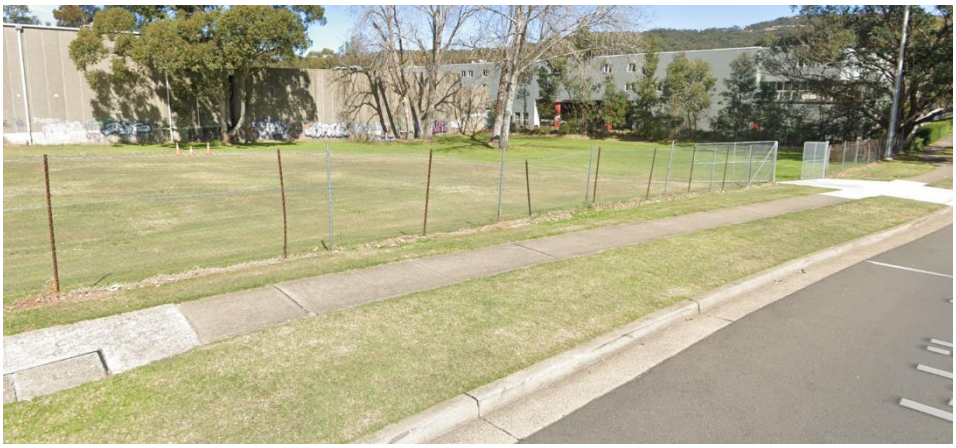
FLOOD RISK MANAGEMENT & EVACUATION STRATEGY REPORT:

15 JUBILEE AVENUE, WARRIEWOOD

Project No.00016108

Date: 13 August 2020



Prepared for:
Comfort DelGro Australia
C/O McNally Management Pty Ltd
Level 9, 47 York Street
Sydney NSW 2000

Disclaimer

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Introduction

This report has been prepared to accompany the Development Application for the development known as LOT 202 DP 1019363 – 15 Jubilee Avenue, Warriewood.

This report details the flood risk management strategies and recommendations to address the flood related controls that apply to the development. Upon review of the Ingleside, Elanora and Warriewood Overland Flow Flood Study 2019 it appears that the site is affected by flooding waters during storms events up to the 1% Annual Exceedance Probability (AEP) and Probable Maximum Flood Event (PMF).

The assessment takes into consideration the safety, economic, engineering, environmental and social aspects of to effectively address the flood evacuation of people who are within the vicinity of the development site.

Site Context

The proposed development address is 15 Jubilee Avenue, Warriewood (the Site) also known as Lot 202 DP1019363. The existing greenfield site covers an area of approximately 4560m2 bordered by Jubilee avenue along the northern boundary, industrial units along the western and southern boundaries, and a single residential dwelling along the eastern boundary. A generalised slope runs from northeast to southwest across the site, consisting mostly of short grass with some mild to dense vegetation in the southwest corner. Easements are located along the southern boundary, over an existing channel along the western boundary and over a sewer pipe that runs in a north-south direction through the site. The site is accessed via a single driveway access point along Jubilee Avenue. The location of the site is shown in Figure 1.

