Barrenjoey Consulting Engineers pty ltd
Stormwater Structural Civil
abn 13124694917 acn 124694917

FLOOD MANAGEMENT REPORT
PROPOSED SHOP TOP HOUSING
21 OAKS AVE
DEE WHY

Job No 231103
March 2024
Prepared by
Lucas Molloy
MIEAust / CPEng / NER / APEC / Engineer / IntPE(Aus)

CONTENTS

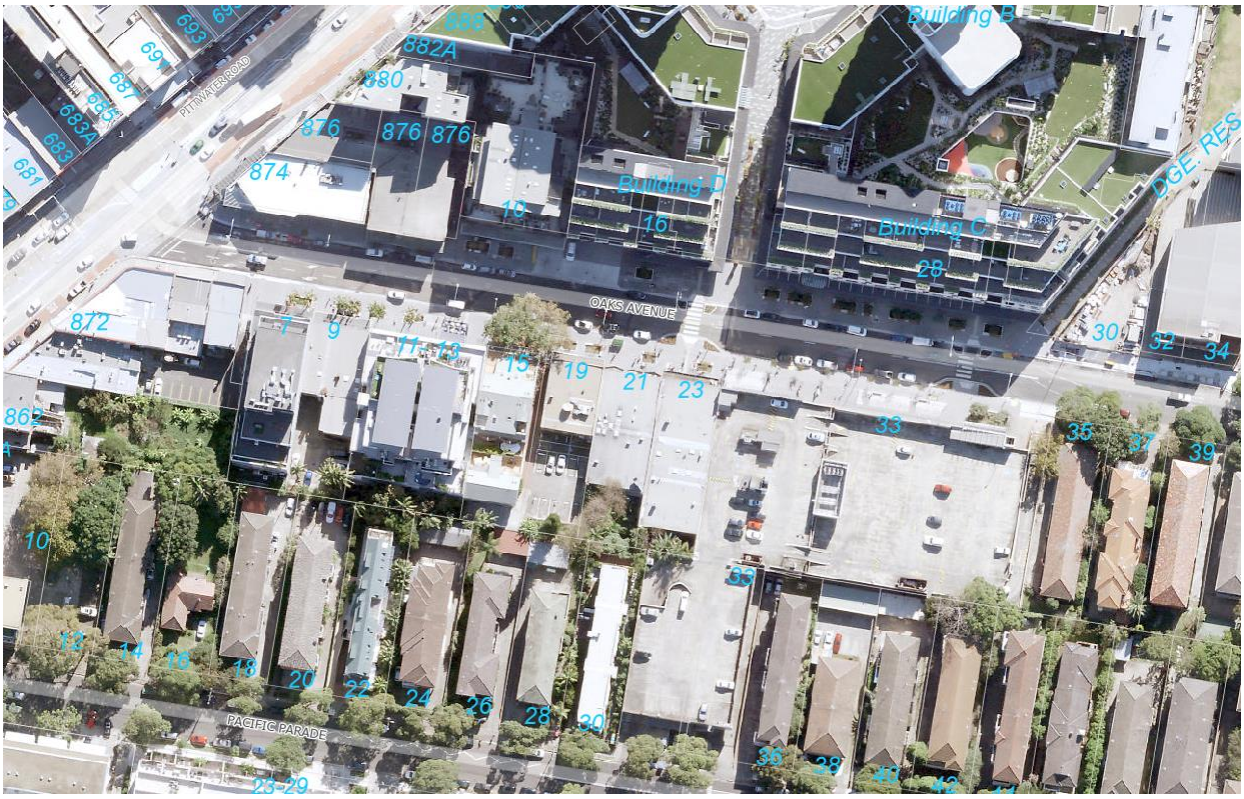
1. INTRODUCTION

This report has been prepared in support of the proposed Development Application for Shop Top Housing at No 21 Oaks Ave Dee Why in respect to potential flood inundation / impacts and Northern Beaches Councils Water Management for Development Policy Section 10.0 Flood Risk Management and the Warringah Development Control Plan » Part E The Natural Environment » E11 Flood Prone Land.

It is proposed to construct Shop Top Housing as detailed in the architectural plans by *Gartner Trovato Architects* refer Appendix A.

Existing site survey as SDG pty ltd 8737_DETAIL_220517_Rev A.dwg, refer Appendix B.

Barrenjoey Consulting Engineers p/l inspected the site on 1st Dec 2023 / 7th Dec 2023.



Aerial Image of No 21 Oaks Ave Dee Why
(Northern Beaches Council web site)

The extent of flooding is as summarized in the “Flood Information Report (Comprehensive)” data as supplied by Northern Beaches Council, refer Appendix C.

The site contains elements of the broad drainage system that transverses Dee Why CBD to the receiving waters of Dee Why Lagoon, refer Appendix D. Within the development site components of this system include the concrete drainage channel (~ 1.35/1.9mD x 2.4mW) along the sites southern boundary, and the Oaks Ave extents (ie kerb to kerb cross section) along the sites northern boundary.

MAP B: FLOODING - 1% AEP EXTENT & KEY POINTS

Notes:
- Extent represents the 1% Annual Exceedance Probability (AEP) flood event.
- Flood events exceeding the 1% AEP can occur on this site.
- Extent does not include climate change.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Dee Why South Catchment Flood Study 2013, Cardno) and aerial photography (Source Near Map 2014) are indicative only.

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The Flood Planning Level varies across the site and at worst case is 18.62 AHD, (Flood Levels ID 5 1.59m depth RL 18.10 AHD) within 6.1m easement extents / predominately the conc culvert and an area of no proposed development works.

For the 1% AEP event the site is classified -

Flood Hazard	varies across site H1 – H5
Flood Hydraulic Category	Fringe + Storage + Floodway
Flood Risk Precinct	Medium / High
Land Use Group	Shop Top Housing

2. WARRINGAH DEVELOPMENT CONTROL PLAN » PART E THE NATURAL ENVIRONMENT » E11 FLOOD PRONE LAND

A. FLOOD EFFECTS CAUSED BY DEVELOPMENT

A1	Development shall not be approved unless it can be demonstrated in a Flood Management Report that it has been designed and can be constructed so that in all events up to the 1% AEP event. a) There are no adverse impacts on flood levels or velocities caused by alterations to the flood conveyance; and b) There are no adverse impacts on surrounding properties; and c) It is sited to minimise exposure to flood hazard. Major developments and developments likely to have a significant impact on the PMF flood regime will need to demonstrate that there are no adverse impacts in the Probable Maximum Flood **The proposed building extents are wholly located outside of the 1% AEP event extents and will therefore satisfy this requirement, refer Appendix E.** **The proposed development will not have a significant impact on the PMF flood regime as the existing high-density Dee Why CBD building extents will dictate the PMF flood regime.**
A2	Development shall not be approved unless it can be demonstrated in a Flood Management Report that in all events up to the 1% AEP event there is no net loss of flood storage. Consideration may be given for exempting the volume of standard piers from flood storage calculations. If Compensatory Works are proposed to balance the loss of flood storage from the development, the Flood Management Report shall include detailed calculations to demonstrate how this is achieved. **The proposed building extents are wholly located outside of the 1% AEP event extents and will therefore satisfy this requirement, refer Appendix Z**

B. BUILDING COMPONENTS AND STRUCTURAL SOUNDNESS

B1	All buildings shall be designed and constructed as flood compatible buildings in accordance with Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas, Hawkesbury-Nepean Floodplain Management Steering Committee (2006). **Achievable using conventional building practices (ie reinforced concrete etc).**
B2	All structures must be designed and constructed to ensure structural integrity up to the Flood Planning Level, taking into account the forces of floodwater, wave action, flowing water with debris, buoyancy and immersion. Structural certification shall be provided confirming the above. Where shelter-in-place refuge is to be provided the structural integrity is to be to the Probable Maximum Flood level. **Achievable using conventional building and engineering practices (ie reinforced concrete etc.)**
B3	All new electrical equipment, power points, wiring, fuel lines, sewerage systems or any other service pipes and connections must be waterproofed and/or located above the Flood Planning Level. All existing electrical equipment and power points located below the Flood Planning Level must have residual current devices installed that turn off all electricity supply to the property when flood waters are detected. **Achievable using conventional building practices.**

C. FLOOR LEVELS

C1	New floor levels within the development shall be at or above, the Flood Planning Level. **As per Council PLM (refer Appendix F) the FPL level of 17.88 AHD has been adopted and achieved in the architectural layout, refer Appendix A. This level reflects the northern flood extents in the Oaks Ave cross section, noting the development will be protected from southern flood extents in the concrete culvert, by a fully enclosed concrete structure.**
C2	**Not applicable to this development / land use category**
C3	All development structures must be designed and constructed so as not to impede the floodway or flood conveyance on the site, as well as ensuring no loss of flood storage in a 1% AEP Event. **The proposed building extents are wholly located outside of the 1% AEP event extents and will therefore satisfy this requirement, refer Appendix E.** For suspended pier/pile footings: The underfloor area of the dwelling below the 1% AEP flood level is to be designed and constructed to allow clear passage of floodwaters, taking into account the potential for small openings to block; and At least 50% of the perimeter of the underfloor area is of an open design from the natural ground level up to the 1% AEP flood level; and No solid areas of the perimeter of the underfloor area would be permitted in a floodway **Not applicable to this development as all proposed works outside the 1% AEP event extents**
C4	A one- off addition or alteration below the Flood Planning Level of less than 30 square metres may be considered only where: (a) it is an extension to an existing room (b) the Flood Planning Level is incompatible with the floor levels of the existing room (c) out of the 30 square metres, not more than 10 square metres is below the 1% AEP flood level. This control will not be permitted if this provision has previously been utilised since the making of this Plan. The structure must be flood proofed to the Flood Planning Level and the Flood Management Report must demonstrate that there is no net loss of flood storage in all events up to the 1% AEP event **na to this development, see associated requirement C7 below**
C5	**Not applicable to this development / land use category**
C6	Any existing floor level may be retained below the Flood Planning Level when undertaking a first floor addition provided that: (a) it is not located within a floodway; (b) the original foundations are sufficient to support the proposed final structure above them. The Flood Management Report must include photos and the structural certification required as per Control B2 must consider whether the existing foundations are adequate or should be replaced; and (c)The maximum area for the floor area to be below the Flood Planning Level for an individual premises is 30 square metres, and (d) There is direct internal access between areas above and below the Flood Planning Level for each individual premises **na to this development**
C7	Consideration may be given to a floor level below the Flood Planning Level within the first 5 metres from the street front in an existing business zone provided it can be demonstrated that: (a) The minimum floor level is no lower than the adjacent footpath level, and

