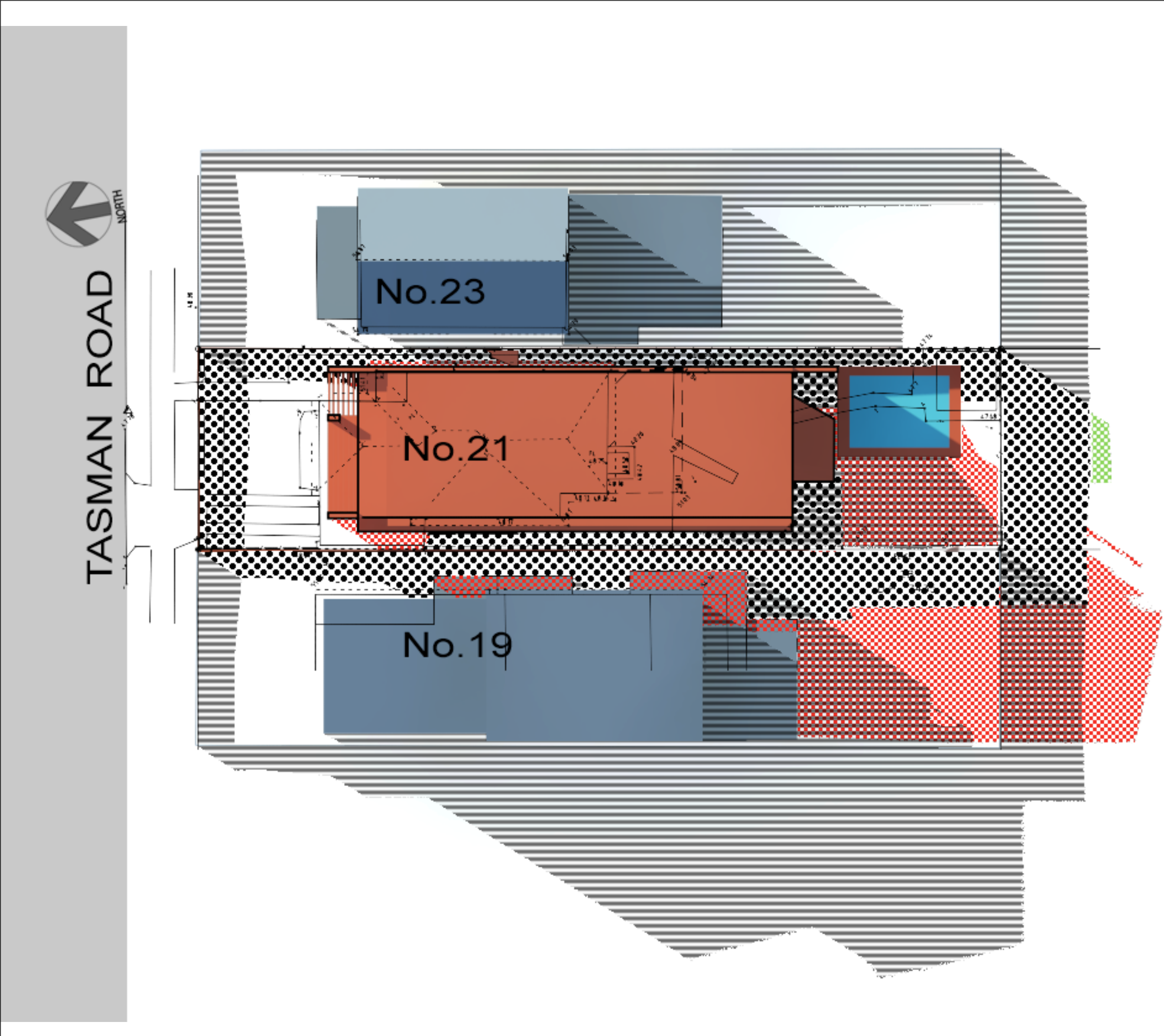
### 7. Shadow Parts and edge accuracy.

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.

### 8. 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 m<sup>2</sup>). 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  
No : SDC166101 - Refer to attached Certificate.

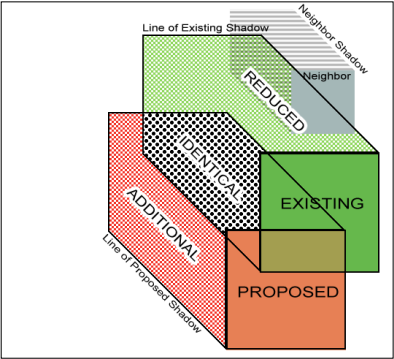
Certifier: C McFadzean B Arch BA (Arch) IES ABSA AAAI  
Member of IES (The Illuminating Engineers Society of Australia)

