



LOT 82-83, 3 PIGEON MOUNTAIN ROAD
RESIDENTIAL DEVELOPMENT

DAYLIGHT ASSESSMENT REPORT



Prepared for

HND HMB Ltd.

By

2KO Engineering Ltd.

Revision History

Revision	Prepared By	Reason of Issue	Date
0	Timothy Tong	For Consent	11/10/23

Document Acceptance

Action	Name	Date
Complied by	Timothy Tong	11/10/23
Reviewed by	Wilson Yu	11/10/23
Approved by	Leo Yang	11/10/23

This document is prepared for the sole use of the Principal and for the intended purposes as stated in the agreement between the Principal and 2KO Engineering Ltd (2KO), under which this work was completed.

1 INTRODUCTION

2KO Engineering Ltd. has been engaged to provide a desktop assessment for part of a proposed development at Lot 82-83, 3 Pigeon Mountain Road, in Auckland. We have assessed the typical residential terrace houses that are identical across Lot 82 and 83 of the development against section G7 of the New Zealand Building Code (NZBC) in terms of the availability of natural light within interior habitable spaces and awareness of the outside, as described in sections G7.3.1 and G7.3.2 of the code.

Using the Daylight Factor calculation method in combination with geo-located weather data from NIWA, we found that the ground floor open plan living space in each dwelling exceeded the minimum requirement of 30 lux at floor level for 75% of the standard year and is therefore compliant with section G7.3.1 of the code.

The large ranch slider located on the ground floor's habitable space provides views of the exterior from the dining/living space and by extension, awareness of the outside in compliance with section G7.3.2 of the code.

The result of our modelling and calculations are shown on the attached drawings EL-01 to EL-03 inclusive and summarised in this report.

2 PREAMBLE

2.1 Introduction

This report details the modelling and calculation methods used to determine compliance with NZBC section G7.3.1 based on compliance document G7/VM1 (2021).

2.2 Background and Scope

The proposed development is located at Lot 82-83, 3 Pigeon Mountain Road, Auckland. The drawings provided to us show the proposed development to be medium-density residential in nature.

As is typical for such developments, the buildings at Lots 82 and 83 are identical in size and shape and oriented such that the street frontage faces generally east (Image 1).



Image 1: Site location and orientation

Our task was to review the proposed design of a typical dwelling for available natural light penetration into the ground floor open plan habitable space, and to determine the degree of compliance with NZBC section G7 “Natural Light”.

The dwellings are arranged in pairs and along a common central wall with the same layout and orientation. Daylight enters the ground floor via the large 1800mm (W) x 2400mm (H) glazed ranch slider located on the east-facing exterior wall of the dining/living area of each dwelling and a 160mm (W) x 2050mm (H) vertical glazed panel adjacent to the main entry door. The large glazed ranch slider located on the ground floor dining/living spaces provides an excellent view of the outdoor area and by extension, awareness of the outside in compliance with G7.3.2 of the code. (Image 2).



Image 2: Ground Floor plan and daylight entry

Due to the design of the ground floor living space comprising daylight illuminance mainly from one ranch slider, we elected to assess the project using the verification method as described within the compliance document G7/VM1.

The scope of our assessment was limited to the ground floor interior habitable space of the typical dwelling configurations in accordance with Clause A2 of the NZBC.

2.3 Purpose of Report

This report details the daylight modelling undertaken for a typical dwelling building configuration and is intended to demonstrate compliance with NZBC Clause G7.3.1. Natural Light, and G7.3.2 Openings.

The Criteria for compliance with NZBC section G7.3.1 reads; “Natural Light shall provide an illuminance of no less than 30lux at floor level for 75% of the standard year”. Clause G7.3.2 reads; “Openings to give awareness of the outside shall be transparent and provided in suitable locations”.

3 METHODOLOGY

3.1 Daylight Modelling

To determine compliance with the NZBC with respect to minimum illuminance in each room we have performed our calculations using the ‘Daylight Factor Method’.

Section 9.2 of AS/NZS1680.1:2006 describes daylight factor as the amount of diffused natural light that is available for use within a predetermined space, expressed as a ratio between it and the illuminance that is simultaneously present outdoors.

Put simply, the minimum required illuminance of 30lux when expressed as a ratio of 11,500lux, being the amount of natural light available for 75% of the standard year in Auckland, is equal to a minimum daylight factor ratio of 0.26%.