	(b) The maximum internal distance from the front of the building is 5 metres, which can only apply to one side of an individual premises, and (c) The maximum area for the floor area to be below the Flood Planning Level for an individual premises is 30 square metres, and (d) There is direct internal access between areas above and below the Flood Planning Level for each individual premises **As proposed in the architectural plans, and is justified to ensure adequate (able / disable) commercial access to the retail premises from the Oaks Ave footpath.**

D. CAR PARKING

D1	Open carpark areas and carports shall not be located within a floodway. **na to this development**
D2	The lowest floor level of open carparks and carports shall be constructed no lower than the natural ground levels, unless it can be shown that the carpark or carport is free draining with a grade greater than 1% and that flood depths are not increased. **na to this development**
D3	Carports must be of open design, with at least 2 sides completely open such that flow is not obstructed up to the 1% AEP flood level. Otherwise it will be considered to be enclosed. When undertaking a like-for-like replacement and the existing garage/carport is located on the street boundary and ramping is infeasible, consideration may be given for dry floodproofing up to the 1% AEP flood level. **na to this development**
D4	Where there is more than 300mm depth of flooding in a car park or carport during a 1% AEP flood event, vehicle barriers or restraints are to be provided to prevent floating vehicles leaving the site. Protection must be provided for all events up to the 1% AEP flood event. **na to this development**
D5	Enclosed Garages must be located at or above the 1% AEP level. **na to this development**
D6	All enclosed car parks (including basement carparks) must be protected from inundation up to the Flood Planning Level. All access, ventilation, driveway crests and any other potential water entry points to any enclosed car parking shall be above the Flood Planning Level. Where a driveway is required to be raised it must be demonstrated that there is no net loss to available flood storage in any event up to the 1% AEP flood event and no impact on flood conveyance through the site. Council will not accept any options that rely on electrical, mechanical or manual exclusion of the floodwaters from entering the enclosed carpark **As proposed in the architectural plans, Oaks Ave access drive to crest at the FPL, noting the development will be protected from southern flood extents in the concrete culvert, by a fully enclosed concrete structure.**
D7	**Not applicable to this development / land use category**

E. FLOOD EMERGENCY RESPONSE

E1	If the property is affected by a Flood Life Hazard Category of H3 or higher, then Control E1 applies and a Flood Emergency Assessment must be included in the Flood Management Report. If the property is affected by a Flood Life Hazard Category of H6, then development is not permitted unless it can be demonstrated to the satisfaction of the consent authority that the risk level on the property is or can be reduced to a level below H6 or its equivalent. If the property is flood affected but the Flood Life Hazard Category has not been mapped by Council, then calculations for its determination must be shown in the Flood Management Report, in accordance with the "Technical Flood Risk Management Guideline: Flood Hazard", Australian Institute for Disaster Resilience (2012). Where flood-free evacuation above the Probable Maximum Flood level is not possible, new development must provide a shelter-in-place refuge where: a) The floor level is at or above the Probabl Maximum Flood level; and b) The floor space provides at least $2m^2$ per person where the flood duration is long (6 or more hours) in the Probable Maximum Flood event, or $1m^2$ per person for less than 6 hours; c) It is intrinsically accessible to all people on the site, plainly evident, and self-directing, with sufficient capacity of access routes for all occupants without reliance on an elevator; and d) It must contain as a minimum: sufficient clean water for all occupants; portable radio with spare batteries; torch with spare batteries; and a first aid kit Class 10 classified buildings and structures (as defined in the Building Codes of Australia) are excluded from this control. In the case of change of use or internal alterations to an existing building, a variation to this control may be considered if justified appropriately by a suitably qualified professional. Note that in the event of a flood, occupants would be required to evacuate if ordered by Emergency Services personnel regardless of the availability of a shelter-in-place refuge. **Achievable by adhering to this report.**
E2	If a shelter-in-place refuge is required, it must contain as a minimum: sufficient clean water for all occupants; portable radio with spare batteries; torch with spare batteries; a first aid kit; emergency power; and a practical means of medical evacuation. **Achievable by adhering to this report.**
E3	It must be demonstrated that evacuation or a shelter-in-place refuge in accordance with the requirements of this DCP will be available for any potential development arising from a Torrens title subdivision. **Achievable by adhering to this report**

F. FENCING

F1	Fencing, (including pool fencing, boundary fencing, balcony balustrades and accessway balustrades) shall be designed so as not to impede the flow of flood waters and not to increase flood affectation on surrounding land. At least 50% of the fence must be of an open design from the natural ground level up to the 1% AEP flood level. Less than 50% of the perimeter fence would be permitted to be solid. Openings should be a minimum of 75 mm x 75mm. **na to this development, as no fencing proposed.**

G. STORAGE OF GOODS

G1	Hazardous or potentially polluting materials shall not be stored below the Flood Planning Level unless adequately protected from floodwaters in accordance with industry standards. **Achievable using conventional building practices**

H. POOLS

H1	Pools located within the 1% AEP flood extent are to be in-ground, with coping flush with natural ground level. Where it is not possible to have pool coping flush with natural ground level, it must be demonstrated that the development will result in no net loss of flood storage and no impact on flood conveyance on or from the site. All electrical equipment associated with the pool (including pool pumps) is to be All chemicals associated with the pool are to be stored at or above the flood planning level. **na to this development, as no pool proposed**

3. FLOOD RISK ASSESSMENT

A flood risk assessment was carried out for the 1% AEP and PMF event adopting the following

- Likehood of the hazard occurring
  - Almost Certain 1:10
  - Likely 1:100
  - Possible 1:1000
  - Unlikely 1:10000
  - Rare 1:100000
- Consequence of the hazard to persons and property
  - Insignificant no injury / $ 0 - low
  - Minor first aid injury / $ low - medium
  - Moderate medical treatment required / $ medium – high
  - Major serious injuries / $ major
  - Catastrophic death / $ major ++

	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain					
Likely (1%)					
Possible					
Unlikely (PMF)					
Rare					

Legend

Low - acceptable
Moderate – tolerable
Sever – unacceptable

1 Risk to persons 'shelter in place' provisions as per the *Flood Risk Management Report* specified / ensured, therefore risk assessment -
1% event – minor injuries possible therefore moderate / tolerable risk assessment
PMF event – minor injuries possible therefore low / acceptable risk assessment
2 Risk to structures adequate structural capacity to resist the flood forces (water and debris) as per the *Flood Risk Management Report* specified / ensured, therefore risk assessment -
1% event – insignificant therefore low /acceptable risk assessment
PMF event – minor damage to structures therefore low / risk assessment
3 Risk to vehicles vehicles protected from flood exposure, therefore risk assessment -
1% event – insignificant therefore low /acceptable risk assessment
PMF event – major damage therefore moderate / tolerable risk assessment
4 Risk to services protection of services from flood exposure as per the *Flood Risk Management Report* specified / ensured, therefore risk assessment -
1% event – insignificant therefore low /acceptable risk assessment
PMF event – major damage therefore moderate / tolerable risk assessment

4. SUMMARY

Assessment of Impacts Compliance Table

	Compliance		
	Not Applicable	Yes	No
A Flood effects caused by Development	-	X	-
B Building Components & Structural Soundness	-	X	-
C Floor Levels	-	X	-
D Car Parking	-	X	-
E Flood Emergency Response	-	X	-
F Fencing	-	X	-
G Storage of Goods	-	X	-
H Pools	X	-	-

The proposed works if carried out in accordance with recommendations within this *Flood Management Report* by Barrenjoey Consulting dated Dec 2023 will satisfy the intent of Northern Beaches Councils Water Management for Development Policy Section 10.0 Flood Risk Management and the Warringah Development Control Plan » Part E The Natural Environment » E11 Flood Prone Land. Noting the following measures are to be implemented into the works –

- **All occupants are to be informed of the sites flooding potential / impact and available warning services (ie : Councils *Floodwatch*, SES services etc).**
- **All occupants are to be informed of the sites flooding potential / impact and the residences 'shelter in place' capacity.**
- **All structures must be designed and constructed to ensure structural integrity up to the Flood Planning Level**
- **All occupants are to be informed of the sites flooding potential and requirements for goods / valuables storage etc.**

