PART 3
SPECIALIST REPORTS

- Updated Stormwater Management Plan (including Healthy Waters Code Assessment).
- Updated Geotechnical Report.

OTHER CHANGE – OTH/2025/12

776 PACIFIC PARADE, CURRUMBIN

JOB – 2130201

MICHEL
GROUP SERVICES

COZENS REGAN GROUP PTY LTD
CONSULTING ENGINEERS • CIVIL • STRUCTURAL

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ABN 41 855 634 529 / ACN 009 914 274
as trustee for the Cozens & Regan Trust

Our Ref: 220627
Council Ref: OTH/2025/12

11th June 2025

City of Gold Coast
PO Box 5042
Gold Coast Mail Centre QLD 9726

RE: RESPONSE TO INFORMATION REQUEST
776 PACIFIC PARADE, CURRUMBIN, QLD 4223

Cozens Regan Group Pty Ltd has provided the following responses to the relevant queries raised in City of Gold Coast's Information Request (issued to John Fuglsang Developments Pty Ltd, dated 10/04/2025) related to the Material Change of Use application at 776 Pacific Parade, Currumbin.

C. Hydraulic Matters

i. Stormwater Quality

- Stormwater treatment has been included in the updated proposal.
- The proposed treatment provisions meet Council's pollutant load reduction targets. See updated Stormwater Management Plan Report.
- See updated drawings 220627/SK02 & SK04 showing further details and sections of the proposed stormwater treatment / detention provisions.
- The stormwater treatment system is sized to cater for the runoff from the proposed roof area of the development (0.054Ha).
- The MUSIC model file has been submitted to Council for review.

ii. Stormwater Quantity Control

- The above-ground O.S.D. tank is no longer proposed. Please see updated drawings 220627/SK02 & SK04 which show the updated proposal for stormwater detention.
- The Stormwater Quantity Calculations show that the increase in peak runoff flow rates is very small (maximum of 4 l/s for 2% AEP event), and so a minimum detention allowance of 2m³ has been proposed and will be sufficient to cater for the negligible flow rate increase. Therefore, no modelling software has been used.
- Please refer to the updated Stormwater Management Plan Report.

iii. Stormwater Management Plan Details

- Please refer to the updated External Catchment Plan (220267/SK03).
- The overland flow path through the rear of the property is existing. In our opinion, the development will not increase the flow through this existing overland flow path. Therefore, it is considered appropriate to maintain the existing conditions to the rear of the building to cater for External Catchment A.
- The drainage channel to the south of the property is existing. In our opinion, the development will not increase the flow through this channel. Therefore, it is considered appropriate to maintain the existing channel to cater for External Catchment A.
- A shallow V-channel and rock scour protection has been proposed to convey the minor flow from External Catchment B. See updated drawing 220627/SK02.

Yours faithfully,

T.W. NELSON
RPEQ 15735
For and on behalf of
COZENS REGAN GROUP PTY LTD

SITE BASED STORMWATER MANAGEMENT PLAN

Proposed Residential/Commercial Development
776 Pacific Parade, Currumbin
Lot 1 on SP348547

Prepared for:

JOHN FUGLSANG DEVELOPMENTS PTY LTD

Prepared By:

Mr Tristan Nelson
Director
Cozens Regan Group Pty Ltd
RPEQ: 15735

Date:
July 2023

DOCUMENT CONTROL RECORD

Report Details

Client: John Fuglsang Developments Pty Ltd
Document Name: Site Based Stormwater Management Plan
Site Address: 776 Pacific Parade, Currumbin
Lot 1 on SP348547
Job Number: 220627
File Name: 220627_SWMP_REPORT_F

Issue	Rev	Approved	Date	Distributed to:	Qty.
Preliminary	A		05/07/23	MICHEL GROUP SERVICES	1
Final	B		07/07/23	MICHEL GROUP SERVICES	1
Final	C		12/07/23	MICHEL GROUP SERVICES	1
Final	D		03/02/25	MICHEL GROUP SERVICES	1
Final	E		25/02/25	MICHEL GROUP SERVICES	1
Final	F		11/06/25	MICHEL GROUP SERVICES	1

Table of Contents

EXECUTIVE SUMMARY

This report examines and evaluates options for Stormwater Management during the construction and operational phase for the proposed Residential/Commercial Development at 776 Pacific Parade, Currumbin.

The strategies proposed in this report will provide short- and long-term community benefits with an Environmentally Sensitive Design emphasis.

The Water Sensitive Urban Design objectives are met by:

Erosion and Sediment Control

Provision of sediment fencing and drainage structure protection.

Stormwater Quality

A treatment train consisting of 2 x Atlan Filter Cartridges is proposed in order to meet Gold Coast City Council's pollutant reduction targets.

Stormwater Quantity

The lawful point of discharge has been determined as the existing stormwater manhole in Pacific Parade.

The development will result in a minor increase in peak stormwater discharge due to an increase in impervious area and therefore On-Site Detention is proposed in the form of a 2kl above-ground detention tank.

1.0 INTRODUCTION

1.1 GENERAL INTRODUCTION

Cozens Regan Group Pty Ltd has been commissioned by John Fuglsang Developments Pty Ltd to prepare a Site Based Stormwater Management Plan for the Proposed Residential/Commercial Development at 776 Pacific Parade, Currumbin.

This Site Based Stormwater Management Plan is required to support a proposed Material Change of Use application to Gold Coast City Council.

The proposed area of works is shown on the architectural site plan contained in Appendix A.

1.2 SCOPE OF PLAN

In accordance with Councils' City Plan Version 6 – Healthy Waters Compliance Code and the Land Development Guidelines - Water Sensitive Urban Design, the matters which have been addressed within the scope of this report and the area to which they apply are described below.

- Erosion and Sediment Control
- Stormwater Quality
- Stormwater Quantity

Councils City Plan – Healthy Waters Code Assessment (Feb 2024) has been completed and is contained within Appendix F.

1.3 SITE LOCATION

The subject site comprises of one lot described as Lot 1 on SP348547 at 776 Pacific Parade, Currumbin. The site is bound by Pacific Parade to the East, existing residential properties to the North, South and West.

The subject site and approximate area of works is shown in Figure 1 below.

Figure 1 – Aerial Photograph (QLD Globe)

1.4 SITE DESCRIPTION

The site is currently a vacant lot covered with grass and vegetation.

The total site area is equal to 722m^2.

A detail survey has been provided which indicates the site falls towards Pacific Parade.

Levels on the site range from approximately RL 20.50 along the Western Boundary (from QLD Globe contours) to RL 4.60 along the Eastern Boundary (from survey).

Site drainage currently discharges via mixture of piped drainage and overland flow to the existing drainage system in Pacific Parade.

1.5 DESCRIPTION OF DEVELOPMENT

The proposed development incorporates the construction of a residential/commercial development. The development will require the construction of a building, access driveways, parking areas, stormwater, sewer, water supply and landscaping.

Refer Architectural Plans contained within Appendix A for more information regarding the proposed development.

2.0 SEDIMENT AND EROSION CONTROL

2.1 OBJECTIVES

The objectives of this erosion and sediment control plan are:

a) To ensure that the water quality of the receiving waters is not worsened by the site development.
b) Minimise sediment transport in surface water runoff during the construction and operational stages.
c) Provide a monitoring and maintenance programme for implementation during the construction phase.

2.2 POTENTIAL SEDIMENT GENERATION

The development will result in one catchment from which sediment can be generated. The area to be disturbed is approximately 0.072 ha which is the entire site. While the potential exists for sediment to be generated during the construction phase, the potential sediment volume is dependent upon rainfall, site topography, the material type exposed, flow characteristics, and the construction practices and programme.

Control of the construction impacts is the primary objective for sediment and erosion control practices.

The management of erosion and sediment control for the development has been undertaken in accordance with Gold Coast City Council Planning Scheme – Land Development Guidelines and the referenced Best Management Practices for Sediment and Erosion Control.

Based on the expected potential for sediment generated, the provision of sediment fencing has been proposed along with a series of stormwater pit protection measures. These provisions are considered adequate to control the mobilisation of sediment.

The installation of pollution control devices in the operational phase will further decrease the potential sediment loading; however, the effect of these is ignored.

2.3 CONSTRUCTION PHASE CONTROL MEASURES

The works proposed to control erosion are:

a) Erect sediment and dust fences at the lower perimeter of the site. Sediment fences to be included on site safety fence, including hessian or approved dust control cloth.
b) Remove from the site any material which is not required for rehabilitation of disturbed areas.
c) Preparation of building pad and removal of surplus material off site.
d) Exposed soils and stockpiles are to be watered, as required, to minimise soil losses as a result of wind.
e) Place geo-textile field gully inlet filters and drainage structure protection around entry points to the drainage system until the pavement is complete or until grass is established.
f) Finalised earthworks to be top soiled and seeded/hydro-mulched or landscaped as directed.
g) Construct buildings.
h) Geo-textile filters to be replaced with mesh filters until landscaping is complete and stabilised.
i) Maintain all sediment devices and other interim controls regularly. Including the removal of accumulated sediment.

j) Remove sediment fences and inlet filters including accumulated sediment after the establishment of the landscaping and grass cover.

2.4 MAINTENANCE

The installation of erosion and sediment control devices requires maintenance of these devices to ensure their effectiveness in the control of potential environmental impact. Summary of the maintenance requirements for this project are detailed below.

The Contractor is responsible for the installation and maintenance of the sediment and erosion control measures during the construction phase and the defects liability period (normally six months).

Maintenance responsibilities for the establishment of vegetation, that is the requirement to irrigate the plants and grass used to generate ground cover lies with the Contractor initially but ultimately reverts to the owner once the defects liability period has expired.

Maintenance will require:

a) Inspection of silt fences and drainage paths during construction and after any rainfall event.
b) Clean out sediment build-up following each event that causes deposits.
c) Clean up soil and sediment deposits promptly as they occur.
d) Provide inlet protection where soil disturbance is to occur.

2.5 RESPONSES TO COMPLAINTS

Complaints during this type of construction usually relate to noise and dust. Generally, the complaint is made known to the Contractor, the Principal, the Superintendent and/or the Council.

The Contractor shall keep a record of all complaints identifying the nature of the complaint and any remedial action taken to address such complaint. The Contractor shall act as soon as possible to remedy the problem, if the complaint is considered valid and reasonable. A complaints record shall be made available by the contractor for regular inspection by the Superintendent. For the purpose of direction by others, the Contractor's details are to be supplied to Council prior to commencement of the works.

Complaints relating to dust shall require the Contractor to immediately water the exposed earth surfaces and any soil stockpile areas as well as haul roads to control dust. Such watering shall occur immediately after the complaint is registered with the Contractor. Watering should continue periodically until conditions suit, or the works are completed to a state that prevents dust transport.

2.6 MONITORING

The installation of the erosion and sediment control measures as detailed in this report and attached figures will ameliorate potential impact to water quality in the receiving waters. A monitoring program is proposed to ensure that the control measures achieve the desired goals. It is considered appropriate that only a visual monitoring program be required. Following rainfall events and prior to discharge water quality monitoring will be conducted on the any stored water to check suspended solids.

3.0 STORMWATER QUALITY ASSESSSMENT

3.1 WATER QUALITY TREATMENT TARGETS

The Gold Coast City Council City Plan – Land Development Guidelines - Water Sensitive Urban Design sets the requirements for stormwater quality management for the site which also reference the Queensland State Planning policy. The Objective for stormwater treatment consist of pollution reduction targets as follows.

Table 3.1: Pollutant Reduction Targets

Pollutant	Reduction Target
Total Suspended Solids (TSS)	80%
Total Phosporus (TP)	60%
Total Nitrogen (TN)	45%
Gross Pollutants	90%

3.2 MUSIC MODELLING

As discussed in Section 3.1 to meet the pollutant reduction targets a treatment train consisting of 2 x Atlan Filter Cartridges is proposed.

To confirm the proposed size/number of treatment devices to meet the targets, water quality modelling with the software package MUSIC has been undertaken. The Music model has been calibrated in accordance with the Gold Coast City Council MUSIC modelling guidelines. The catchment breakdown for the site has been determined as follows.

Table 3.2.1: Music Catchment Table

Catchment	Area	Impervious Fraction
Roof	0.0540	100%

Table 3.2.2: Treatment Device Details

Treatment Devices	Number/Size	Catchment(s) Treated
Atlan Filter Cartridges	2 x Full Height (FIL-3.0)	Roof

Figure 3.2.3: Music Model

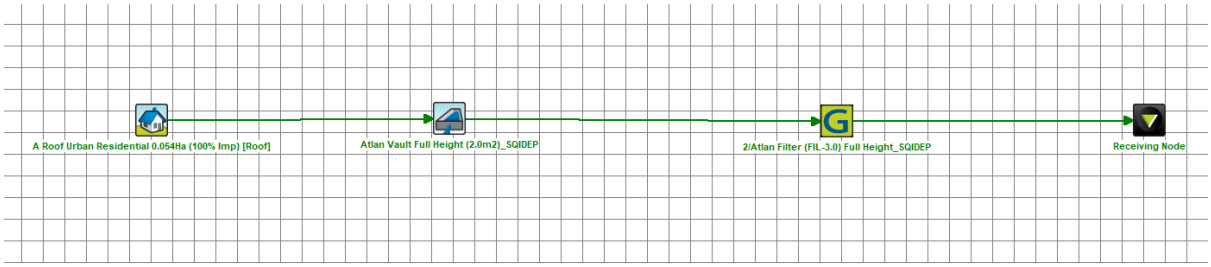


Figure 3.2.4: Music Model Results

	Sources	Residual Load	% Reduction
Flow (ML/yr)	0.541	0.541	0
Total Suspended Solids (kg/yr)	15.9	2.87	82
Total Phosphorus (kg/yr)	0.0908	0.0261	71.3
Total Nitrogen (kg/yr)	1.13	0.486	57.2
Gross Pollutants (kg/yr)	12.9	0	100

As demonstrated within the MUSIC model and results above the proposed treatment devices achieve the required pollutant reduction in accordance with the Council requirements.

Refer to Drawings 220627/SK02 & SK04 for the location and layout of the treatment system.

3.3 MONITORING

The objective is to provide a stormwater drainage system that reduces the impact the development may pose to the local environment.

Maintenance responsibilities for the operating life of the project revert to the owner/business operators once the defects liability period has expired.

Maintenance will require as a minimum:

- Regular inspections after rainfall events.
- Cleaning/replacement of the treatment devices in accordance with the manufacturer's recommendations and the Water by Design Technical Guidelines.
- Removal of accumulated gross pollutants.

Failure to maintain the proposed stormwater treatment devices and infrastructure will lead to poor aesthetics and site amenity, increased potential for erosion, scouring, increased discharges of stormwater pollutants, and higher potential for adverse stormwater impacts to be imposed on adjacent and downstream properties and waterways.

4.0 STORMWATER QUANTITY

4.1 LAWFUL POINT OF DISCHARGE

In accordance with Section 3 of the Queensland Urban Drainage Manual all development must address the 3 Point Lawful Point of Discharge Test.

The criteria for determining the lawful point of discharge are:
(i) Will the proposed development alter the site's stormwater discharge characteristics in a manner that may substantially damage a third party property?

In the pre-developed state, the site currently discharges to Pacific Parade via a combination of piped and overland flow drainage to the existing drainage system in Pacific Parade. No inter-allotment drainage is known to exist at the rear of the property.

It is the objectives of this stormwater assessment to ensure that the proposed development will not alter the site's stormwater discharge characteristics in a manner that may substantially damage a third-party property and therefore the answer to this test is no and thus no further steps are required to obtain tenure for a lawful point discharge.

Regardless of the requirement to provide a Lawful Point of Discharge as per the QUDM LPD Test it is noted that the existing stormwater manhole in Pacific Parade is considered an appropriate Lawful Point of Discharge for this development.

4.2 OBJECTIVES

In accordance with the requirements of Gold Coast City Council – City Plan Version 9 the development is to ensure the following design objectives are met for stormwater quantity over the site.

All runoff from developed catchments is managed to ensure that property and infrastructure upstream or downstream is protected from impacts of flooding and meets with the following:

1) development does not adversely impact on land, drainage system or watercourse.
2) the flood behaviour of the whole catchment must not change as a result of the development; and
3) at the boundary of the development site or at nominated locations downstream of the development the following is achieved:
    (a) no increase in peak flood flow rate for all events up to and including the 1% AEP (i.e. 100-year ARI) event.
    (b) no increased in peak flood velocities.
    (c) no increase in flood level for all events up to and including the 1% AEP (i.e. 100-year ARI) event.
    (d) no material changes in rate of flood rise; and
    (e) stormwater outfall or discharge is located to avoid conflict with existing usage of downstream land or impact on existing waterway or drainage.

4.3 DETERMINATION OF AN INCREASE IN PEAK STORMWATER DISCHARGE

In accordance with QUDM Section 4 the rational method was adopted to calculate the peak stormwater discharges for the site to compare both the pre-developed and developed scenario.

Parameters adopted for use in the rational method calculation are in accordance with the Queensland Urban Drainage Manual and are highlighted below.

Table 4.3.1: Calculation of Initial Runoff Input Parameters

	PRE-DEV'T	POST-DEV'T		
Catchment area (ha)	**0.072**	**0.072**		
Impervious area (ha)	**0.035**	**0.053**	**Ha**	
Fraction impervious	48.5	73	%	
Intensity - 1 hr, 10 yr (mm/hr)	**70.0**		**IFD:**	**Currumbin**
t_c existing (min.)	5.00			
t_c post-developed (min.)	5.00			

Table 4.3.2: Estimation of Peak Flows

ARI	**Existing**				**Post development**			
	C	I (mm/hr)	Q (m^3/min)	**Q (m^3/s)**	C	I (mm/hr)	Q (m^3/min)	**Q (m^3/s)**
1EY	0.64	119	0.92	0.015	0.68	119	0.97	0.016
0.5EY	0.68	135	1.10	0.018	0.72	135	1.17	0.019
20%	0.76	184	1.68	0.028	0.81	184	1.79	0.030
10%	**0.80**	**218**	**2.10**	**0.035**	**0.85**	**218**	2.23	**0.037**
5%	**0.84**	**251**	**2.53**	**0.042**	**0.89**	**251**	2.68	**0.045**
2%	0.92	296	3.27	0.055	0.98	296	3.49	0.058
1%	**0.96**	**331**	**3.82**	**0.064**	**1.00**	**331**	3.98	**0.066**

Table 4.3.3: Increase in Runoff

ARI	Increase (L/s)	Increase %
1EY	1	6.3%
0.5EY	1	5.9%
20%	2	6.6%
10%	**2**	**6.3%**
5%	**3**	**6.0%**
2%	4	6.5%
1%	**3**	**4.2%**

This peak stormwater discharge comparison was assessed for all AEP up to the 1% AEP. The highest yielding increase was 4l/s for the 2% AEP event.

Refer to Appendix C for more detailed peak stormwater discharge calculations.

The results from these calculations show in the unmitigated state that the proposed development will result in a minor increase in peak stormwater flows and therefore On-Site Detention is proposed. Refer Section 4.4 for more information.

4.4 ON SITE DETENTION

To meet the Gold Coast City Council and QUDM requirements of a 'no-worsening' affect to downstream stormwater infrastructure, the peak stormwater flows for the developed scenario are required to be reduced to that equal to or less than pre-developed conditions. This reduction in peak stormwater discharge is proposed to be met by providing an on-site stormwater detention system.

As the time of concentration is short and the volume of detention being less than 10m3, the initial sizing of on-site detention requirements has been undertaken by a comparison of the four detention sizing equations (Culp, Boyd, Carrol and Basha) and adopting the highest yield.

The required detention storage volume is determined as **1.1m3** for the major event. This volume would be seen as less than the minimum required for On Site Detention to be practical and thus a conservative allowance of **$2m^3$ (2kl)** is proposed to be provided within an above ground detention tank.

An orifice plate or weir arrangement will be required to be installed within the outlet structure of the proposed detention tank in order to restrict the rate of stormwater discharge to maintain pre-developed flows.

The abovementioned stormwater detention requirements if installed correctly will sufficiently attenuate stormwater flows to that equal of predevelopment levels and will mitigate any potential adverse effects on downstream/neighbouring infrastructure or property in accordance with the objectives of this section.

Refer to Appendix C for peak stormwater discharge and on-site detention basin sizing calculations. Refer also to Sketch Drawing 220627/SK02 for location and layout of Civil stormwater system, including the stormwater detention.

5.0 QUALIFICATIONS

This site-based stormwater management plan for 776 Pacific Parade, Currumbin has been prepared specifically for this development as requested by John Fuglsang Developments Pty Ltd. Our analysis and approach are limited to the scope stated at the beginning of the report. As such third parties are not authorised to utilise this report without the written approval and advice form Cozens Regan Group Pty Ltd.

Cozens Regan Group Pty Ltd relied on the following supplied information in preparation of this report:

- Detail Survey provided by Michel Group Services.
- Building and site layout supplied by MI Studios.
- Rainfall data for Southport supplied by the Bureau of Meteorology.

The accuracy of this report is dependent on the accuracy of the information supplied.

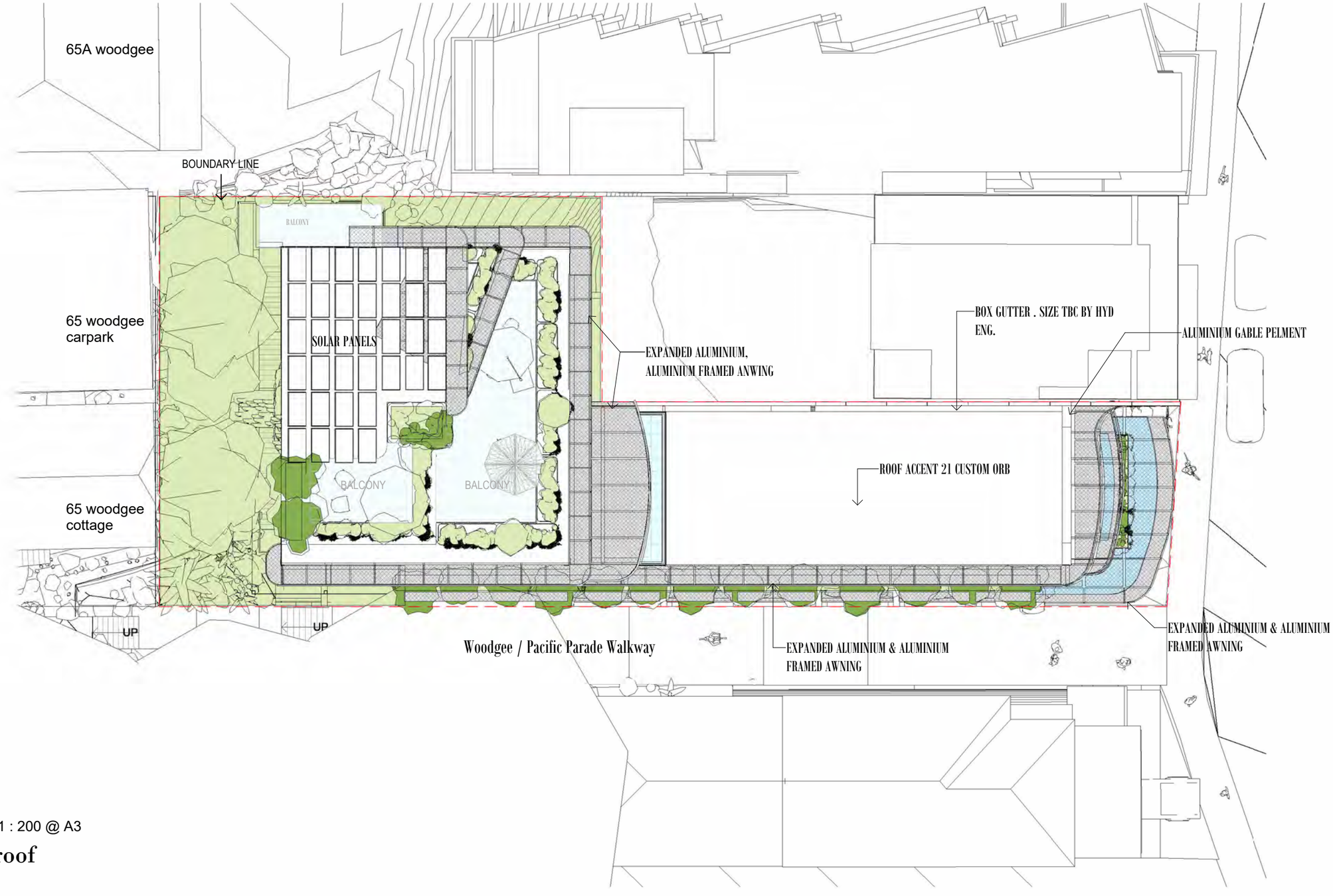
While Cozens Regan Group Pty Ltd has taken every precaution to ensure the accuracy of the assessment it should be noted that the catchment is ungauged and as such future observed flows may vary from that predicted.

REFERENCES

- Gold Coast City Council City Plan – Land Development Guidelines - Water Sensitive Urban Design (WSUD)
- Gold Coast City Council – Music Modelling Guidelines 2006
- Queensland Urban Drainage Manual 2016(Natural Resources and Water)
- Urban Stormwater – Queensland best practice environmental guidelines January 2009 (Environmental Protection Agency)
- Queensland Water Quality Guidelines Version 3 September 2009 (Department of Environment and Resource Management)
- Urban Stormwater Quality Planning Guidelines (Department of Environment and Resource Management 2010);
- Gold Coast City Council Plan – 9.4.5. Healthy Waters Code Feb 2024 – Code Template

Appendix A

ARCHITECTURAL SITE PLAN

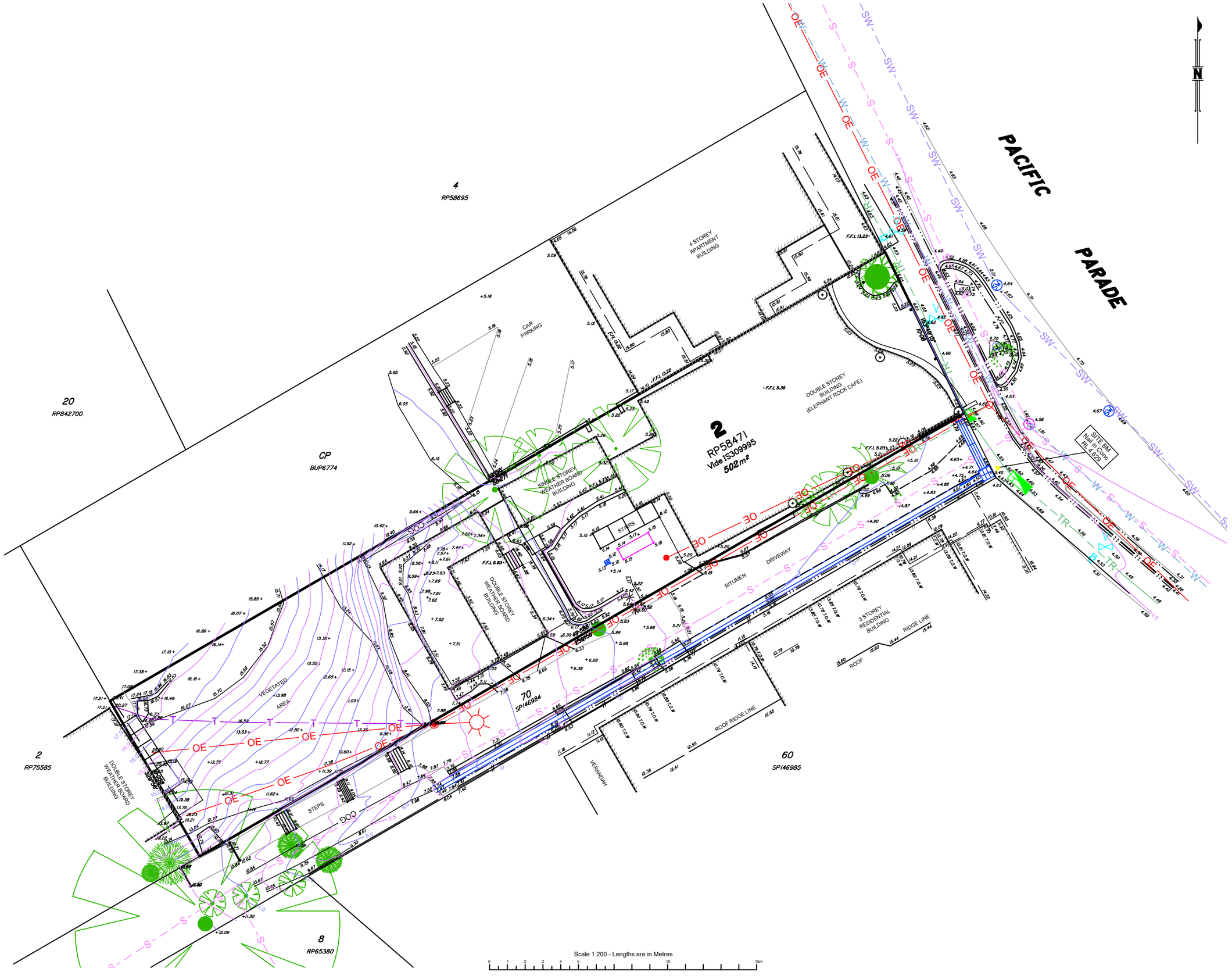

65A woodgee
BOUNDARY LINE
BALCONY
65 woodgee
carpark
SOLAR PANELS
EXPANDED ALUMINIUM,
ALUMINIUM FRAMED ANWING
BOX GUTTER . SIZE TBC BY HYD
ENG.
ALUMINIUM GABLE PELMENT
ROOF ACCENT 21 CUSTOM ORB
BALCONY
BALCONY
65 woodgee
cottage
UP
UP
Woodgee / Pacific Parade Walkway
EXPANDED ALUMINIUM & ALUMINIUM
FRAMED AWNING
EXPANDED ALUMINIUM & ALUMINIUM
FRAMED AWNING

1 : 200 @ A3

roof

Appendix B

DETAIL SURVEY



Scale 1:200 - Lengths are in Metres

0 1 2 3 4 5 10 15m

ISSUE	SUBJECT	BY	DATE

AMENDMENTS

NOTES & DISCLAIMERS

1. This plan was prepared for JOHN FUGLSANG from a combination of field survey and existing records for the purpose of DESIGN and must not be used for any other purpose, particularly demolition, excavation or construction.
2. The title boundaries shown on this plan were surveyed as part of this survey and have been compiled from IS309995.
3. Services shown on this plan have been located where possible by field survey. If underground and not able to be so located, services have been plotted from the records (where available) of the relevant Authority and have been noted accordingly on this plan. They may therefore be incomplete and/or erroneous.
4. Refer to CAD file for additional information not shown on this plan for clarity purposes. Due to extensive detail, not all detail could be shown on the face of the plan.
5. Only significant trees/vegetation have been located and shown on this plan.
6. Contour interval is 0.5m.
7. This note is integral part of this plan.