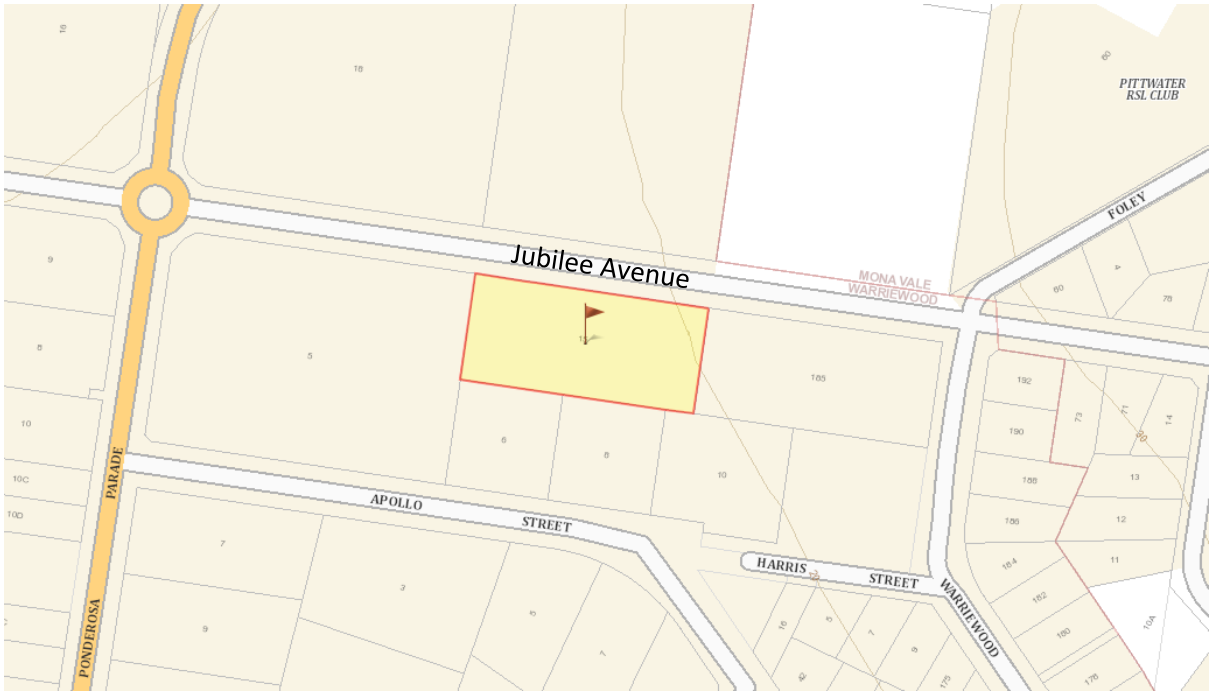


Figure 1 – Locality map (Source: https://maps.six.nsw.gov.au/, accessed 12/08/20).

Proposed Development

The proposed bus depot upon completion of all works will consist of new hardstand pavement with associated parking spaces, a small office building, landscaped areas, a bioretention basin, and a below ground on-site detention (OSD) tank. Figure 2 below is the proposed development architectural plan.

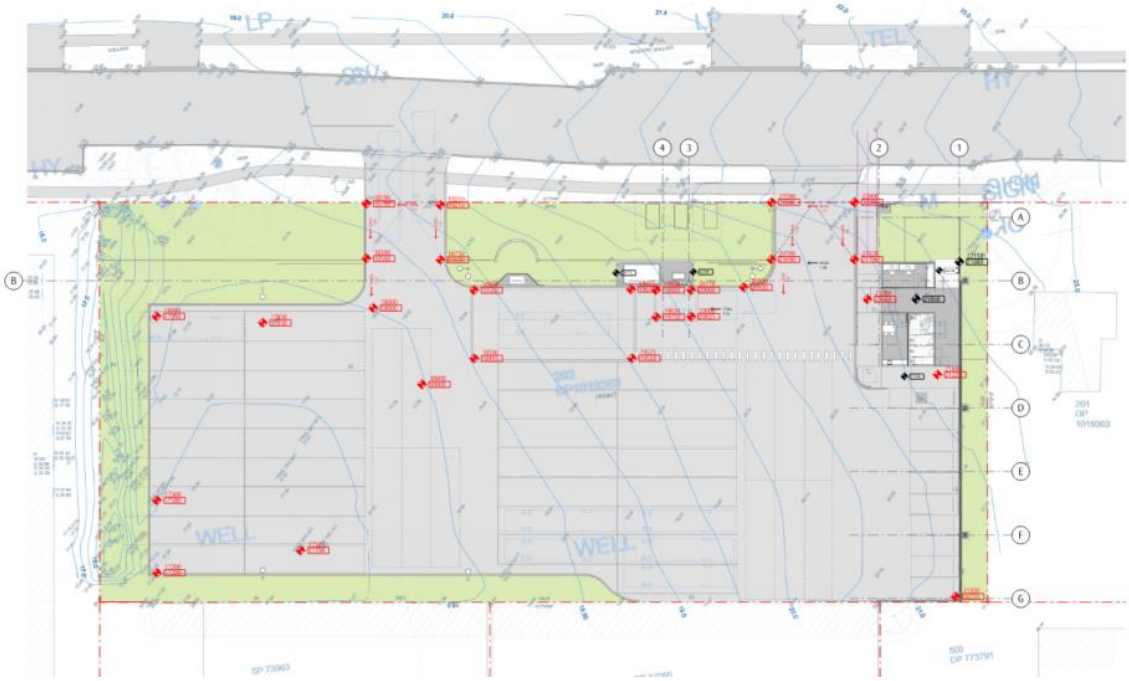


Figure 2– Proposed development footprint

Existing flood regime

Review of the following available information was undertaken to assess the existing flood regime on the development site:

- Ingleside, Elanora and Warriewood Overland Flow Flood Study – 2019
- Flood hazard mapping tool – Northern Beaches Council eServices

Further to the available information from Council's resources, Council have provided further advice on the flood specific levels identified for the site reported below.

- % Annual Exceedance Probability (AEP) existing flood levels applicable to the site are approximately:
  - North western corner of the site RL 17.86m AHD
  - South Western corner of the site RL 17.90m AHD
- Probable Maximum Flood level RL 18.7m AHD

In review of the above information, we have considered that the Flood Planning Level (FPL) to be the 1% AEP flood level + 0.5m freeboard. Therefore, an appropriate FPL is RL 18.4m AHD.

It appears from the flood mapping available the existing open channel along the western boundary has a minor area of high hazard flows. However, internal to the site the hazard is considered medium risk (see Appendix-A for extract of the flood hazard for the site).