To calculate the daylight factor for the habitable spaces it was necessary to first construct a 3D computer simulation of a typical dwelling immediate building surrounds, complete with glazing for daylight penetration as per the drawings provided.

The model was constructed using SketchUp Pro v2021 3D modelling software. Daylight Factor calculations were performed using two methods; point illuminance was calculated using AGi32 v20.9, a specialist lighting design and calculation computer program. Interior spaces pseudo mapping was performed using Radiance software plugin within Trimble SketchUp Pro v2023. Both software packages have been validated in accordance with CIE 171.

To increase the accuracy of our computer calculations, we applied conservative surface finish RLVs (reflective light values) and glass visible light transmission ratios (VLTs) provided by the manufacturers.

Our calculations are based on the following assumed values;

Surface	Description	Visible Light Effect
Internal Walls	Medium Coloured Paint	Reflectance = 40%
Internal Ceilings	Matt White Ceiling Paint	Reflectance = 70%
Floors	Medium carpets, timber finishes	Reflectance = 20%
External Façade Glazing	Typical Thermal Double Glazing	Transmission = 80%

The surfaces within our 3D model were adjusted using these reflectance and transmission values and can be visualized on our drawings.

A series of calculation points were placed at floor level within the ground-floor open-plan living spaces of the typical dwelling within the model to calculate the daylight factor. The calculation points were inserted

in a grid formation in accordance with G7/VM1 C.3.4.1, approximately 1000mm from the walls to replicate the useable portion of the room.

The orientation of the site in relation to the movement of the sun was also considered by aligning the model with compass north as indicated on the drawings. The architectural plans provided indicate that the street frontages of LOTS 82 and 83 faces generally east.

The entire model was then calculated using the CIE type 1 overcast sky model as described in AS/NZS1680.1:2006 which is a mostly uniform diffused sky with no direct sunlight component, but varied sky luminance from the horizon to zenith. The Radiance model was calculated using geo-specific climate based weather data provided by NIWA. The data of the EPW weather file is from the Niwa weather station located at Auckland International Airport.

4 RESULT

4.1 Calculation Results

The individual calculation results shown in table 1 are also included in our drawings.

Label	Location	Calculation Type	Avg	Max	Min	Min Lux	G7 Compliant
DF1_1	Ground Floor Dining/Living	Daylight Factor (%)	4.32	12.36	0.83	95 lx	YES
DF1_2	Ground Floor Kitchen	Daylight Factor (%)	0.41	0.52	0.33	38 lx	YES

Table 1: Point Calculation Results

Table 1 above summarizes the areas of minimum calculated illuminance within the ground level of the typical dwelling. Full calculation results can be found on our drawings EL-01 to EL-03 inclusive.

4.2 Risks, Assumptions and Uncertainties

1. Calculation results are dependent on the accuracy of the reflectance values as provided.
2. Changes, or variations to the materials used may affect the calculation results.
3. Changes to the dimensions of the glazing portion of windows may affect the calculation results.
4. Window treatment obstructions, such as Curtains or Blinds have been excluded from our calculations.
5. Other habitable spaces not referred to in this assessment e.g. bedrooms with large external vertical windows, are deemed to comply with NZBC G7/AS2, parts 2 and 3.

5 CONCLUSION

Our computer simulations indicate that the modelled habitable spaces will receive sufficient natural light based on the drawings and information provided to us and used in our calculations.

The required minimum illuminance of 30lux has been achieved within all calculated habitable spaces and so we have concluded that the development as designed will comply with the requirements and intent of the New Zealand Building Code G7.3.1 “Natural Light”.

