SHADOW DIAGRAM CERTIFICATION

NUMBER: SDC109001
DATE: 13.06.14
PROJECT: Mandarin Centre Chatswood NSW

denebdesign

Client Details:
Ms Sylvia Vasak
Bates Smart
NSW

CERTIFICATION FOR :			
DA ☒ DA council application	L&E ☒ All Other Planning Documentation	EXPERT ☐ Expert Witness Review / Statement	CONSULTANT Primary ☐ Other ☒
DOCUMENT CONTENTS:			
CERTIFICATE ☒ This Page	Calculations ☒ ITEM 1	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. This certification is applicable only to the shadow diagrams produced as listed below.

CERTIFICATION DETAILS FOR SHADOW DIAGRAMS		
Project Details	Mandarin Centre Chatswood. Proposed Design as documented in 3D Model provided by BATESSMART and verified against "Design Report".	
Applicable for Shadow Diagrams Numbered	SD 01 - 08	
Issue	Version 01	
Dated	13.06.2014	
ACCURACY DETAILS	**DATA**	**TOLERANCE**
TRUE NORTH	Survey – 73 Albert Ave (ACAD File provided without Survey Title Block)	+/- 150mm Replication of Survey data.
Neighbouring Buildings	3D Model by BatesSmart. Key locations / heights verified against RL information provided within BATESMART DESIGN REVIEW document.	+/- 150mm Replication of tolerance embedded into 3D Model or otherwise stated in numerical spot points
Topography and Site		
Proposed Design		
RL critical heights	Architectural Plans & Survey	+/- 50mm Key points
Shadow Cast per Component	3D Modelling Software	+/- 3m (1:1000 resolution)
Comparative Shadow Analysis per time	3D Model & Post Processsing	5% tolerance in total image
PRECEDENCE RULE - DATA		
1. Survey 2. Section BB by BATESSMART 3. BATESMART Design Review RL data 4. 3D Model provided by BATESSMART		

DATA PROVIDED:
3D Model file provided by BATESSMART
Section BB and Typical PLAN by BATESSMART, REF S11596, issued 11 June 2014 (no title information)
Design Review document by BATESMART, REF S11596 Titled "Mandarin Centre_Design Report_GATEWAY_June2014.pdf" as issued 11 June 2014
Survey – for Original Site Detail Survey of 73 Albert Ave, for determination of Solar True North. (no title information) provided by BATESSMART

CERTIFIER SIGNED:

Cameron McFadzean

Certifier:
Cameron McFadzean BA (Architecture) B Architecture, AssessorABSA, AssocIES
Deneb Design

ITEM 1. LIST OF DATA CALCULATIONS / DATA SOURCE

LIST OF KEY DATA POINTS AND SOURCES					
CONTROL POINT NAME	**DATA SOURCE**	**BatesSmart Listed RL**	**3D Raw from Model**	**Deneb Verified**	**As Modelled for SOLAR ANALYSIS**
TRUE NORTH	Survey - 73 Albert Ave, as provided by Bates Smart ACAD		unknown	YES	Survey TRUE North
Proposed Design	Section BB				
Tower Height 1		181.95	180	YES	181.95
2nd Tower Height		140.79	138	YES	140.79
Street Parapet		114.05	112.14	YES	114.05
Street level - Albert Ave		92	90.5	YES	92
Sage - Roof	Design Report Doc	163.5	161.2	YES	163.5
Sage - Podium		159.52	157.6	YES	159.52
Sebel - Ridge			Adjusted		
Sebel - Roof		182.13	New Podium	YES	182.13
Sebel - Podium			Adjusted		
Various Buildings					
RL 221.95		as per name	221.2	YES	221.95
RL 253.35			245	YES	253.35
RL 247.0			247	YES	247
RL 234.0			234	YES	234
RL 201.0			201	YES	201
RL 182.0			164	YES	182
RL 161.0			174	YES	161
Chatswood Park RL					
Spot Heights Provided	no RL data available , only 3D file			MEASURED	Measured Spot Heights as indicated for reference

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ITEM 2. SHADOW DIAGRAM – Statement

3D MODEL DATA

Some component buildings within the imported 3D Model were found to be inaccurate by +/- 2 meters typical up to 13 meters one on occasion when comparing the RL heights to those listed in the Bates Smart "Design Review" document. The 3D Model was adjusted in all instances to reflect the information provided in the "Design Review" document. A Graphic illustration of the Key locations is shown on the 3D View of the KEY page on our accompanying Shadow Diagrams.

As the overshadowing predominantly falls across the Chatswood PARK and interconnected pathways around the Chatswood Oval, the determination of the terrain in this area is significant. Only the 3D Model provided such information, thus SPOT LEVELS as determined from the surface of the 3D Model have been provided to clarify the terrain surface levels used in this area.

BATES SMART SHADOW DIAGRAMS

The Shadow Diagrams produced by BATESSMART as attached in the Appendix of the Design Review document, have not been used in any manner in the production of our Shadow Diagrams. The data source of the 3D data may possibly be the same in both diagrams, however we have independently created a new sunlight system, aligned to True North and run solar analysis for the Mid Winter period in order to produce our Shadow Diagrams. The data source, the precedence of data and the resulting adjusted 3D Model , and the calculated True North from the 73 Albert Ave Survey are as documented by Deneb Design in our certification procedure.

As such the Deneb Design shadows are an independent assessment of the solar impact and overshadowing of the proposed design as documented.