Extracts taken the Ingleside, Elanora and Warriewood Overland Flow Flood Study depict the extent of flooding for the development site and surrounding areas for the events of 20% (Annual Exceedance Probability) up to the 1% AEP and Probable Maximum Flood (PMF) presented below.

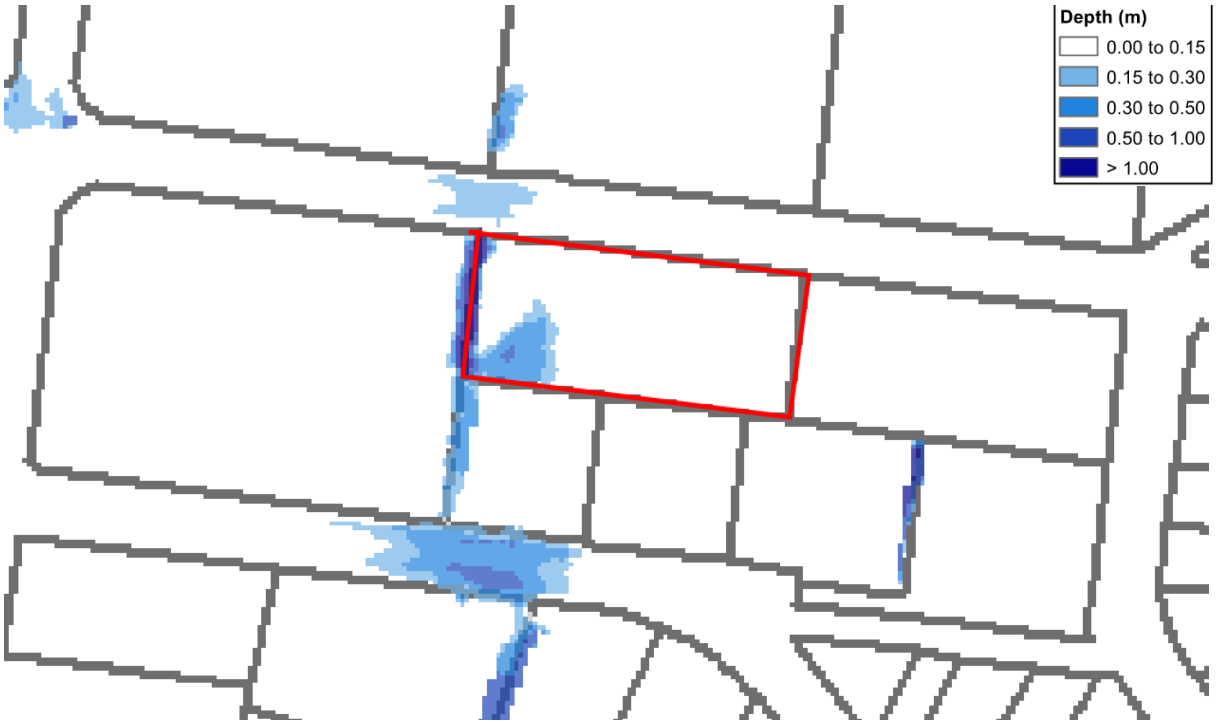


Figure 3 - 20% AEP Flood extent

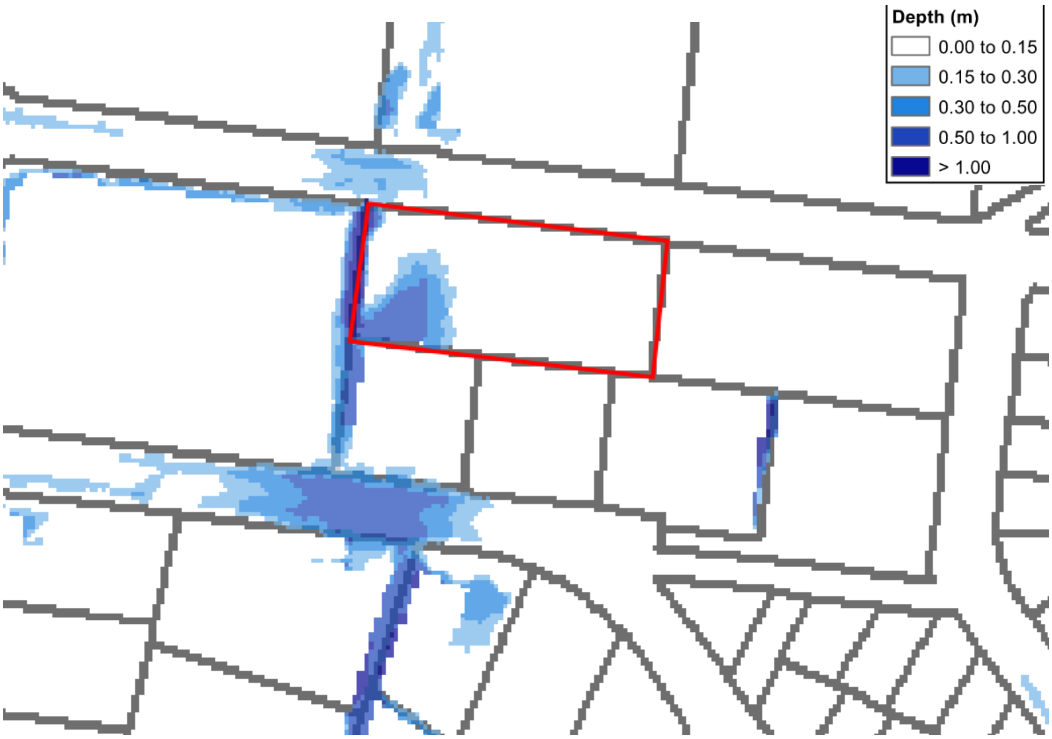


Figure 4 - 1% AEP Flood extent

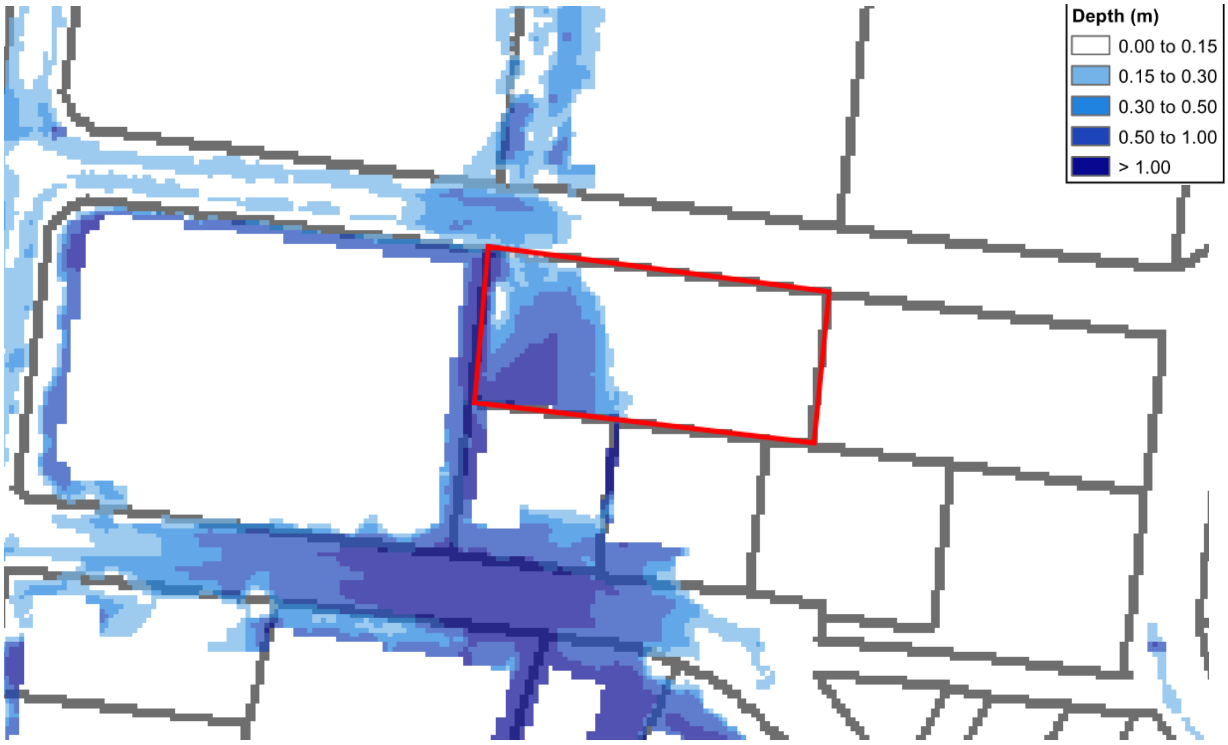


Figure 5 - PMF extent

It is worth noting that the flood extent within the development site (but outside of the open channel along the Western Boundary) experiences an extremely low velocity. This would indicate that the type of flooding in this area is slowly rising floodwaters most likely as a result of back flow from the downstream capacity constraints (i.e. buildings). This is relevant for addressing the development controls for the site including operational use for the depot. See image below depicting the velocity for the 1% AEP event.