LINETYPE LEGEND:

Overhead Electrical	OE
Stormwater Via. Records	
Sewer Via. Records	
Water Via. Records	
Telstra Via. Records	
Overhead Telstra	T
Fence	
Kerb Line	
Edge of Bitumen	
Linemarking	
Top of Window	13.85 T.O.W

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PROJECT
776 PACIFIC PARADE CURRUMBIN

CLIENT
JOHN FUGLSANG

DRAWING TITLE
LEVEL AND FEATURE SURVEY PLAN OF LOT 2 ON RP 58471 776 PACIFIC PARADE CURRUMBIN

PARISH:		COUNTY:
SCALE	DATE	DRAWN
1:200 @ A3	28/02/2022	NDB
LEVEL DATUM	LEVEL ORIGIN	ORIGIN RL
AHD	PM17393	4.135
AZIMUTH	CO-ORD SYSTEM	CO-ORD ORIGIN
MGA Vide IS309995	LOCAL	
EASTING	NORTHING	SURVEYOR
		DA
AUTOCAD FILE	SURVEY FILE	JOB No.
21302-1	21302	21302
CHECKED	QT	DATE IMAGED
DA	GL	6/3/2022

SHEET NUMBER 1 OF 1

PLAN No. ISSUE
21302-1

Appendix C

CONCEPT ENGINEERING PLANS

PROPOSED BUILDING ROOF OUTLINE

SEDIMENT FENCE

SHAKEDOWN AREA

PACIFIC PARADE

20 RP842700

4 RP58695

2 RP75585

CP BUP6774

CAR PARKING

4 STOREY APARTMENT BUILDING

SINGLE STOREY WEATHER BOARD BUILDING

DOUBLE STOREY WEATHER BOARD BUILDING

VEGETATED AREA

STAIRS

DOUBLE STOREY BUILDING (ELEPHANT ROCK CAFE)

2 RP58471 Wide IS309995

70 SP146984

STEPS

BITUMEN DRIVEWAY

VERANDAH

3 STOREY RESIDENTIAL BUILDING

8 RP65380

60 SP146985

LEGEND

DENOTES TEMPORARY SILTATION CONTROL

DSP DENOTES DRAINAGE STRUCTURE PROTECTION.

TEMPORARY CONSTRUCTION ACCESS SHAKEDOWN

IMPORTANT NOTE:

BEFORE YOU DIG www.byda.com.au

ALL UNDERGROUND SERVICES SHOULD BE LOCATED ONSITE BY RELEVANT AUTHORITIES BEFORE ANY WORK IS COMMENCED.

UNDER QUEENSLAND LEGISLATION, THE GENERAL BIOSECURITY OBLIGATION REQUIRES ALL REASONABLE STEPS TO BE TAKEN TO PREVENT THE SPREAD OF FIRE ANTS.

ALL SUSPECTED SIGHTINGS OF FIRE ANTS MUST BE REPORTED WITHIN 24 HOURS OF THEIR DISCOVERY (PH: 13 25 23). THE MOVEMENT OF FIRE ANTS IS PROHIBITED. FAILING TO COMPLY MAY INCUR PENALTIES.

THE CONTRACTOR SHALL ACQUIRE THE NECESSARY PERMITS AND EDUCATION TO MOVE ORGANIC MATERIALS THAT MAY CONTAIN FIRE ANTS.

No.	DATE	ISSUE	REVISED	CHECKED
P3	17.02.25	PRELIMINARY ISSUE - NEW SITE LAYOUT	ZCL	TWN
P2	30.01.25	PRELIMINARY ISSUE - NEW SITE LAYOUT	ZCL	TWN
P1	07/23	ORIGINAL ISSUE	BAR	TWN

IN ASSOCIATION WITH

PRELIMINARY NOT FOR CONSTRUCTION

SCALE A 0 1 2 3 4 5 1 : 100

SCALE B

DATUM AHD (U.N.O.)

SCALES SHOWN ARE AT A1 SIZE

COZENS REGAN GROUP
CONSULTING ENGINEERS • CIVIL • STRUCTURAL
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P: (07) 5578 4100
F: (07) 5578 4092
E: mail@cozreg.com.au
W: www.cozreg.com.au
CONSULT AUSTRALIA Member Firm

DESIGNED BAR
DRAWN BAR
CHECKED TWN

APPROVED FOR AND ON BEHALF OF COZENS REGAN GROUP PTY LTD
(RPEQ No 15735)

CLIENT JOHN FUGLSANG DEVELOPMENTS PTY LTD

PROJECT PROPOSED STORMWATER MANAGEMENT PLAN
776 PACIFIC PARADE, CURRUMBIN
CONCEPT EROSION AND SEDIMENT CONTROL PLAN

JOB NO. 220627

DRAWING NO. SK01

ISSUE P1 P2 P3

PROVIDE SHALLOW V-DRAIN

PROPOSED ROCK SCOUR PROTECTION

EXISTING OVERLAND FLOW PATH TO BE MAINTAINED TO CATER FOR EXTERNAL CATCHMENT

EXISTING GULLY PIT CATERING FOR EXTERNAL CATCHMENT

EXISTING COUNCIL 675ø PIPE

EXISTING LANDSCAPED MEDIAN TO BE REMOVED AND ROAD REINSTATED

PACIFIC PARADE

EX. 1200 SW MH

BREAK INTO AND CONNECT NEW PIPE TO EXISTING MH

300ø RCP CLASS 3
USIL 3.00
DSIL 2.89

150ø uPVC SN8 STUB FOR ROOFWATER CONNECTION
IL 3.60

PROPOSED TREATMENT AND DETENTION TANK. REFER DETAIL SK04

EXISTING DRAINAGE CHANNEL CATERING FOR EXTERNAL CATCHMENT

ROOF OUTLINE OF PROPOSED BUILDING

CP BUP6774

2 RP75585

70 SP146984

2 RP58471

69956

239956

CAR PARKING

4 STOREY APARTMENT BUILDING

SINGLE STOREY WEATHER BOARD BUILDING

DOUBLE STOREY WEATHER BOARD BUILDING

DOUBLE STOREY BUILDING (TELEPLANT ROCK CAFE)

VEGETATED AREA

STAIRS

STEPS

VERANDAH

3 STOREY RESIDENTIAL BUILDING

IMPORTANT NOTE:

BEFORE YOU DIG www.byda.com.au

ALL UNDERGROUND SERVICES SHOULD BE LOCATED ONSITE BY RELEVANT AUTHORITIES BEFORE ANY WORK IS COMMENCED.

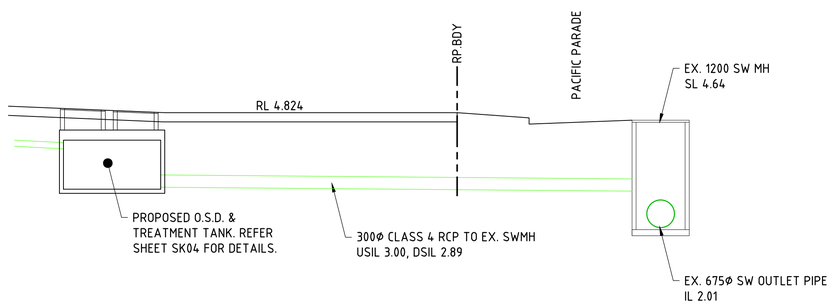
UNDER QUEENSLAND LEGISLATION, THE GENERAL BIOSECURITY OBLIGATION REQUIRES ALL REASONABLE STEPS TO BE TAKEN TO PREVENT THE SPREAD OF FIRE ANTS.

ALL SUSPECTED SIGHTINGS OF FIRE ANTS MUST BE REPORTED WITHIN 24 HOURS OF THEIR DISCOVERY (PH: 13 25 23). THE MOVEMENT OF FIRE ANTS IS PROHIBITED. FAILING TO COMPLY MAY INCUR PENALTIES.

THE CONTRACTOR SHALL ACQUIRE THE NECESSARY PERMITS AND EDUCATION TO MOVE ORGANIC MATERIALS THAT MAY CONTAIN FIRE ANTS.

LEGEND

- RP BOUNDARY
- EXISTING CONTOUR (16.0)
- EXISTING SURFACE LEVEL (+15.76)
- EXISTING WATER (W)
- EXISTING STORMWATER (SW)
- EXISTING SEWER (S)
- EXISTING TELSTRA (T)
- EXISTING ELECTRICAL
- PROPOSED BUILDING BASEMENT OUTLINE
- PROPOSED BUILDING ROOF OUTLINE
- PROPOSED PRIVATE STORMWATER
- EXISTING OVERLAND FLOW PATHS



PROPOSED STORMWATER SECTION

No.	DATE	ISSUE	REVISED	CHECKED
P4	11.06.25	PRELIMINARY ISSUE	ZCL	TWN
P3	17.02.25	PRELIMINARY ISSUE - NEW SITE LAYOUT	ZCL	TWN
P2	30.01.25	PRELIMINARY ISSUE - NEW SITE LAYOUT	ZCL	TWN
P1	07/23	ORIGINAL ISSUE	BAR	TWN

IN ASSOCIATION WITH

PRELIMINARY
NOT FOR CONSTRUCTION

SCALE A 0 1 2 3 4 5 1 : 100

SCALE B

DATUM AHD (U.N.O.) SCALES SHOWN ARE AT A1 SIZE

COZENS REGAN GROUP
CONSULTING ENGINEERS • CIVIL • STRUCTURAL
SUITE 7 ADVANCE BUSINESS CENTRE
39 LAWRENCE DRIVE NERANG
PO BOX 2711 NERANG QLD 4211
P: (07) 5578 4100
F: (07) 5578 4092
E: mail@cozreg.com.au
W: www.cozreg.com.au
CONSULT AUSTRALIA Member Firm

DESIGNED BAR
DRAWN BAR
CHECKED TWN

APPROVED FOR AND ON BEHALF OF COZENS REGAN GROUP PTY LTD (RPEQ No 15735)

CLIENT: JOHN FUGLSANG DEVELOPMENTS PTY LTD

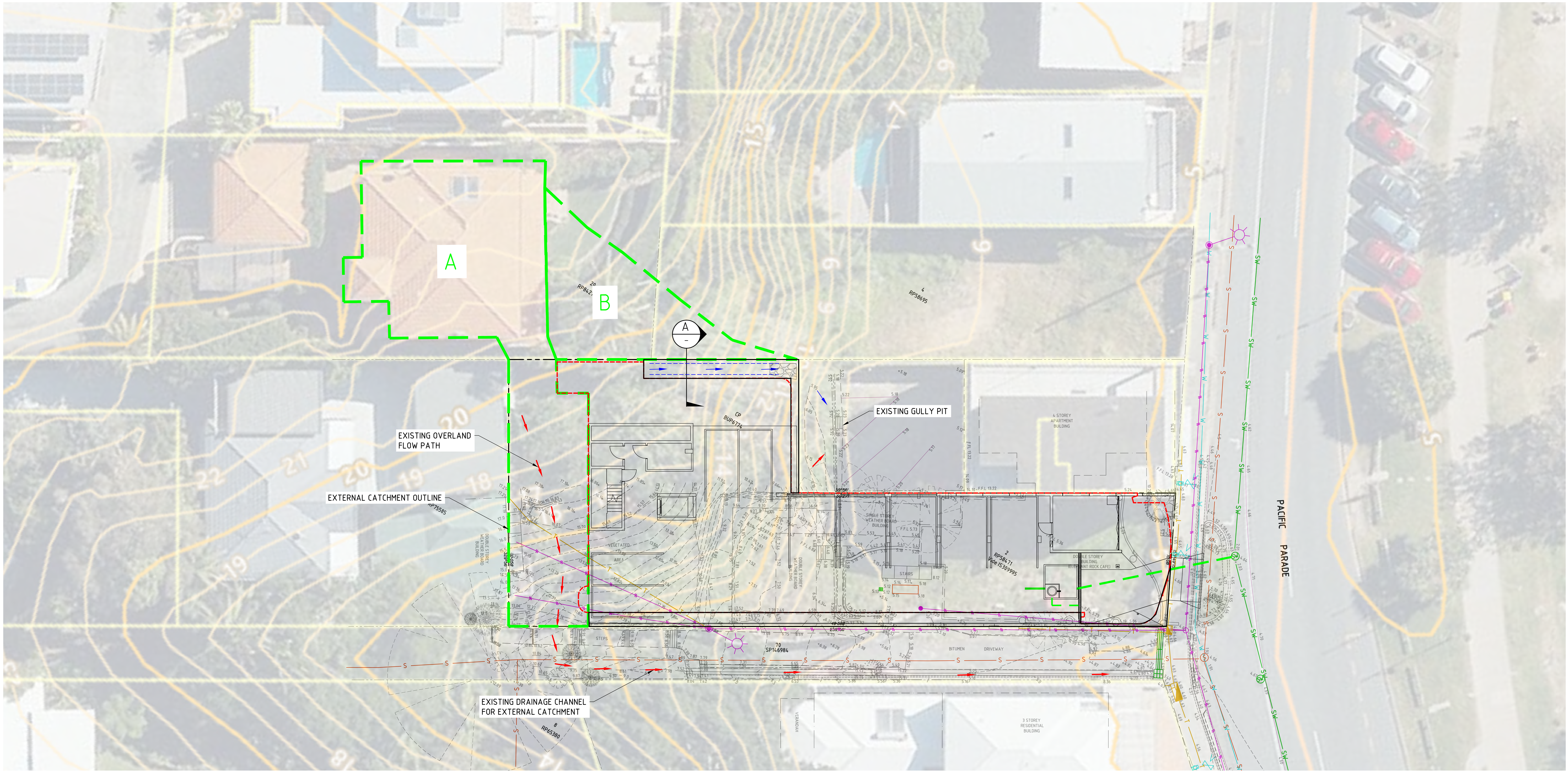
PROJECT: PROPOSED STORMWATER MANAGEMENT PLAN
776 PACIFIC PARADE, CURRUMBIN

CONCEPT STORMWATER MANAGEMENT PLAN

JOB NO. 220627

DRAWING NO. SK02

ISSUE P1 P2 P3 P4

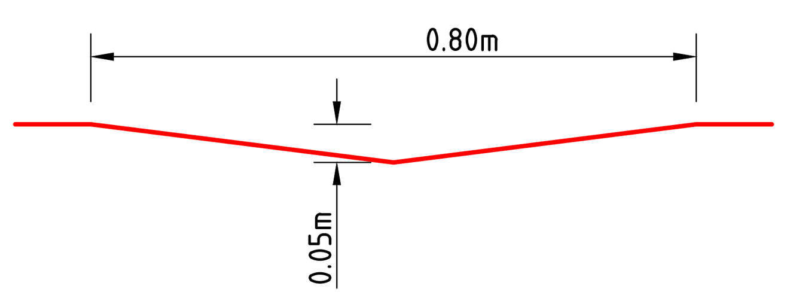


LEGEND

- EXISTING CONTOUR
- EXISTING SURFACE LEVEL
- PROPOSED BUILDING ROOF OUTLINE
- PROPOSED BUILDING BASEMENT OUTLINE
- EXTERNAL CATCHMENT AREA
- EXISTING OVERLAND FLOW PATH TO BE MAINTAINED TO CATER FOR EXTERNAL CATCHMENT FLOWS
- RP BOUNDARY

1% AEP EXTERNAL CATCHMENT FLOW CALCS

CATCHMENT	CATCHMENT SIZE (Ha)	Fi	C(100)	Tc (min)	I (mm/hr)	Q (m3/s)
A	0.033	0.515	0.96	10	255	0.022
B	0.010	0	0.84	5	331	0.008



DETAIL A - V-DRAIN
SCALE 1:10

No.	DATE	ISSUE	REVISED	CHECKED
P3	11.06.25	PRELIMINARY ISSUE	ZCL	TWN
P2	17.02.25	PRELIMINARY ISSUE - NEW SITE LAYOUT	ZCL	TWN
P1	31.01.25	PRELIMINARY ISSUE	ZCL	TWN

IN ASSOCIATION WITH

PRELIMINARY
NOT FOR CONSTRUCTION

SCALE A 0 1 2 3 4 5 1 : 100
SCALE B
DATUM AHD (U.N.O.)
SCALES SHOWN ARE AT A1 SIZE

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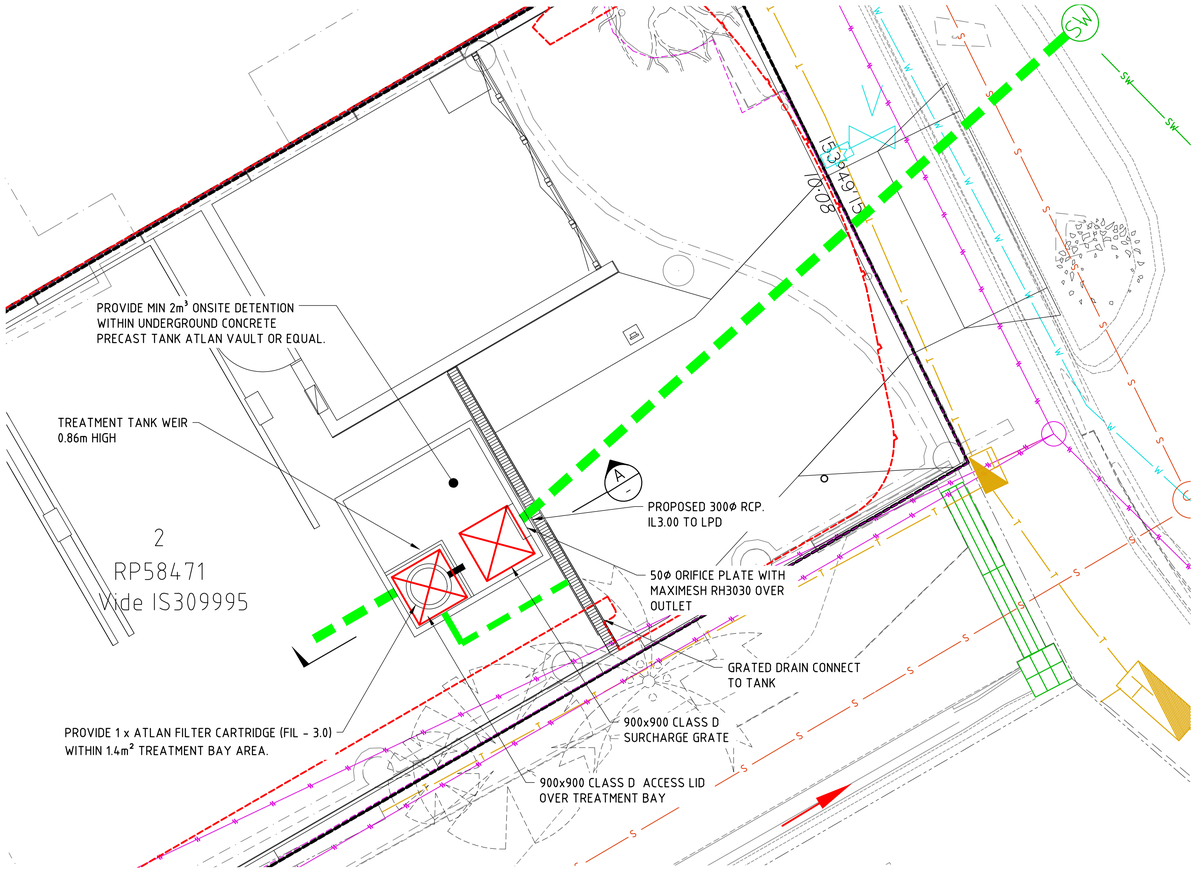
W: www.cozreg.com.au
CONSULT AUSTRALIA Member Firm

DESIGNED ZCL
DRAWN ZCL
CHECKED TWN
APPROVED FOR AND ON BEHALF OF COZENS REGAN GROUP PTY LTD (RPEQ No 15735)

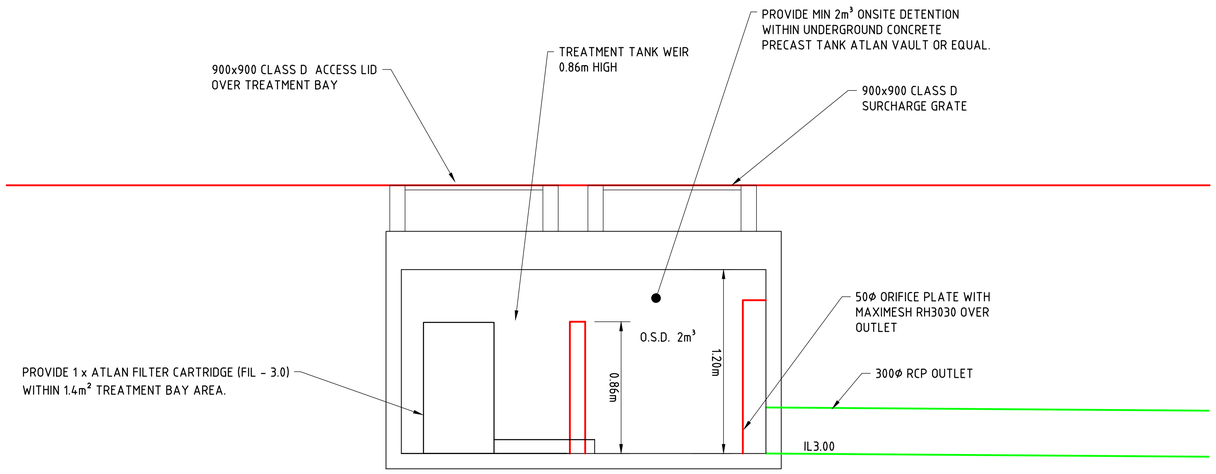
CLIENT: JOHN FUGLSANG DEVELOPMENTS PTY LTD
PROJECT: PROPOSED STORMWATER MANAGEMENT PLAN
776 PACIFIC PARADE, CURRUMBIN
CONCEPT EXTERNAL CATCHMENT PLAN

JOB NO. 220627
DRAWING NO. SK03
ISSUE P1 P2 P3



DETAIL TANK PLAN

SCALE 1:50



TYPICAL TANK SECTION A

SCALE 1:20

No.	DATE	ISSUE	REVISED	CHECKED
P1	11.06.25	ORIGINAL ISSUE	T.W.N.	T.W.N

IN ASSOCIATION WITH

PRELIMINARY
NOT FOR CONSTRUCTION

SCALE A 0 1 2 1 : 50

SCALE B

DATUM AHD (U.N.O.)

SCALES SHOWN ARE AT A1 SIZE

COZENS REGAN GROUP
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W: www.cozreg.com.au
CONSULT AUSTRALIA Member Firm

DESIGNED	TWN
DRAWN	BAR
CHECKED	TWN

APPROVED FOR AND ON BEHALF OF COZENS REGAN GROUP PTY LTD
(RPEQ No 15735)

CLIENT: JOHN FUGLSANG DEVELOPMENTS PTY LTD

PROJECT: PROPOSED STORMWATER MANAGEMENT PLAN
776 PACIFIC PARADE, CURRUMBIN

CONCEPT STORMWATER MANAGMENT DETAILS

JOB NO. 220627

DRAWING NO. SK04

ISSUE P1

Appendix D

RATIONAL METHOD PEAK DISCHARGE CALCULATIONS

Cozens Regan Group Pty Ltd

Project Number: 220627
Description: Stormwater Quantity Assesment
Designed: ZCL 31/1/2025
Location: 776 PACIFIC PARADE, BILINGA

PRE-DEVELOPMENT tc	Major		
Standard Inlet time:	5.0	min	
Friends Eqn:			
High point RL		m AHD	
Low point RL		m AHD	
Flow length:		m	
Site slope	#DIV/0!	%	
Hortons 'n'	0.05		
Overland flow travel time	**#DIV/0!**	**min**	
Kerb and channel flow			
High point RL		m AHD	
Low point RL		m AHD	
Flow length		m	
Slope	#DIV/0!	%	
Kerb travel time	**#DIV/0!**	**min**	
Pipe flow			
High point RL		m AHD	
Low point RL		m AHD	
Flow length		m	
Slope	#DIV/0!	m	
Pipe Size		mm	
n			
Q	**1.22**	m3/s	
Pipe travel time	**#DIV/0!**	**min**	
Channel Flow			
High point RL		m AHD	
Low point RL		m AHD	
Flow length		m	
Slope	#DIV/0!	m	
Hydaulic Radius	0.025	A/WP	
n	0.03		
V	**#DIV/0!**		
Channel Travel Time	**#DIV/0!**	**min**	
Calculated tc		**min**	
Adopted tc	**5.0**	**min**	

MAX 20 min. Refer QUDM 4.06.1

POST DEVELOPMENT tc.	Major		
Standard Inlet time:	5.0	min	
Friends Eqn:			
High point RL		m AHD	
Low point RL		m AHD	
Flow length:		m	
Site slope	#DIV/0!	%	
Hortons 'n'	0.05		
Overland flow travel time	**#DIV/0!**	**min**	**QUDM Eqn 4.06**
Kerb and channel flow			
High point RL		m AHD	
Low point RL		m AHD	
Flow length		m	
Slope	#DIV/0!	%	
Kerb travel time	**#DIV/0!**	**min**	**QUDM Fig 4.10**
Pipe flow			
High point RL		m AHD	
Low point RL		m AHD	
Flow length		m	
Slope	#DIV/0!	m	
Pipe Size		mm	
n	0.013		
Q	**0.20**	m3/s	**FROM FLOW CHART**
Pipe travel time	**#DIV/0!**	**min**	
Channel Flow			
High point RL		m AHD	
Low point RL		m AHD	
Flow length		m	
Slope	#DIV/0!	m	
Hydaulic Radius	0.025	A/WP	
n	0.03		
V	**#DIV/0!**		
Channel Travel Time	**#DIV/0!**	**min**	**Refer QUDM 4.06.10**
Calculated tc		**min**	
Adopted tc	**5.0**	**min**	

MAX 20 min. Refer QUDM 4.06.1

CALCULATION OF INITIAL RUNOFF - QUDM Section 4.00

	PRE-DEV'T	POST-DEV'T	
Catchment area (ha)	**0.072**	**0.072**	
Impervious area (ha)	**0.035**	**0.053**	**Ha**
Fraction impervious	48.5	73	%
Intensity - 1 hr, 10 yr (mm/hr)	**70.0**		**IFD: Currumbin**
t_c existing (min.)	5.00		
t_c post-developed (min.)	5.00		

ESTIMATION OF PEAK FLOWS

ARI/AEP	Existing				Post development				Difference in runoff	
	C	I (mm/hr)	Q (m^3/min)	**Q (m^3/s)**	C	I (mm/hr)	Q (m^3/min)	**Q (m^3/s)**	Increase (L/s)	Increase %
1EY	0.64	119	0.92	0.015	0.68	119	0.97	0.016	1	6.3%
0.5EY	0.68	135	1.10	0.018	0.72	135	1.17	0.019	1	5.9%
20%	0.76	184	1.68	0.028	0.81	184	1.79	0.030	2	6.6%
10%	**0.80**	**218**	**2.10**	**0.035**	**0.85**	**218**	2.23	**0.037**	**2**	**6.3%**
5%	**0.84**	**251**	**2.53**	**0.042**	**0.89**	**251**	2.68	**0.045**	**3**	**6.0%**
2%	0.92	296	3.27	0.055	0.98	296	3.49	0.058	4	6.5%
1%	**0.96**	**331**	**3.82**	**0.064**	**1.00**	**331**	3.98	**0.066**	**3**	**4.2%**

APPROX. PEAK FLOWS LESS THAN Q1

ARI	% of Q1	Existing (L/s)	Post dev't (L/s)	% inc
1 mth	25%	3.8	4.1	6.3%
2 mth	40%	6.1	6.5	6.3%
3 mth	**50%**	7.6	**8.1**	**6.3%**
4 mth	60%	9.2	9.7	6.3%
6 mth	75%	11.4	12.2	6.3%
9 mth	90%	13.7	14.6	6.3%
12 mths (Q1)	100%	15.3	16.2	6.3%

SUMMARY			CHECKED	COMMENT
Item	**Existing**	**Proposed**		
Area Ha	**0.072**	**0.072**		
Imperv A	0.035	0.053		
Fi %	48.5%	72.8%		
tc mins	5.00	5.00		
10yr 1hr I	70.0	70.0		
C10	**0.80**	**0.85**		
C100	0.96	1.00		
Q10 m^3/s	0.035	0.037		
Q20 m^3/s	0.042	0.045		
Q50 m^3/s	0.055	0.058		
Q100 m^3/s	0.064	0.066		
Initial Vs	**Ave (m^3)**	**Max Est Vs (m^3)**		
Q10	0.5	0.9		
Q20	0.6	1.0		
Q50	0.9	1.4		
Q100	0.6	1.1		

INITIAL DETENTION SIZING

Written by OC 17/07/2009
Updated by TWN Jan 2013

Based on QUDM 5.05 'Flood-Routing for Small Basins - Initial Sizing'

Flood Event	Discharge Coeff. of Runoff		Rainfall Intensity		Qi (m3/s)	Qo (m3/s) (allowable outlet flow)	Vi Approx. Inflow Volume (m^3) 4 * Qi * tc/ 3 Vi =	Ratio r = (Qi-Qo)/Qi	INITIAL ESTIMATED Vs					
	Existing Cy	Post-D'ment Cy	Existing I mm/hr	Post-D'ment I mm/hr					Culp (1948) Vs=r{(1+2r)/3}Vi Vs m^3/s	Boyd (1989) Vs=r*Vi Vs m^3/s	Carroll (1990) Vs={r(3+5r)/8}Vi Vs m^3/s	Basha (1994) Vs={r(2+r)/3}Vi Vs m^3/s	Average Vs	Maximum Estimated Vs
1EY	0.64	0.68	119	119	0.016	0.015	6	0.06	0.1	0.4	0.2	0.3	0.2	0.4
0.5EY	0.68	0.72	135	135	0.019	0.018	8	0.06	0.2	0.4	0.2	0.3	0.3	0.4
20%	0.76	0.81	184	184	0.030	0.028	12	0.06	0.3	0.7	0.3	0.5	0.5	0.7
10%	**0.8**	**0.85**	**218**	**218**	**0.037**	**0.035**	15	**0.06**	**0.3**	**0.9**	**0.4**	**0.6**	**0.5**	**0.9**
5%	**0.84**	**0.89**	**251**	**251**	**0.045**	**0.042**	18	**0.06**	**0.4**	**1.0**	**0.4**	**0.7**	**0.6**	**1.0**
2%	0.92	0.98	296	296	0.058	0.055	23	0.06	0.5	1.4	0.6	1.0	0.9	1.4
1%	**0.96**	**1.00**	**331**	**331**	**0.066**	**0.064**	27	**0.04**	**0.4**	**1.1**	**0.4**	**0.7**	**0.6**	**1.1**

Initial Sizing: QUDM (5.05.1)

Note: Initial sizing in above table does not allow for any run-off routing or relationship between catchment size and time of concentration

Appendix E

HEALTHY WATERS CODE ASSESSMENT (FEB 2024 ISS.)

City Plan code template

This code template supports the preparation of a development application against either the acceptable outcome(s) or performance outcome(s) contained in the code. Development assessment rules are outlined in **Section 5.3.3** of the City Plan.

Please note:

Note: In accordance with Section 2.1 of City Plan, an assessment against State interest - Water quality (policies 4 and 5) of the State Planning Policy 2017 is required as the Healthy water development code does not fully integrate this State interest. A response table for policies 4 and 5 have been included below.

For assessment against the overall outcomes, refer to the appropriate code.