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ITEM 3. PROCESS OF SHADOW DIAGRAM PRODUCTION

Digital Shadow 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

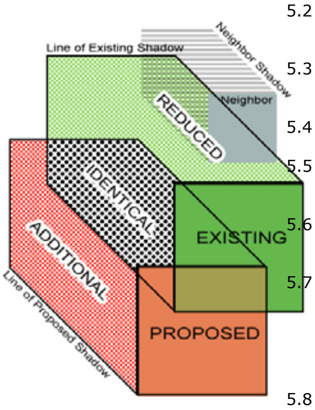
For each and every time slot a image is rendered using the 3D model and daylight system for every component of the shadow set. A single time slot may consist of several (typically 4) shadow types. Due to render resolution and edge bluriness, particularly in low light where the shadow cast becomes difficult 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 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.

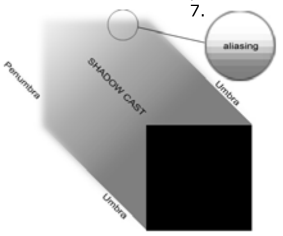


   - 5.1 Existing Building and Shadow– The existing building is 3D modeled and the shadow that is cast is called the existing shadow. This existing shadow may also be divided into IDENTICAL and REDUCED Shadow types.
   - 5.2 Proposed Building (Orange) and Shadow– The proposed building is modeled and typically 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 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.

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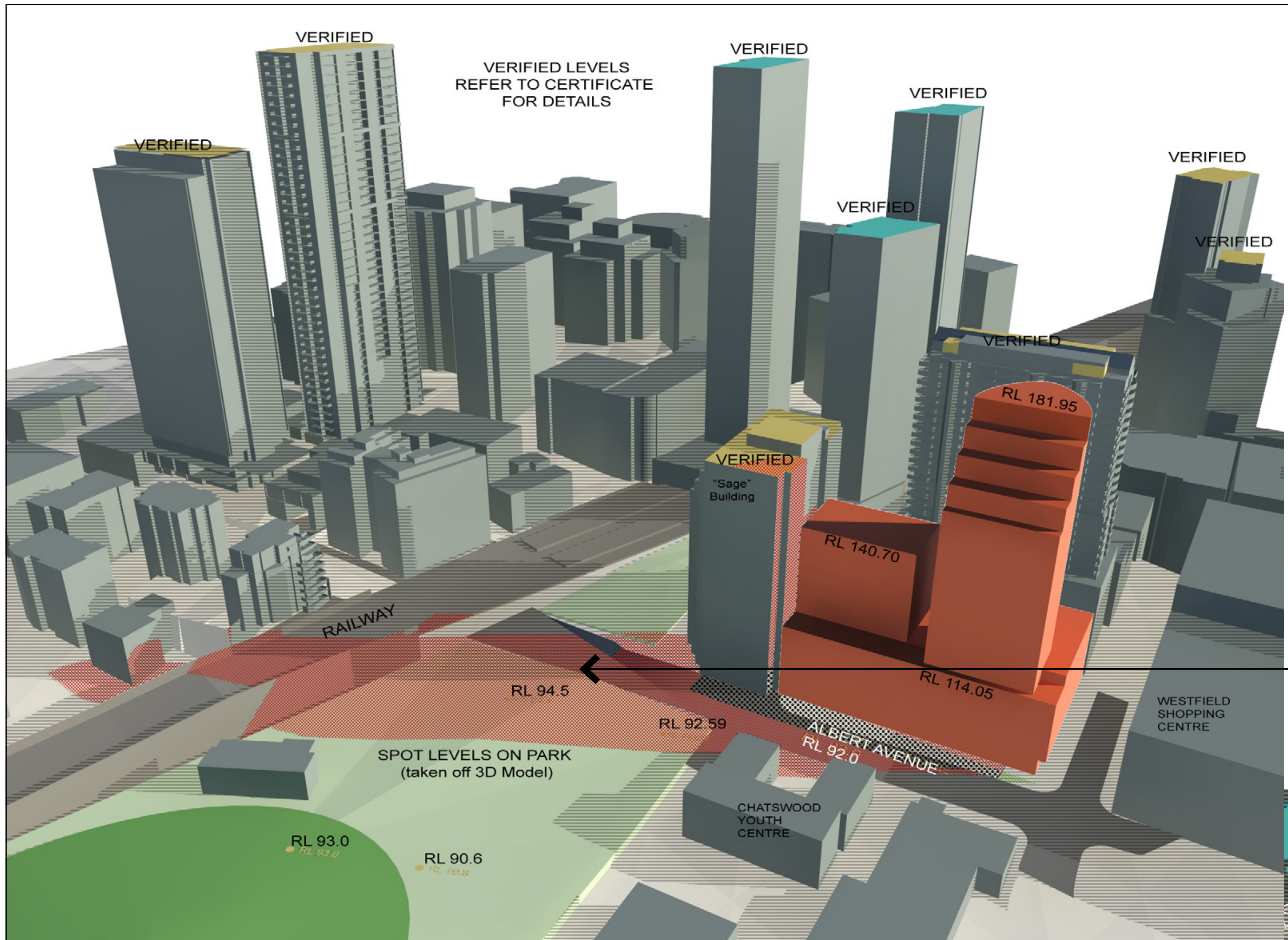