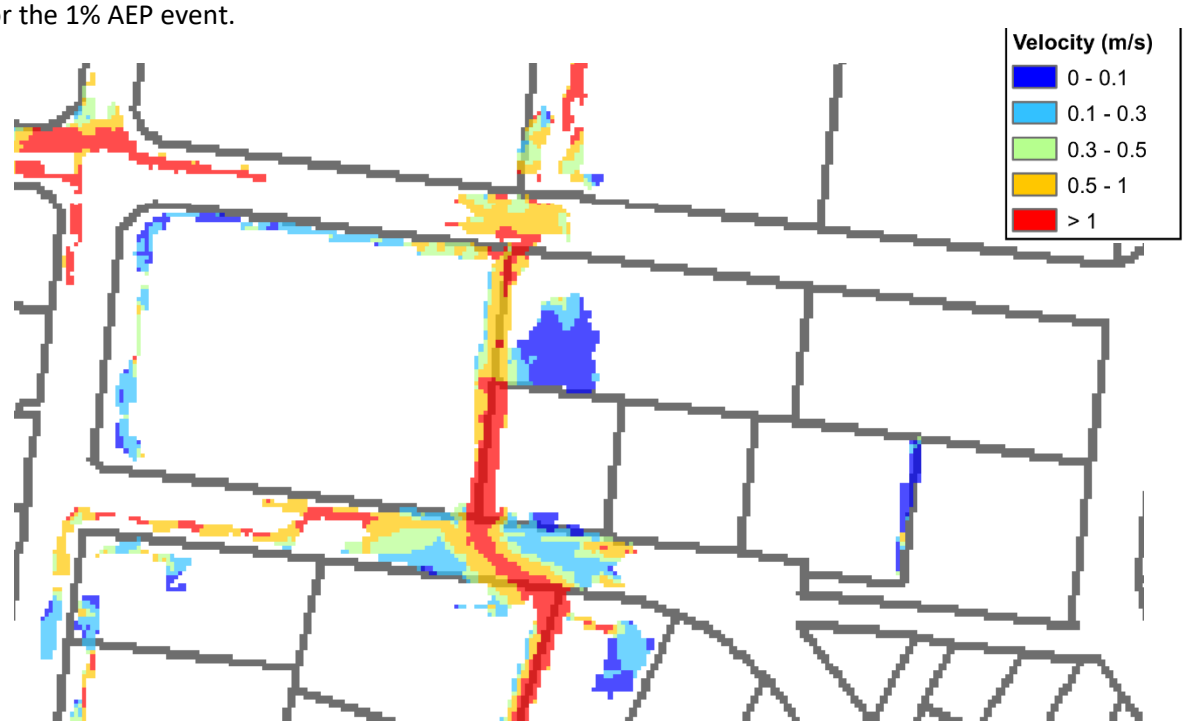


Figure 6 - Velocity during 1% AEP considered low risk

Flooding Management

Given the existing flood regime for the development site, the below information addresses compliance with the Council development controls that apply.

Information relied on to prepare the flood risk and evacuation strategy for the development site include:

- Northern Beaches Council – Flood Management Report
- Pittwater 21 DCP – Part B3.11 Flood Prone Land
- NSW Floodplain development manual 2005
- Australian Rainfall and Runoff 2019

In review of the aforementioned flood risk that applies to the site (medium risk) and the type of development considered "Transport Depot", we have undertaken an analysis of how the flood controls will be addressed on site following the Flood Risk Matrix guidelines stipulated in Council's DCP.

		Medium Flood Risk
		Business
		& Industrial
A	**Flood effects caused by Development**	A1
		A3
B	**Drainage Infrastructure & Creek Works**	B1
		B2
C	**Building Components & Structural**	C1
		C2
		C3
D	**Storage of Goods**	D1
		D2
E	**Flood Emergency Response**	E1
		E2
		E3
F	**Floor Levels**	F1
		F2
		F3
		F4
		F6
		F8
		F9
		F10
		F11
G	**Car Parking**	G1
		G2
		G3
		G4
		G5
		G6
		G7
H	**Fencing**	H1
I	**Pools**	I1

Flood effects caused by Development

A1	Jetty	N/A
A3	The applicant shall include in their submission, calculations to illustrate that any fill or other structures that reduce the total flood storage are replaced by Compensatory Works.	The area of the site that is below the 1% AEP flood extent involves open bus parking area. The proposed works and finished levels over the area that is below the 1% AEP flood extent must not be higher than existing ground levels, thus not impacts on flood storage and/or affecting the flood regime. Details of this is presented in the civil engineering plans prepared by Lindsay Dynan.

Drainage Infrastructure and Creek Works

B1	Flood mitigation works or stormwater devices that modify a major drainage system, stormwater system, natural water course, floodway or flood behaviour within or outside the development site may be permitted subject to demonstration through a Flood Management Report that they comply with the Flood Prone Land Design Standard found on Council's webpage.	Proposed stormwater management design involves the design and construction of an on-site detention facility located outside of the 1% AEP flood extent. The design intent is to limit the post-development flows to the pre-development scenario. No major works occur with the existing channel located along the western boundary. Only the discharge pipe connection.
B2	A Section 88B notation under the Conveyancing Act 1919 may be required to be placed on the title describing the location and type of flood mitigation works with a requirement for their retention and maintenance.	Noted. To be addressed via conditions of consent (if required)

Building Components and Structural Soundness

C1	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).	All proposed buildings are location on the eastern side of the site located outside of the PMF flood level.
C2	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.	Noted. Structural design and certification to be provided at Construction Certificate stage. All proposed buildings are location on the eastern side of the site located outside of the PMF flood level.
C3	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.	Noted.