Note: The whole of the planning scheme is identified as the assessment benchmark for impact assessable development. This specifically includes assessment of impact assessable development against this strategic framework. The strategic framework may contain intentions and requirements that are additional to and not necessarily repeated in zone, overlay or other codes. In particular, the performance outcomes in zone codes address only a limited number of aspects, predominantly related to built form. Development that is impact assessable must also be assessed against the overall outcomes of the code as well as the strategic framework.

9.4.5 Healthy waters code

9.4.5.1 Application

This code applies to assessing material change of use, reconfiguring a lot or operational work for development where indicated within:

(1) **Part 5 Tables of assessment**; and

(2) **Table 9.4.5.1-1: Development triggers for applying the Healthy waters code.**

Table 9.4.5.1-1: Development triggers for applying the Healthy waters code

Topic	Assessment triggers	Applicable assessment benchmarks
Erosion and sediment control	All development.	For accepted development subject to requirements: **RO1, RO2**
		For assessable development: **PO1, PO2**
Stormwater quality and	For residential land uses involving one or more of the following:	For accepted development subject to requirements:

Topic	Assessment triggers	Applicable assessment benchmarks
waterway stability	(a) 3 or more dwellings; or (b) a land area greater than 1,200m^2; or (c) a newly constructed road (previously unformed road) exceeding 30m in total length; or (d) 200m^2 or more of uncovered new or refurbished car park area including parking bays and circulation driveways; or (e) the creation of high polluting outdoor activities (including Bulk landscape supplies, Garden centres, Tourist parks, Transport depots, Warehouses and Wholesale nurseries).	**RO3, RO5** For assessable development: **PO3, PO4, PO8 – PO13**
	For non-residential land uses involving one or more of the following: (a) a land area greater than 1,200m^2; or (b) a newly constructed road (previously unformed road) exceeding 30m in total length; or (c) 200m^2 or more of uncovered new or refurbished car park area including parking bays and circulation driveways; or (d) the creation of high polluting outdoor activities (including Bulk landscape supplies, Garden centres, Tourist parks, Transport depots, Warehouses and Wholesale nurseries).	For accepted development subject to requirements: **RO4, RO5** For assessable development: **PO3, PO4, PO8 – PO14**
Stormwater quantity	For residential activities, development associated with the creation of 3 or more dwellings, resulting in either: (a) an increase in the total impervious area; or (b) an alteration of upstream conveyance or change to existing discharge location or condition.	For accepted development subject to requirements: **RO3, RO6, RO7** For assessable development: **PO5 – PO14**
	For all other land uses, development that results in either: (a) an increase in the total impervious area; or (b) an alteration of upstream conveyance or change to existing discharge location or condition.	For accepted development subject to requirements: **RO4, RO6, RO7** For assessable development: **PO5 – PO14**
Woongoolba flood mitigation catchment area	Development that is code or impact assessable, on land within the 'Woongoolba flood mitigation catchment area' on the **Water catchments and dual supply system area overlay map**.	For assessable development: **PO15**

This code does not apply in the following instances:

(1) where the development involves internal works or minor building works to a lawfully established building; or

(2) a sales office.

When using this code, reference should be made to **Section 5.3.2** and, where applicable, **Section 5.3.3**, in **Part 5**.

9.4.5.2 Purpose

(1) The purpose of the Healthy waters code is to:

(a) protect the quality of the city's waters and watercourses by managing the impacts of development on quality and quantity of surface and ground water runoff; and

(b) ensure that development does not cause adverse impact on people and/or property.

(2) The purpose of the code will be achieved through the following overall outcomes:

(a) Total water cycle management and water sensitive urban design (WSUD) principles are:

(i) implemented to contribute to biodiversity areas and green space values within the city and promote co-location of assets; and

(ii) integrated into the landscape so as to maintain watercourse health, biodiversity and ecosystems.

(b) Development avoids or minimises disturbance to existing landforms, surface drainage, watercourses and groundwater.

(c) Impacts to public health and safety hazards are minimised.

(d) Adverse impacts to people and/or property are prevented and stormwater is safely managed within urban areas.

(e) Development protects existing overland flow paths and watercourses of environmental value.

(f) Development limits the quantity of key pollutants discharged in stormwater to protect the quality of receiving waters.

(g) Development avoids adverse impacts to downstream properties or environmental value from stormwater peak discharge.

(h) Development avoids or minimises adverse impacts on the environmental values of receiving waters from the release and mobilisation of nutrients and sediments.

(i) The drainage capacity of the Woongoolba Flood Mitigation Scheme Area for rainfall events up to 1 in 10 year 72 hours is maintained (contained within the Scheme drains within a 4 day period) and this capacity is not to be eroded due to cumulative impact of development.

9.4.5.3 Specific benchmarks for assessment

PART B – ASSESSABLE DEVELOPMENT BENCHMARKS

Table 9.4.5-3: Healthy waters code – for assessable development

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets <u>either</u> the performance outcome or overall outcome	Internal use

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
Erosion and sediment control			
PO1 Stormwater discharge from a development site achieves the construction phase water quality objectives of **SC6.12 City Plan policy – Land development guidelines**, **Section 4 – Stormwater drainage and water sensitive urban design standards**.	**AO1** No acceptable outcome provided.	**YES.** Appropriate Erosion and Sediment Control measures have been proposed within the Stormwater Management Plan prepared by Cozens Regan Group in order to meet water quality objectives during construction.	
PO2 Erosion, sediment and dust is appropriately managed during the construction phase.	**AO2** The level of risk for soil erosion and sediment pollution to the environment is determined by an erosion hazard assessment, completed by a suitably-qualified person in accordance with the criteria in **Table 9.4.5-4: Erosion hazard assessment**. Where the erosion hazard assessment has a risk score of: (a) less than or equal to 10: A deemed to comply report is prepared by a suitably qualified person for Council approval, including conceptual location and design drawings of each treatment measure in plan and section views, in accordance with the *Best Practice Erosion and Sediment Control: International Erosion Control Association, (IECA) 2008, Australasia Chapter 2008*. (b) greater than 10 or developments involving multiple stages of disturbance or more than 1.25 ha of land: (i) For material change of use or reconfiguring a lot, a conceptual erosion and sediment control plan (ESCP) is prepared by a	**YES.** The Erosion and Hazard Assessment table has been completed and returned a score of 10. All earthworks are to be carried out in accordance with the Erosion and Sediment Control Requirements as set out within the Erosion and Hazard Control Section of the Stormwater Management Plan prepared by Cozens Regan Group.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets <u>either</u> the performance outcome or overall outcome	Internal use
	suitably-qualified person for Council approval in accordance with **SC6.12 City Plan policy – Land development guidelines, Section 4 – Stormwater drainage and water sensitive urban design standards**, and the *Best Practice Erosion and Sediment Control: International Erosion Control Association (IECA) 2008, Australasia Chapter 2008*. (ii) For operational work, a detailed ESCP is prepared by a suitably-qualified person in accordance with **SC6.12 City Plan policy – Land development guidelines, Section 4 – Stormwater drainage and water sensitive urban design standards**, and *Best Practice Erosion and Sediment Control: International Erosion Control Association (IECA) 2008, Australasia Chapter 2008*. The ESCP is to detail appropriate treatment measures for the construction phase of development, demonstrating how the minimum design objectives in **Table 9.4.5-5: Stormwater design objectives** are achieved, including: (a) measures to ensure the release of sediment-laden stormwater for the nominated design storm are minimised when the design storm is exceeded; (b) detailed design, installation, construction, monitoring and maintenance requirements of all approved proprietary products in		

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
	accordance with local conditions and manufacturer's recommendations; and (c) details of how the ESCP aligns with the approved development staging plan.		
Stormwater quality			
PO3 Development appropriately manages stormwater quality to: (a) protect natural ecosystems; (b) protect water quality; (c) reduce runoff and peak flows; and (d) meet the water quality objectives and environmental values for Queensland waters. **Note: Water quality objectives and environmental values for Queensland waters are contained within *Schedule 1* of the *Environmental Protection (Water) Policy 2009*. Water quality objectives are locally specific and vary between and within river catchments.** **Note: A stormwater quality management plan prepared by a suitably qualified person in accordance with SC6.12 City Plan policy – Land development guidelines, Section 4 – Stormwater drainage and water sensitive urban design standards, is Council's preferred method for addressing this performance outcome.**	**AO3.1** For post developed sites, the following minimum pollutant reduction targets are achieved: (a) Gross pollutants (>5mm) – 90%; (b) Total Suspended Solids (TSS) – 80%, (c) Total Phosphorus (TP) – 60%; and (d) Total Nitrogen (TN) – 45%.	**YES.** As indicated in the Stormwater Management Plan prepared by Cozens Regan Group, the development does not require stormwater quality management and only compliance with the Queensland Development Code, specifically NMP 1.8 – Stormwater Drainage (Jan 2008) is proposed.	
	AO3.2 For development on land less than 1.25ha, a deemed to comply solution for stormwater quality is achieved in accordance with **Table 9.4.5-6: Stormwater quality deemed to comply solutions**.		
	AO3.3 For development on land greater than 1.25ha, a stormwater quality management plan is to be prepared by a suitably qualified person in accordance with **SC6.12 City Plan policy – Land development guidelines**, **Section 4 – Stormwater drainage and water sensitive urban design standards**, is required.		
Waterway stability			
PO4 In-stream erosion, downstream of urban	**AO4** Post-development peak 0.632 Annual	**N/A.** Receiving environment is Pacific Parade.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets <u>either</u> the performance outcome or overall outcome	Internal use
development is prevented by controlling the rate (or magnitude) and duration of sediment transporting flows.	Exceedance Probability (AEP) event discharge within receiving waterway is limited to pre-development peak 0.632 AEP event discharge and is in accordance with **SC6.12 City Plan policy – Land development guidelines**, **Section 4 – Stormwater drainage and water sensitive urban design standards.**		
Stormwater quantity control			
PO5 Stormwater quantity management outcomes demonstrate no adverse impact on stormwater flooding or the drainage of properties external to the subject site.	**AO5** The following is achieved external to the development site: (a) no increase in peak flood flow rate from the development site for all events up to and including the 1% AEP; (b) no increase in peak flood velocities from the development site for all events up to and including the 1% AEP; (c) no increase in peak flood level from the development site for all events up to and including the 1% AEP; and (d) stormwater outfalls or discharge is located to avoid conflict with existing usage of downstream land or impacts on existing watercourse or drainage.	**YES.** As indicated in the Stormwater Management Plan prepared by Cozens Regan Group, it is proposed to install a 2kl above-ground stormwater detention tank to restrict flows to the predevelopment level for up to and including the 1% AEP rainfall event. Stormwater is to be discharged into Pacific Pde and no adverse effects regarding increases in peak flood levels, flood velocities or impacts on existing downstream land is anticipated.	
Lawful point of discharge			
PO6 Development ensures the stormwater systems are designed to not cause actionable nuisance that would adversely affect adjoining (upstream or downstream) properties.	**AO6** A lawful point of discharge must be identified and demonstrated that all discharge point/s from the development are in accordance with **SC6.12 City Plan policy – Land development guidelines**, **Section 4 – Stormwater drainage and**	**YES.** The lawful point of discharge is determined to be the kerb and channel in Pacific Parade.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
	water sensitive urban design standards.		
Overland flow paths			
PO7 Development must not obstruct free open surface flow of stormwater through a site.	**AO7** Overland flowing stormwater is allowed free open surface flow between the street and any waterway at the rear or sides of a property, in accordance with the provisions of the *Building Code of Australia.*	**YES.** The development does not obstruct overland flow and the unaffected existing drainage provisions will allow for the free flow of stormwater to Pacific Parade.	
Whole of life costs			
PO8 Stormwater infrastructure is designed and constructed to: (a) remain fit for purpose for the life of the development and maintains full functionality in the design flood event; (b) be cost effective to maintain; and (c) ensure no structural damage to existing stormwater infrastructure.	**AO8** No acceptable outcome provided.	**YES.** Stormwater infrastructure has been designed to achieve all three items under PO8.	
Landscape integration			
PO9 Stormwater treatment devices and stormwater infrastructure are designed to: (a) integrate with the urban design and landscape outcomes of the development; (b) complement natural environments, wetlands and watercourses; (c) protect environmental values; (d) enhance visual amenity; and (e) incorporate CPTED principles in accordance with **SC6.12 City Plan**	**AO9.1** Where stormwater treatment devices and stormwater infrastructure are integrated into public open space, a Statement of Landscape Intent is to be prepared by a suitably qualified person, for approval by Council. The plan is to demonstrate that the operation of stormwater infrastructure does not compromise the function of any co-located uses and reflect the design principles within **SC6.12 City Plan policy – Land development guidelines**, **Section 4 – Stormwater drainage and water sensitive urban design standards.**	**YES.** Stormwater infrastructure has been designed to achieve all five items under PO9.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
policy – Land development guidelines, Section 4 – Stormwater drainage and water sensitive urban design standards.	**Note: A Statement of landscape intent is to be prepared in accordance with SC6.13 City Plan policy – Landscape work.**		
	AO9.2 Stormwater treatment devices are located offline to any upstream catchment. **Note: This provision relates to the integration of stormwater treatment devices and stormwater infrastructure into the landscape. Development identified on the Environmental significance – wetlands and watercourse overlay map will still require assessment against the Environmental significance overlay code.**		
	AO9.3 All stormwater outlets that are located adjacent to watercourses, creeks and drainage paths are aligned at a maximum of 45 degrees to the downstream direction of flow, and energy dissipation measures installed to minimise scour.		
Public safety			
PO10 Stormwater treatment devices and stormwater infrastructure minimise impacts on public health and safety.	**AO10** All stormwater quantity control measures are designed in accordance with **SC6.12 City Plan policy – Land development guidelines**, **Section 4 – Stormwater drainage and water sensitive urban design standards**.	**YES.**	
Maintenance access			
PO11 Maintenance access is provided for all stormwater management systems and considers:	**AO11.1** All weather vehicle access is to be provided to inlet zones of the stormwater treatment systems in accordance with **Table 9.4.5-7: Maintenance access**	**YES.**	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets <u>either</u> the performance outcome or overall outcome	Internal use
(a) the type of vehicle or machinery needed to service particular assets; and (b) the need to ensure a safe working environment for maintenance personnel and the public.	**requirements (slope).**		
	AO11.2 Maintenance access is to be provided around the perimeter of all stormwater treatment systems in accordance with **Table 9.4.5-8: Maintenance access requirements (size).**		
	AO11.3 A maintenance buffer is provided around the perimeter of all stormwater treatment devices and adjoining private property equal to: (a) 1m in width; or (b) the width of a perimeter maintenance access, as delivered in AO11.2, plus 0.5m. The maintenance buffer is measured from the adjacent allotment boundary to the top of batter around the treatment measure. The maximum slope on the maintenance buffer is 1 in 10.		
Fauna movement			
PO12 Stormwater conveyance structures and channels are designed to ensure the safe movement of native fauna and provide for terrestrial and aquatic passage.	**AO12.1** Stormwater drainage structures and channels minimise impacts on aquatic fauna and associated habitats and provide opportunities for beneficial habitat uses of structures in accordance with the *Department of Primary Industries and Fisheries – Fisheries guidelines for Fish-friendly structures (2006).*	**YES**	
	AO12.2 Stormwater drainage structures allow for		

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
	the safe movement of terrestrial fauna in accordance with: (a) the Queensland Government Fauna Sensitive Road Design Manual Volume 2: Preferred Practices; and (b) the Queensland Government Koala-Sensitive Design Guidelines.		

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
Wastewater management			
PO13 Development does not discharge wastewater to receiving waters or areas external to the site unless demonstrated to be the best-practice environmental management for that site and takes into consideration: (a) the applicable water quality objectives for the receiving waters; and (b) the potential adverse impact on ecosystem health of receiving waters.	**AO13** Where the development involves the discharge of wastewater, a Wastewater Management Plan (WWMP) is prepared, demonstrating compliance with the performance outcome, by a suitably qualified person and submitted to the Council, detailing all of the following: (a) wastewater type; (b) climatic conditions; (c) water quality objectives; (d) best-practice environmental management; (e) waste management hierarchy; and (f) the WWMP provides for the management of wastewater in accordance with a wastewater management hierarchy that: (i) avoids wastewater discharge to watercourses; or (ii) if wastewater discharge to the environment cannot practicably be avoided wastewater discharge to watercourses is minimised through re-use, recycling, recovery and treatment for disposal to sewer, surface water and groundwater.	**YES** The development will be serviced by Council's public reticulation system.	
Dewatering management			
PO14 Dewatering occurs in accordance with an approved Dewatering management plan.	**AO14** No acceptable outcome provided.	**N/A**	
Woongoolba flood mitigation catchment area			

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
PO15 In the Woongoolba flood mitigation catchment area, shown on the **Water catchments and dual supply system area overlay map**, peak outflow and its timing for Q2, Q5 and Q10 for rainfall events up to 72 hours does not change as a result of development.	**AO15** No acceptable outcome provided.	**N/A**	

State Planning Policy July 2017

Policies	Demonstrate how the proposal meets the policy?	Internal use
State interest – water quality		
ASSESSMENT BENCHMARK 4 (POLICY 4): At the construction phase, development achieves the applicable stormwater management design objectives in table A (appendix 2) of the State Planning Policy.		
ASSESSMENT BENCHMARK 5 (POLICY 5): (5) At the post-construction phase, development: a) achieves the applicable stormwater management design objectives on-site, as identified in table B (appendix 2) of the State Planning Policy; or b) achieves an alternative locally appropriate solution off-site that achieves an equivalent or improved water quality outcome to the relevant stormwater management design objectives in table B (appendix 2) of the State Planning Policy.		

Table 9.4.5-3: Erosion hazard assessment

Controlling factor	Points	Score
Average slope of the whole site prior to operational works		
Slope less than 2%	0	
More than or equal to 2% but less than 5%	1	
More than or equal to 5% but less than 10%	2	
More than or equal to 10% but less than 15%	4	
More than or equal to 15%	5	High risk
Soil type (to be disturbed)		
Gravels and sandy soils	1	
Sandy loam	2	
Clays on flood plains	3	
Shallow soils on slopes	4	
Clays on slopes greater than 5%/imported fill or untested fill	5	High risk
Anticipated duration of site disturbance		
Duration less than 2 weeks	0	
More than 2 weeks but less than 3 months	2	
More than 3 months but less than 6 months	4	
More than 6 months	5	High risk
Anticipated erosive rainfall risk during site disturbance		
Low (monthly average rainfall less than 45 mm)	0	
Moderate (monthly average rainfall 46 - 100 mm)	1	
High (monthly average rainfall 101 - 225 mm)	2	
Very high (monthly average rainfall 226 - 1500 mm)	4	
Extreme (monthly average rainfall more than 1500 mm)	5	High risk

Controlling factor	Points	Score
Off-site sediment control (down-slope of the soil disturbance)		
Score 1 point if there is no purpose-built sediment trap (e.g. sediment basin, gross pollutant trap or purpose-built wetland).	1	
Run-off entering the site		
Score 1 point if stormwater run-off is not diverted from entering the site or away from soil disturbance.	1	
Extent of site disturbance		
Score 2 points if the building works requires reshaping of the ground surface.	2	
Total Score **Note: High erosion risk - if score 11 or greater, or five for any factor.**		

This Erosion Hazard Assessment form is adapted from the *Best Practice Erosion and Sediment Control, International Erosion Control Association (Australasia), IECA 2008 Appendix H - Building Sites, the Brisbane City Council Erosion Hazard Assessment Form* and *Attachment 2 to the QDC Draft Part 16 Erosion and Sediment Control*.

Table 9.4.5-5: Stormwater design objectives

Construction phase stormwater design objectives	Notes
Drainage control	
Design life and design storm of temporary drainage works: (1) Disturbed area open for less than 12 months - 1 in 2 ARI. (2) Disturbed area open for 12-24 months - 1 in 5 ARI. (3) Disturbed area open for more than 24 months - 1 in 10 ARI.	• ARI = Average Recurrence Interval (see Engineers Australia document Australian Rainfall and Runoff). • Design capacity excludes minimum 150mm freeboard. • A higher drainage design objective may be required for temporary drainage structures upslope of occupied properties. • A revised drainage design storm may be required if these design objectives are found to be impracticable.
Erosion control	
(1) Stage clearing and construction works to minimise the area of exposed soil at any one time. (2) Effectively cover or stabilise exposed soils prior to predicted rainfall. (3) Prior to completion of works for the development, and prior to removal of sediment controls, all site surfaces must be effectively stabilised using methods which will achieve effective short-term stabilisation. (4) Avoid or minimise large construction activities in the 'wet season'. (5) Divert water run-off from undisturbed areas around disturbed areas. (6) Use erosion risk ratings to determine appropriate erosion control measures.	• 'Wet season' means the high rainfall months, e.g. the four highest rainfall months. • For point 6, determine the erosion risk rating using local rainfall erosivity, rainfall depth, or soil loss rate or other acceptable method. A rating scale such as very low, low, moderate, high, extreme should be applied. Such ratings should reflect the local area. Example ratings may be shown in local council guidelines or detailed in best-practice guidelines.
Sediment control	
(1) Use soil loss rates to determine appropriate sediment control measures. (2) Direct runoff from exposed site soils to sediment controls that are appropriate to the extent of disturbance and level of erosion risk. (3) All exposed areas greater than 2500 metres must be provided with sediment controls which are designed, implemented and maintained to a standard which would achieve at least 80% of the average annual	• For point 1, surrogate determinations may be used such as monthly erosion or average monthly rainfall. • A commonly used design storm for basin sizing is 80th percentile five-day event. Depending on the settling characteristics of local soils, a higher 'operational' design storm can be achieved with chemical dosing operated in flow-through mode in a large storm with rainfall-activated auto-flocculent dosing, and advanced hydraulic efficiency features such as floating off-takes,

runoff volume of the contributing catchment treated (i.e. 80% hydrological effectiveness) to 50mg/L Total Suspended Solids (TSS) or less, and pH in the range (6.5–8.5).	and a sediment forebay. • TSS = Total Suspended Solids. Turbidity measurements (e.g. 60 Nephelometric Turbidity Units (NTU)) could be used; however, for accuracy, a site-specific relationship should be developed between turbidity and TSS.

Table 9.4.5-6: Stormwater quality deemed to comply solutions

The following deemed to comply solutions are to be documented within a Stormwater quality management plan prepared by a suitably-qualified person in accordance with **SC6.12 City Plan policy – Land development guidelines**, **Section 4 – Stormwater drainage and water sensitive urban design standards**.

Development type			**Stormwater treatment train**		**Land ownership[2]**
Land use	**Scenario**	**Scale**			
Residential	>2 lots up to 20 lots	N/A	Tank Volume per dwelling: • Detached 5 kl • Attached 3 kl	Bio retention[3] @ 1.3% of impervious catchment area.[1]	Public and/or Private
			No Tanks	Bio retention[3] @ 1.8% of impervious catchment area.[1]	Public and/or Private
			Tank Volume per dwelling: • Detached 5 kl • Attached 3 kl	Wetland @ 5% of impervious catchment area.	Public and/or Private
			No Tanks	Wetland @ 7% of impervious catchment area.[1]	Public and/or Private
	> 2 dwellings (Townhouse style up to 2 storeys	≤ 12,500m^2	Tank Volume per dwelling: • Detached 5 kl • Attached 3 kl	Bio retention[3] @ 1.3% of impervious catchment area.[1]	Private
			No Tanks	Bio retention[3] @ 1.8% of impervious catchment area. [1]	Private
			Tank Volume per dwelling: • Detached 5 kl • Attached 3 kl	Wetland @ 5% of impervious catchment area.[1]	Private
			No Tanks	Wetland @ 7% of impervious catchment area.[1]	Private

	High density multiple dwelling apartments (flats, high-rise)*	≤ 12,500m^2	Tank Volume per dwelling: • Detached 5 kl • Attached 3 kl	Bio retention[3] @ 1.8% of impervious catchment area.[1]	Private
			No Tanks	Wetland @ 7% of impervious catchment area.[1]	Private
Commercial, Industrial and Retail (including retail at the bottom floors of high rise)[4]	Commercial and/or Industrial uses	≤ 12,500m^2	Tank Volume per dwelling: • Detached 5 kl • Attached 3 kl	Gross pollutant management (GPT) + Bio retention[3] @ 1.8% of impervious catchment area.[1]	Public and/or Private
			No Tanks	Gross pollutant management (GPT) + Wetland @ 8% of impervious catchment area.[1]	Public and/or Private

[1] For developments that results in an increase in less than 15% imperviousness (i.e. roof and ground level impervious), then stormwater management to focus on the impervious areas only.

[2] Ultimate owner of the device and responsible for maintenance.

[3] For bioretention basins larger than 800m^2, an inlet pond will be required.

[4] The City requires gross pollutant management for these land uses. It is preferred that these are located on private property, but in larger scale Reconfiguring a lot applications it is logical to have a single gross pollutant trap for the site. The City will not accept proprietary devices for nutrient management on public/City land.

Table 9.4.5-7: Maintenance access requirements (slope)

Treatment type	Access track slope	Material and width
Stormwater inflows where pipe is 450mm or greater (where there is no forebay or inlet pond)	1 in 4 or flatter	2.5m wide minimum Gravel or reinforced turf from inlet
Coarse sediment forebay	1 in 4 or flatter	2.5m minimum Reinforced concrete in accordance with *IPWEAQ standard drawing RS-051* Concrete paver (subject to City approval), cement treated gravel

		250mm thick may be accepted by the City through negotiation.
Inlet pond (wet) for retention or wetland Sediment basins	1 in 4 or flatter	3m wide Reinforced concrete in accordance with Heavy Vehicle Crossing Industrial (*refer IPWEAQ standard drawing RS-051*). Where this access crosses perpendicular to pedestrian paths, the path must be 200mm thick, double reinforced and 42MPa.
Proprietary devices	1 in 4 or flatter	Reinforced concrete in accordance with Heavy Vehicle Crossing Industrial (refer *IPWEAQ standard drawing RS-051*).

Table 9.4.5-8: Maintenance access requirements (size)

Treatment type	Size	Maintenance access requirements (all paths 1 in 10 cross fall or less and maximum 1 in 4 longitudinal grade)
Bioretention	< 500m^2	Access path to > 40% of perimeter. ≥ 0.75m wide. Grass, mulch, gravel or concrete suitable for access on foot.[1]
	≥ 500m^2	Access path to > 40% of perimeter. ≥ 2.5m wide. Reinforced grass, gravel or concrete for light vehicles.[1] Remainder of perimeter as per < 500m^2 bioretention.
Wetland	<1000m^2	Access path to > 40% of perimeter. ≥ 0.75m wide. Grass, mulch, gravel or concrete

		suitable for access on foot.
	≥ 1000m^2 to < 5000m^2	Access path minimum 40% of perimeter. ≥ 2.5m wide. Reinforced grass, gravel or concrete for light vehicles.[1] Remainder of perimeter ≥ 0.75m wide.
	≥ 5000m^2	Access path 100% of perimeter. ≥ 2.5m wide. Cement treated gravel 200mm or concrete for large vehicles.

[1] Determine access path treatment based on slope, maintenance vehicle and the surrounding landscape. For example, turf is not appropriate where the treatment system is located against conservation open space, and where revegetation for the treatment system complements the surroundings, the use of gravel or concrete is preferred.

Pacific Geotech
Consulting Geotechnical Engineers

GEOTECHNICAL REPORT: Amended Geotechnical Investigation and Slope Stability Assessment for Proposed Residence

776 Pacific Parade

Currumbin

John Fuglsang Development Pty Ltd

June 2025

PG-7503

VERSION 3

E: info@pacgeo.com.au
www.pacgeo.com.au ABN: 62 615 248 952

Pacific Geotech
Consulting Geotechnical Engineers

Ref: PG-7503, 2022-05-13, GR VER 3
Author: Leigh Bexley

13th June, 2025

John Fuglsang Development Pty Ltd
Email: johnfuglsang@gmail.com
CC: tim.riches@mgs-gc.com.au

Dear Sir,

AMENDED GEOTECHNICAL INVESTIGATION AND SLOPE STABILITY ASSESSMENT FOR PROPOSED RESIDENCE 776 PACIFIC PARADE, CURRUMBIN

Enclosed is a copy of our report for the above project dated June 2025. An electronic copy of the report has been issued.

The report has been revised to take into consideration the additional land of the development added since the original assessment and concerns raised in regard to the stability of the escarpment at the rear of the site. It should be noted that the proposed development, upon completion, will result in a significant improvement in the stability of the escarpment, with a resulting reduction in the landslide hazard risk from its current very high condition to a very low to low condition.

Should you have any queries regarding this report, please do not hesitate to contact Leigh Bexley or Peter Elkington at this office.

Yours faithfully,

P. ELKINGTON (RPEQ 7226)

For and on behalf of
PACIFIC GEOTECH PTY LTD

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Appendices

1.0 INTRODUCTION

This Report is an amended report to the original report which presents the results of a geotechnical investigation and slope stability assessment for a proposed new residence at 776 Pacific Parade, Currumbin. The work was requested by Mr John Fuglsang, the owner of the property.

From the information supplied by the Client, it is understood that the proposed development is to comprise the construction of a multi storey residential building at the above site. Earthworks are expected to involve minor cuts and fills within the flat eastern flat portion of the Lot. Moderate cuts up to approximately 5m within the upslope western sloping portion of the Lot will be required to form a level pad for the proposed development.

The Lot is located within an area comprising sloping topography which has been categorised as being partially within a "Moderate" Landslide Hazard area on the Council City Plan Overlay Map. A geotechnical slope stability assessment is therefore required to be carried out for the Lot to continue with the application to Council.

The slope stability assessment was confined to an evaluation of the Lot only, identifying any major geotechnical constraints or issues which would impact on the proposed development. It identifies the constraints associated with the proposed development as well as providing recommendations to reduce the risk of future slope instability. A Landslide Susceptibility Rating has also been assigned to the Lot and recommendations to maintain or improve stability have been provided. The slope stability assessment has been carried out in accordance with the City of Gold Coast (Council) "SC6.10 City Plan Policy - Geotechnical Stability Assessment Guidelines," January 2021.

A geotechnical investigation for the proposed new residential dwelling including a site classification in accordance with AS.2870 "Residential Slabs and Footings" has also been provided.