SHADOW KEY

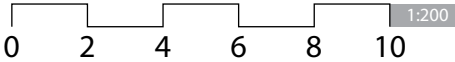
- ADDITIONAL SHADOW AREA**
  - PROPOSED LESS EXISTING
  - AS CAST FROM PROJECT SITE ONLY
- REDUCED SHADOW AREA**
  - EXISTING LESS PROPOSED
  - AS CAST FROM PROJECT SITE ONLY
- IDENTICAL SHADOW AREA**
  - EXISTING + PROPOSED ARE THE SAME
  - AS CAST FROM PROJECT SITE ONLY
- NEIGHBOURING**
  - SHOWN AS NEIGHBOURING SHADOWS WHICH OVERLAP PROJECT SITE SHADOWS



HOW TO READ



- NOTES:**
- Trees, landscape omitted from calculations
  - True north used as solar north.
  - Terrain is approximate outside of the site
  - Limited survey information available on adjoining sites.
  - Winter solstice - 21 June
  - Time Zone - AEST unless noted (Aust. Eastern Standard Time - AEST)



0900 JUNE 21

TITLE  
SHADOW DIAGRAMS - PLAN  
WINTER SOLSTICE  
21 JUNE

PROJECT  
PROPOSED DESIGN  
21 TASMAN STREET  
DEE WHY

DESIGNER  
Deneb Design Architecture

DATA SOURCE (In order of precedence)  
• Registered Survey - Survcorp ref 3545 dated 9.04.2019  
• Architecturals - Deneb Design Architecture Ref. Dec 2019 DA01

PAGE : SD 01  
SCALE : 1:200 (A3)  
DATE : 18.12.19  
VERSION : 01  
REF : 1661



3D SHADOW DIAGRAMS /  
VISUALISATION + ANALYSIS  
**DENEb DESIGN**  
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info@denebdesign.com.au  
www.denebdesign.com.au



CERTIFIED SHADOW DIAGRAM  
No : SDC166101 - Refer to attached Certificate.

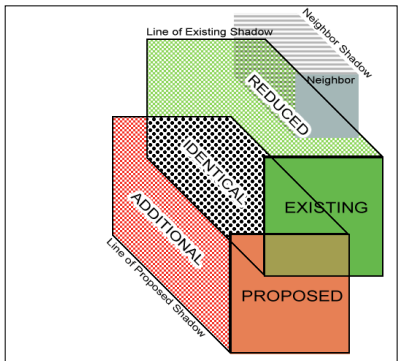
Certifier: C McFadzean B Arch BA (Arch) IES ABSA AAAI  
Member of IES (The Illuminating Engineers Society of Australia)

SHADOW KEY

- SHADOWS CAST FROM PROJECT SITE
- ADDITIONAL SHADOW AREA**
    - PROPOSED LESS EXISTING
    - AS CAST FROM PROJECT SITE ONLY
  - REDUCED SHADOW AREA**
    - EXISTING LESS PROPOSED
    - AS CAST FROM PROJECT SITE ONLY
  - IDENTICAL SHADOW AREA**
    - EXISTING + PROPOSED ARE THE SAME
    - AS CAST FROM PROJECT SITE ONLY
  - NEIGHBOURING**
    - SHOWN AS NEIGHBOURING SHADOWS WHICH OVERLAP PROJECT SITE SHADOWS



HOW TO READ



- NOTES:**
- Trees, landscape omitted from calculations
  - True north used as solar north.
  - Terrain is approximate outside of the site
  - Limited survey information available on adjoining sites.
  - Winter solstice - 21 June
  - Time Zone - AEST unless noted (Aust. Eastern Standard Time - AEST)

0 2 4 6 8 10 1:200

1200 JUNE 21

TITLE  
SHADOW DIAGRAMS - PLAN  
WINTER SOLSTICE  
21 JUNE

PROJECT  
PROPOSED DESIGN  
21 TASMAN STREET  
DEE WHY

DESIGNER  
Deneb Design Architecture

DATA SOURCE (In order of precedence)