Storage of Goods

D1	Hazardous or potentially polluting materials shall not be stored below the Flood Planning Level unless adequately protected from floodwaters in accordance with industry standards.	Noted.

D2	Goods, materials or other products which may be highly susceptible to water damage are to be located/stored above the Flood Planning Level.	Noted.

Flood Emergency Response

E1	Development shall comply with Council's Flood Emergency Response Planning for Development in Pittwater Policy and the outcomes of any Flood Risk Emergency Assessment Report where it applies to the land.	Noted. See further in this report for Flood emergency report
E2	New development must provide an appropriately sized area to safely shelter in place above the Probable Maximum Flood level and appropriate access to this area should be available from all areas within the development.	Noted. See further in this report for Flood emergency report
E3	Adequate Warning Systems, Signage and Exits shall be installed to allow safe and orderly evacuation without reliance upon the SES or other authorised emergency services personnel.	Noted. See further in this report for Flood emergency report

Floor Levels

F1	New floor levels within the development shall be at or above, the Flood Planning Level. A reduced Flood Planning Level may be considered only where it is permitted in this Development Control Plan. The structure must be flood proofed (wet or dry) to the Flood Planning Level.	Noted. Proposed buildings are located above the PMF and nominated FPL.

	This control cannot be applied to critical or vulnerable uses.	
F2	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. Where the dwelling is located over a flow path it must be elevated on suspended pier/pile footings such that the level of the underside of all floors including balconies and decks within the flood affected area are at or above, or raised to the Flood Planning Level to allow clear passage of the floodwaters under the building. The development must comply with the Flood Prone Land Design Standard.	Noted. Proposed buildings are located above the PMF and nominated FPL.
F3	Where the lowest floor has been elevated to allow the passage of flood waters, a restriction shall be imposed on the title of the land, pursuant to S88B of the Conveyancing Act confirming that the undercroft area is not to be enclosed.	N/A
F4	A one- off addition or alteration below the Flood Planning Level of less than 30 square metres or an increase of less than 10% of the ground floor area (whichever is the lesser) for residential development 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 This control will not be permitted if this provision has previously been utilised since the making of this Plan.	N/A

	The structure must be flood proofed to the Flood Planning Level.	
F6	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) there is no increase to the building footprint below the Flood Planning Level; (c) it is flood proofed to the Flood Planning Level;	N/A
F8	The minimum floor level of any first floor additions shall be at or above the Probable Maximum Flood Level.	N/A
F9	Foyers – consideration may be given to a minimum floor level of a foyer being set at the 5% AEP flood level, provided it can be demonstrated that it complies with the Flood Prone Land Design Standard.	N/A
F10	Consideration may be given to a minimum floor level for the first 5 metres from the street front of new development in business zonings below the Flood Planning Level provided it can be demonstrated that it complies with the Flood Prone Land Design Standard.	Noted. Proposed buildings are located above the PMF and nominated FPL.

F11	A one-off addition or alteration below the Flood Planning Level of less than 100 square metres or an increase of less than 10% of the ground floor area (whichever is the lesser) for non-residential development may be considered only where the required floor level cannot be achieved for the following reason: (a) it would be incompatible with floor levels of the existing building This control will not be considered if the existing floor level of the additions/alterations are located within a high hydraulic hazard area. This control will not be permitted if this provision has previously been utilised since the making of this Plan. Any features of the additions or alterations on the floor level must be flood proofed to the Flood Planning Level	N/A

Car Parking

G1	Open carpark areas and carports shall not be located within a floodway.	Carpark areas located outside of open channel floodway area and easement. Proposed developed is designed to not reduced flood storage and finished levels are proposed no higher than existing ground levels.
G2	The lowest floor level of open carparks and carports (unroofed or with open sides) shall be constructed no lower than the natural ground levels.	Proposed developed is designed to not reduced flood storage and finished levels are proposed no higher than existing ground levels. Details of this is presented in the civil engineering plans prepared by Lindsay Dynan.
G3	All enclosed car parks must be protected from inundation up to the relevant flood planning level. For example, basement carparks must be provided with a crest at the entrance, the crest of which is at the relevant Flood Planning Level. All access, ventilation and any other potential water entry points to any enclosed car parking shall be above the relevant Flood Planning Level.	N/A