This report contains the results of the Geotechnical Investigation and Slope Stability Assessment and provides advice and recommendations relating to the following:

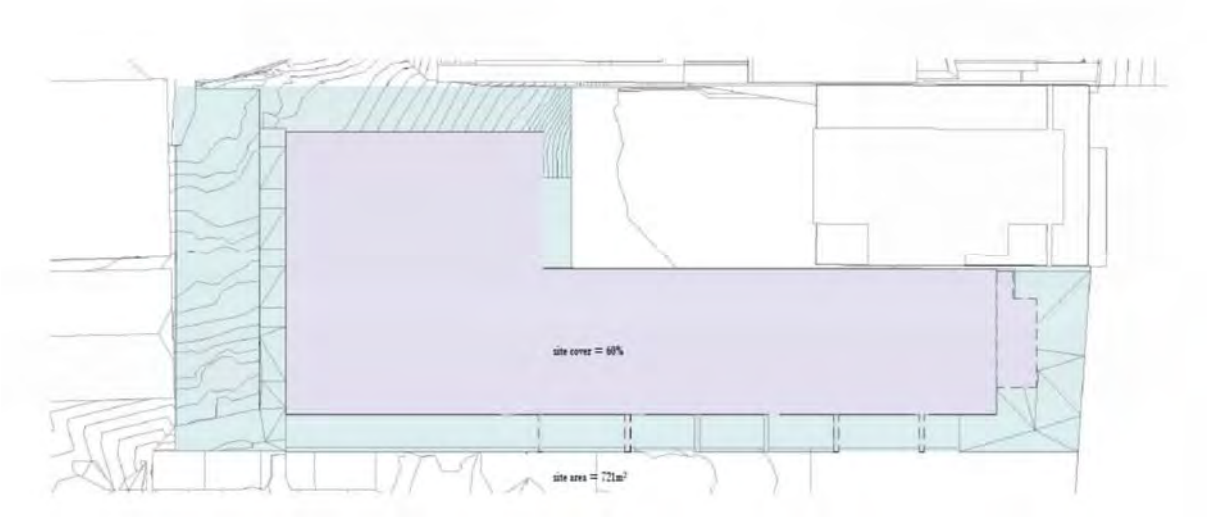
- Subsurface conditions in accordance with AS 1726, including strength properties of encountered materials.
- Slope stability assessment which assesses the suitability of the proposed new residence for residential development. A Landslide Risk Rating has been assigned to the Lot for the proposed new residence and recommendations have also been provided to maintain or improve stability.
- Geotechnical issues or constraints for development.
- Drainage recommendations.
- Batter slope recommendations.

- Site trafficability of subsoil material.
- Earthworks considerations including stripping depths, site preparation, filling recommendations, suitability of excavated material for reuse as structural fill and suggested compaction standards for structural fill.
- Recommended footing systems for residential development at the site, including ultimate bearing pressures for deep footings as well as shaft adhesion for piles.
- Retaining wall design parameters
- General recommendations for development at the site.

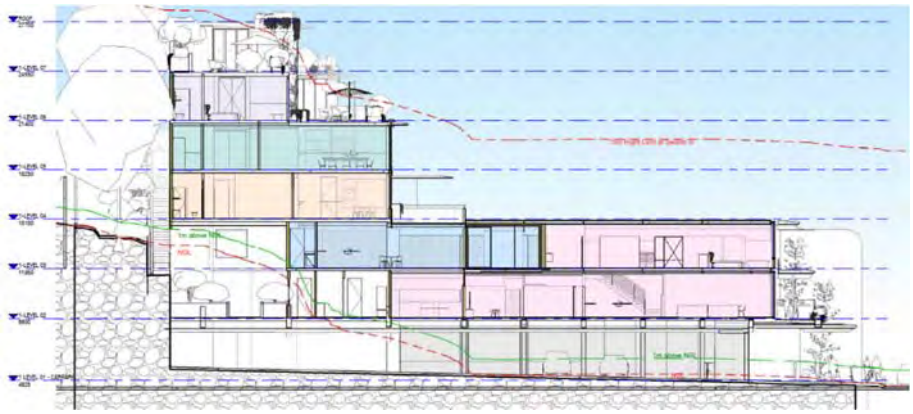
It should be noted that the site is located outside of the City of Gold Coast Council (CofGCC) defined scour zone.

A section of the proposed development is shown below.

PROPOSED LAYOUT



PROPOSED SECTION



2.0 METHODOLOGY

A desk study of the Moreton 1:500,000 Geological Map as well as aerial photographs, contour plans and the landslide overlay maps from Council were initially carried out to identify the site geology, sloping terrain and areas of potential instability at the site.

Following the desk study, a walkover survey of the site was performed by a Principal Engineering Geologist from Pacific Geotech. This involved mapping and measuring features of significance to slope stability such as slope angles and direction, erosion features, surface and subsurface drainage, wet zones, vegetation density, cut and fill areas and the presence of any irregular surface features such as curved trees, slips, slumps, debris slides or any associated features.

To assess the subsurface conditions at the site, three (3) boreholes (BH01 to BH03) were drilled where suitable access was available at the site. The boreholes were drilled using a Compac 018 drilling rig fitted with 100mm solid flight augers and extended to depths ranging between 2.5m and 3.7m. Dynamic Cone Penetrometer (DCP) testing was carried out adjacent to the boreholes and at two (2) additional locations (DCP04 & DCP05).

The boreholes and results of DCP testing were used to assess subsurface profiles to assist with the slope stability assessment.

The soil classification descriptions and field tests were carried out in general accordance with Australian Standards.

AS 1726	Geotechnical Site Investigations
AS 1289	Methods of Testing Soils for Engineering Purposes

Site photographs are shown in the site description below. The logs of the boreholes including the DCP test results are presented in Appendix B. A Site Plan showing the contours and location of the boreholes is attached in Appendix C. The Guidelines for Hillside Construction are presented in Appendix D to this report whilst the standard proforma for geotechnical certification and Landslide Susceptibility Analysis Form are attached in Appendix E. The Engineering Drawings are attached in Appendix F.

3.0 SITE DESCRIPTION

The Lot is located at 776 Pacific Parade and at the rear of 778 Pacific Parade, Currumbin and is 'L shaped' in shape being approximately 50m long and 10m wide at the front and widens to 20m at the rear. It is bound by residential and commercial Lots to the north and west, a small narrow easement to the south and Pacific Parade to the east with the Ocean beach being located approximately 30m to 40m to the east.

The surface topography typically comprises moderate sloping terrain within the upslope western portion of the Lot which slopes downwards towards the east at an angle of approximately 20° to 25°. The central and eastern downslope portion of the

Lot is typically flat or gentle sloping with a surface gradient of less than 5º. Excavations have been carried out within the moderate sloping terrain in the western portion of the Lot to form a flat pad for the existing residence and associated café at the front. The excavations range up to approximately 2m to 2.5m in height and expose weathered rock within most of the exposed face. The lower 1.5m of the excavation is near vertical whilst the upper section has been battered back.

The easement along the southern boundary of the Lot is approximately 4m wide and has been paved at the surface. From results of borehole drilling and an assessment of the topography of the site, it appears this easement previously formed a small west to east draining gully which has now been filled.

Drainage at the site is assessed to be fair as surface water is expected to flow into dedicated subsurface drainage systems or the easement to the south.

At the time of the investigation, the sloping terrain to the west supported a dense cover of native and exotic vegetation whilst the remainder of the Lot had been cleared of vegetation and comprised mostly paved areas around the existing building with several small garden beds.

Refer following aerial and site photographs for typical site conditions.

AERIAL IMAGE

SITE PHOTOGRAPHS

Plate 1 – Front of Lot with easement on left.

Plate 2 – Small courtyard in central portion of the Lot with easement on right.

Plate 3 – Easement on left with courtyard on right and natural sloping terrain upslope behind building.

Plate 4 – Easement along southern side of Lot.

Plate 5 – Cut behind existing building exposing weathered rock in the face.

Plate 6 – Natural sloping terrain upslope of building which extends down to easement.

4.0 GEOTECHNICAL MODEL

4.1 Regional Geology

The regional geology of the area forms part of the Neranleigh Fernvale Group which is undifferentiated but thought to have been formed in the Silurian to Devonian Geological Time Period. It comprises greywacke, argillite, quartzite, chert, shale, sandstone and greenstone (Murwillumbah 1:100 000 Geological Series, Sheet 9541 – Queensland Government Department of Natural Resources, Mines and Water, 2006).

4.2 Local Geology

Based on the results of borehole drilling at the site, the subsurface conditions encountered in the boreholes typically consists of fill material underlain by a thin layer of natural firm sandy clay, which overlies medium dense/dense silty sand and sand. The natural sand is underlain by hard, silty clay and sandy clay of low to medium plasticity which overlies weathered siltstone rock extending to the borehole refusal depths. In borehole BH01 only, the natural sand directly overlies the weathered rock.

No information with regards to the existing fill material at the site has been provided. On this basis, the existing fill material must necessarily be classified as uncontrolled. Most of the fill material evident onsite is most likely associated with the filling of the gully for the easement to the south of the Lot.

Due to no access being available for a drilling rig to the front eastern portion of the Lot, it is recommended that when access is available, additional drilling be carried out to assess the subsurface conditions in this area.

Table 1 presents a summary of the encountered subsurface profile. Detailed borehole record sheets are appended to this report.

TABLE 1 – SUBSURFACE PROFILE SUMMARY

BH No.	FILL			NATURAL				BH TD
	Sandy CLAY		Silty Gravelly SAND	Silty SAND	Silty CLAY/ Silty CLAY		XW/HW Siltstone	
	Firm/Firm to Stiff	Stiff/Very Stiff/Hard	Loose/Loose to Medium dense	Medium Dense/Dense	Firm	Hard	Very Low Strength	
BH01	0.0-1.8	1.8-2.3	NE	2.3-3.3	NE	NE	3.3-TD	3.7*
BH02	NE	NE	0.0-0.7	1.2-1.6	0.7-1.2	1.6-2.0	2.0-TD	2.5*
BH03	NE	NE	0.0-1.6	1.8-3.0	1.6-1.8	3.0-3.3	3.3-TD	3.7*

Notes:
1. All depths in metres below ground level at time of investigation.
2. TD - Termination Depth; NE – Not Encountered; *Drilling Refusal on Weathered Rock.

Groundwater was encountered in borehole BH03 only, at a depth of 2.5m at the time of drilling. Moist to wet soils were also encountered at a depth of 2.3m in borehole BH01 at the time of drilling.

Typically the standing ground water level is expected to be at about RL 0.5m to RL 1.0m with fluctuations of ±0.5m under normal (non-flood) conditions. Rises in groundwater to RL 1.5m to RL 2.0m (AHD) have been recorded in the Gold Coast area under heavy and prolonged rainfall periods (flood conditions).

5.0 SLOPE STABILITY ASSESSMENT

There is no evidence of existing or recent past slope instability involving small scale or large scale movements of significant quantities of soil or rock in a short duration event such as a slip or landslide within the Lot. There is, however evidence of creep movement at the surface of the natural sloping terrain within the upslope western portion of the Lot. Excavations into the sloping terrain have also been carried out at the rear of the existing building with minor uncontrolled fill also evident within the Lot.

Creep movement is evident at the surface of the natural moderate sloping terrain within the upslope western portion of the Lot by the presence of back slants on several trees. The creep movement is likely to be limited to the upper 0.3m soil profile but possibly deeper in located areas. Recommendations in this report must be followed with regards to foundations to reduce the potential for creep movement to impact on the proposed development.

An excavation into the slope ranging up to approximately 2.5m is evident within the western portion of the Lot to form a flat pad for the existing residence and associated café at the front. The excavation exposes weathered rock in most of the face and is near vertical in the lower 1.5m of the excavation whilst the upper section has been battered back. Some root jacking is also evident along several of the rock joints at this location. Minor fallout of rock can be expected within the lower section however, this area is proposed to be cut back and structurally retained as part of the proposed development.

Fill material appears to have been placed over the natural ground surface to form a flat pad for the existing development. The fill material appears to be more prominent towards the southern boundary where the gully has been filled to form the existing easement. It is expected that most of the fill material will be removed as part of the excavations for the partial basement associated with the proposed development.

In all terrain within the proposed development area at the site, the likelihood of slope movement in the form of deep seated failures through the soil or rock mass is considered to be low, due to the estimated friction angle of the soil being higher than the angle of the natural slope.

Due to the presence of sloping terrain as well as creep movement and existing uncontrolled fill material, precautions must be taken during development in relation to earthworks, foundations and drainage to reduce the potential for instability and erosion, particularly at the far western end of the Lot. This includes implementing and maintaining properly designed and constructed drainage structures upslope and

around the proposed development areas and extending the foundations below all soil prone to movement.

5.1 Landslide Hazard Risk Rating

The slope stability assessment methodology adopted for this assessment is in accordance with the City of Gold Coast (Council) "SC6.10 City Plan Policy - Geotechnical Stability Assessment Guidelines," January 2021. These guidelines have been applied to the Lot in its existing condition.

On this basis, it can be expected that some areas of the Lot may contain higher Levels of Risk to Property than the overall assigned rating for the Lot. Subsurface profiles have been obtained from borehole drilling within the Lot.

The Lot has been assigned a Landslide Risk Rating based on:-

- Ground surface slope angle and shape
- Geology
- Typical depth of soil cover
- Presence of excavations, uncontrolled fill, erosion features, drainage features, slips or surface irregularities
- Seepage and drainage conditions as assessed during the walkover survey carried out for this study

The results of the slope stability assessment are presented in Table 2 below.

TABLE 2 – LANDSLIDE SUSCEPTIBILITY RATING

Lot	Relative Frequency	Assessed Landslide Susceptibility Rating	Required Works to Maintain Susceptibility Rating to Low or Better
776 Pacific Parade	4.9116	High	Sections 6.0 to 11.0 as reported herein

From results of the desk study and walkover survey, we assess the Lot as having a Landslide Susceptibility Rating of "High" in its existing condition but assuming that the Lot will be appropriately retained following the excavation for the partial basement. From a perusal of the engineering drawings it is expected that the proposed development will improve the existing stability of the site. However, due to the presence of sloping terrain, uncontrolled fill and creep movement, precautions must be followed to maintain a Landslide Susceptibility Rating to a level of "Low" or better.

If the recommendations outlined in Sections 6.0 to 11.0 below are followed and the retention system is appropriately designed and installed, the Lot is expected to maintain a "Low" or better Landslide Susceptibility Rating for the long term.

5.2 Implications of Hazard Classifications

The implications of Hazard Risk Ratings are presented in the City of Gold Coast publication "Guidelines for Control of Slope Instability within the City of the Gold Coast" and reproduced in Table 3.

TABLE 3 – IMPLICATIONS OF HAZARD CLASSIFICATIONS (CoGCC Publication)

Hazard Rating	Implications
VH (Very High Hazard)	Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to acceptable levels.
H (High Hazard)	Detailed investigation, planning and implementation of treatment options required to reduce risk to acceptable levels.
M (Moderate Hazard)	Tolerable provided treatment plan is implemented to maintain or reduce risk. May be accepted. May require investigation and planning of treatment options.
L (Low Hazard)	Usually accepted. Treatment requirements and responsibility to be defined to maintain or reduce risk.
VL (Very Low Hazard)	Accepted. Managed by routine procedures.

6.0 RECOMMENDATIONS TO MAINTAIN LANDSLIDE RATING TO LOW

The Landslide Susceptibility Rating for the Lot is assessed to be "Low" for the long term with appropriate construction methodology. However, due to the presence of several minor development constraints such as sloping terrain, creep movement and uncontrolled fill, risk maintenance and reduction strategies are required to maintain the Landslide Susceptibility Rating to level of "Low" or better.

- All foundations within sloping terrain (>5˚ to 8˚ slope angle, subject to confirmation by Pacific Geotech) must be founded on a deep foundation system socketed into the natural hard clay or weathered siltstone rock below a depth of at least 2.0m. Piles must be adequately designed to resist lateral loads due to potential soil creep in accordance with the structural engineer's requirements. Where cuts are carried out to form a flat pad for the proposed development, high level footings can be adopted founding into the medium dense or better natural sand, hard natural clay or weathered siltstone rock.
- Upslope of the proposed building, a transverse lined surface drain must be constructed to intercept and reduce runoff from upslope discharging over the ground surface behind or beneath the house and saturating the footings or fill platforms. This drain should collect upslope surface water and direct this water into dedicated drainage easements.
- All building pad runoff and roof water should be discharged into drainage features or into stormwater systems via a system of pipe conduits to minimise water infiltration into the slopes and fill platforms. Alternatively, roof water can be discharged into roof water tanks for storage.
- All storage tank overflow water must be piped into the stormwater system. Uncontrolled discharge onto the site is not permitted.

- The partial basement must be suitably retained by an adequately designed and constructed retention system.
- The recommendations described in Sections 6.0 to 11.0 of this report must be followed which includes recommendations for foundations, drainage, site preparation prior to filling, filling, safe cut and fill batters slope angles and general recommendations for residential development.

7.0 EARTHWORKS RECOMMENDATIONS

Earthworks are expected to involve minor cuts and fills within the flat eastern portion of the Lot and moderate cuts up to approximately 5m within the upslope western sloping portion of the Lot to form a level pad for the proposed development. Cuts and fills should be suitably retained with structurally designed retaining walls or battered to appropriate angles provided below. All proposed retaining walls and bulk earthworks design should be assessed for global stability by Pacific Geotech as part of the design process.

It is recommended that the following site preparation and earthworks procedures be carried out as part of the earthworks procedures during development.

- All earthworks operations should be carried out under appropriate supervision and in general accordance with AS 3798-2007 "Guidelines on Earthworks for Commercial and Residential Developments".
- No filling or residential development should take place within any surface irregularities such as slips, washouts, hummocky terrain, seepage zones, uncontrolled fill or erosion features without detailed assessment by Pacific Geotech.
- If filling is to be carried out, all trees, grass, topsoil, uncontrolled fill, soils containing deleterious matter and surface irregularities (as described above) must be removed from the existing ground surface.
- If natural soils are exposed during stripping of the ground surface, the stripped surface should be proof rolled using a suitably sized vibrating roller, to identify areas of weak surficial soils and to compact the upper level material.
- Trafficability across the site at the time of the investigation was assessed to be fair. If significant rainfall events occur during the earthworks operation, difficulties could be experienced in trafficking the exposed surface, particularly following stripping of the ground surface to expose the fill or natural clay soils. Site trafficability may be improved by constructing haulage tracks into and on the site or placing gravel/crushed rock along high traffic areas.
- The majority of soils on site will be suitable for re-use as structural fill, provided material is free of organic matter and deleterious material. It is likely that the soils will require moisture conditioning to bring them to optimum moisture content. If the clays are overly moist, difficulty in achieving compaction of the materials will be encountered and moisture conditioning will be required.

- Imported fill should be of fair to good quality with a minimum Soaked CBR value of 10%, a maximum Iss=1.0% and a maximum particle size of 75mm.
- All filling should be undertaken in layer thicknesses of approximately 250mm (or as appropriate for the compaction equipment being used). Fill should be compacted to at least 95% Standard Maximum Dry Density at a placement moisture content of +/-2% of Optimum Moisture Content (OMC) and be "Controlled Fill" in accordance with A.S. 2870 (Clause 6.4.2 (a)) – "Residential Slabs and Footings" and A.S. 3798.
- Where the ground surface slopes, the stripped surface shall be benched prior to filling to key in the new fill and the fill supported by engineered retaining walls or battered to the slope angles described below.
- Natural soil and structural fill batters should be battered to an angle of no steeper than 2(H):1(V) or 26˚ whilst cut batters in rock should be battered to an angle of no steeper than 1(H):1(V) or 45˚ but subject to inspection following excavation.
- Fill slopes should be over-constructed and trimmed back to ensure compaction in the outer zones.
- Excavations into the slope must not undermine the stability of the upslope or adjacent structures. Ie. all footings from adjacent buildings or structures must be founded at least 200mm below a line drawn up at 45 degrees from the base of any excavation.

8.0 SITE CLASSIFICATION

Due to the sloping nature of the site, the site must be classified as a Class 'P' site in accordance with AS 2870-2011 *Residential Slabs and Footings – Construction.*

From a reactive perspective and for hydraulic design, in areas where the natural soils are exposed at the surface, the site is expected to be equivalent to a Class 'M' site in accordance with AS 2870-2011 following appropriate ground improvement works below the footings, if required.

Where cuts are to be carried out to exposed the highly or less weathered rock at the surface, the site would be equivalent to a Class 'S' site in accordance with AS 2870-2011.

It is recommended that the readers satisfy themselves that the use of AS 2870-2011 is applicable for the proposed design and the above site classification re-confirmed following the completion of the bulk earthworks operation.

9.0 BUILDING FOUNDATION

9.1 General

It is expected that founding conditions will vary from front to rear, from sands and clays to weathered rock.

The most appropriate footing system for the proposed building will depend on construction considerations, scour considerations, the practicality of ground improvement works and the ability of the structure to tolerate differential settlement along the structures.

It should be noted that whilst this site is not located within the City of Gold Coast Council defined scour zone, careful consideration must be given to the potential for the loss of support from scouring of the upper level sands associated with a significant rainfall event. Providing sufficient support against scour can be provided, a high-level footing system founding in the sand may be considered.

It is therefore recommended that the proposed new residence be founded on high level footings in the front areas where the terrain is flat or cuts are to be carried out to form a flat pad and a deep footing system be adopted where the natural sloping terrain is greater than 5˚ to 8˚ or fills are to be carried out over the sloping terrain.

9.2 High Level Foundations

It is recommended that a high level footing system, founding through any proposed or existing fill material and socketed into the medium dense or better natural sand, hard natural clay or weathered siltstone rock, be adopted for the support of the proposed building where cuts have been carried out to form a flat pad or the sloping terrain is less than 5^{o}.

An allowable bearing capacity of 125kPa in surficial sands would be available provided the founding soils are recompacted to achieve a Minimum Density Index of 75% for a minimum depth of 900mm below the footings, subject to inspection at the time of excavation. This could be achieved by the over-excavation of the footings by approximately 200mm to 300mm, in-situ compaction of the exposed soils using a small vibrating plate compactor (300kg or larger) or small smooth drum roller, and the replacement and recompaction of the sands to the design base footing level.

For footings founding in the natural clay or weathered rock in the rear western portion of the site, an allowable bearing capacity of 400kPa in the hard natural clay and 500kPa in the weathered siltstone rock would be available, subject to inspection at the time of excavation.

The total long term settlements of strip and pad footings founding in the compacted sand and dimensioned for a maximum allowable bearing pressure of 125kPa can be assessed as 13.5B (mm) for strips and 8B (mm) for pads where B(m) is the footing width. Strip footing widths of less than 2m will be required to limit settlements to less than

25mm to 30mm, while settlements of pad footings up to 3m in width should not exceed 25mm.

The total long term settlements of strip and pad footings founding in the hard natural clay and dimensioned for a maximum allowable bearing pressure of 400kPa can be assessed as 14.5B (mm) where B(m) is the footing width. Strip footing widths of less than 2m will be required to limit settlements to less than 25mm to 30mm, while settlements of pad footings up to 3m in width should not exceed 25mm.

For footings founding in the weathered rock dimensioned for an allowable bearing capacity of 500kPa, total settlements of less than 10mm are anticipated.

Considering the above settlement estimates, differential settlements in the order of 20mm to 25mm are anticipated. Suitable articulation of the proposed structure is recommended where footings found in different materials.

It is recommended that footing inspections be undertaken by Pacific Geotech, following excavation, to confirm the specified founding strata has been achieved. Testing should be undertaken in accordance with AS 1289 5.5.1/5.6.1 to confirm the required density index has been achieved under the footings.

It is suggested that masonry walls supported on high level footings be suitably articulated to reduce the potential for distress due to different footing settlements.

Where footings are located adjacent to excavations such as underground service trenches, it is recommended that the footings be deepened to found at least 200mm below a line drawn up at 30 degrees from the base of the trench.

9.3 Deep Foundations

Where the potential differential settlements cannot be tolerated, greater capacities are required, uncontrolled fill is evident, the natural sloping terrain exceeds 5˚ to 8˚ in slope angle or the ground improvement works are not considered practical, a deep footing system could be considered.

Considering the subsurface profile encountered, CFA grout injected piles, driven piles or screw piles founding in the medium dense or better natural sands, hard natural clay or weathered rock are considered suitable deep footing options for this site. Due to the groundwater table and collapsing sand soils, bored piles are not considered practical. The hard natural clay soils or the weathered rock are the preferred founding strata for piles.

The deep foundation system should be designed in accordance with the recommendations of AS 2159-2009 'Piling – Design and Installation'.

The ultimate geotechnical strength ($R_{d,ug}$) of piles can be calculated using the unfactored, ultimate shaft adhesion and end bearing values given in Table 4. The $R_{d,ug}$ values given in Table 4 will need to be multiplied by a suitable geotechnical strength reduction factor ($ø_g$) to obtain the design geotechnical strength ($R_{d,g}$) of

piles. In accordance with AS2159-2009, the $ø_g$ value must be determined by the designer, but based on the anticipated site, design and installation risk factors, a $ø_g$ value of 0.48 is recommended. Higher values may be applicable with suitable supervision.

If working stress methods are used in the pile design, the $R_{d,ug}$ values given in Table 4 will need to be divided by a Factor of Safety of 2.5 to calculate the maximum axial single pile working load.

TABLE 4 – ULTIMATE (UNFACTORED) PILE DESIGN PARAMETERS

Material	Ultimate Unfactored End Bearing* (kPa)		Ultimate Unfactored Shaft Adhesion* (kPa)
	L < 4D(2)	L > 4D(2)	
Existing Fill	NR(1)	NR(1)	15
Natural Clay - Firm	NR(1)	NR(1)	15
Natural Sands – Loose	NR(1)	NR(1)	15
Natural Sands – Medium Dense/Dense	1200(3)	1800(3)	45
Natural Clay – Hard	1200	1800	45
Siltstone – XW/HW	1800	2700	90

Notes:
*Geotechnical strength reduction factor needs to be applied to these parameters.
1. NR – Not Recommended.
2. L – total pile length; D – pile diameter.
3. Potential effects of the underlying clays should be taken into consideration in the final detailed pile design

Construction Considerations

The bases and sides of bored pile holes must be thoroughly cleaned of all loose soil and rock debris using a proper cleaning tool. The practice of adding water and spinning the auger is generally not acceptable.

Drilling piles is not only dependent on the subsurface profile characteristics, but also the type (power and size) of the bored pile drilling rig, drilling teeth, size of pile, etc. It is recommended that a specialist drilling contractor be consulted to be able to manage the above conditions and materials encountered.

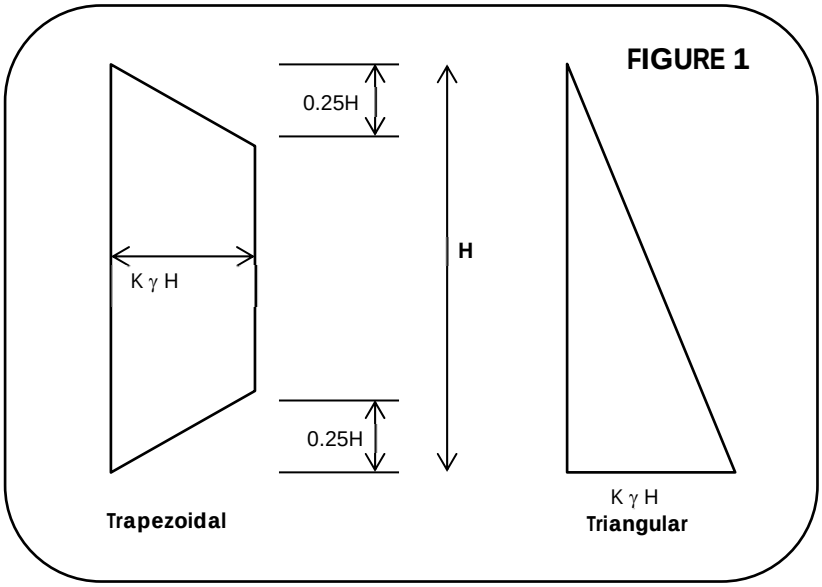
During construction, all bored piles must be inspected by a geotechnical engineer to confirm the geotechnical strength parameters presented in Table 4 and to check the capacity of the piles.

10.0 RETAINING WALL DESIGN PARAMETERS

Retaining walls should be specifically engineer designed in accordance with AS 4678-2002 (Ref 9).

The design of flexible retaining walls could be undertaken using a triangular pressure distribution and the earth pressure parameters given in Table 5. Flexible walls are those which are free to rotate or tilt (such as cantilevered walls) and should be designed using active (Ka) earth pressure coefficient. Rigid walls are those which are restrained

against rotation or tilt (i.e. single anchored/propped walls) and should be designed using the at-rest earth pressure (Ko) and a trapezoidal pressure distribution as per Figure 1.



Passive resistance (Kp) at the toe of the wall should be ignored in the zone where future disturbance (e.g. services trenches) could occur.

The effects of surcharge in the retained zone should be included by multiplying the vertical pressure developed by the surcharge by the appropriate lateral earth pressure coefficient. Allowance should also be made for the surcharge due to sloping crests, where applicable.

TABLE 5 – EARTH PRESSURE COEFFICIENTS (NON-SLOPING CREST BACKFILL)

Material	Unit Weight (kN/m³)	Cohesion c' (kPa)	Friction Angle (degrees)	Active Ka	At Rest Ko	Passive Kp
Uncontrolled Sand Fill*	18	0	30	0.33	0.50	3.00
Uncontrolled Clay Fill*	18	2	24	0.42	0.59	2.39
Natural Sand – Loose	19	0	30	0.33	0.50	3.00
Natural Sand - Medium Dense/Dense	20	0	32	0.31	0.47	3.26
Natural Clay - Firm	19	3	24	0.42	0.59	2.39
Natural Clays - Hard	20	5	26	0.39	0.56	2.57
XW/HW Siltstone	23	8	34	0.28	0.44	3.55

**Depends on fill classification and level of compaction*

The above typical parameters do not take into account a sloping crest or toe or potential soil creep loads. Parameters should be refined when wall geometry and locations are finalized but the earth pressure values will vary if sloping backfills are present above and below the walls.

The generalized lateral earth pressure distribution is given as:

$p = K\gamma H + Kq + \sigma L$ (kPa)

- K is either K_a, K_o, or K_p for "active", "at rest" or "passive" earth pressure conditions, respectively
- γ (kN/m^3) is the relevant density of the soil or rock
- H (m) is the distance down from the top of the wall
- q (kPa) is any uniform surface surcharge load behind the wall
- σL (kPa) is the lateral pressure on the wall resulting from adjacent surcharges.

Whilst it is assumed that following excavation that no groundwater will be present, walls should be designed for full suitable water pressures and adequate drainage be provided behind the wall.

It is recommended that the design parameters for retaining walls presented in this section be confirmed by on-site inspection when the subsurface conditions are exposed during construction.

Preference should be given to adopting thin soil layers and using small hand-controlled compaction equipment during backfilling against retaining walls. This is in order to limit the stress applied to the walls during construction. Should heavy compaction be required, then wall stresses will be well in excess of Ko and temporary propping should be used.

Clay backfill should not be placed dry of optimum moisture content, as this can lead to increased future swelling with changes to moisture content or inundation from water creating additional load on the back of the wall.

Additional guidelines on wall drainage are provided in Appendix G of AS 4678-2002.

11.0 GENERAL RECOMMENDATIONS FOR DEVELOPMENT

To maintain the long term performance of any proposed development, good management of the soil conditions and the development is critical throughout the life of the development.

The following are some specific comments with respect to site management and general development at the site:

- The ground surface around the perimeter of the building should slope away from the structure and fall to the stormwater system. Water should not be allowed to pond adjacent to the building.
- Founding soils should not be allowed to become saturated. Saturation of the on-site material will result in an increase in potential ground surface movements.
- Service trenches under the building should be kept to a minimum.