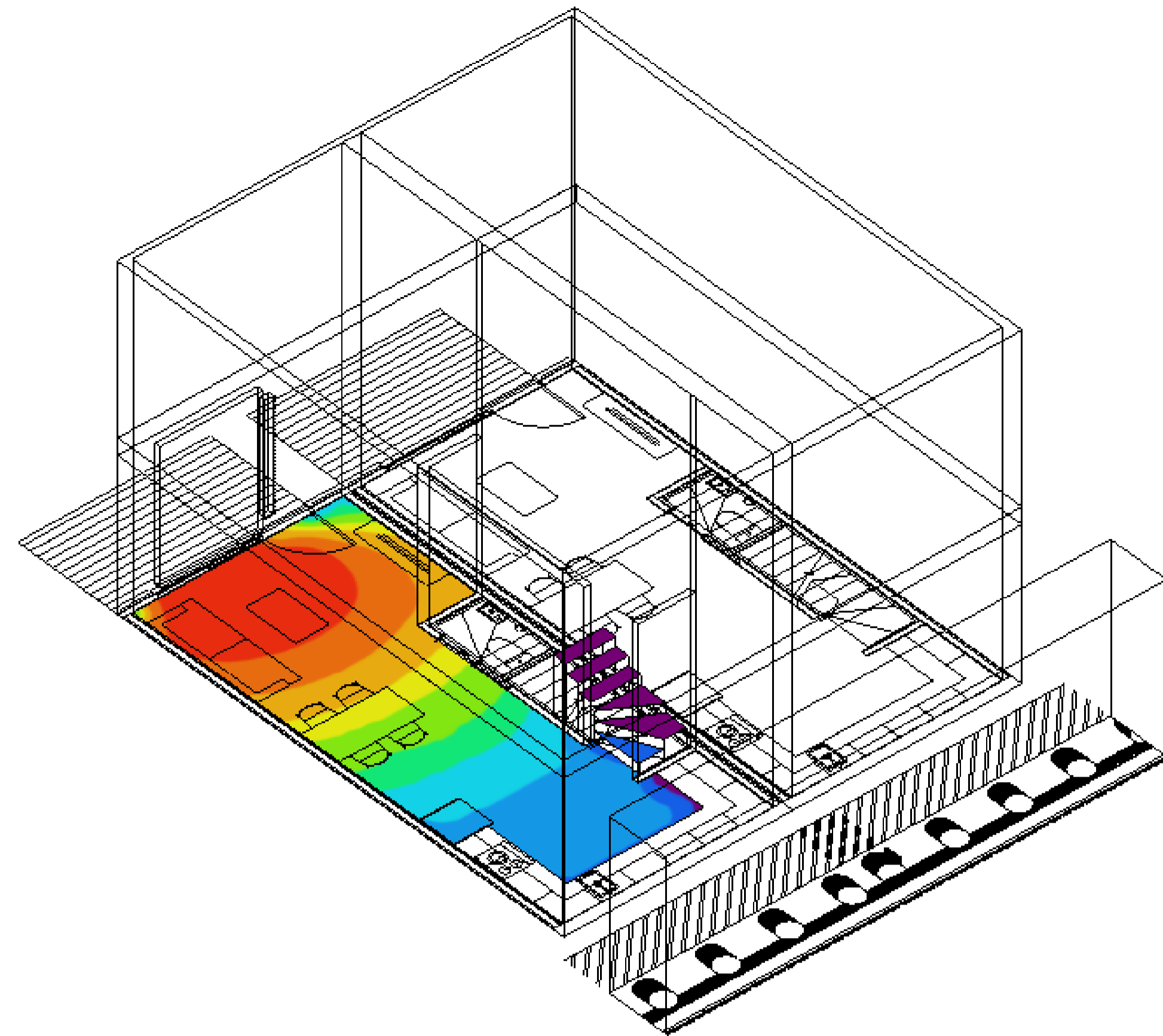
Furthermore, the ranch slider proposed on the exterior wall of the dining/living space will provide exterior views from the ground floor habitable space and will comply with the requirements and intent of the New Zealand Building Code G7.3.2 “Outside Awareness”.

Timothy Tong

On behalf of

2KO Engineering Ltd.

Email: timothy.tong@2koengineering.co.nz



Daylight Model Overview



LOT 82-83, 3 pigeon mountain Road site orientation

- NOTES:
1. DAYLIGHT MODELLING AND CALCULATIONS IN ACCORDANCE WITH NZBC G7/M1, ASNZS1680.1 AND NZS6703.
 2. WINDOW SIZE, LOCATION AND GLAZING SIZE PER ARCHITECTURAL DETAILS PROVIDED. VLT% TAKEN FROM APPENDIX C OF G7/M1.
 3. INTERIOR SURFACE LRV "HIGH REFLECTANCE" VALUES PER TABLE C.2.5.1A OF G7/M1.
 4. ALL OTHER BUILDING INFORMATION MODELLED FROM DRAWINGS PROVIDED BY PROJECT ARCHITECTS.