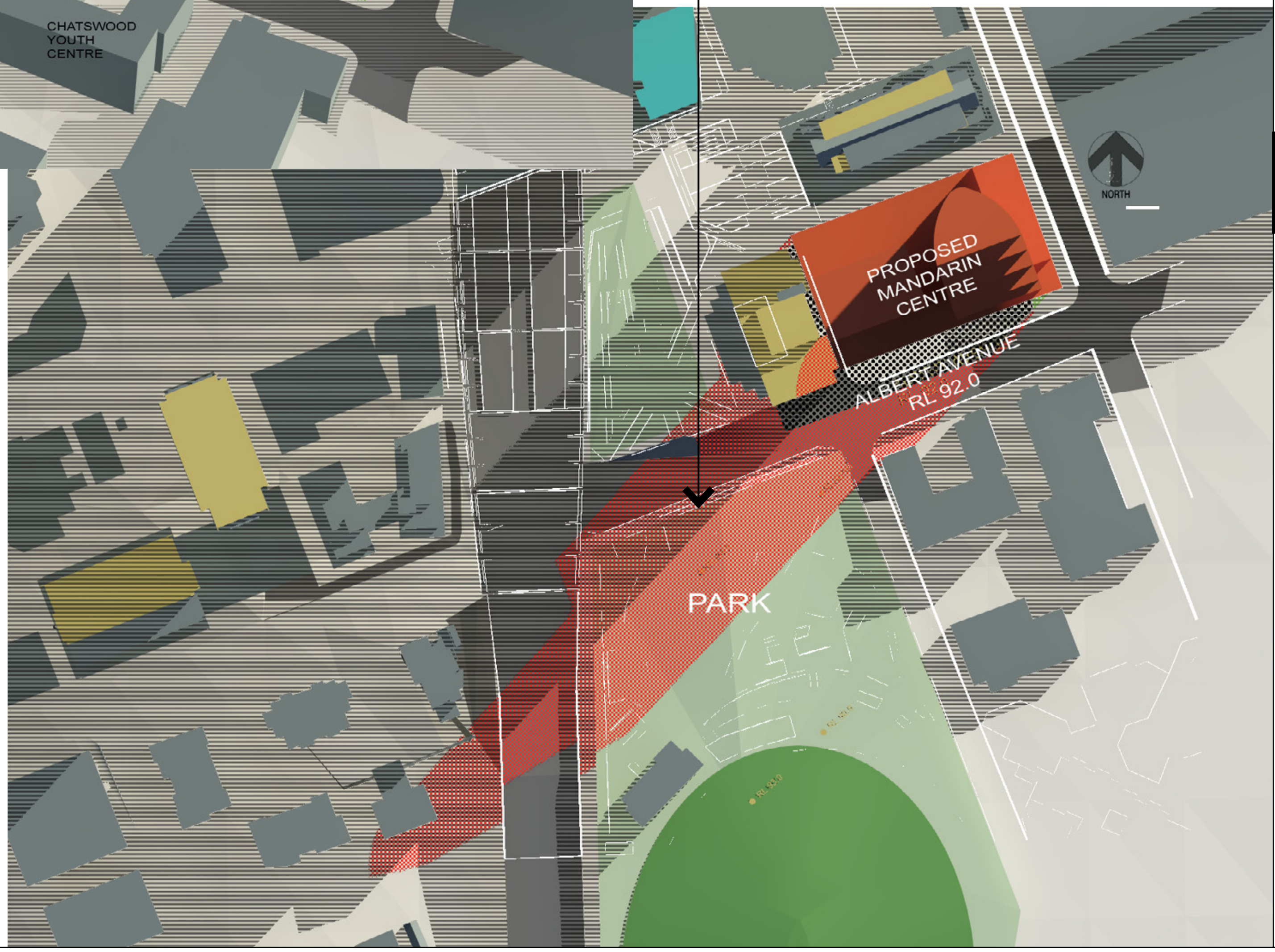
VERIFIED POSITION ON 3D Model

VERIFIED as correct RL , raw 3D Model information used.

ADJUSTED 3D Model to correct RL as verified from "Design Manual" documentation provided by Bastes Smart

EXPLANATORY NOTE:
1. PROPOSED SHADOW shown in its entirety and shown overlapping Neighbour shadow components.

2. In Areas of BOTH Neighbour shadow and Proposed Shadow, the area is already in shade form sources outside of the target site.



CERTIFIED SHADOW DIAGRAM
No : SDC109001 - Refer to attached Certificate.

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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
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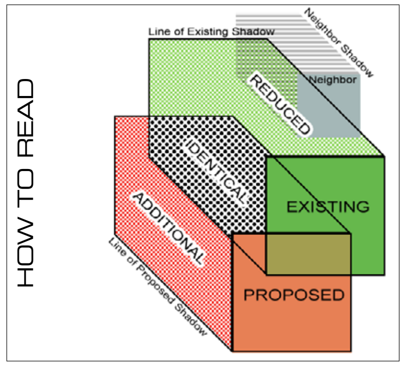
- NEIGHBOURING
  - SHOWN AS NEIGHBOURING SHADOWS WHICH OVERLAP PROJECT SITE SHADOWS

HOW TO READ



NOTES:
1. Trees, landscape and fences all 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. Refer to Certification for Data sources and verifications
6. Winter solstice - 21 June
7. Time Zone - AEST unless noted (Aust. Eastern Standard Time - AEST)

KEY not to scale

TITLE
SHADOW DIAGRAMS - PLAN

WINTER SOLSTICE
21 JUNE

PROJECT
MANDARIN CENTRE CHATSWOOD
PROPOSED BY BATESSMART REF S11596

DESIGNER
PROPOSED DESIGN
BY BATES SMART ARCHITECTS

Job Ref : S11596
Rev Version : Files as submitted 11.06.14

DATA SOURCE (In order of precedence)
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- Details - 3D File by Bates Smart and Verified with "Design Report" Documentation