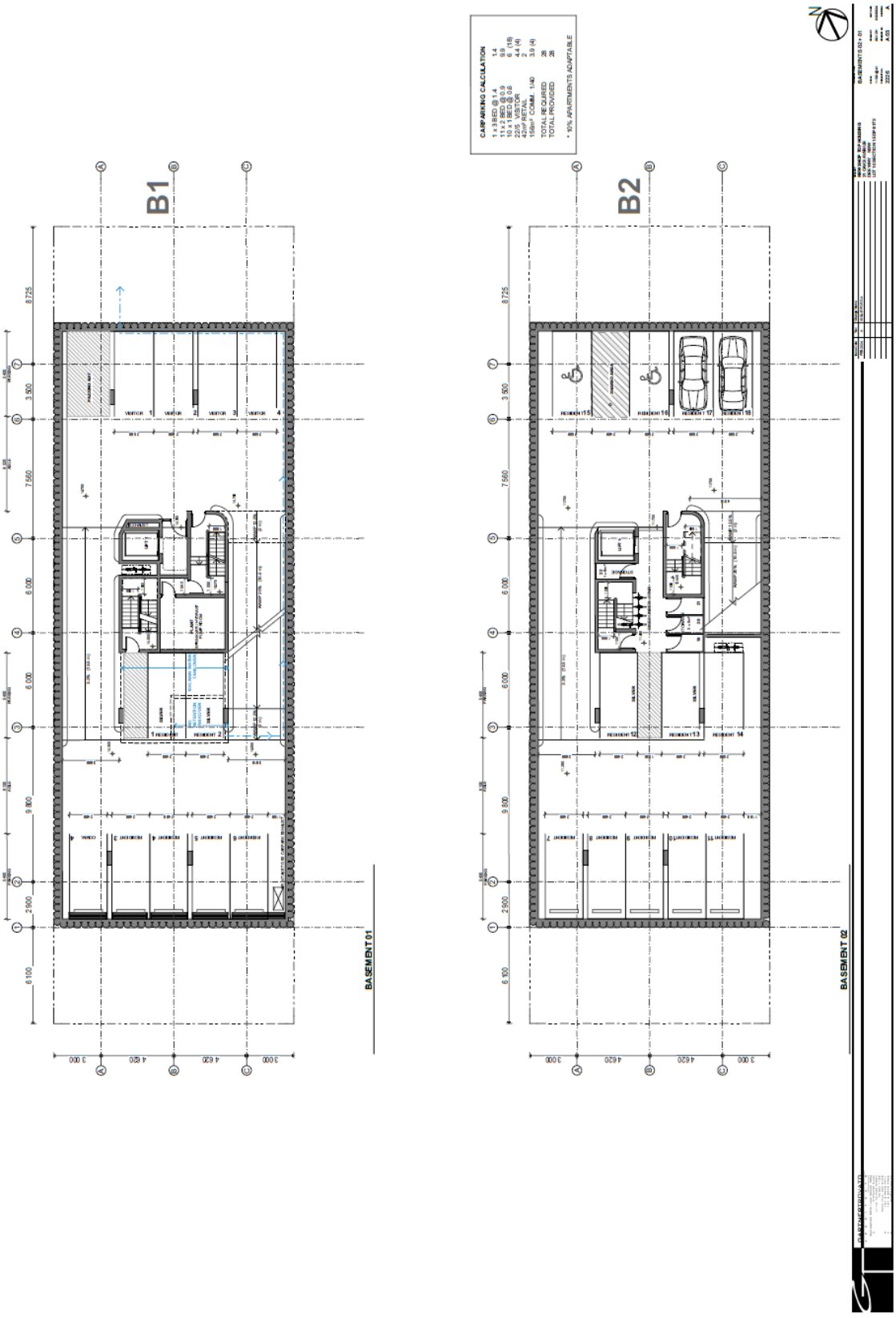
It is to be noted that, due to the many complex factors that can affect a site, the subjective nature of a risk analysis, and the imprecise nature of the science of flood analysis, the risk of persons being injured, to life and property cannot be completely removed. The recommendations within this Report do not remove the risk associated with the predicted flooding event, though lower those risks to an acceptable level reasonably anticipated by the community in everyday life.

Regards
BARRENJOEY CONSULTING ENGINEERS pty ltd

Per
Lucas Molloy (Director)
MIEAust / CPEng / NER /
APEC / Engineer / IntPE(Aus)

Appendix A

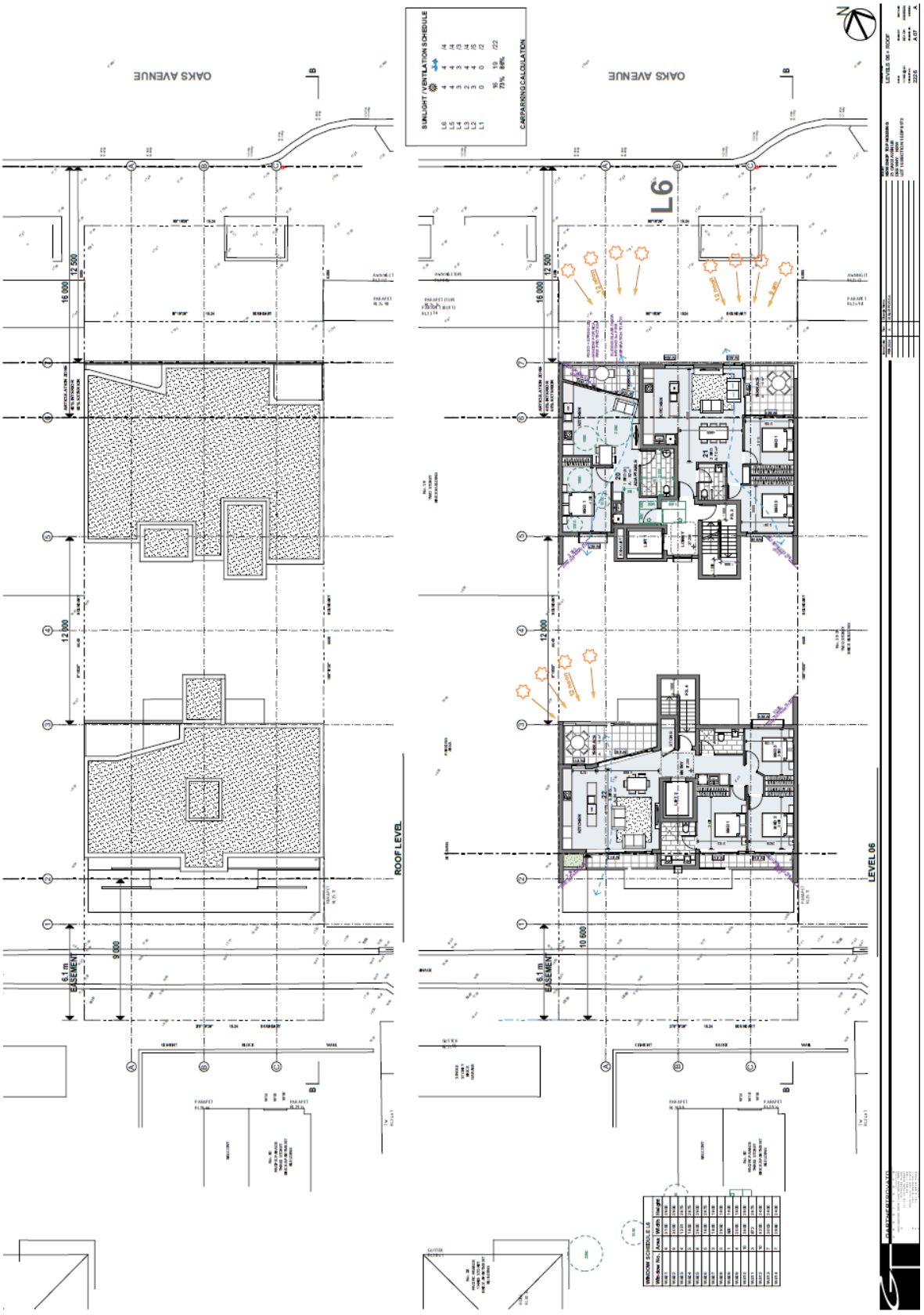
Architectural plans
Gartner Trovato Architects