NZBC G7/M1 Assessment Criteria

NZS6703 Tabl 1
Values of Outdoor Illuminance Exceeded For Various Percentages of a Standard Year

Percentage of standard Year	Outdoor Illuminance, E _o			
	Auckland (Mangere)	Wellington (Kelburn)	Christchurch	Invercargill
%	klx	klx	klx	klx
90	6.4	5.1	5.1	4.1
80	9.9	7.8	9.3	7.1
75	11.5	9.2	11.0	8.6
70	13.1	10.6	12.6	10.1
60	16.3	13.2	15.6	13.0
50	19.3	16.0	18.8	16.0

NZBC G7/M1 - Table 2.1.2.3: Minimum Daylight Factors

Climate Region	Daylight Factor (%)
Auckland	0.26
Wellington	0.32
Christchurch	0.27
Invercargill	0.34

Daylight Model Parameters

Surface Reflectance LRV

Assumed Surface Reflectance		
Ceiling	Walls	Floor
0.7	0.4	0.2

Glass VLT

Assumed Glass VLT%	
Ext Low-E Dbl	Internal
80%	N/A

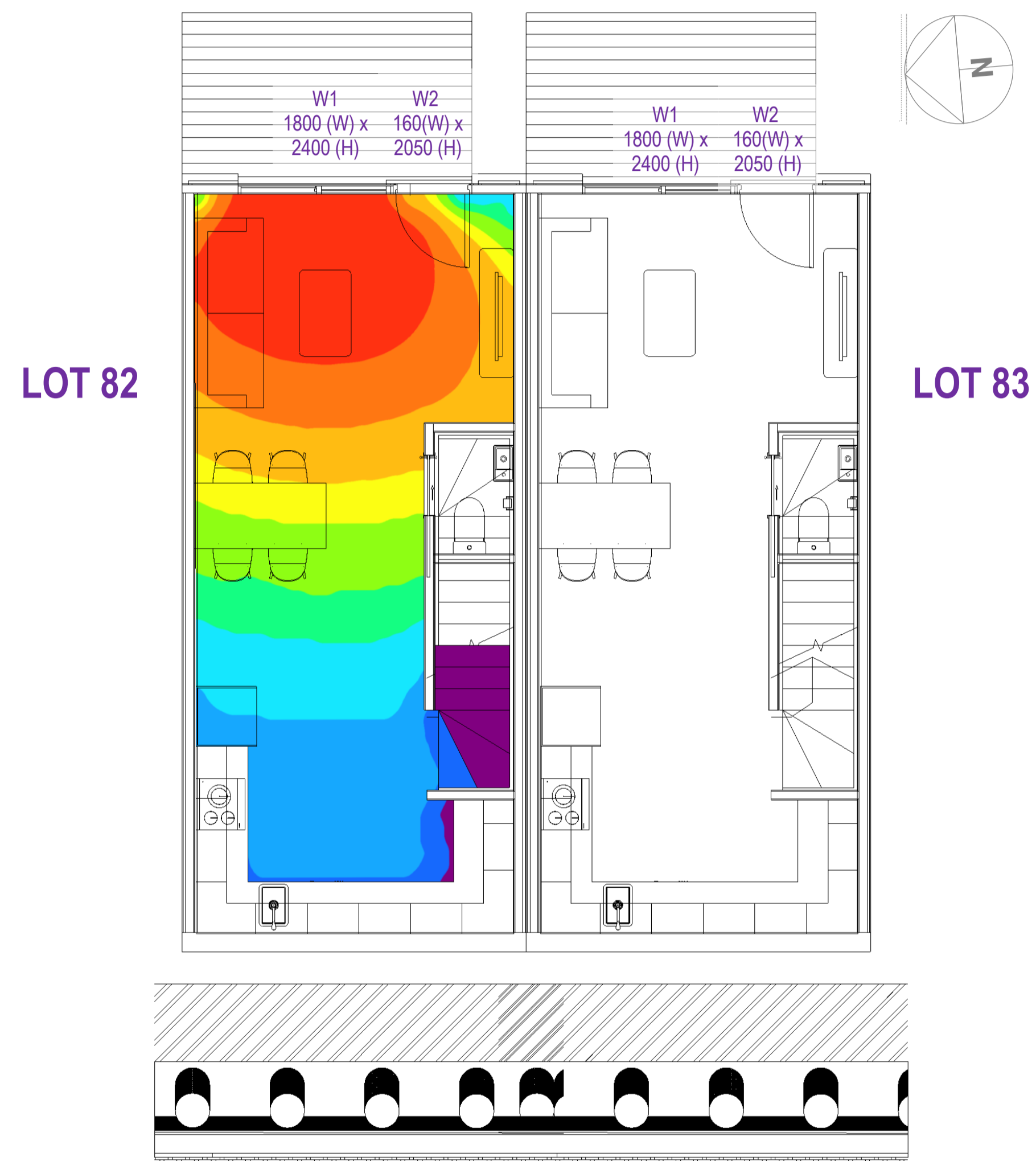
Elevation - Assessment Area - Glazing



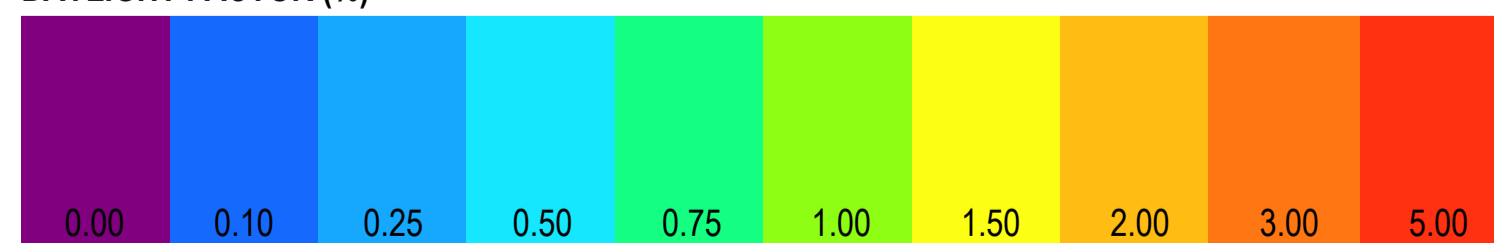
*NOTE: THE WINDOW SIZES ARE BASED ON ARCHITECTURALL DRAWING PROVIDED BY ASC ARCHITECTS PROJECT NO. 22924 DRAWING RA1314 REV B DATED 03/10/2023



JOB TITLE:	LOTS 82-83, 3 PIGEON MOUNTAIN ROAD, BUCKSLAND BEACH	JOB NO.:	23-605
SKETCH TITLE:	DAYLIGHT ANALYSIS PARAMETERS, CALCULATION TABLES	SKETCH NO.:	EL-01