PAGE No : SD 01
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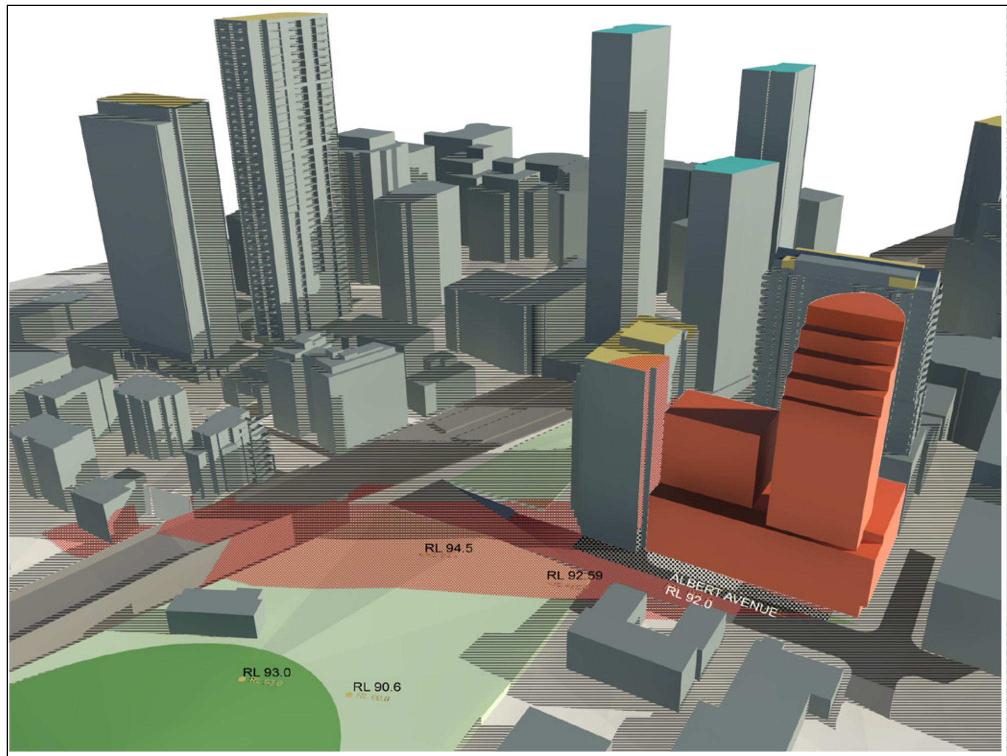

3D View - Axonometric (no scale)

PLAN - 1:1000 (A3)

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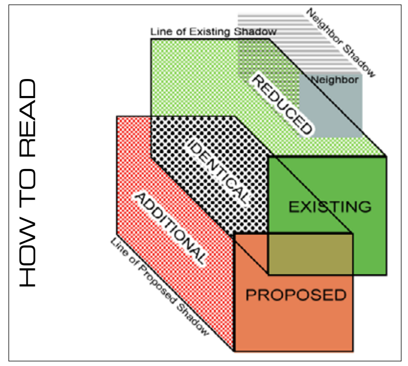

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0900 JUNE 21

TITLE
SHADOW DIAGRAMS - PLAN
WINTER SOLSTICE
21 JUNE

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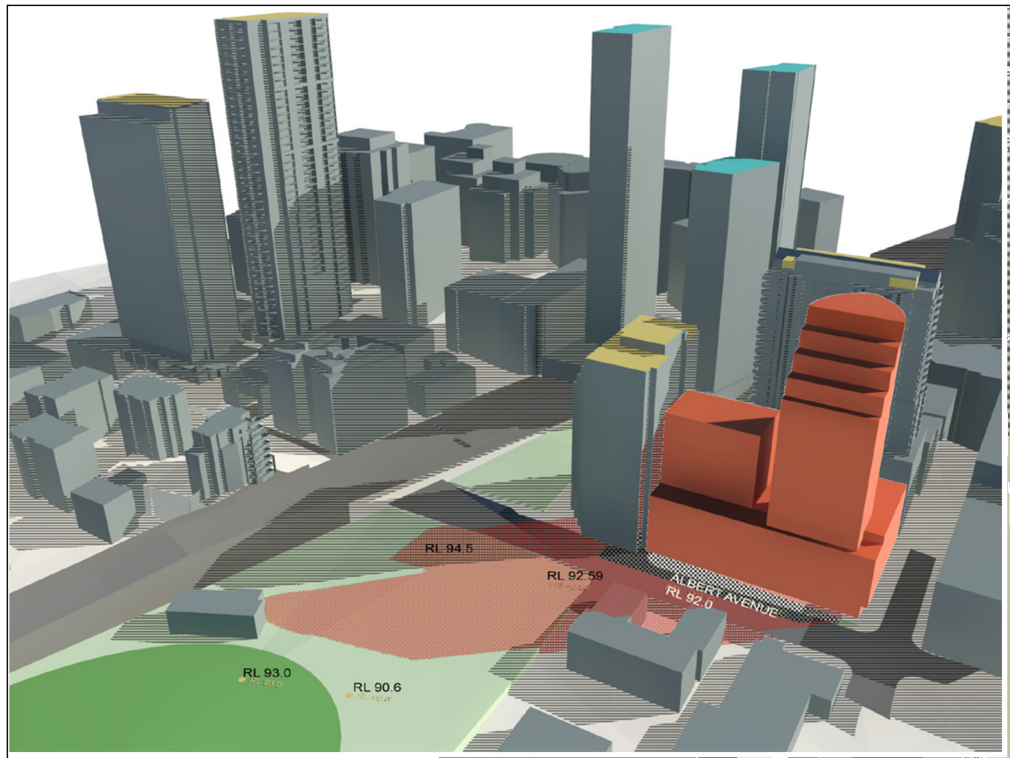

3D View - Axonometric (no scale)

PLAN - 1:1000 (A3)