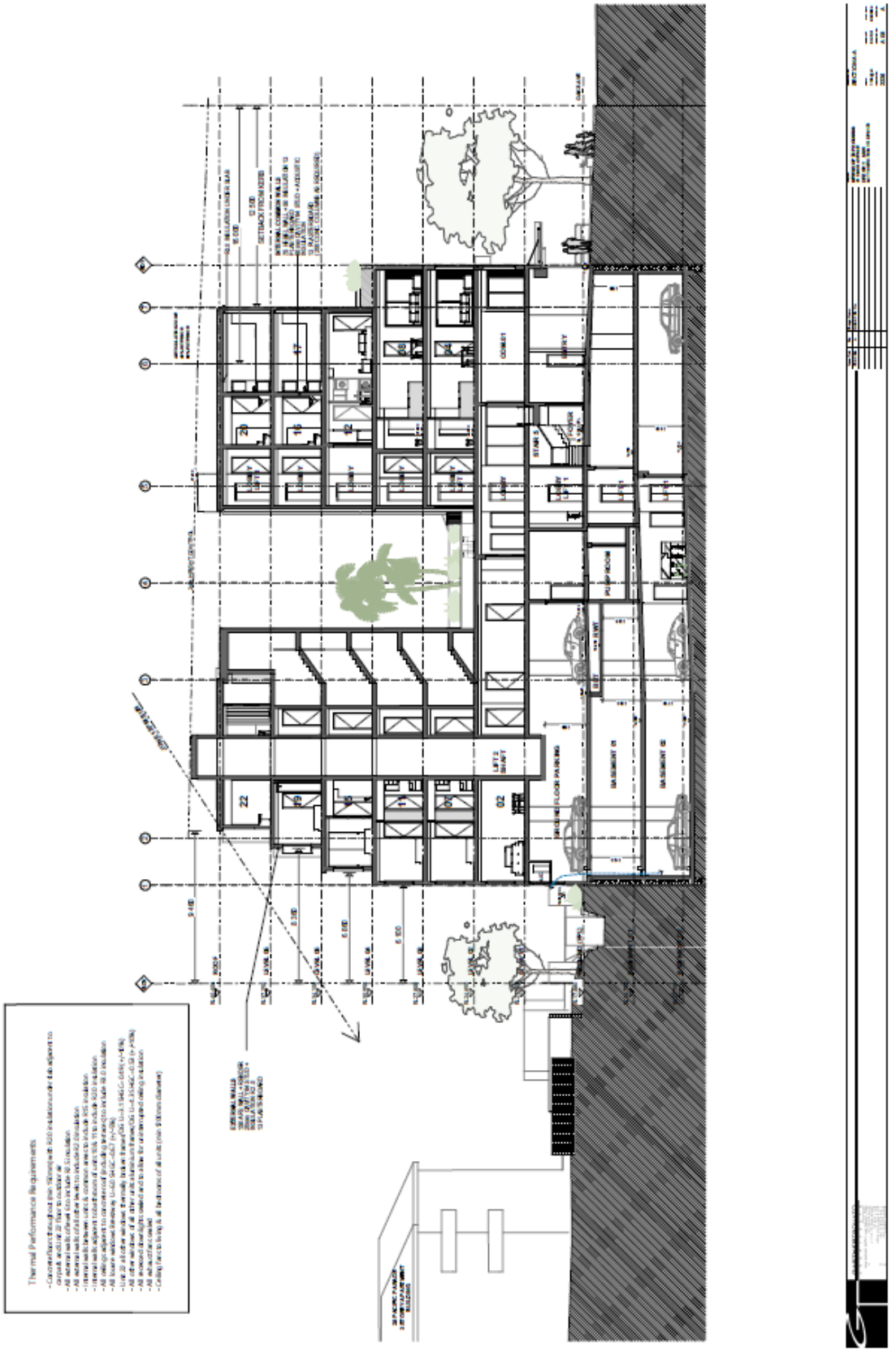

B1
B2
CARPARKING CALCULATION
TOTAL REQUIRED
TOTAL PROVIDED
+ 10% APARTMENTS ADAPTABLE
BASEMENT 01
BASEMENT 02

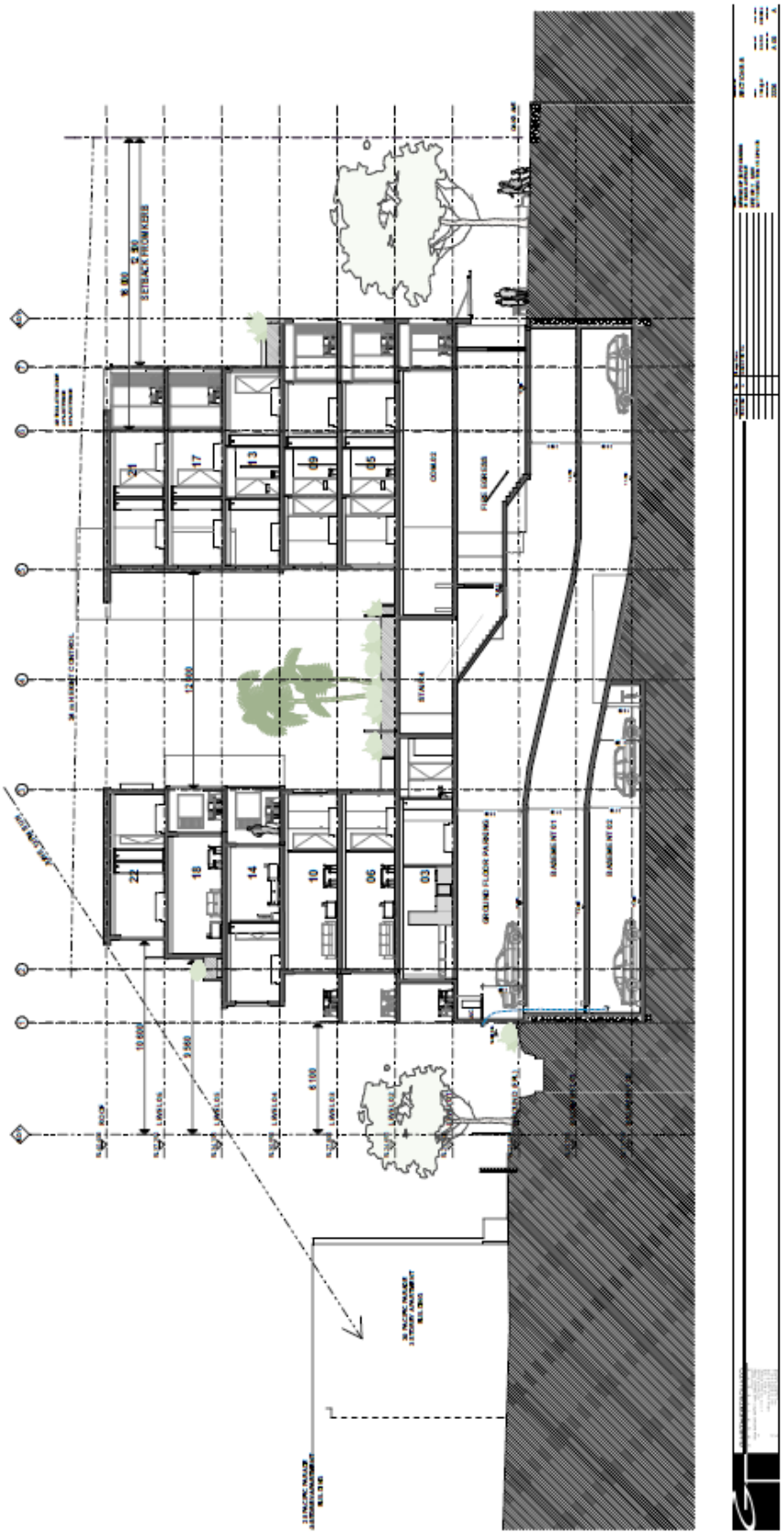

OAKS AVENUE
OAKS AVENUE
L1
GF
LEVEL 01
GROUND
SUNLIGHT / VENTILATION SCHEDULE
CARPARKING CALCULATION
TOTAL REQUIRED
TOTAL PROVIDED
* 30% APARTMENTS ADAPTABLE
6.1 m EASEMENT
6.1 m EASEMENT