	Council will not accept any options that rely on electrical, mechanical or manual exclusion of the floodwaters from entering the enclosed carpark	
G4	Vehicle barriers or restraints are to be provided to prevent floating vehicles leaving the site where there is more than 300mm depth of flooding in a 1% AEP flood event. The minimum height of the vehicle barriers or restraints must be at or above the Flood planning Level. Vehicle barriers or restraints must comply with the Flood Prone Land Design Standard.	It is proposed that the proposed depot will facilitate and allow for parked bus vehicles on site. It is considered unlikely that the vehicles will be float when any inundation occurs as they are not considered watertight. In addition, the flood regime during the 1% AEP is significantly low velocity which would result in buses unlikely to be moved during a flood event. As a provision, an on-site operational movement of buses during any major flood event should be prepared.
G5	Enclosed Garages must be located at or above the 1% AEP level	N/A
G6	Carports must comply with the Flood Prone Land Design Standard	N/A
G7	Where a driveway is required to be raised it must be demonstrated that there is no loss to flood stage in the 1% AEP flood event and no impact on flood conveyance through the site	It should be noted that both access driveways are outside of the 1% AEP and PMF levels. Internally, the finished design levels of the site are designed so no fill above the existing natural ground level occurs.

Fencing

H1	Fencing, including pool fencing, shall be designed so as not to impede the flow of flood waters and not to increase flood affectation on surrounding land. Appropriate fencing must comply with the Flood Prone Land Design Standard in addition to other regulatory requirements of pool fencing.	Noted

Pools

I1	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 waterproofed and/or located at or above the Flood Planning Level. All chemicals associated with the pool are to be stored at or above the flood planning level.	N/A

Flooding Emergency Response Strategy (FERS)

The FERS sets out the potential consequences of flooding, the time at which action should be taken to evacuate and the procedures to be followed in a possible flood event. The FERS should be provided as part of the contract for all development lots and should be conditioned to be mounted in prominent locations throughout the future development where it can be seen by the occupants/patrons (for example; in hallways, the garage, where medical provisions are kept, electrical switchboard box, etc...)

The FERP outlines that the occupants to move outdoor equipment, garbage, chemicals and poisons to higher locations and also plan which indoor items they will raise or empty if water threatens the home (e.g. freezers and refrigerators), check their emergency kit and safeguard their pets. They need to communicate with friends, family and neighbours about their plans etc.

The FERS also describes what should be done after a flood event.

A copy of the FERS for the development should be used as a guideline for the occupants/patrons as they may wish to adjust some of the items included in the document.

It should be noted that the proposed building/office on the development site residues well above the PMF levels. The building finished floor level at the time of documenting this report was RL 21.86m AHD. The PMF level is approximately RL 18.7m AHD.

It is therefore advised that during any potential flood event, that any occupants on the site at his time should take shelter in place.

At this time, further advice should be sort from the relevant authorities outlined below.

Procedure in Case of Flooding

The procedure outlined below is in accordance with the NSW Government – NSW State Emergency Services (SES) 'Flood Safe' guidelines.

In lieu of any flood event, a 'Business Flood Safe Toolkit' should be undertaken and regularly updated. The primary goal of the 'Business Flood Safe Toolkit' may assist you in reducing the impact flooding may have on your business. The 'Toolkit' can be completed online at:

(http://floodsafe.ses.org.au/floodsafe/businesstoolkit/)

Steps to be Followed in the Event of Possible Flooding

1. Flood information including 'Flood Watches' and 'Flood Warnings' issued by the Bureau of Meteorology (BOM), road closures and advice on evacuations and property protection will be updated on the BOM website (http://www.bom.gov.au/nsw/warnings/), broadcast over ABC, other national, state and local radio stations. The ABC is the Emergency Services Broadcaster.

2. The NSW SES issue Flood Bulletins to radio stations which inform people about what is expected to happen during flooding. SES Flood Bulletins provide information on likely flood consequences and what actions are required to protect yourself and your property. Radio stations are asked to read the Flood Bulletin 'word for word' over a period of time.

3. Other ways you may be informed of possible flooding is through doorknocking by emergency services, through word of mouth or the SES may issue an Emergency Alert. An Emergency Alert is a message that is sent to your landline or mobile phone as a voice or text message. The SES advises people to always follow instructions given by the emergency services and make sure neighbours, family friends are aware of possible flooding.

IN THE EVENT THAT THE STATE EMERGENCY SERVICES HAS NOT PROVIDED AN EMERGENCY ALERT MESSAGE OR ARE UNABLE TO BE CONTACTED, THE FOLLOWING INSTRUCTIONS SHOULD BE FOLLOWED. HOWEVER, ANY MESSAGE AND INSTRUCTIONS RECIEVED BY STATE EMERGENCY SERVICES SHOULD GOVERN THE TRIGGER LEVELS OUTLINED BELOW.