- Footings should be poured immediately after excavation. If footings cannot be poured on the same day as excavation, a blinding layer of 50mm thickness is recommended.
- Trees, garden beds and other vegetation should be planted at a distance at least equivalent to three quarters of their mature height away from the structures. This will assist in minimising shrinkage movements in the expansive onsite soils.
- Excavations for the proposed development must not undermine the stability of adjacent buildings, retaining walls or other structures.
- All permanent excavations and batters must be supported by adequately engineered retaining walls incorporating drainage or battered at appropriate angles.
- All retaining walls must be individually designed to have a Factor of Safety of at least 1.5 with respect to internal stability, including sliding and overturning. This is the responsibility of the retaining wall designer. The global stability of the wall profiles should be assessed by Pacific Geotech when the wall profiles have been determined.
- The development must be designed, constructed and maintained in accordance with the attached Guidelines for Hillside Construction and the development examples of good and poor hillside practice.
- Revegetation must commence immediately after the completion of any potential earthworks to minimise future erosion.

It is recommended that Council impose conditions of approval that require pre-construction certification by the project geotechnical engineer (prior to building approval) as well as post construction certification (prior to building final).

12.0 LIMITATIONS

We have prepared this report for the Amended Geotechnical Investigation and Slope Stability Assessment for Proposed Residence at 776 Pacific Parade, Currumbin. The report is provided for the exclusive use of John Fuglsang Development Pty Ltd, for this project only and for the purposes outlined in the report. It should not be used by, or relied upon, for other projects on the same or different sites or by a third party. In preparing this report, we have relied upon information provided by the client or their agents.

The results are indicative of the subsurface conditions on site only at the specific testing locations. Subsurface conditions can change between test locations and the design and construction should take the spacing of the testing and testing methods adopted and the potential for variation between the test locations.

It is recommended that Pacific Geotech be engaged to provide advice and ensure the development is undertaken in accordance with the assumptions made in writing this report.

This is not to reduce the level of responsibility accepted by Pacific Geotech, but rather to ensure that the parties who may rely on the information contained in this report are aware of the responsibilities they assume in doing so.

L. BEXLEY
For and on behalf of
PACIFIC GEOTECH PTY LTD

P. ELKINGTON (RPEQ 7226)

APPENDICES

APPENDIX A

NOTES RELATING TO THIS REPORT

Notes Relating to this Report

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis.

Every care has been taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical conditions and contains recommendations or suggestions for design and construction. However, unexpected variations in ground conditions will occur. The potential for this will depend partly on testing, spacing and sampling frequency.

If variations are identified, Pacific Geotech would be pleased to assist with additional investigations or advice to resolve the matter.

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Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Description and Classification Methods

The description and classification of soils and rocks used in this report are based on AS 1726.

Soil types are described according to the predominating particle size and behaviour as set out in the attached Unified Soil Classification Table qualified by the percent of other particles present (e.g. sandy clay) as set out below:

Soil Classification	Particle Size
Clay	less than 0.002mm
Silty	0.002 to 0.06mm
Sand	0.06 to 2mm
Gravel	2 to 60mm

Non-cohesive soils are classified on the basis of relative density which can be correlated from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very Loose	less than 4
Loose	4 – 10
Medium Dense	10 – 30
Dense	30 – 50
Very Dense	greater than 50

Cohesive soils are classified on the basis of strength (consistency) and can be quantified by the Pocket Penetrometer test, Vane Shear test, laboratory testing or engineering examination. The strength terms are defined as follows:

Classification	Unconfined Compressive Strength kPa
Very Soft	less than 25
Soft	25 - 50
Firm	50 – 100
Stiff	100 – 200
Very Stiff	200 - 400
Hard	greater than 400
Friable	strength not attainable – soil crumbles

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc.

Planarity	
CU	Curved
DIS	Discontinuous
IR	Irregular
PR	Planar
ST	Stepped
UN	Undulose

Roughness	
POL	Polished
RJ	Rough
S	Smooth
SL	Slickened
VR	Very Rough

Defects	Type
BP	Bedding Parting
CL	Cleavage
CO	Contact
CS	Crushed Seam
CZ	Crushed Zone
DB	Drilling Break
DK	Dyke
DL	Drill Lift
DZ	Decomposed Zone
FC	Fracture
FL	Foliation
FZ	Fracture Zone
HB	Handling Break
IS	Infilled Seam
JT	Joint
H	Schistosity
SI	Sill
SM	Seam
SS	Shear Seam
SZ	Shear Zone
VN	Vein
VO	Void

Sampling

Sampling is undertaken during the fieldwork to allow examination of the soil or rock and to allow laboratory testing to be undertaken.

Disturbed samples taken during drilling provide information on plasticity, grain size, colour, moisture content and minor constituents. Bulk samples are similar but of greater volume required for some test procedures such as CBR testing.

Undisturbed samples are taken by pushing a thin-walled sample tube, usually 50mm diameter (known as a U50), into the soil and collecting a sample of the soil contained in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling used are given on the attached logs.

Investigation Methods

Test Pits: These are typically undertaken with a backhoe or a tracked excavator, allowing examination of the insitu soils. Limitations of test pits are the problems associated with collapse of the pits, disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of typical diameter of between 50mm to 75mm advance manually operated equipment. Premature refusal of the hand augers can occur on a variety of materials such as fill, gravel, hard clays and collapse of the borehole (typically in non-cohesive soil).

Continuous Spiral flight Augers: The borehole is advanced using 65mm to 100mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and insitu testing. Augers of up to 300mm in diameter are used to recover larger volumes of sample. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights. Samples can be disturbed and layers may become mixed. Augering below the groundwater table can be less reliable than augering above the water table.

A Tungsten Carbide (TC) bit for auger drilling into rock can be used to indicate rock strength and continuity by variation in drilling resistance and from examination of recovered rock fragments but provides only an indication of the likely rock strength. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is advanced by a bit attached to the end of a hollow rod string, with water being pumped down the drill rods and returned up the annulus of the borehole, carrying the drill cuttings. Changes in stratification can be determined from the return, together with information from “feel” and rate of penetration.

The borehole can be stabilised through the use of drilling mud as a circulating fluid. The term 'mud' encompasses a range of products ranging from bentonite to polymers such as Revert or Biogel.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. This technique provides a reliable (but relatively expensive) method of investigation. In rocks, an NMLC triple tube core barrel is used, which gives a core of about 50mm diameter. The length of core recovered is compared to the length drilled and any length not recovered is shown as CORE LOSS.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils as a means of indicating density or strength and also of obtaining a disturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposed", Test 6.3.1.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63kg hammer, with a free fall of 760mm. The sample is driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense soils, hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In the case where full penetration is obtained with successive blow counts for each 150mm of , say, 4, 6 and 7 blows, as
  N = 13
  4, 6, 7
- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm, as
  N > 30
  15, 30/40mm

Cone Penetrometer Testing (CPT): Cone Penetrometer Testing with or without pore pressure measurement (CPTu) is carried out using a Cone Penetrometer in general accordance with AS 1289 6.5.1, 1999.

In the tests, a 36mm diameter rod with a conical tip is pushed continuously into the soil, the reaction being provided by a hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the fractional resistance on a separate 135mm long sleeve, immediately behind the cone. Pore Pressure is recovered through a pore ring located either within, or more usually immediately behind the cone/tip.

As penetration occurs (at a rate of approximately 20mm per second) and data is recorded every 20mm of penetration, the results are presented graphically.

The information provided on the plot comprises:

- Cone resistance – expressed in mPa
- Sleeve friction – expressed in kPa
- Friction ratio – the ratio of sleeve friction to cone resistance expressed as a percentage.
- Pore pressure in kPa
- Tilt of probe (in degrees).

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1% to 2% are commonly encountered in sands and rising to 2% to as high as 8%, and higher in organic soils. Soil descriptions based on cone resistance and friction ratios are only inferred and must not be considered as exact.

Stratification can be inferred from the cone and friction traces and from experience and information from nearby boreholes, etc. Where shown, this information is presented for general guidance, but must be regarded as interpretive.

Dynamic Cone Penetrometers:

Dynamic Cone Penetrometer (DCP) tests are carried out by driving a 16mm diameter rod into the ground with a 9kg sliding hammer dropping 510mm and counting the blows for successive 100mm increments of penetration.

Logs

The borehole or test pit logs are an interpretation of the subsurface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of the boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than "straight line" variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

Groundwater

Where groundwater levels are measured in boreholes, there are several potential problems:

- Although groundwater may be present, in low permeability soils it may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction.
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be flushed from the hole and drilling mud must be washed out of the hole or 'reverted' chemically if water observations are to be made.

More reliable measurements can be made by installing standpipes from which ongoing monitoring can be undertaken.

Fill

The present of fill materials can often be determined only by the inclusion of foreign objects (e.g. bricks, steel ,etc.) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult to reliably determine the extent of the fill.

Laboratory Testing

Laboratory testing is carried out in general accordance with Australian Standard 1289 'Methods of Testing Soil for Engineering Purposes'.

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage.

Review of Design

Where major civil or structural developments are proposed or where only a limited investigation has been completed or where the geotechnical conditions/constraints are quite complex, it is prudent to have a design review.

Site Inspection

Pacific Geotech would be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related:

Requirements could range from:

i. a site visit to confirm that conditions exposed are no worse than those interpreted, to
ii. a visit to assist the contractor or other site personnel in identifying various soil/rock types such as appropriate footing or pier founding depths, or
iii. full time engineering present on site.

APPENDIX B

BOREHOLE RECORD SHEETS

Pacific Geotech
Consulting Geotechnical Engineers

Borehole No.
BH01
Page 1 of 1

Project No.: PG-7503

Client:	John Fuglsang Development Pty Ltd	Commenced:	22/04/2022
Project Name:	Slope Stability Assessment	Logged By:	SR
Hole Location:	776 Pacific Parade, Currumbin	Checked By:	
Hole Position:			
Drill Model and Mounting:	Compac 018	RL Surface:	No survey
Hole Diameter:		Datum:	AHD Operator: SR

Drilling Information							Soil Description			DCP
Method	Casing	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	0 5 10 15 20 25
AD/T						0.00		CI	FILL Sandy CLAY (CI) Firm, medium plasticity, grey brown, fine to medium grained sand, trace of fine to medium sized gravel, w>pl.	
						1.00		CI	FILL Sandy CLAY (CI) Firm to stiff, medium plasticity, brown grey with pale orange brown mottled, fine to medium grained sand, trace of fine to medium sized gravel, w>pl.	
						1.80		CI	FILL Sandy CLAY (CI) Stiff, medium plasticity, grey brown, fine to medium grained sand, trace of fine to medium sized gravel, w>pl.	
						2.10		CL	FILL Sandy CLAY (CL) Hard, low plasticity, pale orange brown, fine to medium grained sand, trace of fine to medium sized gravel, w>pl.	
						2.30		SM	NATURAL Silty SAND (SM) Medium dense, fine to medium grained, grey, moist to wet.	
						3.30			SILTSTONE (HW) Highly weathered, very low strength, grained, grey mottled pale orange brown, dry.	
						3.70			Hole Terminated at 3.70 m	

Method
AS - Auger
RR - Rock Roller
WB - Washbore

Water
Level (Date)
Inflow

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
B - Bulk Sample

Remarks
1. Groundwater not encountered.
2. Maximum TC refusal at 3.7m.

Support
C - Casing

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Pacific Geotech
Consulting Geotechnical Engineers

Borehole No.
BH02
Page 1 of 1

Project No.: PG-7503

Client:	John Fuglsang Development Pty Ltd	Commenced:	22/04/2022
Project Name:	Slope Stability Assessment	Logged By:	SR
Hole Location:	776 Pacific Parade, Currumbin	Checked By:	
Hole Position:			
Drill Model and Mounting:	Compac 018	RL Surface:	No survey
Hole Diameter:		Datum:	AHD Operator: SR

Drilling Information							Soil Description			DCP
Method	Casing	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	0 5 10 15 20 25
AD/T						0.70		SM	FILL Silty Gravelly SAND (SM) Loose, fine to medium grained, grey brown, fine to medium sized gravel, moist.	
						1.20		CI	NATURAL Sandy CLAY (CI) Firm, medium plasticity, dark grey, fine to medium grained sand, w>pl.	
						1.60		SM	Silty SAND (SM) Medium dense, fine to medium grained, grey, low plasticity fines, moist.	
						2.00		CL-CI	Silty CLAY (CL-CI) Hard, low to medium plasticity, pale orange brown, w>pl.	
						2.50			SILTSTONE (HW) Highly weathered, very low strength, grained, pale orange brown, dry.	
									Hole Terminated at 2.50 m	

Method
AS - Auger
RR - Rock Roller
WB - Washbore

Water
Level (Date)
Inflow

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
B - Bulk Sample

Remarks
1. Groundwater not encountered.
2. Maximum TC refusal at 2.5m.

Support
C - Casing

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Pacific Geotech
Consulting Geotechnical Engineers

Borehole No.
BH03
Page 1 of 1

Project No.: PG-7503

Client:	John Fuglsang Development Pty Ltd	Commenced:	22/04/2022
Project Name:	Slope Stability Assessment	Logged By:	SR
Hole Location:	776 Pacific Parade, Currumbin	Checked By:	
Hole Position:			
Drill Model and Mounting:	Compac 018	RL Surface:	No survey
Hole Diameter:		Datum:	AHD Operator: SR

Drilling Information							Soil Description			DCP
Method	Casing	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	0 5 10 15 20 25
AD/T		▽				0.80		SM	FILL Silty SAND (SM) Loose to medium dense, fine to medium grained, grey brown, low plasticity fines, moist.	
						1		SP	FILL SAND (SP) Loose, fine to medium grained, pale yellow brown, moist.	
						1.60		CI	NATURAL Sandy CLAY (CI) Firm, medium plasticity, dark grey, fine to medium grained sand, w>pl.	
						1.80		SM	Silty SAND (SM) Medium dense, fine to medium grained, dark grey, moist to wet.	
						2				
						2.50		SP	SAND (SP) Medium dense to dense, fine to medium grained, pale yellow brown, wet.	
						3.00		CL-CI	Sandy CLAY (CL-CI) Hard, low to medium plasticity, pale orange brown, fine grained sand, w>pl.	
						3.30			SILTSTONE (HW) Highly weathered, very low strength, grained, pale orange brown, dry.	
						3.70			Hole Terminated at 3.70 m	
						4				

Method
AS - Auger
RR - Rock Roller
WB - Washbore

Water
Level (Date)
Inflow

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
B - Bulk Sample

Remarks
1. Groundwater not encountered.
2. Maximum TC refusal at 3.7m.

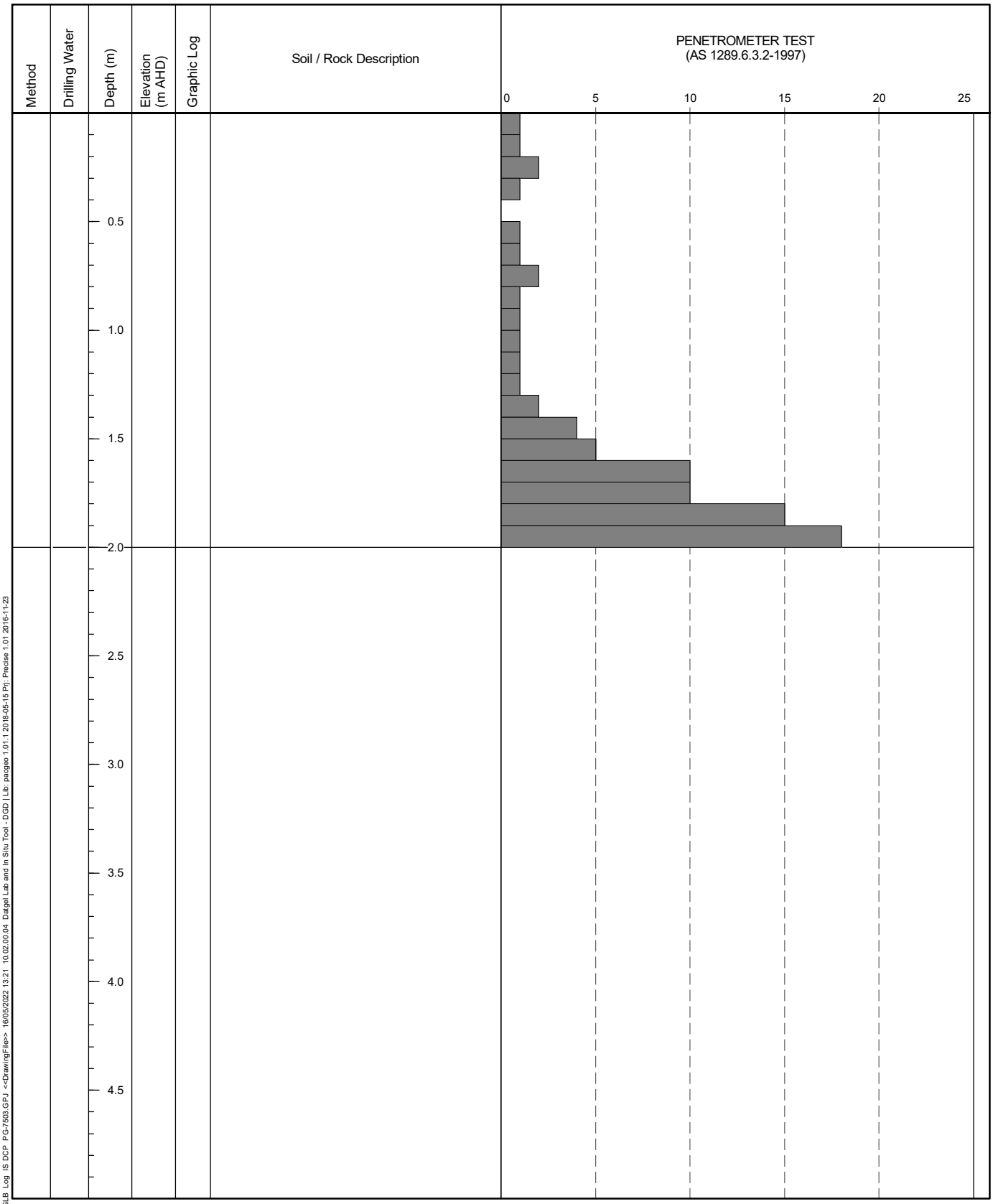
Support
C - Casing

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Pacific Geotech

Hole ID **DCP04**

CLIENT : John Fuglsang Development Pty Ltd	POSITION :	SHEET : 1 OF 1
CONTRACTOR : Pacific Geotech	EASTING :	STATUS : Open
PROJECT : Slope Stability Assessment	NORTHING :	LOGGED BY : SR
LOCATION : 776 Pacific Parade, Currumbin	COORD. SYS. : MGA94 Zone 56	DRILL DATE : 22/04/2022 - 26/04/2022
PROJECT No. : PG-7503	GROUND RL :	



RIG : dcp		CHECKED BY :		REMARK
INCLINATION :		CHECKED DATE :		
AZIMUTH :		APPROVED BY :		
HOLE DIA. :		APPROVED DATE :		

Pacific Geotech

Hole ID **DCP05**

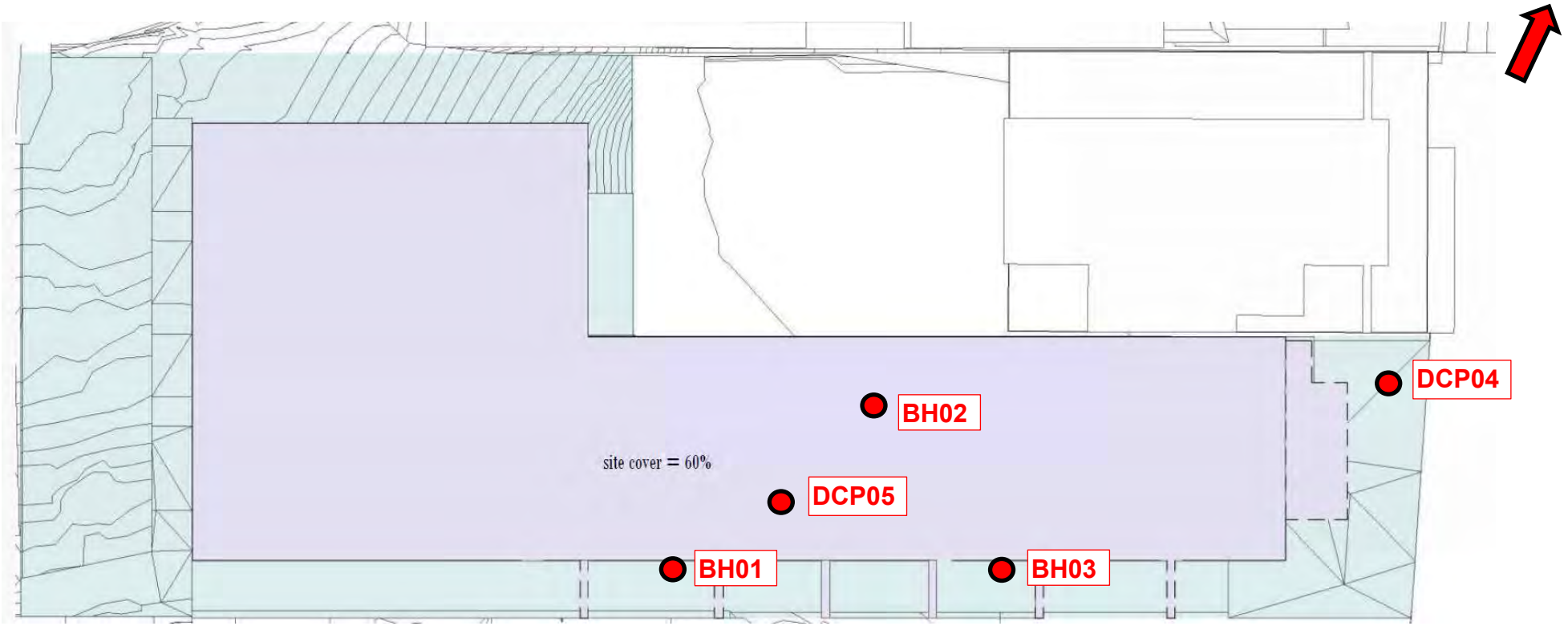
CLIENT	: John Fuglsang Development Pty Ltd	POSITION	:	SHEET	: 1 OF 1
CONTRACTOR	: Pacific Geotech	EASTING	:	STATUS	: Open
PROJECT	: Slope Stability Assessment	NORTHING	:	LOGGED BY	: SR
LOCATION	: 776 Pacific Parade, Currumbin	COORD. SYS.	: MGA94 Zone 56	DRILL DATE	: 22/04/2022 - 26/04/2022
PROJECT No.	: PG-7503	GROUND RL	:		

Method	Drilling Water	Depth (m)	Elevation (m AHD)	Graphic Log	Soil / Rock Description	PENETROMETER TEST (AS 1289.6.3.2-1997)
		0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5				0, 5, 10, 15, 20, 25

RIG	: dcp	CHECKED BY	:	REMARK
INCLINATION	:	CHECKED DATE	:	
AZIMUTH	:	APPROVED BY	:	
HOLE DIA.	:	APPROVED DATE	:	

APPENDIX C

SITE PLAN



Pacific Geotech
Consulting Geotechnical Engineers

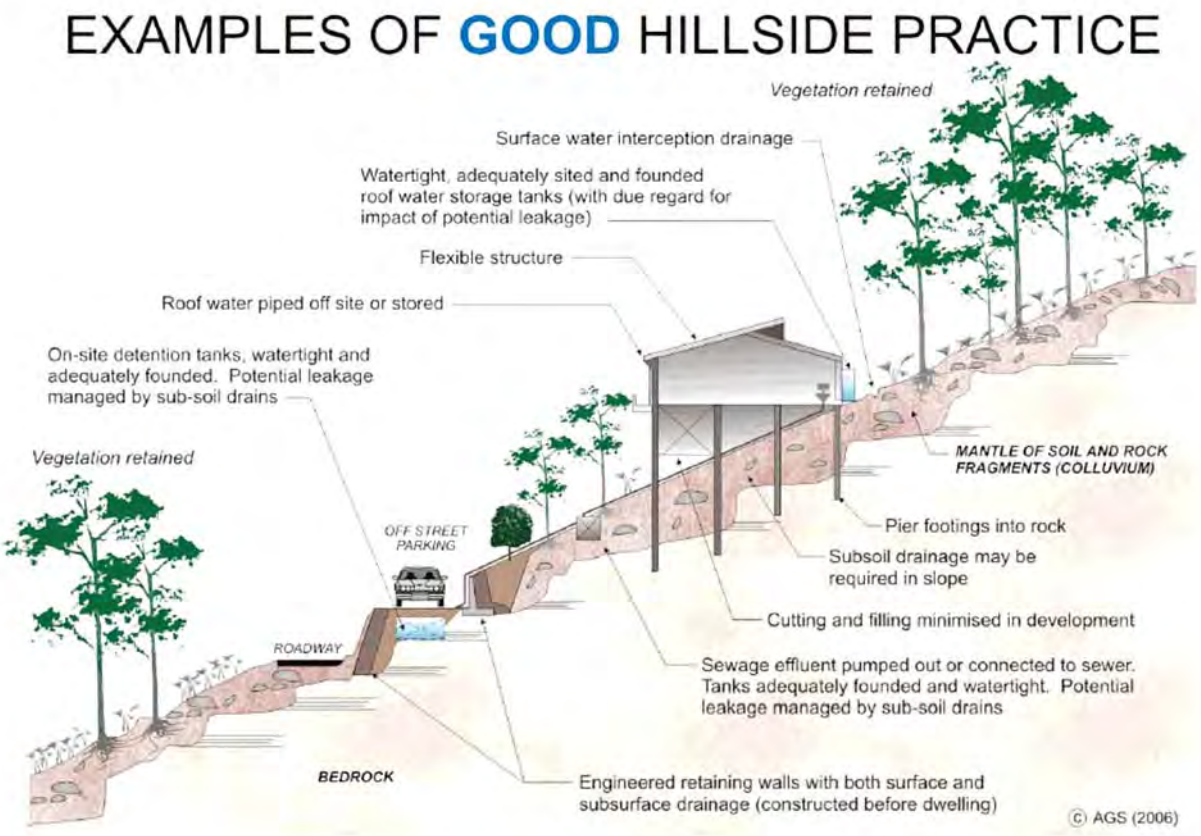
Drawn	Project:	Slope Stability Assessment	Drawing No. PG-7503-02	A4
Date JUN 25	Location:	776 Pacific Parade, Currumbin		
Checked	Client:	John Fuglsang Development Pty Ltd		

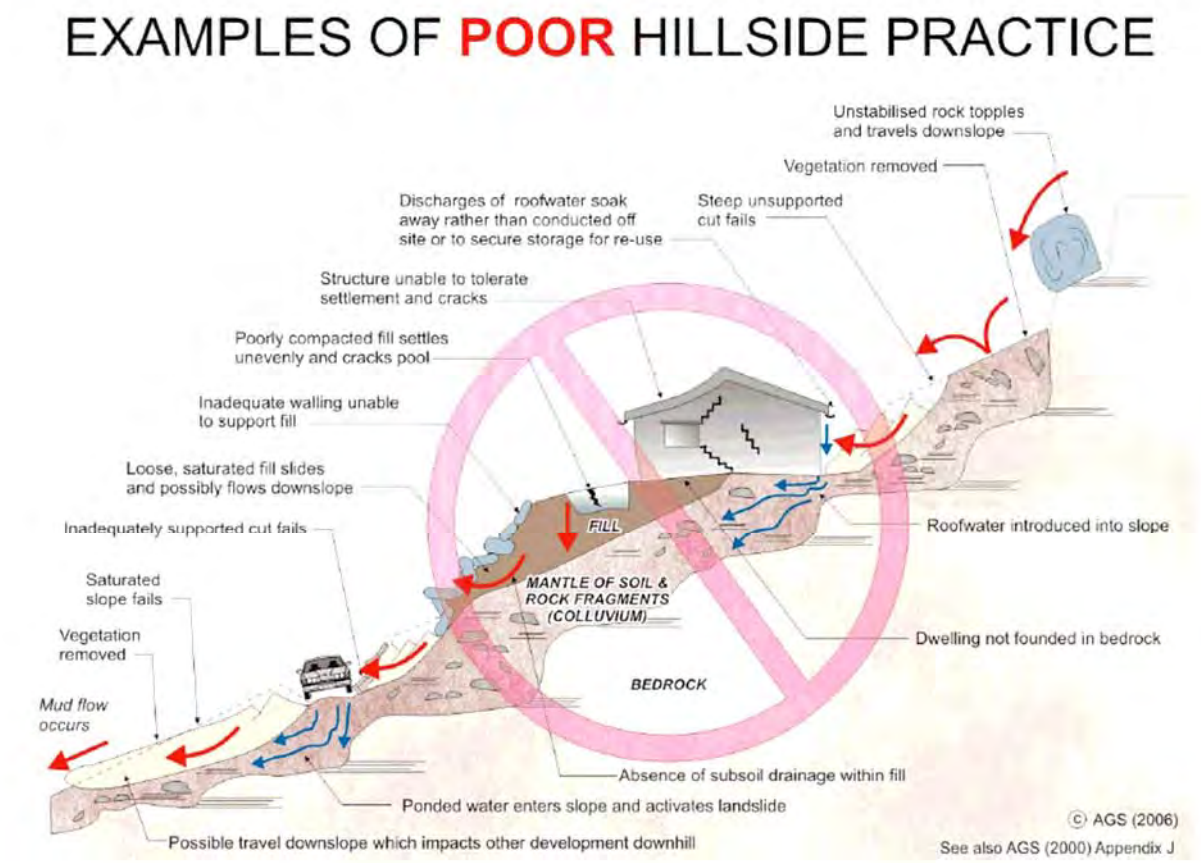
APPENDIX D

GUIDELINES FOR HILLSIDE CONSTRUCTION

APPENDIX G - SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

	GOOD ENGINEERING PRACTICE	*POOR ENGINEERING PRACTICE*
ADVICE		
GEOTECHNICAL ASSESSMENT	Obtain advice from a qualified, experienced geotechnical practitioner at early stage of planning and before site works.	Prepare detailed plan and start site works before geotechnical advice.
PLANNING		
SITE PLANNING	Having obtained geotechnical advice, plan the development with the risk arising from the identified hazards and consequences in mind.	Plan development without regard for the Risk.
DESIGN AND CONSTRUCTION		
HOUSE DESIGN	Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.	Floor plans which require extensive cutting and filling. Movement intolerant structures.
SITE CLEARING	Retain natural vegetation wherever practicable.	Indiscriminately clear the site.
ACCESS & DRIVEWAYS	Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.	Excavate and fill for site access before geotechnical advice.
EARTHWORKS	Retain natural contours wherever possible.	Indiscriminatory bulk earthworks.
CUTS	Minimise depth. Support with engineered retaining walls or batter to appropriate slope. Provide drainage measures and erosion control.	Large scale cuts and benching. Unsupported cuts. Ignore drainage requirements
FILLS	Minimise height. Strip vegetation and topsoil and key into natural slopes prior to filling. Use clean fill materials and compact to engineering standards. Batter to appropriate slope or support with engineered retaining wall. Provide surface drainage and appropriate subsurface drainage.	Loose or poorly compacted fill, which if it fails, may flow a considerable distance including onto property below. Block natural drainage lines. Fill over existing vegetation and topsoil. Include stumps, trees, vegetation, topsoil, boulders, building rubble etc in fill.
ROCK OUTCROPS & BOULDERS	Remove or stabilise boulders which may have unacceptable risk. Support rock faces where necessary.	Disturb or undercut detached blocks or boulders.
RETAINING WALLS	Engineer design to resist applied soil and water forces. Found on rock where practicable. Provide subsurface drainage within wall backfill and surface drainage on slope above. Construct wall as soon as possible after cut/fill operation.	Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork. Lack of subsurface drains and weepholes.
FOOTINGS	Found within rock where practicable. Use rows of piers or strip footings oriented up and down slope. Design for lateral creep pressures if necessary. Backfill footing excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulders or undercut cliffs.
SWIMMING POOLS	Engineer designed. Support on piers to rock where practicable. Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.	
DRAINAGE		
SURFACE	Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. Provide general falls to prevent blockage by siltation and incorporate silt traps. Line to minimise infiltration and make flexible where possible. Special structures to dissipate energy at changes of slope and/or direction.	Discharge at top of fills and cuts. Allow water to pond on bench areas.
SUBSURFACE	Provide filter around subsurface drain. Provide drain behind retaining walls. Use flexible pipelines with access for maintenance. Prevent inflow of surface water.	Discharge roof runoff into absorption trenches.
SEPTIC & SULLAGE	Usually requires pump-out or mains sewer systems; absorption trenches may be possible in some areas if risk is acceptable. Storage tanks should be water-tight and adequately founded.	Discharge sullage directly onto and into slopes. Use absorption trenches without consideration of landslide risk.
EROSION CONTROL & LANDSCAPING	Control erosion as this may lead to instability. Revegetate cleared area.	Failure to observe earthworks and drainage recommendations when landscaping.
DRAWINGS AND SITE VISITS DURING CONSTRUCTION		
DRAWINGS	Building Application drawings should be viewed by geotechnical consultant	
SITE VISITS	Site Visits by consultant may be appropriate during construction/	
INSPECTION AND MAINTENANCE BY OWNER		
OWNER'S RESPONSIBILITY	Clean drainage systems; repair broken joints in drains and leaks in supply pipes. Where structural distress is evident see advice. If seepage observed, determine causes or seek advice on consequences.	