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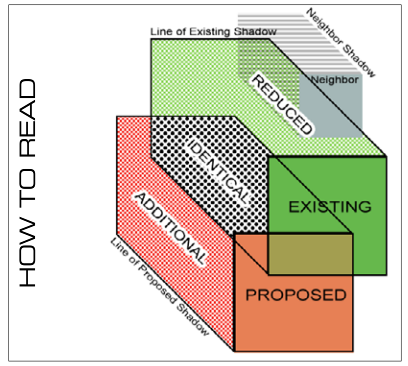

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1000 JUNE 21

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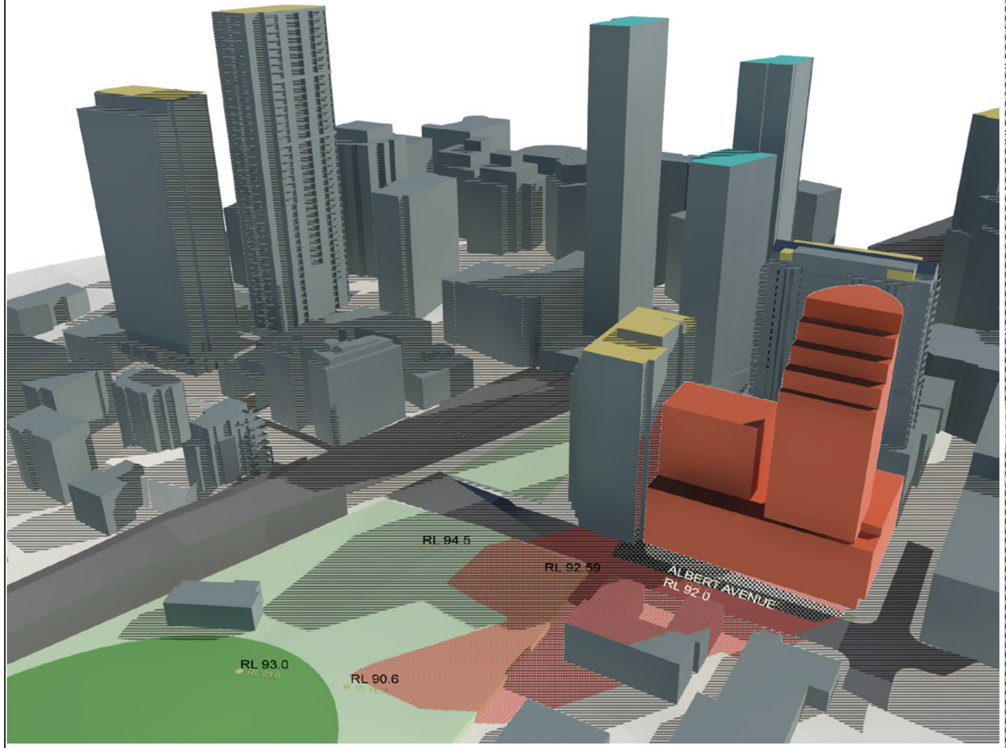

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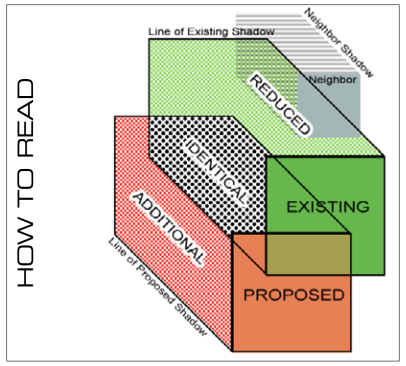

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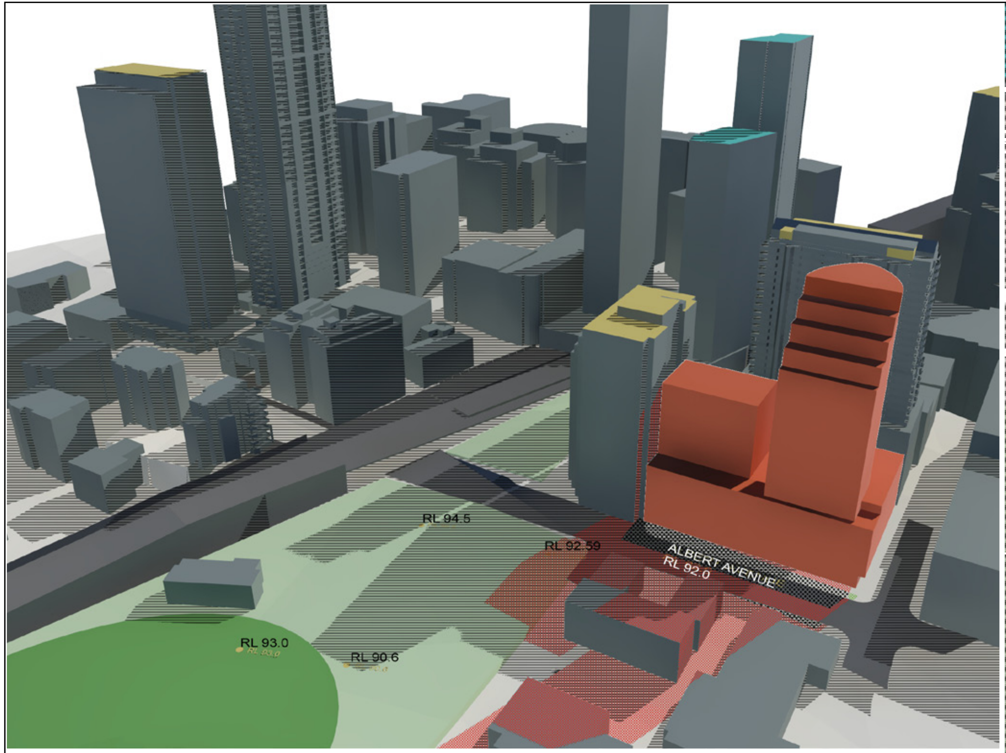