OAKS AVENUE
L3
LEVEL 03
6.1 m EASEMENT
OAKS AVENUE
L2
LEVEL 02
6.1 m EASEMENT


OAKS AVENUE
L5
L4
LEVEL 05
LEVEL 04
6.1 m EASEMENT
SUNLIGHT / VENTILATION SCHEDULE
CARPARKING CALCULATION

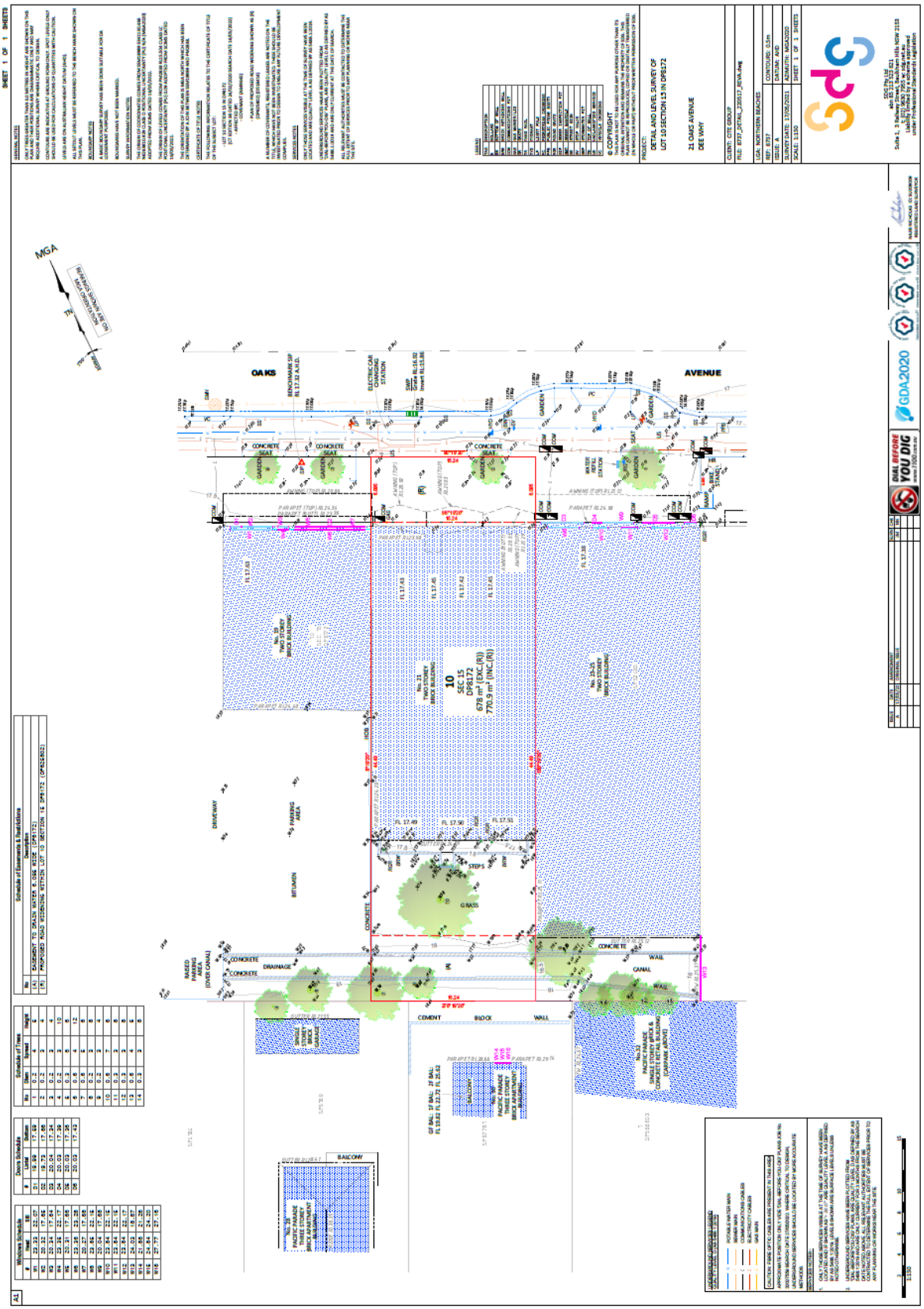

OAKS AVENUE
OAKS AVENUE
L6
ROOF LEVEL
LEVEL 06
6.1 m EASEMENT
6.1 m EASEMENT
SUNLIGHT / VENTILATION SCHEDULE
CARPARKING CALCULATION





Appendix B

Site Survey
SDG pty ltd


SHEET 1 OF 1 SHEETS
GENERAL NOTES
SURVEY NOTES
BOUNDARY NOTES
SURVEY ENCUMBRANCE NOTES
CERTIFICATE OF TITLE NOTES
SERVICES NOTES
LEGEND
PROJECT:
DETAIL AND LEVEL SURVEY OF
LOT 10 SECTION 15 IN DP8172
21 OAKS AVENUE
DEE WHY
CLIENT: CITE GROUP
FILE: ETP_DETAIL_220517_PENN.dwg
LGA: NORTHERN BEACHES
CONTOURS: 0.5m
DATUM: AHD
SURVEY DATE: 17/05/2021
SCALE: 1:150
SHEET 1 OF 1 SHEETS
SDS Pty Ltd
abn 83 133 503 021
Suite 1, 3 Pennant Hills Rd, Pennant Hills, NSW 2120
T: (02) 9875 7253 M: 0409 487 xxx
Lic No: 5057 Nominated Surveyor
Under Professional Standards Legislation
© COPYRIGHT
MGA
OAKS
AVENUE
CONCRETE SEAT
GARDEN
10
SEC 15
DP8172
678 m² (EXC.(R))
770.9 m² (INC.(R))
No 21
TWO STOREY
BRICK BUILDING
No 23
TWO STOREY
BRICK BUILDING
No 25
TWO STOREY
BRICK BUILDING
DRIVEWAY
NO PARKING AREA
BITUMEN
GRASS
STEPS
CONCRETE
DRAINAGE
RAISED PARKING AREA (OVER CANAL)
CANAL
WALL
CEMENT
BLOCK
WALL
No 27
PACIFIC PARADE
SINGLE STOREY BRICK & TIMBER RESIDENCE WITH GARAGE (CARPARK ABOVE)
No 30
PACIFIC PARADE
THREE STOREY
BRICK & TIMBER
APARTMENT
BUILDING
BALCONY
No 28
PACIFIC PARADE
TWO STOREY
BRICK APARTMENT
BUILDING
BALCONY
Schedule of Easements & Restrictions
Schedule of Trees
Windows Schedule
Doors Schedule
DIAL BEFORE YOU DIG
GDA2020
A1

Appendix C

Flood Information Request – Comprehensive
Northern Beaches Council

northern beaches council

FLOOD INFORMATION REPORT (COMPREHENSIVE)

Property: 21 Oaks Avenue DEE WHY NSW 2099
Lot DP: Lot 10 Sec 15 DP 8172
Issue Date: 06/12/2023
Flood Study Reference: Dee Why South Catchment Flood Study 2013, Cardno

Flood Information[1]:

Map A - Flood Risk Precincts
Maximum Flood Planning Level (FPL) [2, 3, 4]: 18.62 m AHD

Map B - 1% AEP Flood & Key points
1% AEP Maximum Water Level [2, 3]: 18.12 m AHD
1% AEP Maximum Depth from natural ground level[3]: 1.59 m
1% AEP Maximum Velocity: 4.48 m/s

Map C - 1% AEP Hydraulic Categorisation
1% AEP Hydraulic Categorisation: Floodway at rear

Map D - Probable Maximum Flood
PMF Maximum Water Level (PMF) [4]: 19.77 m AHD
PMF Maximum Depth from natural ground level: 2.24 m
PMF Maximum Velocity: 2.90 m/s

Map E - Flooding with Climate Change
1% AEP Maximum Water Level with Climate change [3]: 18.33 m AHD
1% AEP Maximum Depth with Climate Change[3]: 1.63 m

Map F - Flood Life Hazard Category in PMF

Map G - Indicative Ground Surface Spot Heights

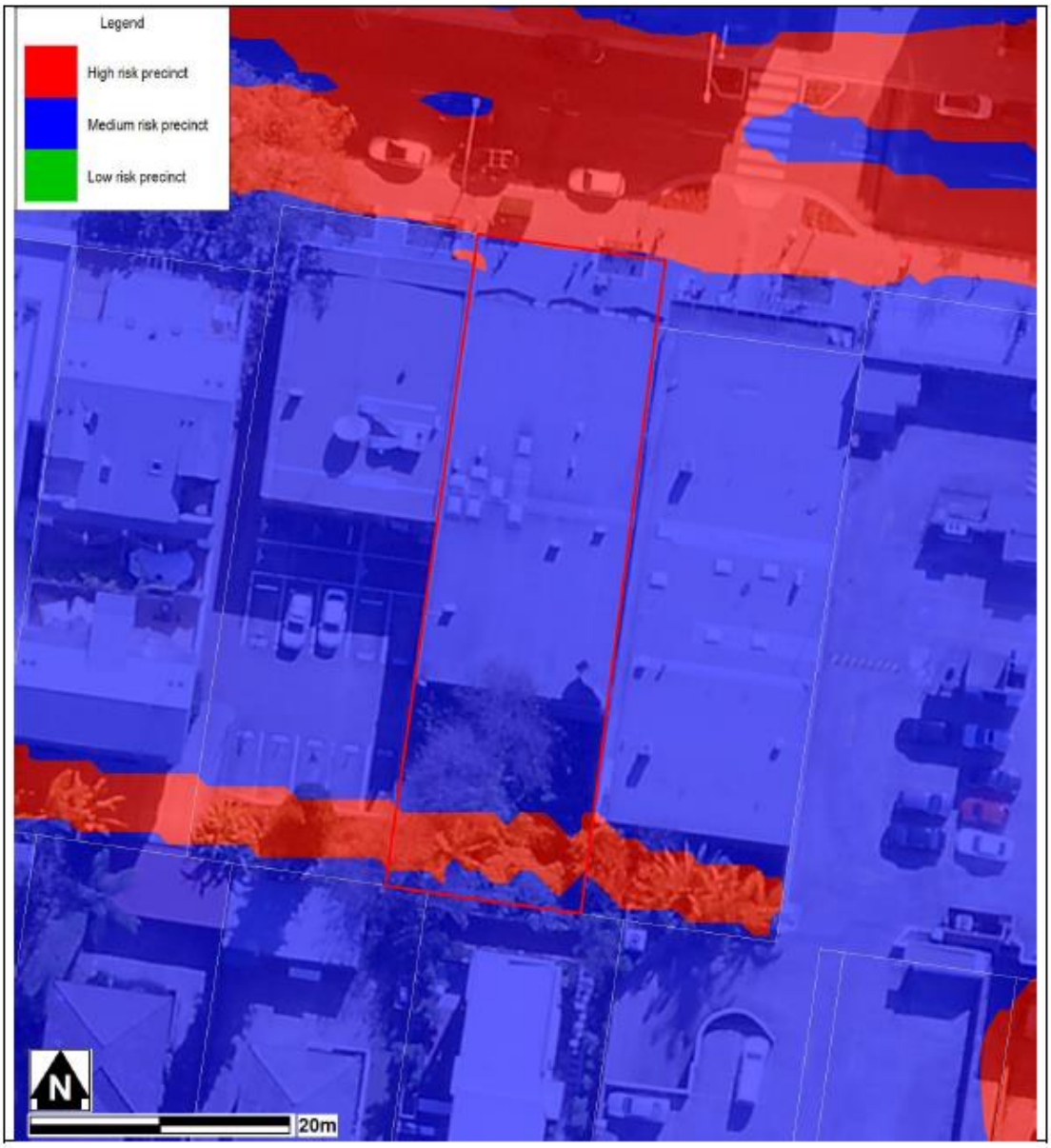
(1) The provided flood information does not account for any local overland flow issues nor private stormwater drainage systems.
(2) Overland flow/mainstream water levels may vary across a sloping site, resulting in variable minimum floor/ flood planning levels across the site. The maximum Flood Planning Level may be in a different location to the maximum 1% AEP flood level.
(3) Intensification of development in the former Pittwater LGA requires the consideration of climate change impacts which may result in higher minimum floor levels.
(4) Vulnerable/critical developments require higher minimum floor levels using the higher of the PMF or FPL