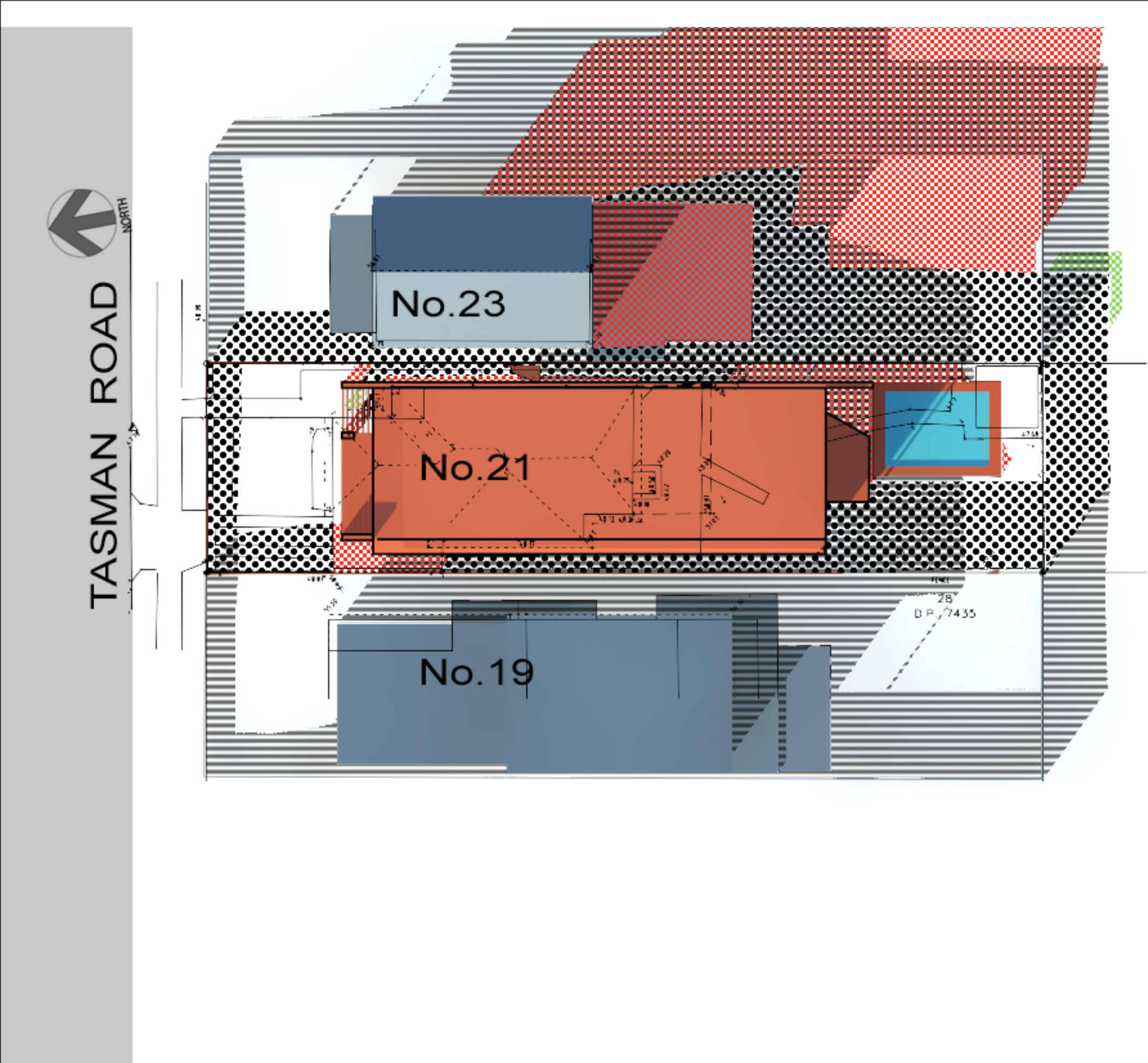
- Registered Survey - Survcorp ref 3545 dated 9.04.2019
- Architecturals - Deneb Design Architecture Ref. Dec 2019 DA01


PAGE : SD 02  
SCALE : 1:200 (A3)  
DATE : 18.12.19  
VERSION : 01  
REF : 1661



3D SHADOW DIAGRAMS /  
VISUALISATION + ANALYSIS  
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CERTIFIED SHADOW DIAGRAM

No : SDC166101 - Refer to attached Certificate.

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

Member of IES (The Illuminating Engineers Society of Australia)

SHADOW KEY

SHADOWS CAST FROM PROJECT SITE

ADDITIONAL SHADOW AREA

• PROPOSED LESS EXISTING

• AS CAST FROM PROJECT SITE ONLY

REDUCED SHADOW AREA

• EXISTING LESS PROPOSED

• AS CAST FROM PROJECT SITE ONLY

IDENTICAL SHADOW AREA

• EXISTING + PROPOSED ARE THE SAME

• AS CAST FROM PROJECT SITE ONLY

NEIGHBOURING

• SHOWN AS NEIGHBOURING SHADOWS WHICH OVERLAP PROJECT SITE SHADOWS

HOW TO READ

Line of Existing Shadow

Neighbor Shadow

REDUCED

EXISTING

ADDITIONAL

Line of Proposed Shadow

PROPOSED

NOTES:

1. Trees, landscape omitted from calculations

2. True north used as solar north.

3. Terrain is approximate outside of the site

4. Limited survey information available on adjoining sites.

5. Winter solstice - 21 June

6. Time Zone - AEST unless noted (Aust. Eastern Standard Time - AEST)

0 2 4 6 8 10

1:200

1500

JUNE 21

TITLE

SHADOW DIAGRAMS - PLAN

WINTER SOLSTICE

21 JUNE

PROJECT

PROPOSED DESIGN

21 TASMAN STREET

DEE WHY

DESIGNER

Deneb Design Architecture

DATA SOURCE (In order of precedence)

• Registered Survey - Survcorp ref 3545 dated 9.04.2019

• Architecturals - Deneb Design Architecture Ref. Dec 2019 DA01

PAGE : SD 03

SCALE : 1:200 (A3)

DATE : 18.12.19

VERSION : 01

REF : 1661

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denebdesign

3D SHADOW DIAGRAMS / VISUALISATION + ANALYSIS

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