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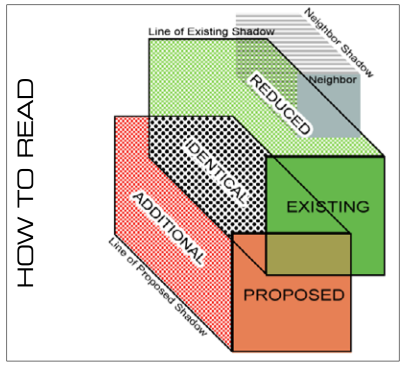

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1200 JUNE 21

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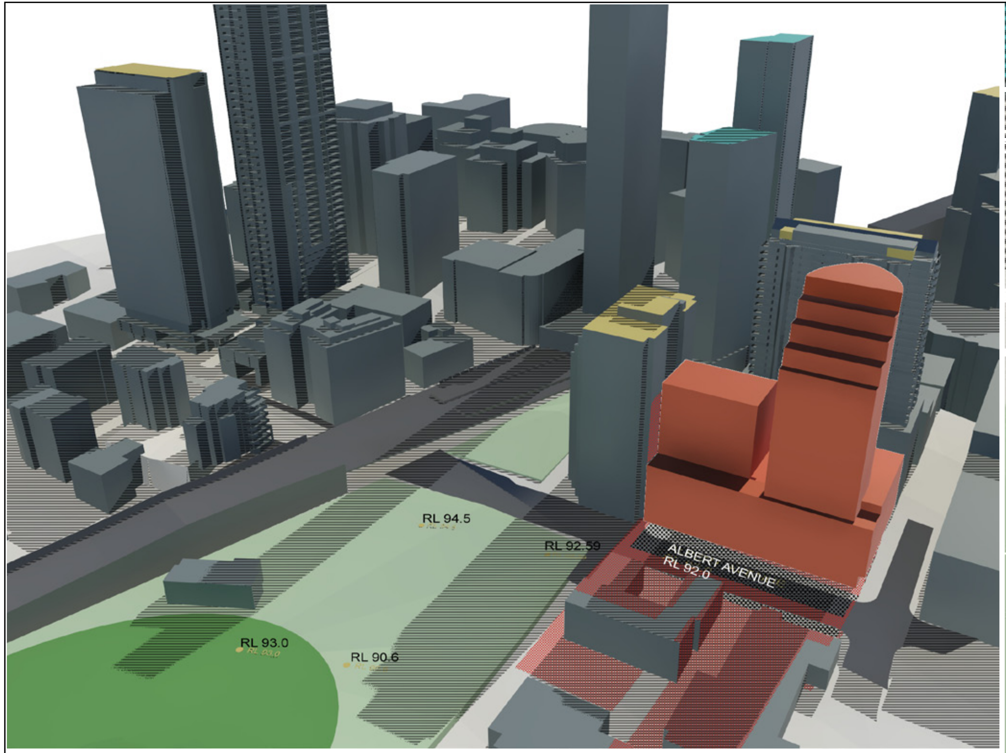


3D View - Axonometric (no scale)

PLAN - 1:1000 (A3)

CERTIFIED SHADOW DIAGRAM
No : SDC109001 - 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

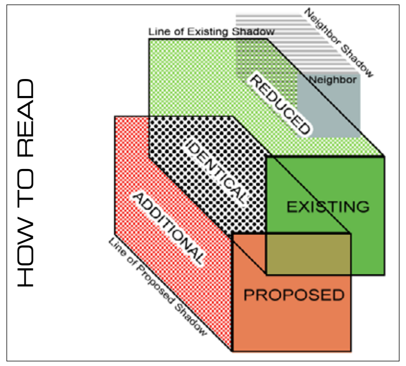
ADDITIONAL SHADOW AREA
- PROPOSED LESS EXISTING
- AS CAST FROM PROJECT SITE ONLY

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:
1. Trees, landscape and fences all 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. Refer to Certification for Data sources and verifications
6. Winter solstice - 21 June
7. Time Zone - AEST unless noted (Aust. Eastern Standard Time - AEST)

1300 JUNE 21

TITLE
SHADOW DIAGRAMS - PLAN
WINTER SOLSTICE
21 JUNE

PROJECT
MANDARIN CENTRE CHATSWOOD
PROPOSED BY BATESSMART REF S11596

DESIGNER
PROPOSED DESIGN
BY BATES SMART ARCHITECTS

Job Ref : S11596
Rev Version : Files as submitted 11.06.14

DATA SOURCE (In order of precedence)
- REFER TO CERTIFICATION for more information
- Registered Survey - TRUE NORTH - Survey for 73 Albert Ave - provided by Bates Smart.
- Details - 3D File by Bates Smart and Verified with "Design Report" Documentation