Notes

General

- All levels are based on Australian Height Datum (AHD) unless otherwise noted.
- This is currently the best available information on flooding; it may be subject to change in the future.
- Council recommends that you obtain a detailed survey of the above property and surrounds to AHD by a registered surveyor to determine any features that may influence the predicted extent or frequency of flooding. It is recommended you compare the flood level to the ground and floor levels to determine the level of risk the property may experience should flooding occur.
- Development approval is dependent on a range of issues, including compliance with all relevant provisions of Northern Beaches Council's Local Environmental Plans and Development Control Plans.
- Please note that the information contained within this letter is general advice only as a detail survey of the property as well as other information is not available. Council recommends that you engage a suitably experienced consultant to provide site specific flooding advice prior to making any decisions relating to the purchase or development of this property.
- The Flood Studies on which Council's flood information is based are available on Council's online Flood Study Reports webpage.
- If the FPL is higher than the PMF level, then the FPL should still be used as the FPL, as it includes freeboard which the PMF does not.
- If the property is affected by an Estuarine Planning Level (EPL) which is higher than the FPL, then the EPL should be used as the FPL.
- Areas affected by an EPL in the former Pittwater LGA are mapped on Council's online Estuarine Hazard Map. Note that areas in the former Manly LGA affected by an EPL have been identified and will be soon added to this map.
- Council's drainage infrastructure is mapped on Council's Stormwater Map. Note that locations are indicative only and may not be exactly as shown.

MAP A: FLOOD RISK PRECINCTS



Notes:

- **Low Flood Risk precinct** means all flood prone land not identified within the High or Medium flood risk precincts.
- **Medium Flood Risk precinct** means all flood prone land that is (a) within the 1% AEP Flood Planning Area; and (b) is not within the high flood risk precinct.
- **High Flood Risk precinct** means all flood prone land (a) within the 1% AEP Flood Planning Area; and (b) is either subject to a high hydraulic hazard, within the floodway or subject to significant evacuation difficulties (H5 or H6 Life Hazard Classification).
- The **Flood Planning Area** extent is equivalent to the Medium Flood Risk Precinct extent and includes the High Flood Risk Precinct within it. The mapped extent represents the 1% annual Exceedance Probability (AEP) flood event + freeboard.
- None of these mapped extents include climate change.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Dee Why South Catchment Flood Study 2013, Cardno) and aerial photography (Source: NearMap 2014) are indicative only.

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MAP B: FLOODING - 1% AEP EXTENT & KEY POINTS

Notes:

- Extent represents the 1% Annual Exceedance Probability (AEP) flood event.
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Flood Levels

ID	5% AEP Max WL (m AHD)	5% AEP Max Depth (m)	1% AEP Max WL (m AHD)	1% AEP Max Depth (m)	1% AEP Max Velocity (m/s)	Flood Planning Level (m)	PMF Max WL (m AHD)	PMF Max Depth (m)	PMF Max Velocity (m/s)
1	17.50	0.19	17.55	0.25	0.74	18.05	18.07	0.77	1.69
2	N/A	N/A	17.38	0.17	0.77	17.88	17.95	0.74	1.83
3	N/A	N/A	N/A	N/A	N/A	N/A	19.03	0.31	0.74
4	N/A	N/A	N/A	N/A	N/A	N/A	19.29	0.21	0.23
5	18.02	1.51	18.10	1.59	3.10	18.60	18.71	2.20	2.22
6	17.87	1.44	17.94	1.51	3.10	18.44	18.62	2.19	2.19

Climate Change Flood Levels (30% Rainfall intensity and 0.9m Sea Level Rise)

ID	CC 1% AEP Max WL (m AHD)	CC1 % AEP Max Depth (m)
1	17.60	0.30
2	17.42	0.21
3	N/A	N/A
4	N/A	N/A
5	18.14	1.63
6	17.97	1.55

WL – Water Level
PMF – Probable Maximum Flood
N/A - No Peak Water Level/Depth/Velocity Available.

Notes:

- The flood planning levels above are calculated by adding a 0.5m freeboard to the 1% AEP water level. However, if the depth of flow is less than 0.3m and a Velocity X Depth product is less than 0.3m²/s, a freeboard of 0.3m may be able to be justified for development.

MAP C: 1% AEP FLOOD HYDRAULIC CATEGORY MAP

Notes:

- Extent represents the 1% Annual Exceedance Probability (AEP) flood event
- Extent does not include climate change
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Dee Why South Catchment Flood Study 2013, Cardno) and aerial photography (Source: NearMap 2014) are indicative only

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MAP D: PMF EXTENT MAP

Notes:

- Extent represents the Probable Maximum Flood (PMF) flood event
- Extent does not include climate change
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Dee Why South Catchment Flood Study 2013, Cardno) and aerial photography (Source: NearMap 2014) are indicative only

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MAP E: FLOODING – 1% AEP EXTENT PLUS CLIMATE CHANGE

Notes:

- Extent represents the 1% annual Exceedance Probability (AEP) flood event including 30% rainfall intensity and 0.9m Sea Level Rise climate change scenario
- Flood events exceeding the 1% AEP can occur on this site.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Dee Why South Catchment Flood Study 2013, Cardno) and aerial photography (Source: NearMap 2014) are indicative only

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MAP F: FLOOD LIFE HAZARD CATEGORY IN PMF

Notes:

- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Dee Why South Catchment Flood Study 2013, Cardno) and aerial photography (Source Near Map 2014) are indicative only.

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MAP G: INDICATIVE GROUND SURFACE SPOT HEIGHTS

Notes:

- The surface spot heights shown on this map were derived from Airborne Laser Survey and are indicative only.
- Accuracy is generally within ± 0.2m vertically and ± 0.15m horizontally, and Northern Beaches Council does not warrant that the data does not contain errors.
- If accuracy is required, then survey should be undertaken by a registered surveyor.

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Preparation of a Flood Management Report

Introduction

These guidelines are intended to provide advice to applicants on how to determine what rules apply on flood prone land, and how to prepare a Flood Management Report. The purpose of a Flood Management Report is to demonstrate how a proposed development will comply with flood related planning requirements.

Planning Requirements for Flood Prone Land

Development must comply with the requirements for developing flood prone land set out in the relevant Local Environment Plan (LEP) and Development Control Plan (DCP). There are separate LEPs and DCPs for each of the former Local Government Areas (LGAs), although preparation of a LGA-wide LEP and DCP is currently under way.

The clauses specific to flooding in the LEPs and DCPs are as follows:

LEP Clauses	DCP Clauses
Manly LEP (2013) – 5.21 Flood Planning Manly LEP (2013) – 5.22 Special Flood Considerations	Manly DCP (2013) – 5.4.3 Flood Prone Land
Warringah LEP (2011) – 5.21 Flood Planning Warringah LEP (2011) – 5.22 Special Flood Considerations Warringah LEP (2000) – 47 Flood Affected Land *	Warringah DCP (2011) – E11 Flood Prone Land
Pittwater LEP (2014) – 5.21 Flood Planning Pittwater LEP (2014) – 5.22 Special Flood Considerations	Pittwater 21 DCP (2014) – B3.11 Flood Prone Land Pittwater 21 DCP (2014) – B3.12 Climate Change

* The Warringah LEP (2000) is relevant only for the "deferred lands" which affects only a very small number of properties, mostly in the Oxford Falls area.

Development on flood prone land must also comply with Council's Water Management for Development Policy, and if it is in the Warriewood Release Area, with the Warriewood Valley Water Management Specification and Clause C6.1 of the Pittwater 21 DCP (2014). Guidelines for Flood Emergency Response Planning are available for addressing emergency response requirements in the DCP. These documents can be found on Council's website on the Flooding page.

Note that if the property is affected by estuarine flooding or other coastal issues, these need to be addressed separately under the relevant DCP clauses.

When is a Flood Management Report required?

A Flood Management Report must be submitted with any Development Application on flood prone land (with exceptions noted below), for Council to consider the potential flood impacts and applicable controls. For Residential or Commercial development, it is required for development on land identified within the Medium or High Flood Risk Precinct. For Vulnerable or Critical development, it is required if it is within any Flood Risk Precinct.

There are some circumstances where a formal Flood Management Report undertaken by a professional engineer may not be required. However the relevant parts of the DCP and LEP would still need to be addressed, so as to demonstrate compliance. Examples where this may apply include:

- If all proposed works are located outside the relevant Flood Risk Precinct extent
- First floor addition only, where the existing ground floor level is above the FPL
- Internal works only, where habitable floor areas below the FPL are not being increased

Note that development on flood prone land will still be assessed for compliance with the relevant DCP and LEP, and may still be subject to flood related development controls.

What is the purpose of a Flood Management Report?

The purpose of a Flood Management Report is to demonstrate how a proposed development will comply with flood planning requirements, particularly the development controls outlined in the relevant LEP and DCP clauses. The report must detail the design, measures and controls needed to achieve compliance, following the steps outlined below.

A Flood Management Report should reflect the size, type and location of the development, proportionate to the scope of the works proposed, and considering its relationship to surrounding development. The report should also assess the flood risk to life and property.