EXAMPLES OF GOOD HILLSIDE PRACTICE
Vegetation retained
Surface water interception drainage
Watertight, adequately sited and founded roof water storage tanks (with due regard for impact of potential leakage)
Flexible structure
Roof water piped off site or stored
On-site detention tanks, watertight and adequately founded. Potential leakage managed by sub-soil drains
Vegetation retained
MANTLE OF SOIL AND ROCK FRAGMENTS (COLLUVIUM)
OFF STREET PARKING
Pier footings into rock
Subsoil drainage may be required in slope
Cutting and filling minimised in development
ROADWAY
Sewage effluent pumped out or connected to sewer. Tanks adequately founded and watertight. Potential leakage managed by sub-soil drains
BEDROCK
Engineered retaining walls with both surface and subsurface drainage (constructed before dwelling)
© AGS (2006)


EXAMPLES OF POOR HILLSIDE PRACTICE
Unstabilised rock topples and travels downslope
Vegetation removed
Discharges of roofwater soak away rather than conducted off site or to secure storage for re-use
Steep unsupported cut fails
Structure unable to tolerate settlement and cracks
Poorly compacted fill settles unevenly and cracks pool
Inadequate walling unable to support fill
Loose, saturated fill slides and possibly flows downslope
Inadequately supported cut fails
FILL
Roofwater introduced into slope
Saturated slope fails
MANTLE OF SOIL & ROCK FRAGMENTS (COLLUVIUM)
Vegetation removed
Dwelling not founded in bedrock
BEDROCK
Mud flow occurs
Absence of subsoil drainage within fill
Ponded water enters slope and activates landslide
Possible travel downslope which impacts other development downhill
© AGS (2006)
See also AGS (2000) Appendix J

APPENDIX E

STANDARD PROFORMA FOR GEOTECHNICAL CERTIFICATION AND LANDSLIDE SUSCEPTIBILITY ANALYSIS FORM

Standard Pro-forma for Geotechnical Certification

City of Gold Coast Council file reference:

PROPOSED WORKS AT (LOCATION): **776 Pacific Parade, Currumbin**

for (proposed development): **Proposed New Residence**

I, Peter ELKINGTON, RPEQ No. 7226, of Pacific Geotech Pty Limited (Consulting Engineers), being duly authorised on this behalf, do certify that:-

The Lot at 776 Pacific Parade, Currumbin has achieved a Landslide Susceptibility Rating of 'Low' or better for the long term (70 years minimum) and will therefore be sustainable and not cause any adverse effects on the stability and integrity of the neighbouring buildings, properties, utility services and infrastructures providing the advice and construction recommendations made in the Pacific Geotech report "Amended Geotechnical Investigation and Slope Stability Assessment For Proposed Residence – 776 Pacific Parade, Currumbin" dated 12th June 2025 Job No. PG-7503 have been followed and implemented and that no other development adversely affects the subject development.

I am aware that the City of Gold Coast Council will rely upon this certificate and any associated geotechnical reports, maps, graphs, tables, attachments etc. produced as a consequence of commissioning this development proposal.

Signed: **PETER ELKINGTON (RPEQ No. 7226)**

Designation: **GEOTECHNICAL ENGINEER**

Certified this: **Twelfth Day of June, 2025.**

LANDSLIDE SUSCEPTIBILITY ANALYSIS FORM

1	Natural Slope Surface		
Site		Level	Factor
○	Less than 5 degrees	L	0.1
○	Between 5 and 15 degrees	M	0.5
◉	Between 15 and 30 degrees	M	0.8
○	Between 30 and 45 degrees	H	1.2
○	More than 45 degrees	M	1.5
○	Custom		0.6

2	Slope Shape		
Site		Level	Factor
○	Crest or ridge	L	0.7
◉	Planar / Convex	M	0.9
○	Rough / Irregular	H	1.2
○	Concave	H	1.5
○	Custom		1

3	Site Geology		
Site		Level	Factor
○	Volcanic Extrusive Rock	H	1.1
◉	Sedimentary Rock	M	1
○	Low Grade Metamorphic Rock	M	1
○	High Grade Metamorphic Rock	L	0.9
○	Volcanic Intrusive Rock	M	1
○	Custom		1

4	Soils		
Site		Level	Factor
○	Rock at Surface	VL	0.1
◉	Residual Soil < 1m deep	L	0.5
○	Residual Soil 1-3m deep	M	0.9
○	Residual Soil >3m deep	H	1.5
○	Colluvial Soil < 1m deep	H	1.5
○	Colluvial Soil 1-3m deep	VH	2
○	Colluvial Soil >3m deep	VH	4
○	Custom		1

5	Fill Height		
Site		Level	Factor
○	None	L	1
○	Less than 1m	M	1.1
◉	Between 1 and 3m	M	1.3
○	Between 3 and 6m	H	1.7
○	More than 6m	VH	2.5
○	Custom		1.4

6	Evidence of Groundwater		
Site		Level	Factor
◉	None apparent	L	0.7
○	Minor moistness	M	0.9
○	Generally wet	H	1.5
○	Surface springs	VH	3
○	Custom		0.7

7	Cut Height		
Site		Level	Factor
◉	None (Go to Section 11)	L	1
○	Less than 1m	M	1.1
○	Between 1 and 3m	M	1.3
○	Between 3 and 6m	H	1.7
○	More than 6m	VH	2.5
○	Custom		2.5

8	Slope of Cut Face		
Site		Level	Factor
◉	NA	NA	1
○	Less than 30 degrees	L	0.5
○	Between 30 and 45 degrees	M	1
○	Between 45 and 60 degrees	H	1.5
○	More than 60 degrees	VH	3
○	Custom		1.5

9	Material in Cutting		
Site		Level	Factor
◉	NA	NA	1
○	High Strength Rock	L	0.5
○	Medium Strength Rock	L	1
○	Low Strength Rock	M	1.2
○	Very Low Strength Rock and Soil	V	1.5
○	Soil	VH	2
○	Custom		1

10	Cut Slope Support		
Site		Level	Factor
◉	NA	NA	1
○	Concrete Wall	L	0.5
○	Crib Wall	M	0.9
○	Gabion Wall	M	1
○	Rock Wall	H	1.5
○	Unsupported	H	2
○	Custom		1

11	Concentration of Surface Water		
Site		Level	Factor
○	Ridge	L	0.7
○	Crest	M	0.8
◉	Upper Slope	M	0.9
○	Mid Slope	H	1.2
○	Lower Slope	H	1.5
○	Custom		1

12	Wastewater Disposal		
Site		Level	Factor
◉	Fully Sewered	M	1
○	Onsite disposal - Surface	M	1.2
○	Onsite disposal - Soak Pits / Trenches	H	1.5
○	Custom		1

13	Stormwater Disposal		
Site		Level	Factor
◉	All stormwater piped into road drainage	L	0.7
○	Rain water tanks with overflows	M	1
○	Stormwater Discharge on site	H	1.5
○	Custom		1

14	Evidence of Instability		
Site		Level	Factor
○	No sign of instability	L	0.8
◉	Soil Creep	H	1.2
○	Minor irregularity	VH	2
○	Major irregularity	VH	5
○	Active instabilty	VH	10
○	Custom		1

Summary

			Factor
1	**Natural Slope Surface**	3	0.8
2	**Slope Shape**	2	0.9
3	**Site Geology**	2	1
4	**Soils**	2	0.5
5	**Fill Height**	3	1.3
6	**Evidence of Groundwater**	1	0.7
7	**Cut Height**	1	1
8	**Slope of Cut Face**	1	1
9	**Material in Cutting**	1	1
10	**Cut Slope Support**	1	1
11	**Concentration of Surface Water**	3	0.9
12	**Wastewater Disposal**	1	1
13	**Stormwater Disposal**	1	0.7
14	**Evidence of Instability**	2	1.2
			0.2477

APPENDIX F

ENGINEERING DRAWINGS

prominent aspect - adjacent walkway

frida beach

aspect - woodgee st/ pacific parade walkway

frida beach

adjacent 754 pacific parade

adjacent 762 pacific parade

adjacent 778 pacific parade

adjacent 785 pacific parade

aspect - currumbin beach walkway montages

frida beach

vikings

north east

north

elevated south east

aspect - currumbin hill montages

frida beach

currumbin hill

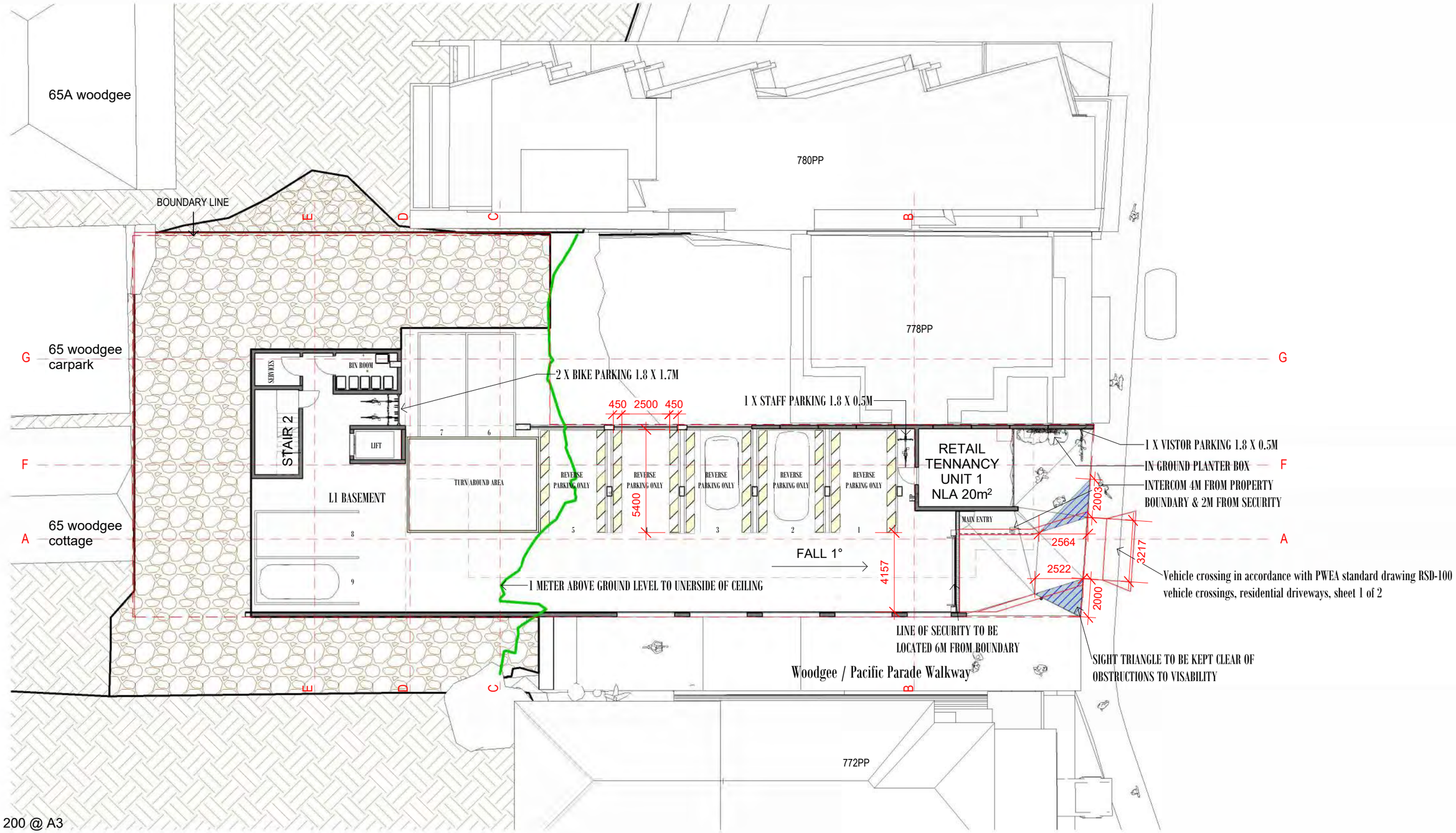
frida beach

garage

65A woodgee

aspect - 776 detailed views

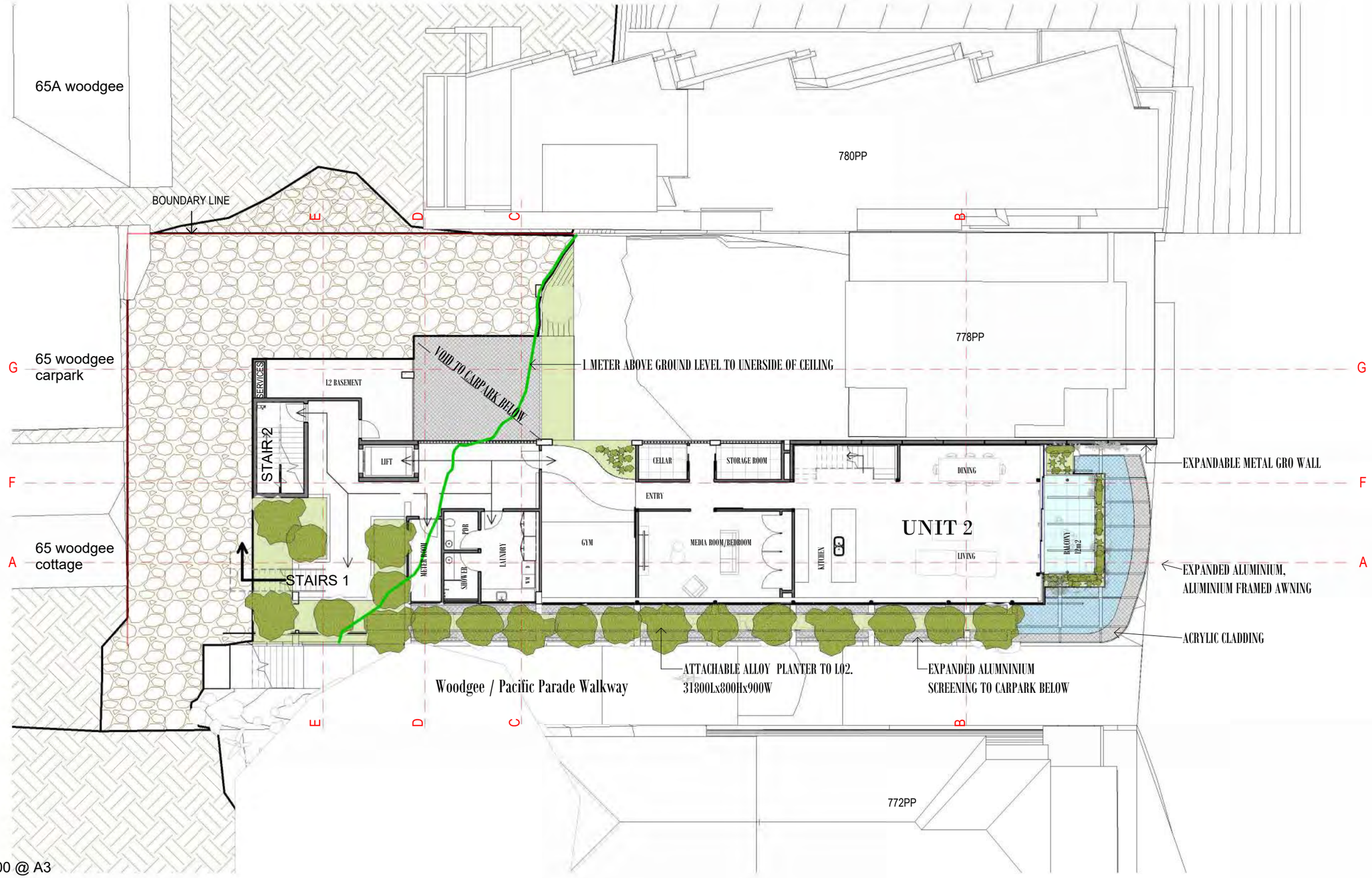
frida beach



1 : 200 @ A3

level 01 carpark

frida beach



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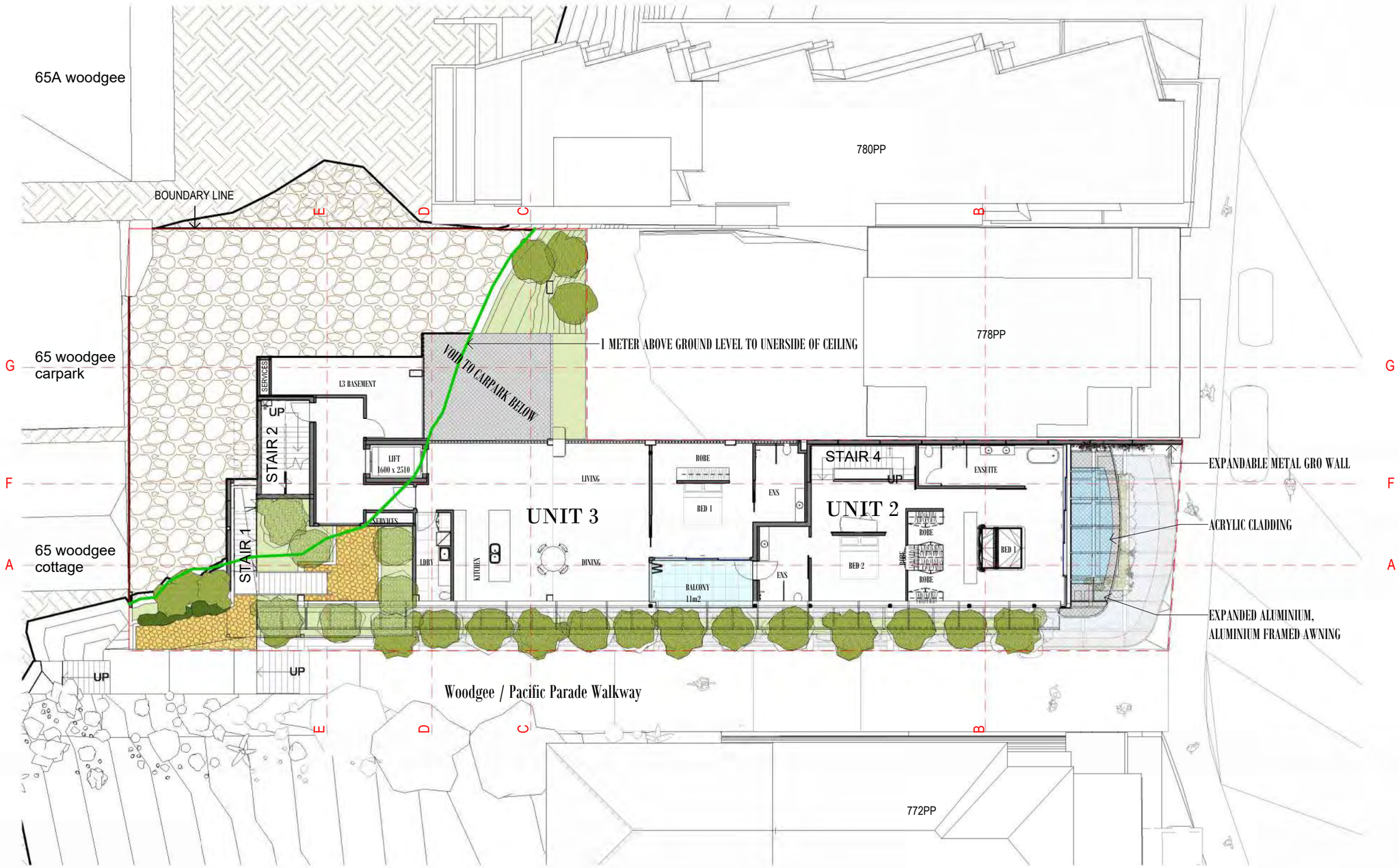
level 02



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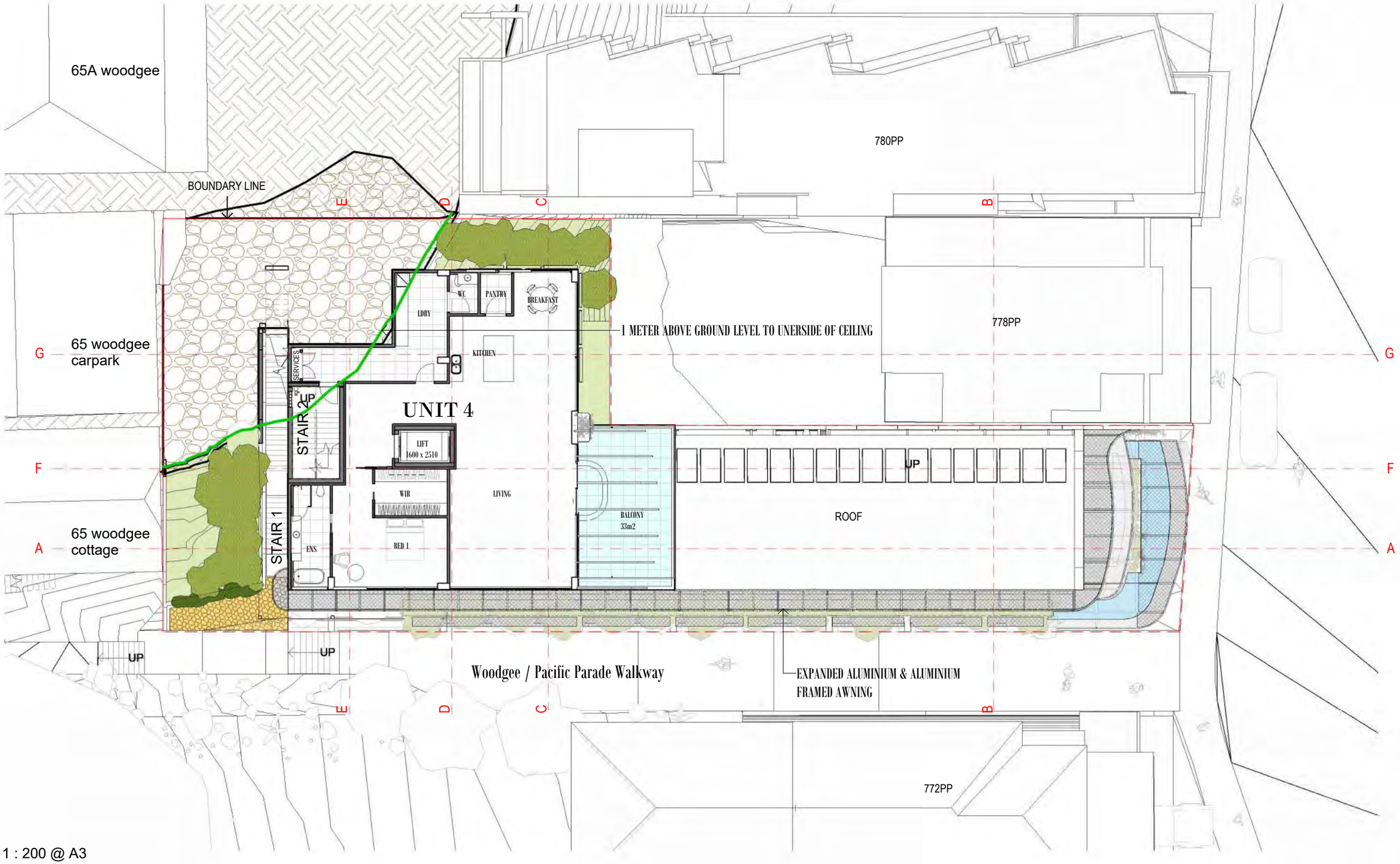
level 03