PAGE No : SD 06
SCALE : 1:1000 (A3)
PLAN ONLY
DATE : 13.06.14
VERSION : 01
REF : 1090

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VISUALISATION + ANALYSIS
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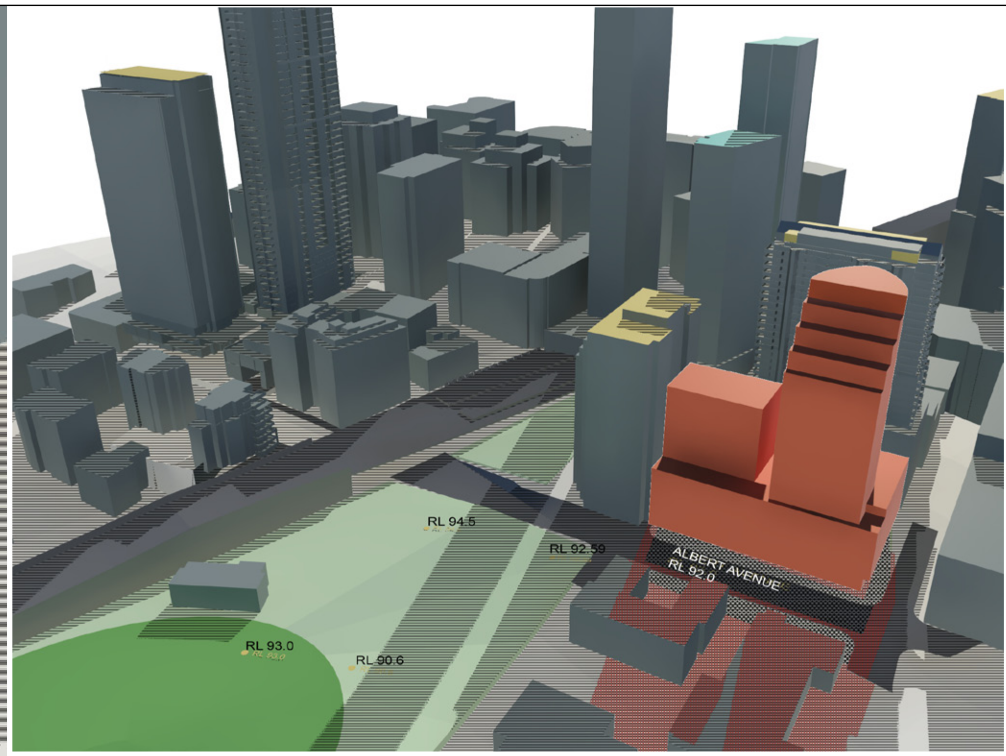
www.denebdesign.com.au

PLAN - 1:1000 (A3)



3D View - Axonometric (no scale)

CERTIFIED SHADOW DIAGRAM
No : SDC109001 - Refer to attached Certificate.

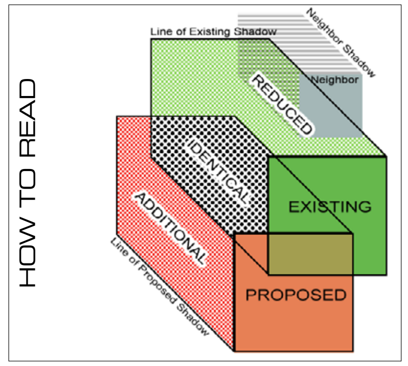
Certifier: C McFadzean B Arch BA (Arch) IES ABSA AAAI
Member of IES (The Illuminating Engineers Society of Australia)

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:

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

1400 JUNE 21

TITLE
SHADOW DIAGRAMS - PLAN
WINTER SOLSTICE
21 JUNE

PROJECT
MANDARIN CENTRE CHATSWOOD
PROPOSED BY BATESSMART REF S11596

DESIGNER
PROPOSED DESIGN
BY BATES SMART ARCHITECTS

Job Ref : S11596
Rev Version : Files as submitted 11.06.14

DATA SOURCE (In order of precedence)

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- Registered Survey - TRUE NORTH - Survey for 73 Albert Ave - provided by Bates Smart.
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PAGE No : SD 07
SCALE : 1:1000 (A3) PLAN ONLY
DATE : 13.06.14
VERSION : 01
REF : 1090