Preparation of a Flood Management Report

The technical requirements for a Flood Management Report include (where relevant):

1. Description of development
   - Outline of the proposed development, with plans if necessary for clarity
   - Use of the building, hours of operation, proposed traffic usage or movement
   - Type of use, eg vulnerable, critical, residential, business, industrial, subdivision, etc

2. Flood analysis
   - 1% AEP flood level
   - Flood Planning Level (FPL)
   - Probable Maximum Flood (PMF) level
   - Flood Risk Precinct, ie High, Medium or Low
   - Flood Life Hazard Category
   - Mapping of relevant extents
   - Flood characteristics for the site, eg depth, velocity, hazard and hydraulic category, and the relevance to the proposed development

   If the property is affected by an Estuarine Planning Level (EPL) which is higher than the FPL, then the EPL should be used as the FPL. If the FPL is higher than the PMF level, then the FPL should still be used as the FPL, as it includes freeboard which the PMF does not.

3. Assessment of impacts
   - Summary of compliance for each category of the DCP, as per the table below.

	Compliance		
	N/A	Yes	No
A) Flood effects caused by Development			
B) Building Components & Structural Soundness			
C) Floor Levels			
D) Car parking			
E) Emergency Response			
F) Fencing			
G) Storage of Goods			
H) Pools			

   - Demonstration of how the development complies with any relevant flood planning requirements

from the DCP, LEP, Water Management for Development Policy, and if it is in the Warriewood Valley Urban Land Release Area, with the Warriewood Valley Water Management Specification (2001)

- For any non-compliance, a justification for why the development should still be considered.
- Calculations of available flood storage if compensatory flood storage is proposed
- Plan of the proposed development site showing the predicted 1% AEP and PMF flood extents, as well as any high hazard or floodway affectation
- Development recommendations and construction methodologies
- Qualifications of author - Council requires that the Flood Management Report be prepared by a suitably qualified Engineer with experience in flood design / management who has, or is eligible for, membership to the Institution of Engineers Australia
- Any flood advice provided by Council
- Any other details which may be relevant

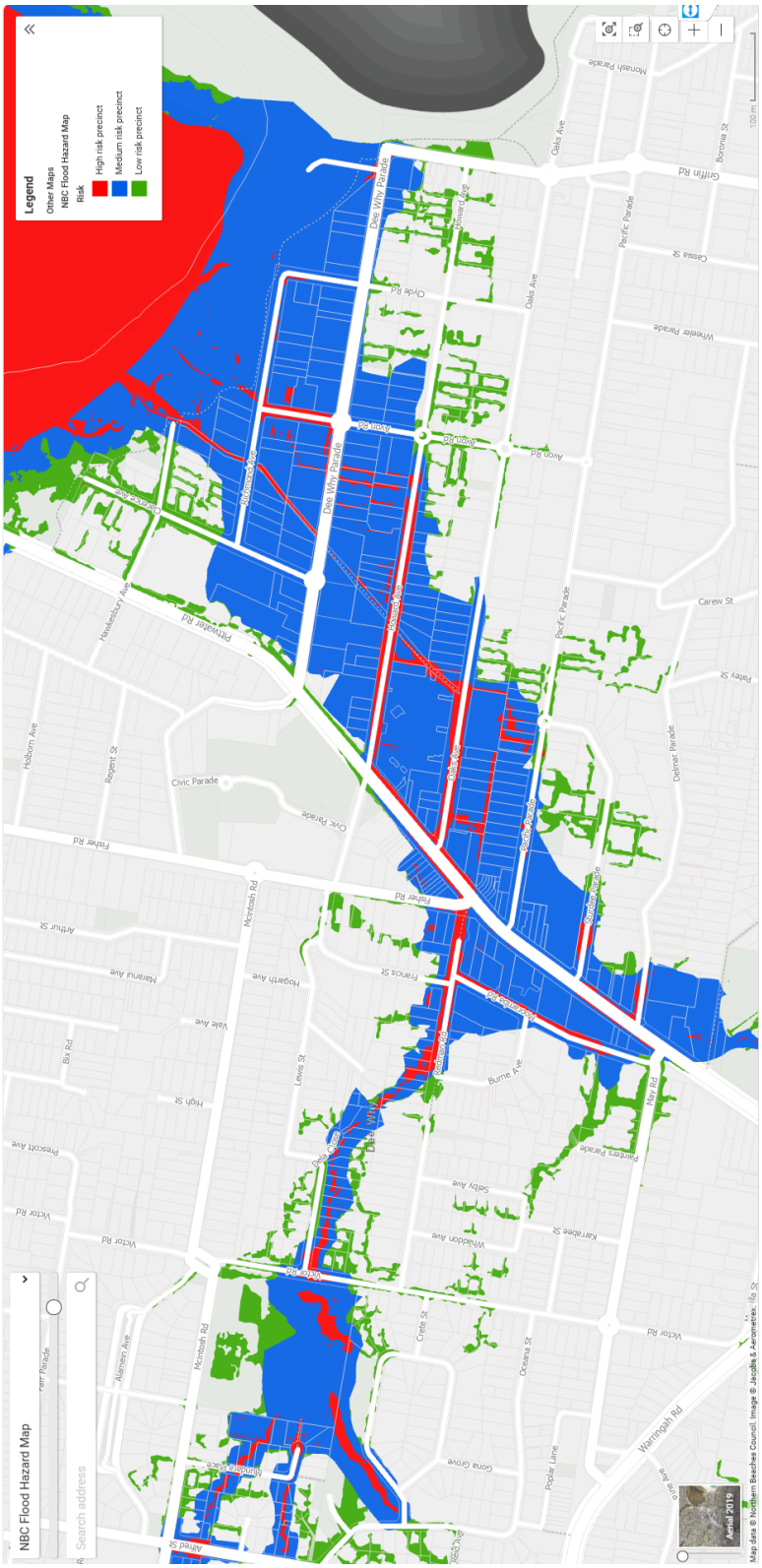
Further information and guidelines for development are available on Council's website at:

https://www.northernbeaches.nsw.gov.au/planning-and-development/building-and-renovations/development-applications/guidelines-development-flood-prone-land

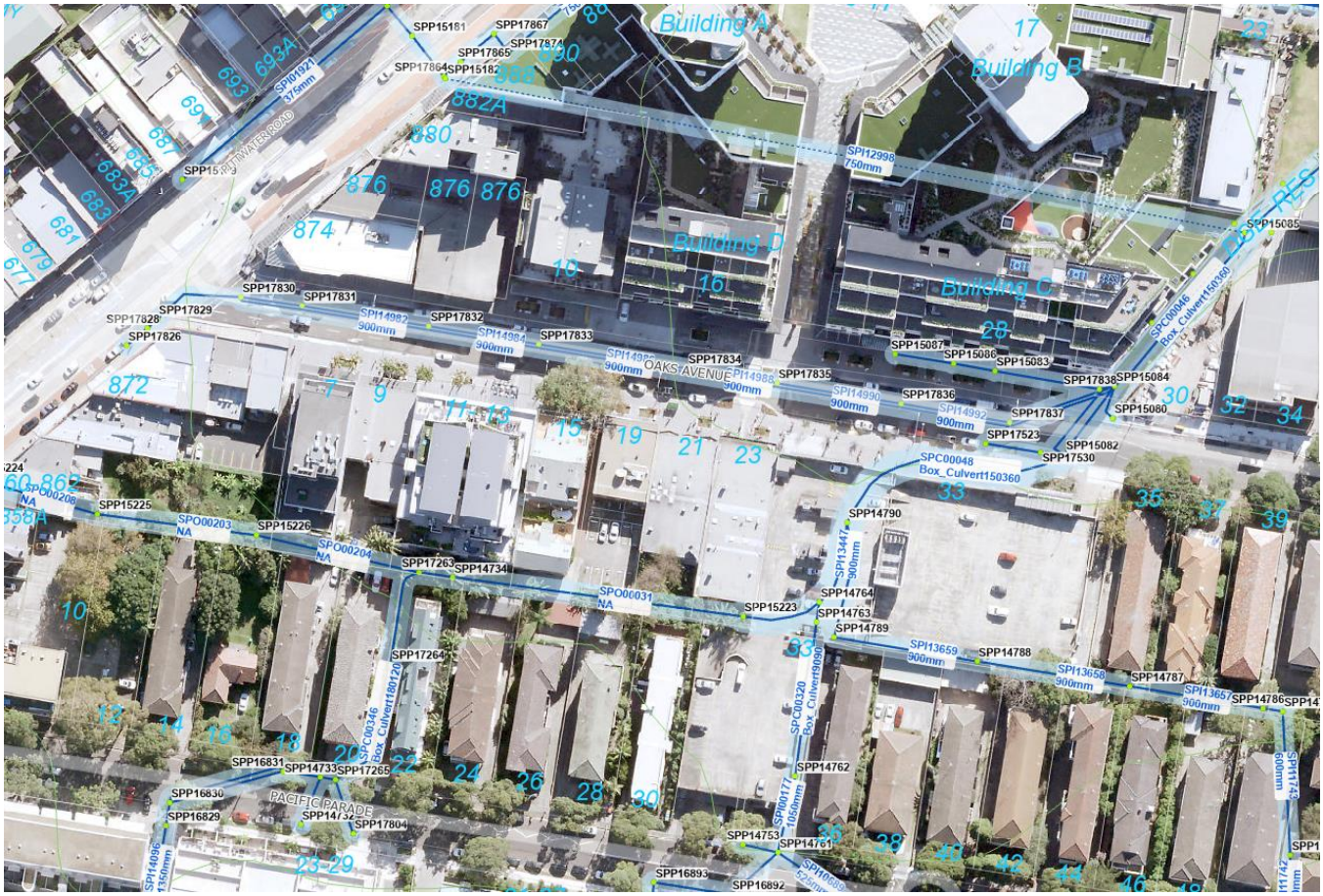
Council's Flood Team may be contacted on 1300 434 434 or at floodplain@northernbeaches.nsw.gov.au .