1 : 200 @ A3

level 04

65A woodgee

BOUNDARY LINE

65 woodgee
carpark

65 woodgee
cottage

BALCONY
12.5m2

LDRY

ENS

BED 1

WIR

SERVICES

KITCHEN

UNIT 5

STAIR 2

LIFT
1600 x 2510

DINING

WIR

STAIR 1

ENS

BED 2

LIVING

EXPANDED ALUMINIUM,
ALUMINIUM FRAMED ANWING

UP

UP

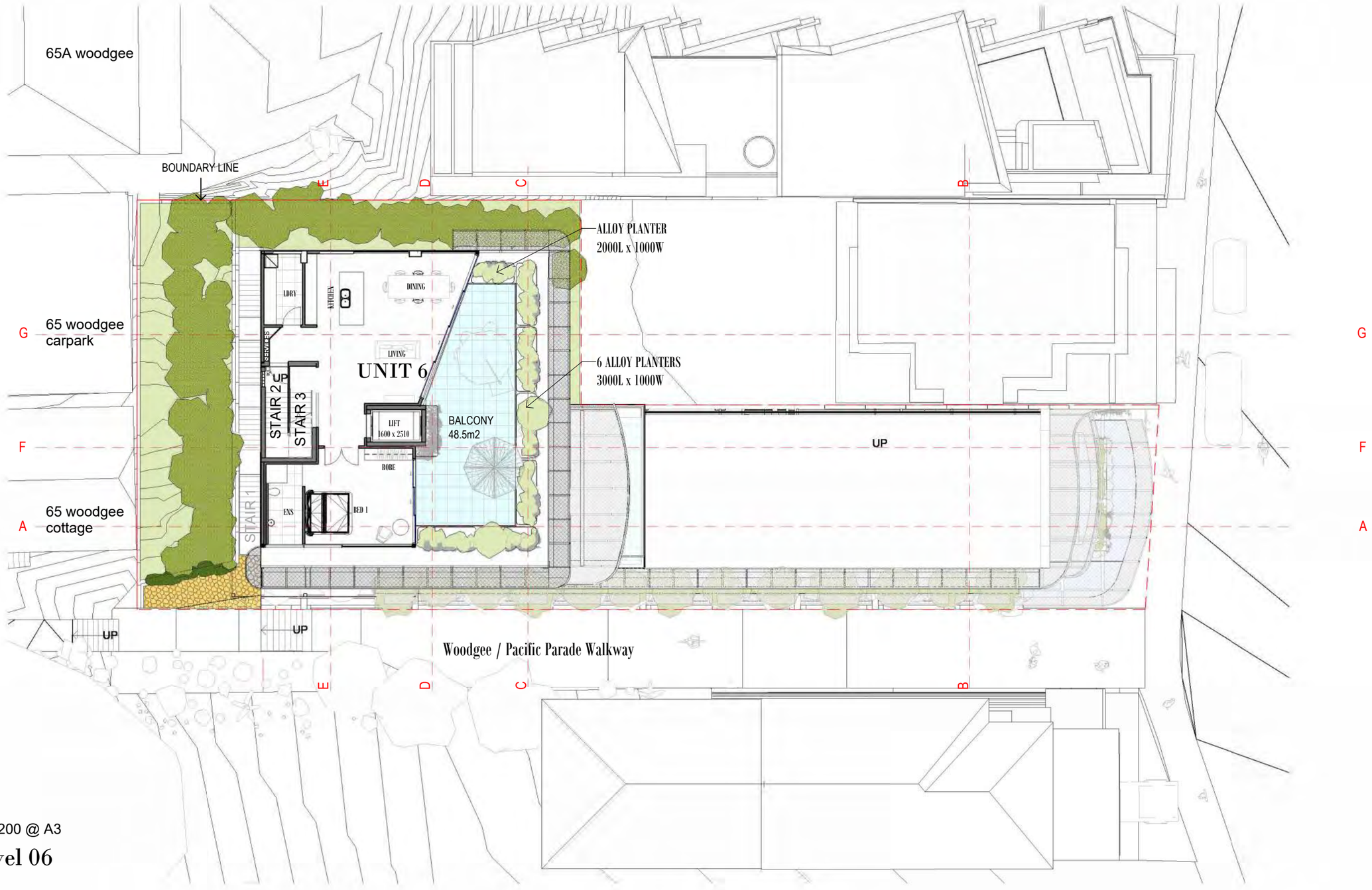
UP

Woodgee / Pacific Parade Walkway

1 : 200 @ A3

level 05

frida beach



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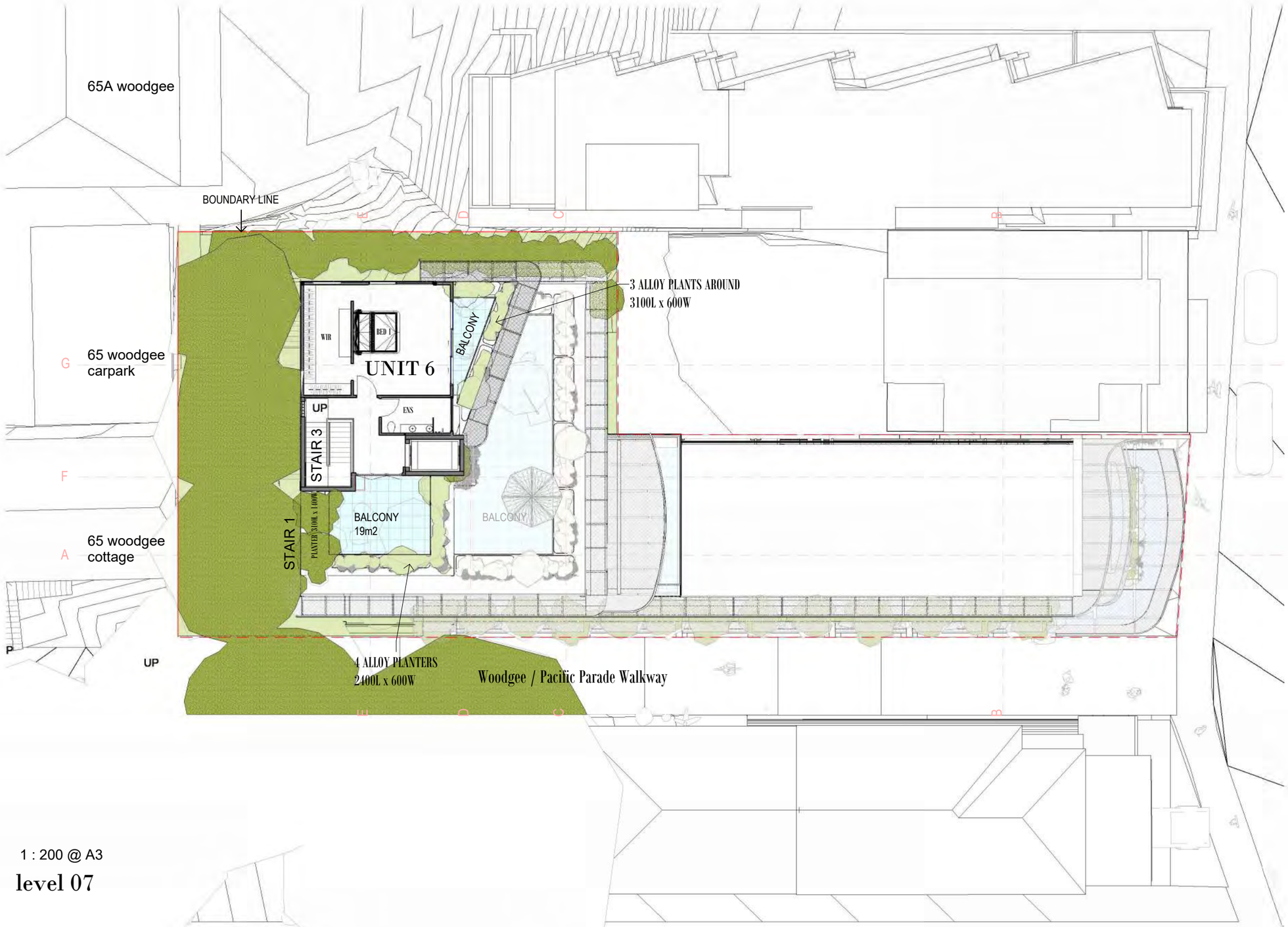
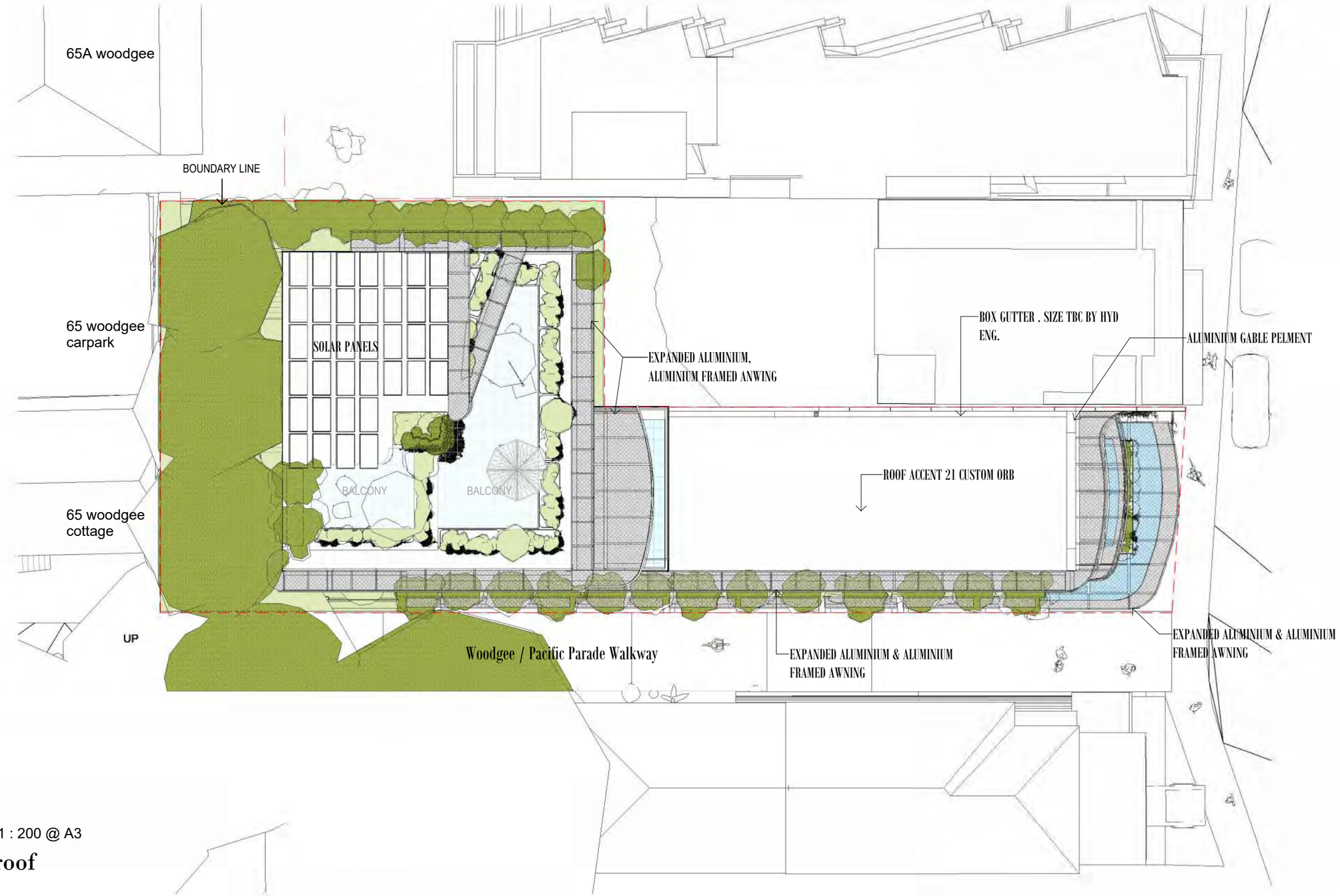
level 06



1 : 200 @ A3

level 07

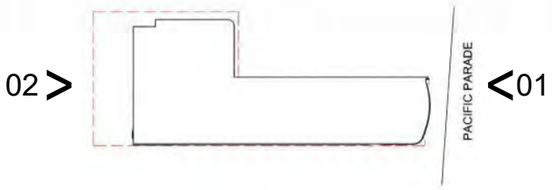
frida beach

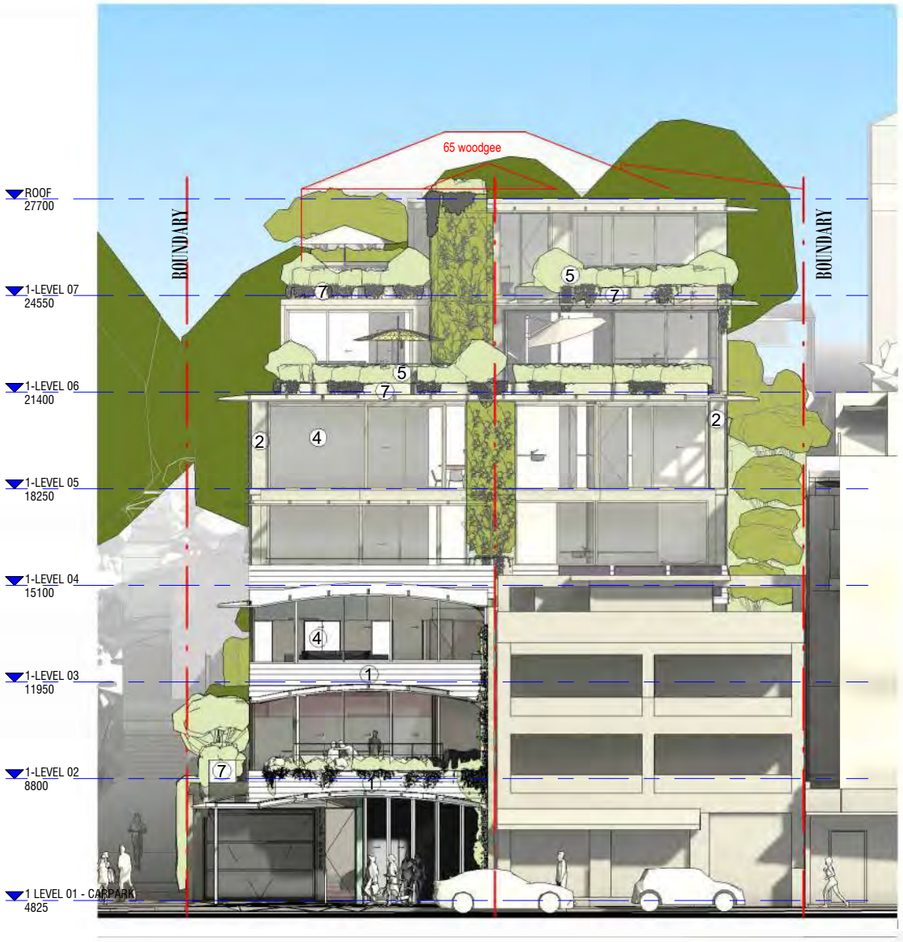


1 : 200 @ A3

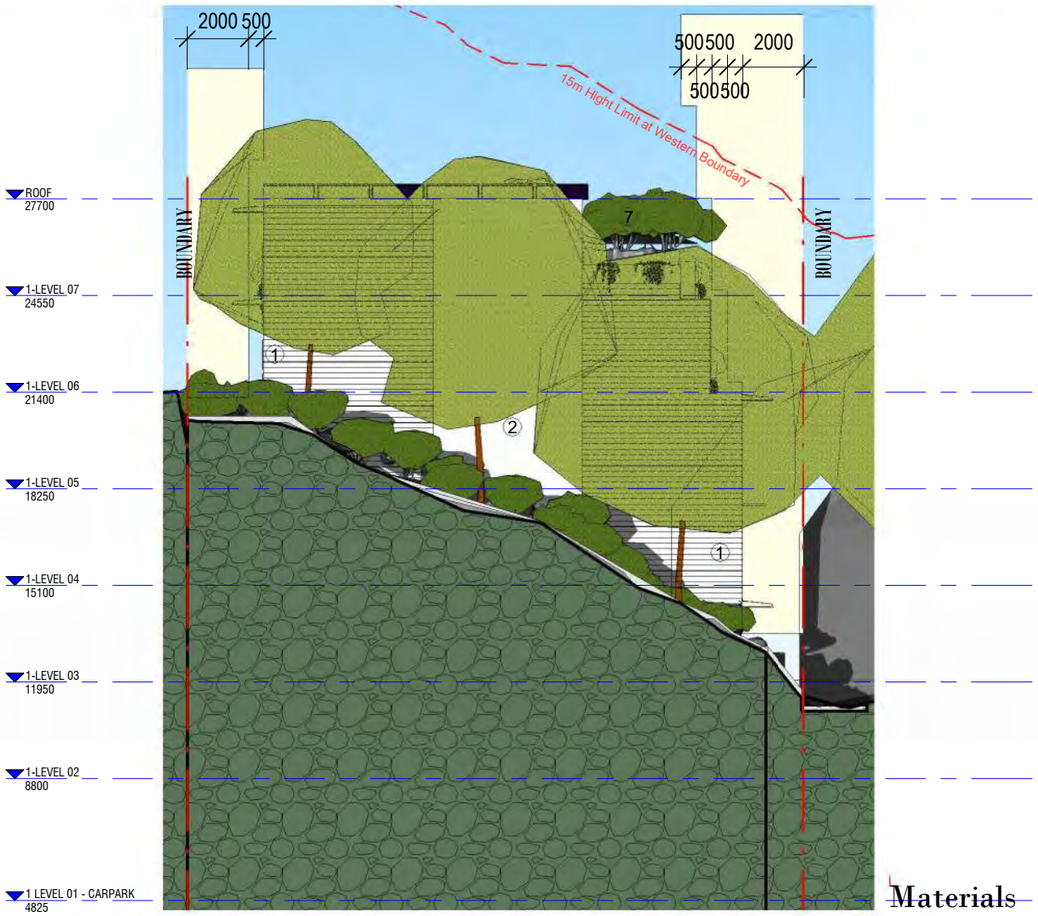
roof

frida beach





01 Pacific Parade - East



02 West

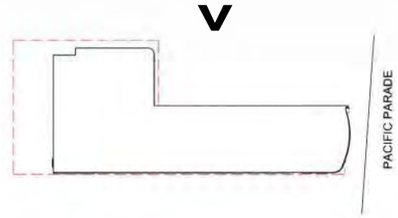
Materials

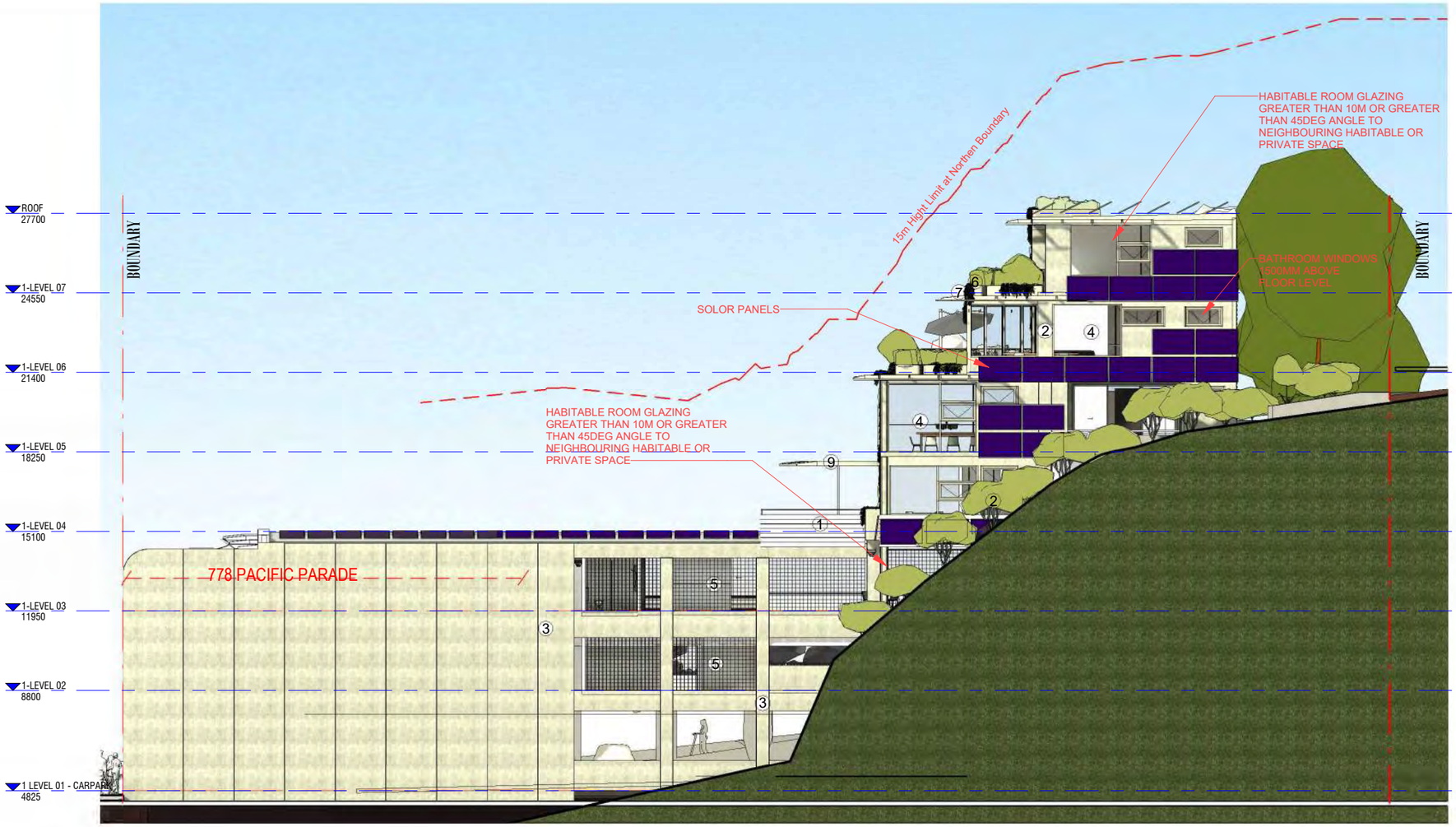
1. weatherboards - y34 hue
2. concrete - n32 hue,textured
3. concrete - y34 hue
4. glazing
5. glass blocks transulent - fire rated
6. glass balustrade
7. Al planter boxes
8. ceiling / grow wall - expanded Al
9. canopy - trafficable expanded Al

1 : 200 @ A3

elevations east + west

frida beach





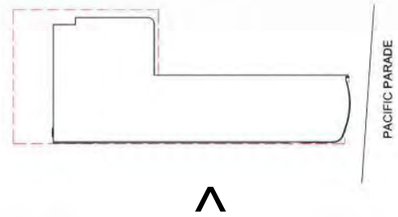
Materials

1. weatherboards - y34 hue
2. concrete - n32 hue,textured
3. concrete - y34 hue
4. glazing
5. glass blocks transulent - fire rated
6. glass balustrade
7. Al planter boxes
8. ceiling / grow wall - expanded Al
9. canopy - trafficable expanded Al

1 : 200 @ A3

elevation north

frida beach



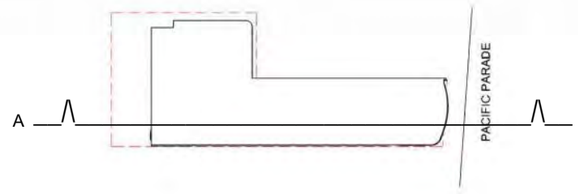
Materials

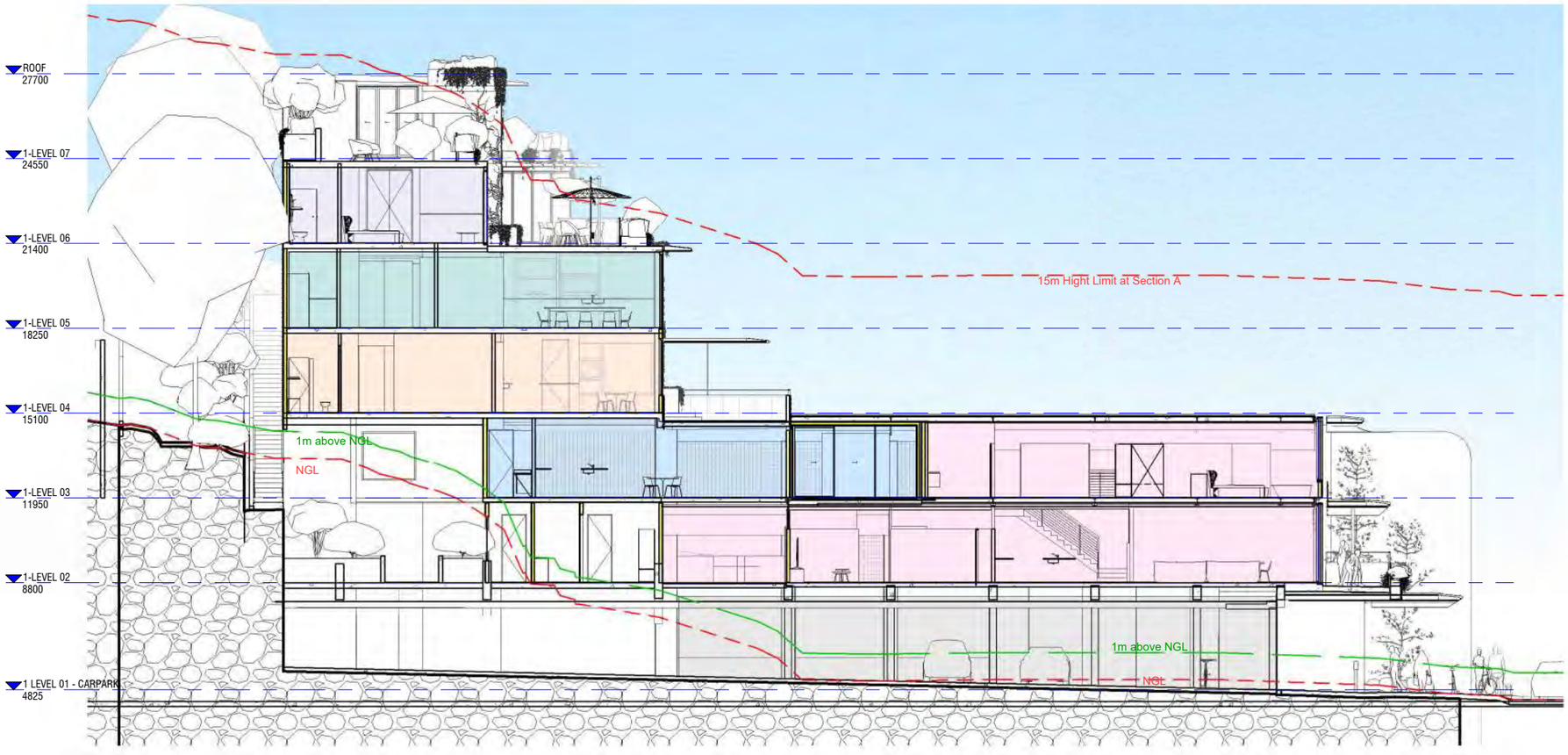
1. weatherboards - y34 hue
2. concrete - n32 hue,textured
3. concrete - y34 hue
4. glazing
5. glass blocks transulent - fire rated
6. glass balustrade
7. Al planter boxes
8. ceiling / grow wall - expanded Al
9. canopy - trafficable expanded Al

1 : 200 @ A3

elevation south

frida beach



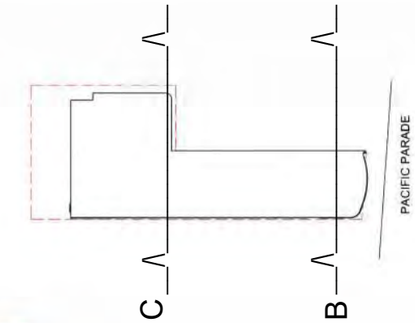


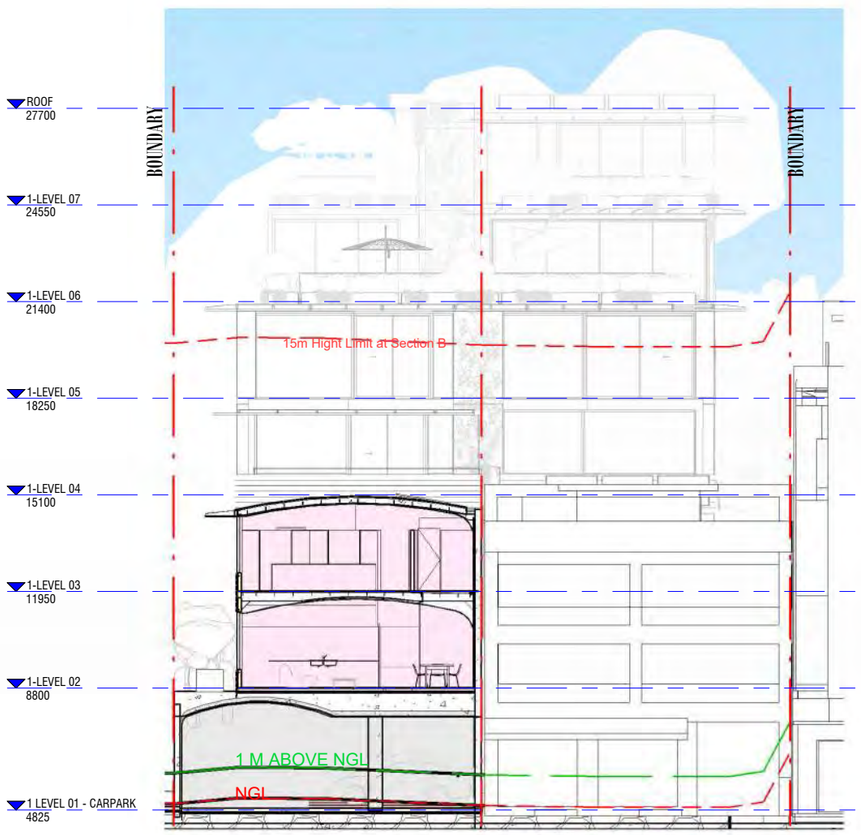
BELOW GROUND & NON STOREY SPACE
RETAIL TENNANCY
GARAGE
UNIT 2
UNIT 3
UNIT 4
UNIT 5
UNIT 6

1 : 200 @ A3

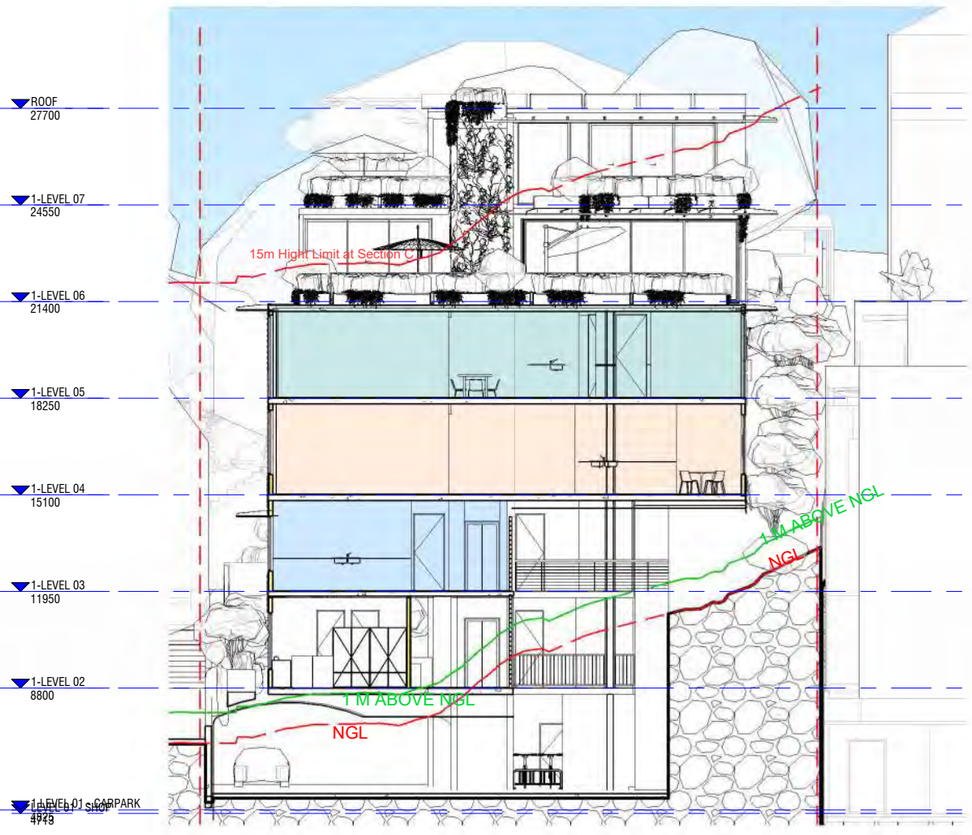
section A

frida beach





SECTION B



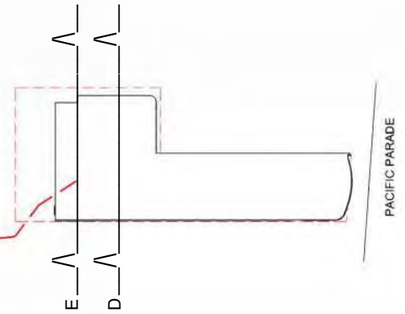
SECTION C

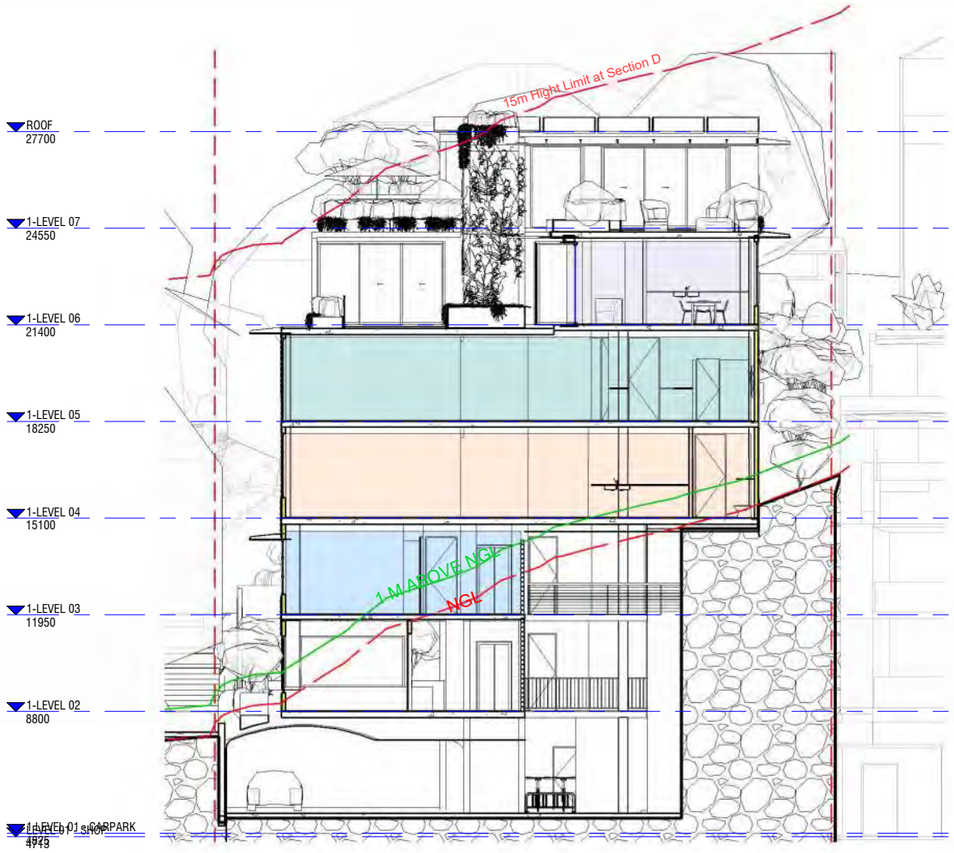
BELOW GROUND & NON STOREY SPACE
RETAIL TENNANCY
GARAGE
UNIT 2
UNIT 3
UNIT 4
UNIT 5
UNIT 6