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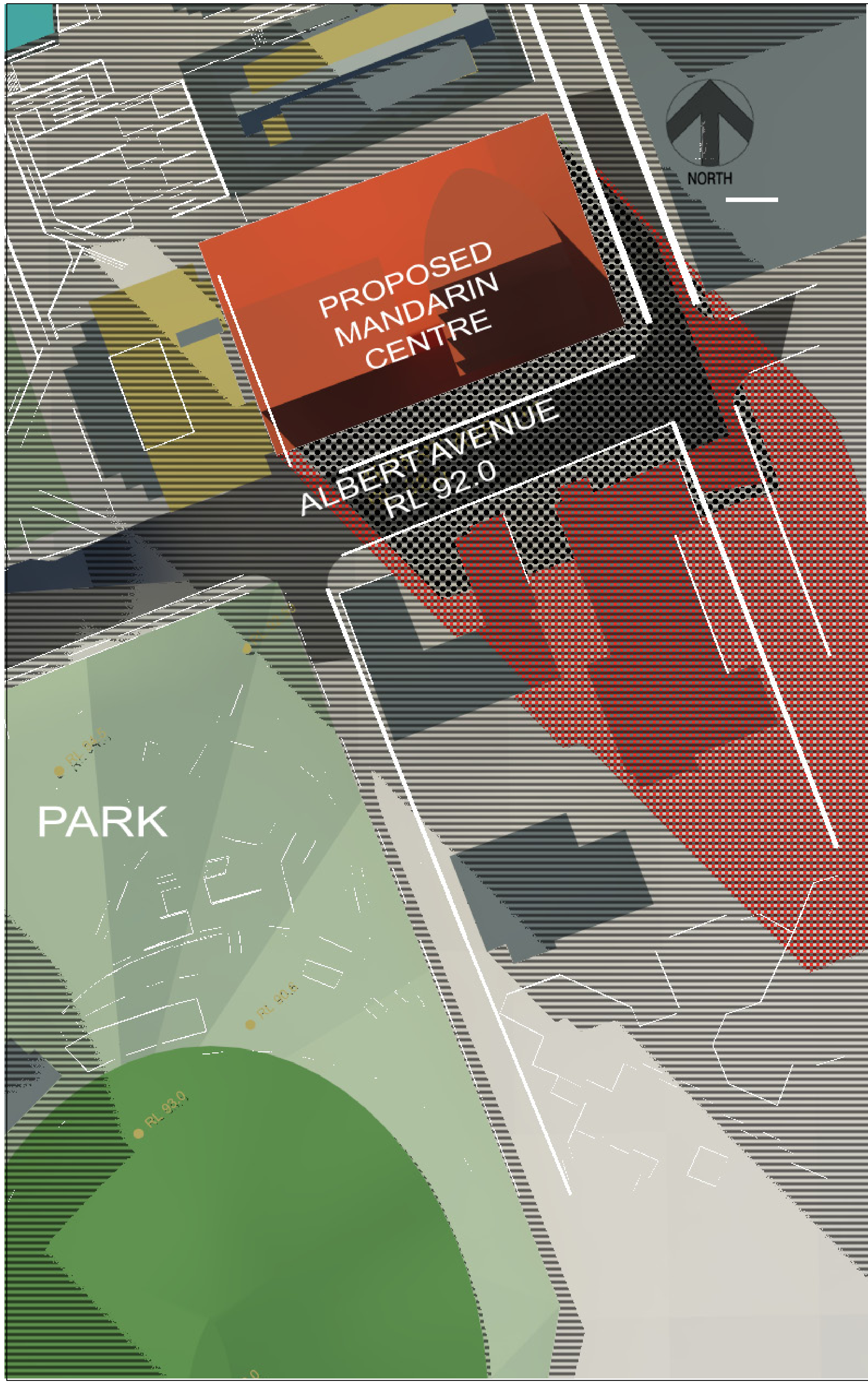
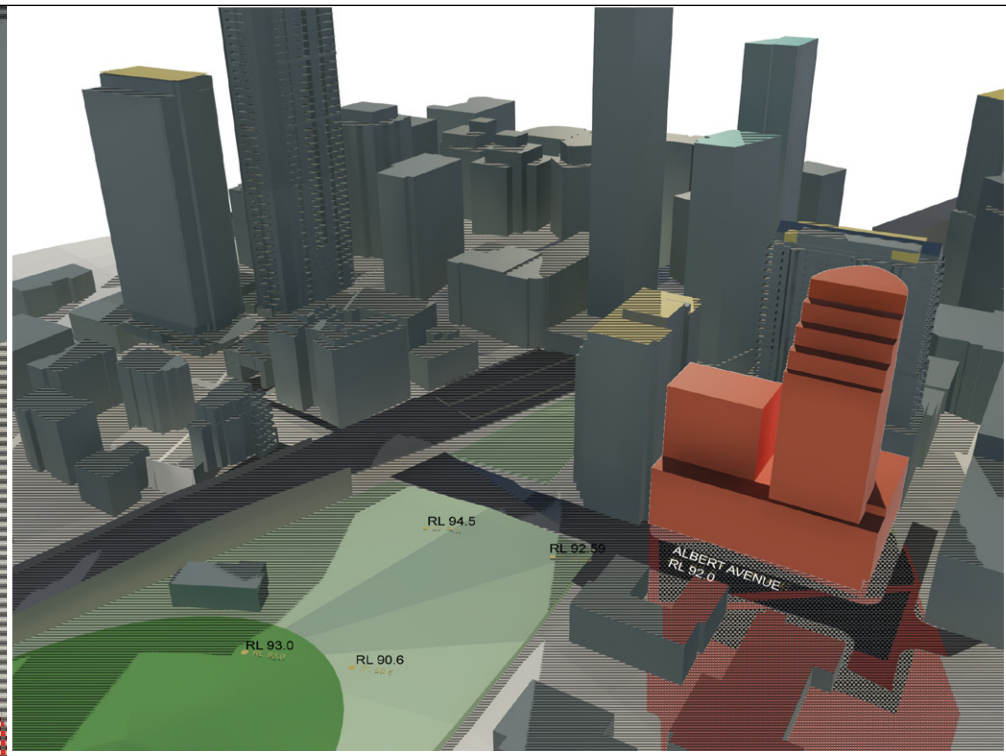


PLAN - 1:1000 (A3)



3D View - Axonometric (no scale)

CERTIFIED SHADOW DIAGRAM
No : SDC109001 - Refer to attached Certificate.

ies The Lighting Society

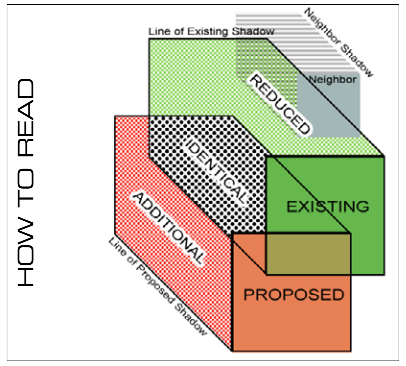
Certifier: C McFadzean B Arch BA (Arch) IES ABSA AAAI
Member of IES (The Illuminating Engineers Society of Australia)

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:

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

1500 JUNE 21

TITLE

SHADOW DIAGRAMS - PLAN

WINTER SOLSTICE
21 JUNE

PROJECT

MANDARIN CENTRE CHATSWOOD
PROPOSED BY BATESSMART REF S11596

DESIGNER

PROPOSED DESIGN
BY BATES SMART ARCHITECTS

Job Ref : S11596
Rev Version : Files as submitted 11.06.14

DATA SOURCE (In order of precedence)

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PAGE No : SD 08
SCALE : 1:1000 (A3)
PLAN ONLY
DATE : 13.06.14
VERSION : 01
REF : 1090

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