Appendix D

Dee Why Lagoon drainage extents / catchment
Dee Why CBD drainage infrastructure
Local flooding – March 2022



Dee Why Lagoon
drainage extents / catchment
(Northern Beaches Council Website)



Dee Why CBD drainage infrastructure
(Northern Beaches Council Website)

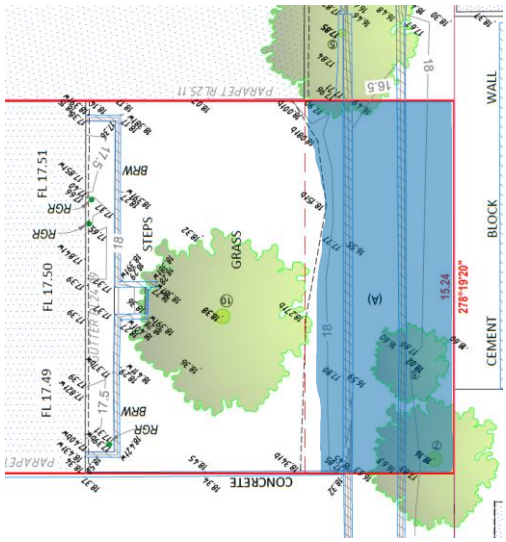
Local flooding – March 2022

Appendix E
Flood extents analysis

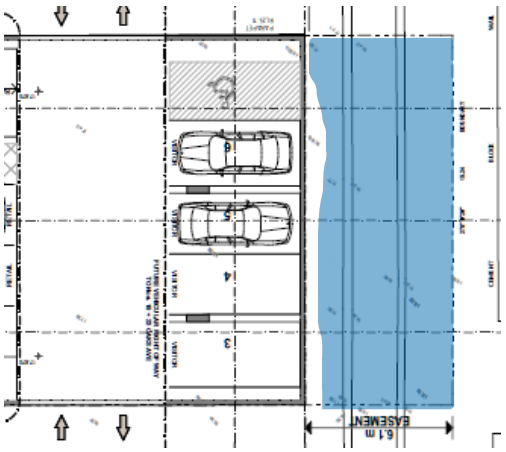
Southern Boundary 1% AEP Flood Extents
Note - Flood Levels ID 5 / 6 (18.10 / 17.94) within 6.1m easement extents / predominately the conc culvert and an area of no proposed works

Flood Data

ID	1% AEP Max WL (m AHD)	1% AEP Max Depth (m)
1	17.55	0.25
2	17.38	0.17
3	N/A	N/A
4	N/A	N/A
5	18.10	1.59
6	17.94	1.51



Existng Survey with in site Flood Extents

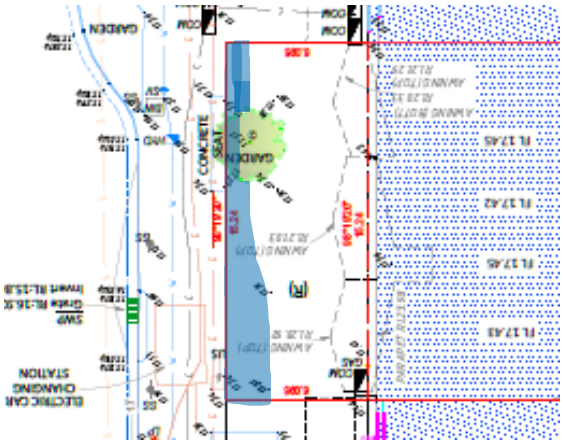


Proposed development with in site Flood Extents

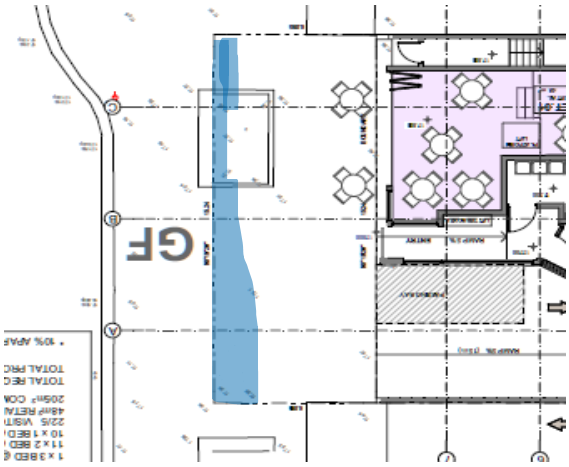
Northern Boundary 1% AEP Flood Extents
Note - Flood Levels ID 1 / 2 (17.55 / 17.38) on northern boundary in an area of no proposed works

ID	1% AEP Max WL (m AHD)	1% AEP Max Depth (m)
1	17.55	0.25
2	17.38	0.17
3	N/A	N/A
4	N/A	N/A
5	18.10	1.59
6	17.94	1.51

Flood Data



Existng Survey with in site Flood Extents



Proposed development with in site Flood Extents

Appendix F

Council PLM notes re FPL

Flooding Engineer
The Flood planning level of 17.88mAHD as marked on the plans is acceptable. Subject to a sufficient Flood Management Report and flood modelling, the development should ok for flooding. I won't come to the PLM is that's ok. Feel free to call me in if needed. Below are my comments. A Flood Management Report (FMR) required to review the design against prescriptive controls in E11 of the WDCP. The Flood Planning Level (FPL) of 17.88mAHD as marked on the plans is acceptable (at the marked locations). The flood levels vary on the site, so a comprehensive Flood Information Report is recommended to be obtained from Council (unless Council's TUFLOW flood model is licenced). It is noted that the rear of the building extends slightly into the 1% AEP (100 year) flood extent as well as the Probable Maximum Flood (PMF) extent. Justification in the FMR is needed to demonstrate that the development will not result in net-loss of flood storage at the rear and not make flooding worse for other properties. Modelling may be required to demonstrate this. Confirmation that that only the first 5m of the street frontage is below FPL. Justification why the lobby can't be raised to the FPL is also required.

Note

Refer Appendix E, Flood Levels ID 5 / 6 (18.10 / 17.94) within 6.1m easement extents / predominately the conc culvert and an area of no proposed works. Therefore the rear of the building extents <u>does not</u> extend slightly into the 1% AEP (100year) flood extent.

Appendix G
Lucas Molloy
CV

Curriculum Vitae 2023

Lucas Molloy
MIEAust / CPEng / NER / APEC / Engineer / IntPE(Aus)

Education -

- 1988 Higher School Certificate
  Pittwater High School NSW Australia
- 1995 Bachelor of Engineering (Civil)
  University of Wollongong NSW Australia

Employment -

- May 2007 to date
  Barrenjoey Consulting Engineers pty ltd
  Director / Engineer / Draftsman
- April 2003 to April 2007
  Northern Beaches Consulting Engineers pty ltd
  Director / Engineer
- Feb 1997 to April 2003
  Northern Beaches Consulting Engineers pty ltd
  Engineer
- Dec 1988 to Dec 1993
  Jack Hodgson Consulting Engineers
  Undergraduate trainee / Engineer

For last sixteen years Director / Engineer / Draftsman of the structural and civil engineering practice Barrenjoey Consulting Engineers pty ltd (est 2007). I am responsible for the structural and civil (including stormwater management) design, documentation, investigation and construction supervision of predominately residential developments.
The spectrum of projects I have consulted on, vary from a 6 square meter timber framed deck extension of a residential house (budget ~ $1,500) to 8 storey commercial development (budget of ~ $10,000,000).

During my career I have been active in the preparation and issuing of –

- 250+ stormwater management plans inc on site detention
- 50+ overflow / flood analysis using DRAINS / HECRAS / AR+R
- 25+ flood inundation & risk assessment reports

Appendix H

Northern Beaches Council
Standard Hydraulic Certification Form

NORTHERN BEACHES COUNCIL
STANDARD HYDRAULIC CERTIFICATION FORM

FORM A/A1 – To be submitted with Development Application

Development Application for

Address of site: **21 Oaks Ave Dee Why**

Declaration made by hydraulic engineer or professional consultant specialising in flooding/flood risk management as part of undertaking the Flood Management Report:

I, **Lucas Molloy** on behalf of **Barrenjoey Consulting Engineers p/l** on this the **15th March 2024** certify that I am engineer or a professional consultant specialising in flooding and I am authorised by the above organisation/ company to issue this document and to certify that the organisation/ company has a current professional indemnity policy of at least $2 million.

Flood Management Report Details:

Report Title: **FLOOD MANAGEMENT REPORT**
PROPOSED SHOP TOP HOUSING
21 OAKS AVENUE DEE WHY

Report Date: **March 2024**
Author: **Lucas Molloy**
Author's Company/Organisation: **Barrenjoey Consulting Engineers p/l**

I: **Lucas Molloy**

Please tick all that are applicable (more than one box can be ticked)
X have obtained and included flood information from Council (must be less than 12 months old)
X have followed Council's Guidelines for Preparing a Flood Management Report
na have requested a variation to one or more of the flood related development controls. Details are provided in the *Flood Management Report*.

Signature

Name **Lucas Molloy**
MIEAust / CPEng / NER 788184 / APEC / Engineer / IntPE(Aus)
Director
Barrenjoey Consulting Engineers p/l

End of Document