DRAWN:	T.T.	REVISION:	0
CHECKED:	W.Y.		
REASON FOR ISSUE:	FOR CONSENT		



DAYLIGHT FACTOR (%)



1:50 @ A1

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JOB TITLE:	LOTS 82-83, 3 PIGEON MOUNTAIN ROAD, BUCKSLAND BEACH	JOB NO.:	23-605
SKETCH TITLE:	DAYLIGHT ANALYSIS, PSEUDO MAP	SKETCH NO.:	EL-02
DRAWN:	T.T.	REVISION:	0
CHECKED:	W.Y.		
REASON FOR ISSUE:	FOR CONSENT		

Mobile: 021-840-139 Email: wilson.yu@2koengineering.co.nz



Daylight Factor Calculation Points Summary							
Project: LOT 82-83 3 Pigeon Mountain Road, Bucklands Beach - Ground Floor							
Label	CalcType	Avg	Max	Min	Min	Min lux	G7 Compliance
DF1_1 GF Dining_Living	Daylight Factor (%)	4.32	12.36	0.83	0.83	95 lx	YES
DF1_2 GF Kitchen	Daylight Factor (%)	0.41	0.52	0.33	0.33	38 lx	YES

1:50 @ A1

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JOB TITLE:	LOTS 82-83, 3 PIGEON MOUNTAIN ROAD, BUCKSLAND BEACH	JOB NO.:	23-605
SKETCH TITLE:	DAYLIGHT ANALYSIS, POINT CALCULATIONS	SKETCH NO.:	EL-03
DRAWN:	T.T.	REVISION:	0
CHECKED:	W.Y.		
REASON FOR ISSUE:	FOR CONSENT		

Mobile: 021-840-139 Email: wilson.yu@2koengineering.co.nz