1 : 200 @ A3

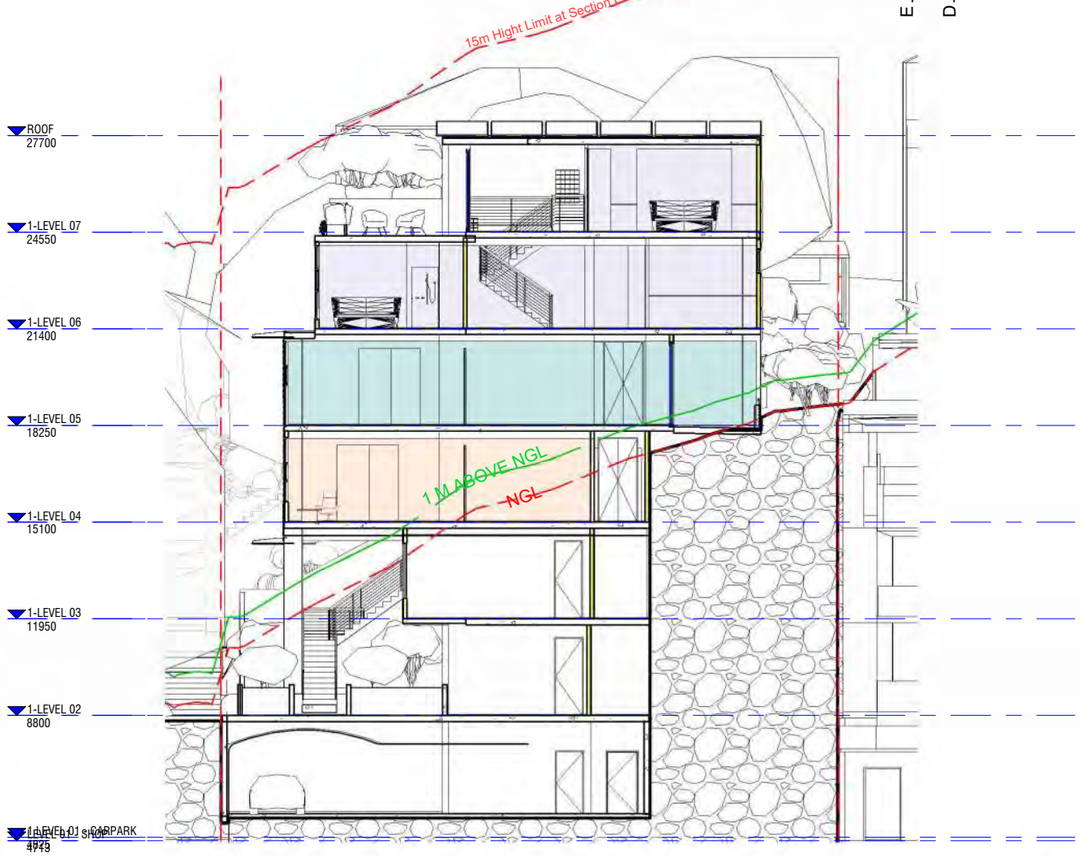
section B + C

frida beach





SECTION D



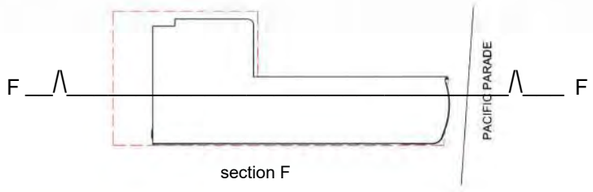
SECTION E

BELOW GROUND & NON STOREY SPACE
RETAIL TENNANCY
GARAGE
UNIT 2
UNIT 3
UNIT 4
UNIT 5
UNIT 6

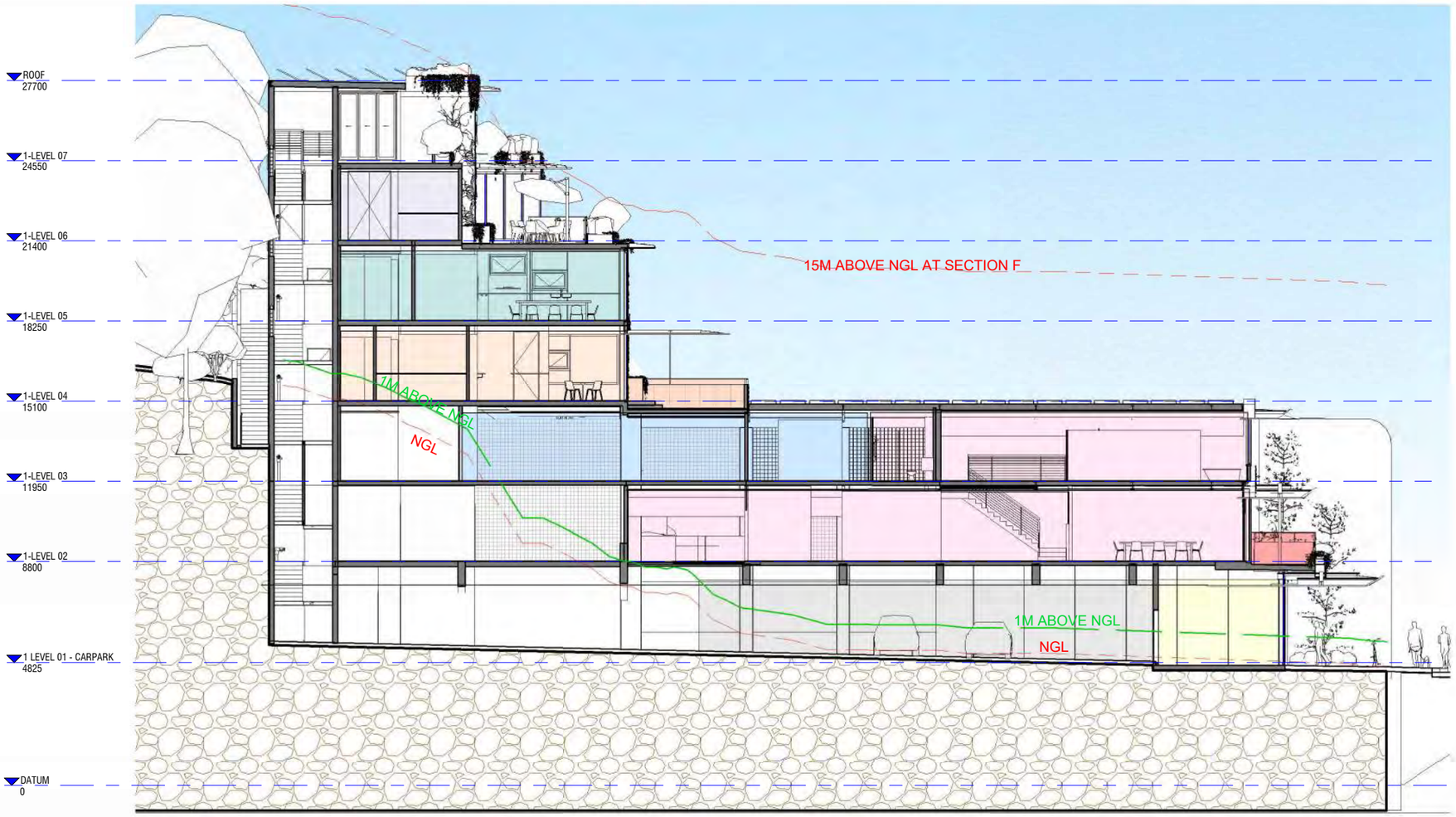
1 : 200 @ A3

section D + E

frida beach



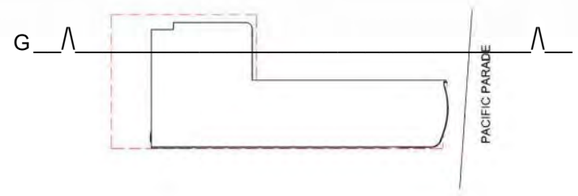
section F

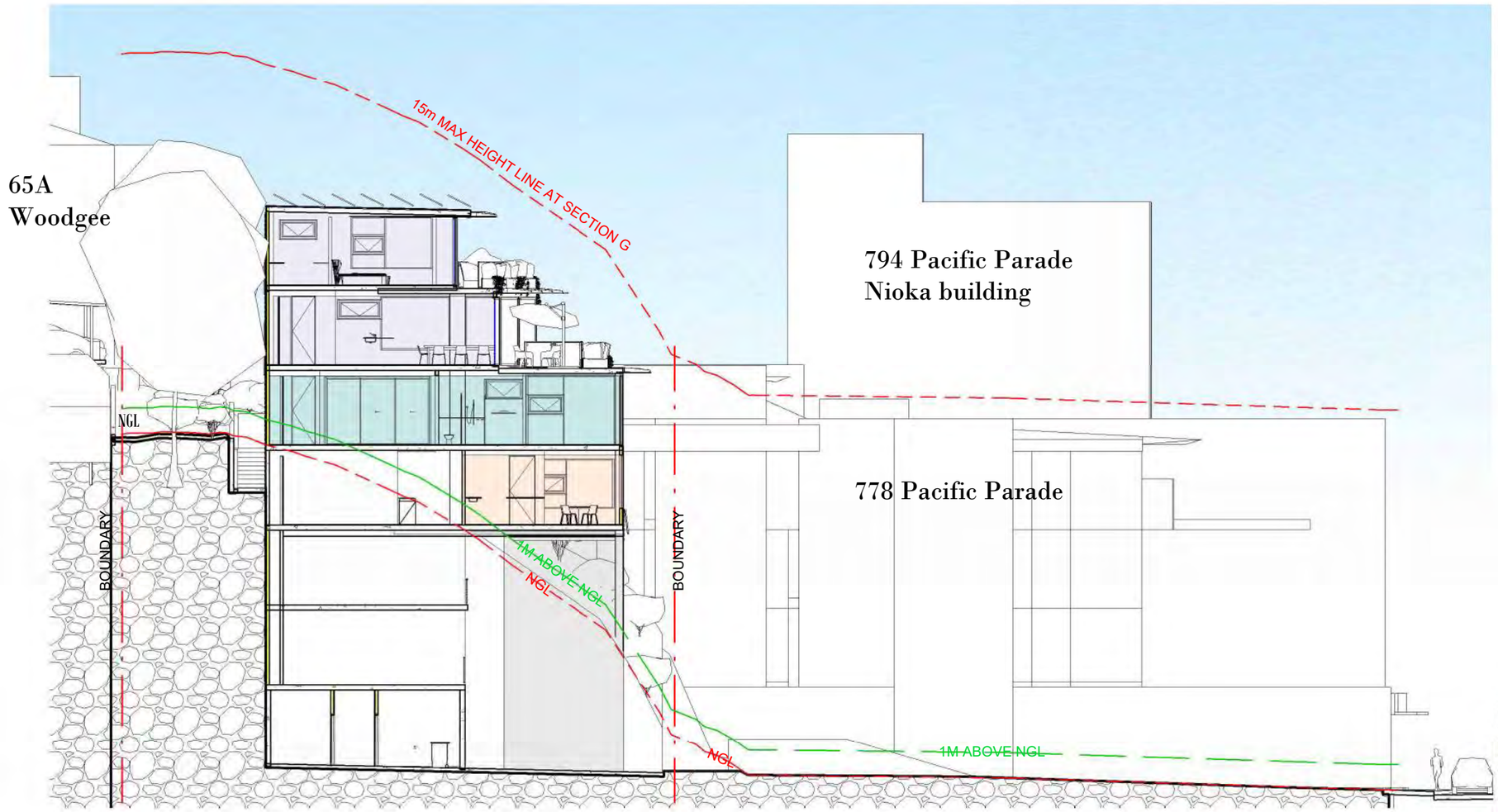


1 : 200 @ A3

section F

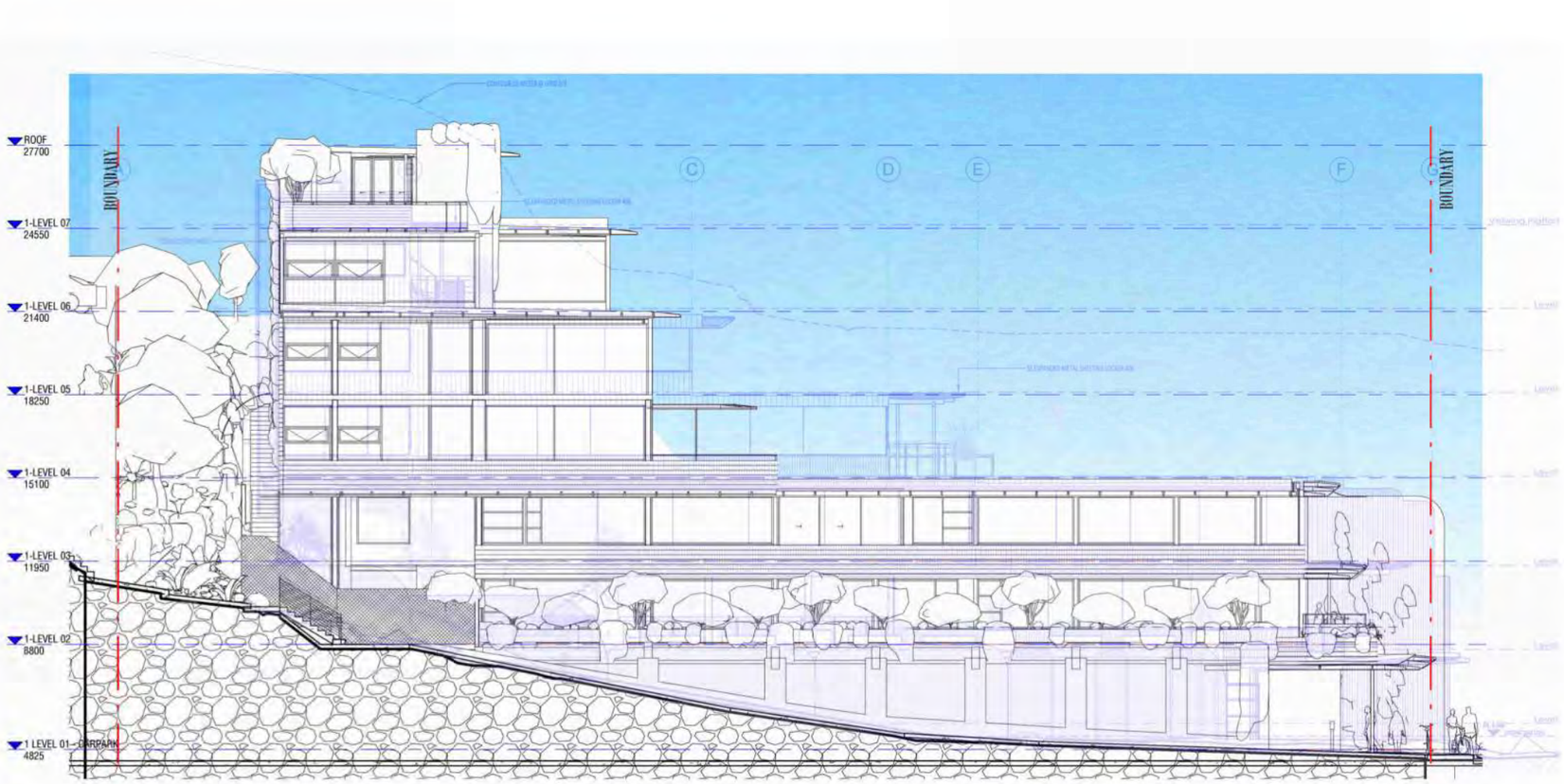
frida beach





1 : 200 @ A3

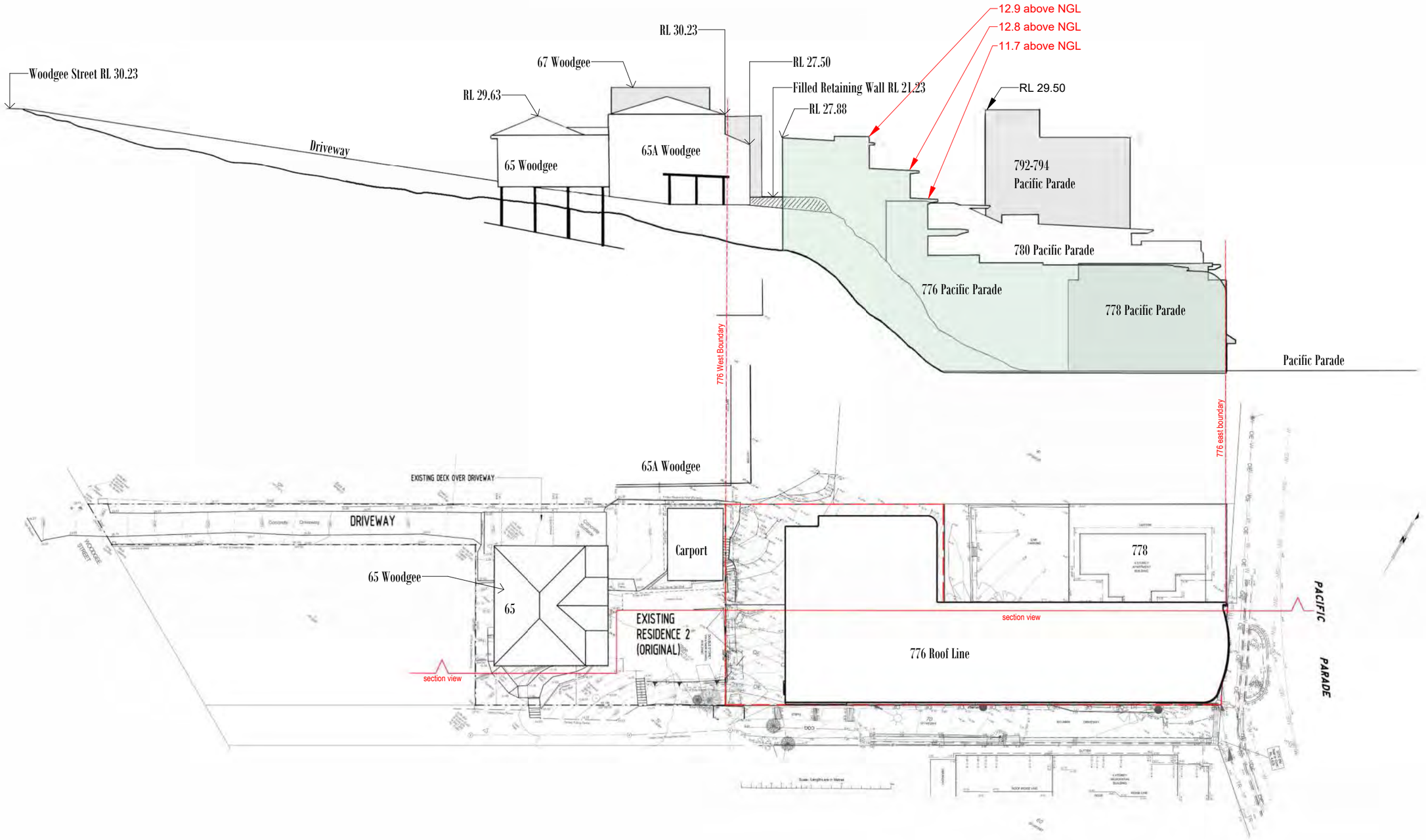
section G



@ A3

Approved DA overlay

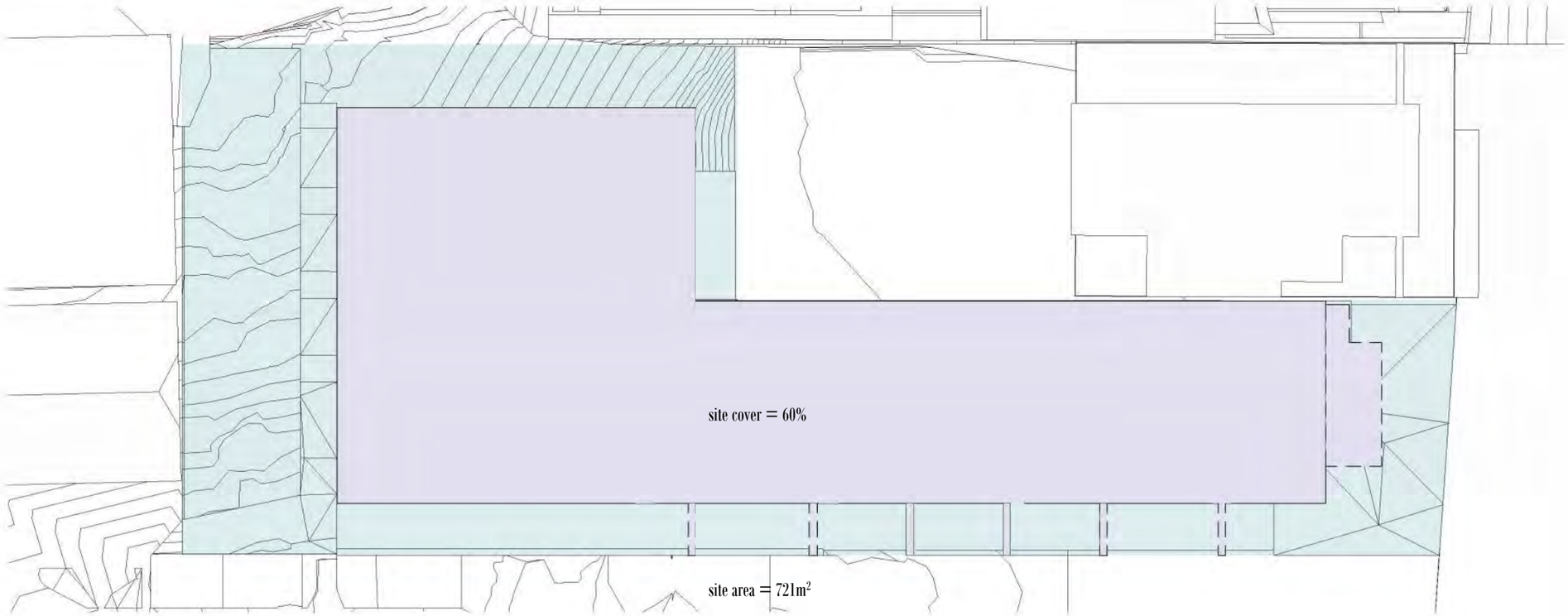
frida beach



1 : 400 @ A3

context section

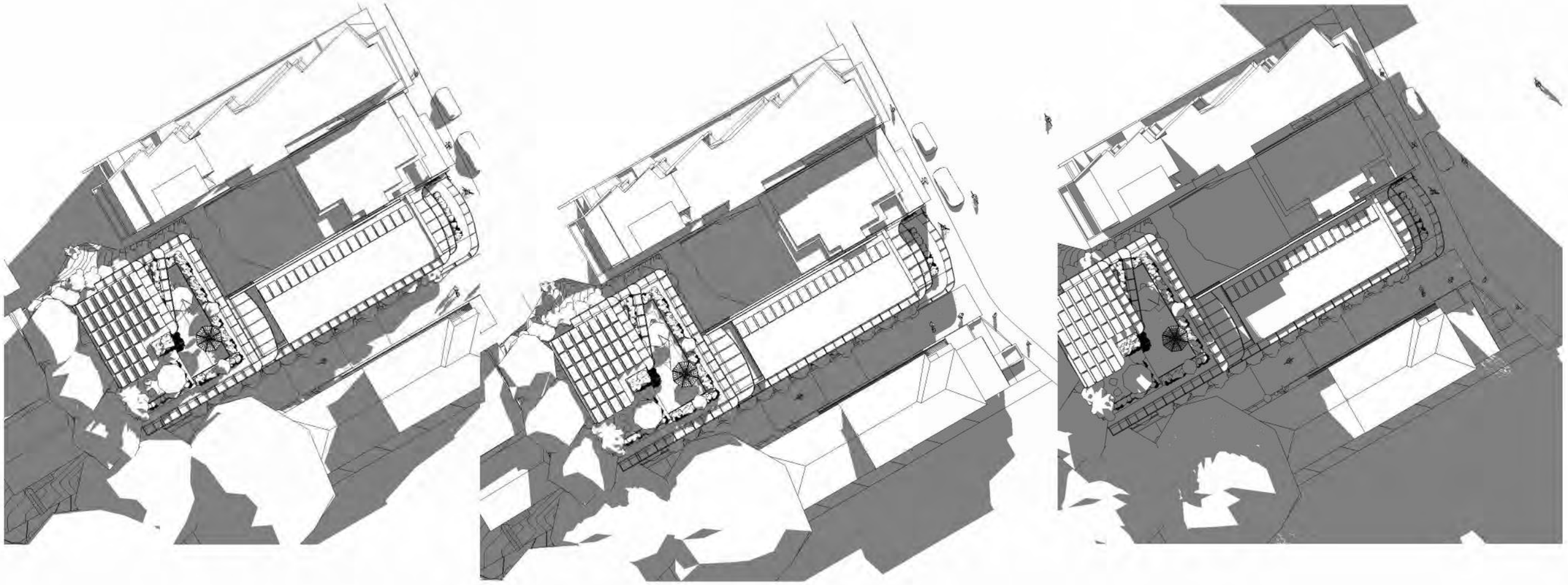
frida beach



1 : 200 @ A3

site cover

frida beach



JUNE 21_9am

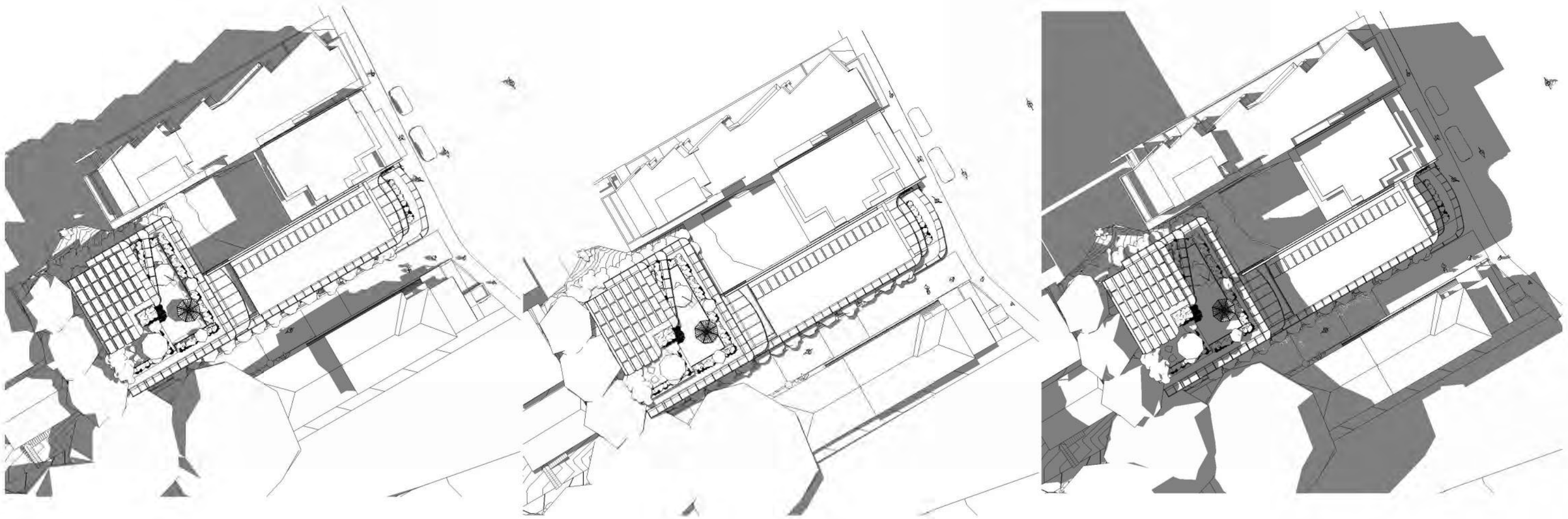
JUNE 21 _ 12pm

JUNE 21 _ 3pm

1 : 500 @ A3

winter sun study

frida beach



DEC 21 _ 9am

DEC 21 _ 12pm

DEC 21 _ 3pm

1 : 500 @ A3

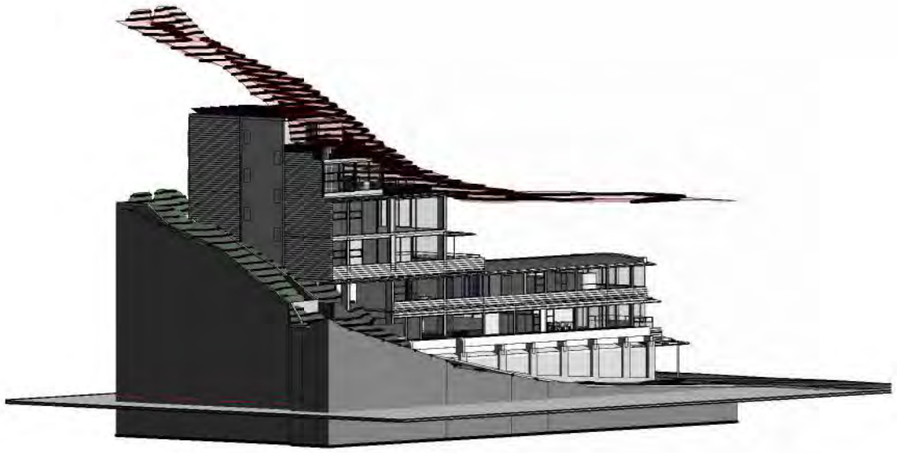
summer sun study

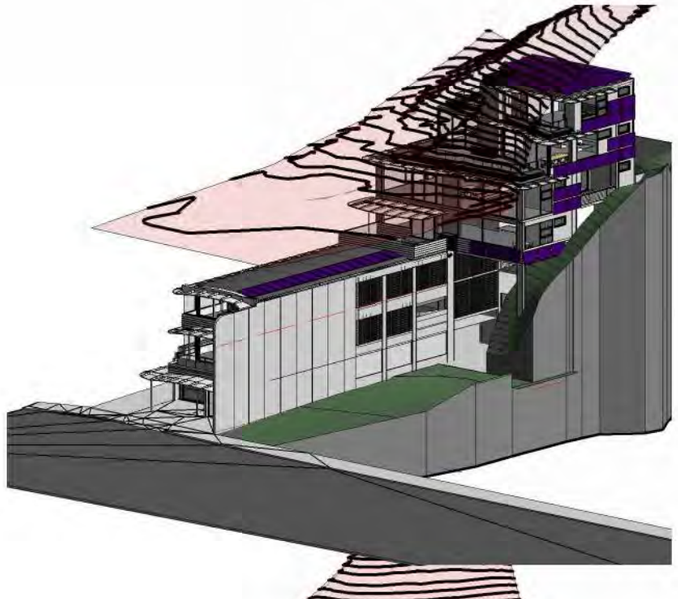
frida beach

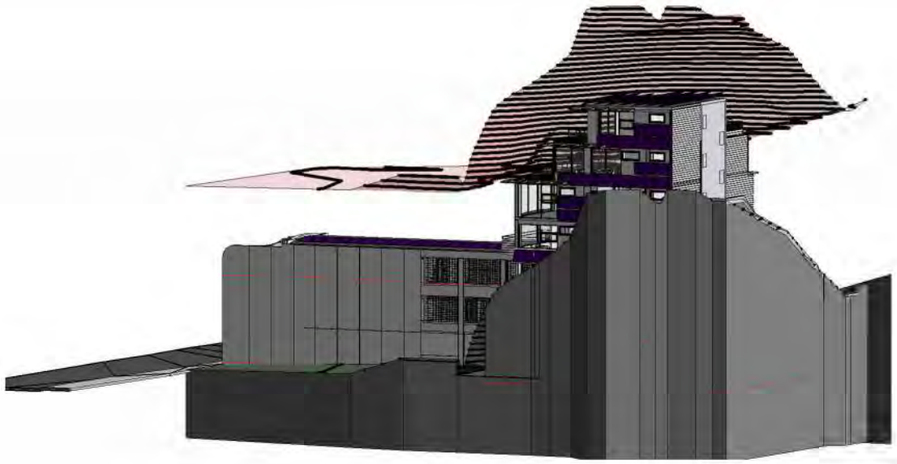
1 : 200 @ A3

site survey

frida beach







@ A3

15m hight overlay

frida beach