1. During floods many local and major streets and roads may be cut off by floodwaters that may make the escape by vehicle extremely difficult. Travelling through floodwaters on foot or in a vehicle can be very dangerous as obstructions can be hidden under the floodwaters, or you could be swept away, even if in a car, or the water may be polluted. It is recommended staying

within the building as much as practical as this is the safest option. If you urgently need to leave the building, do so early in the flood event.

2. In the unlikely event that flood waters have risen up to the building, do not evacuate the building at this time unless instructed to do so by the SES or the Police. Floodwaters are much deeper, run much faster and are more dangerous outside. Any disabled person/s should be assisted and moved to the nominated level in the building as outlined above.

3. In the case of a medical or life threatening emergency ring '000' as normal, but explain about the flooding.

4. Stay tuned on a battery powered radio for official advice and warnings

5. Don't return home until authorities have said it is safe to do so

6. Stay away from drains, culverts and water over knee-deep

7. Do not turn on gas and electricity until it has been checked by a professional/licensed repairer.

8. Avoid using gas or electrical appliances which have been in flood water until checked by for safety by a suitably qualified person.

9. Take photos for insurance purposes.

After the Flood

- Stay tuned to ABC 702 on a battery powered radio for official advice and warnings
- Don't return home until authorities have said it is safe to do so
- Don't allow children to play in or near flood waters
- Avoid entering flood waters, it is dangerous. If you must, wear solid shoes and check depth and current with a stick
- Stay away from drains, culverts and water over knee-deep
- Don't turn on your gas and electricity until it has been checked by a professional/licensed repairer
- Avoid using gas or electrical appliances which have been in flood water until checked for safety
- Boil tap water until supplies have been declared safe
- Watch for trapped animals
- Beware of fallen power lines
- Take many photos for all damage for insurance purposes

- Notify family and friends of your whereabouts

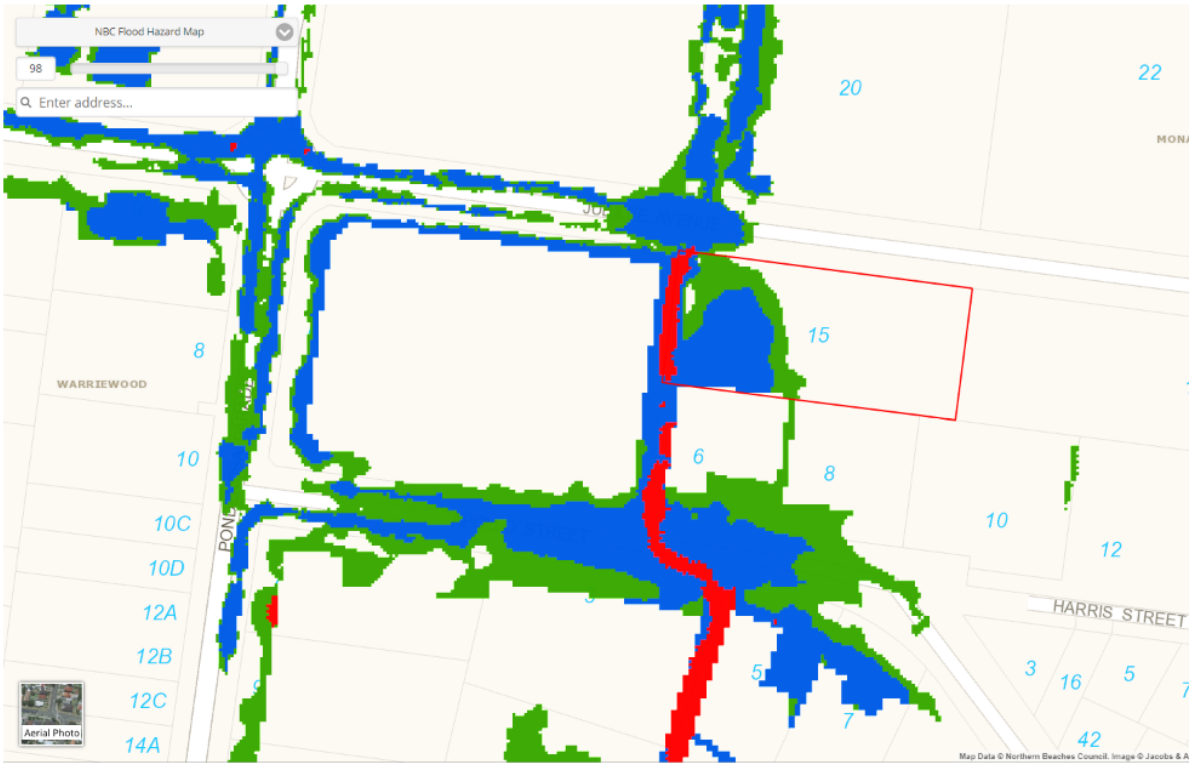
Important Phone Numbers
State Emergency Service: Emergency 132 500 General Enquires: 4251 6111
Police, Fire, Ambulance: Emergency 000
Bureau of Meteorology (Website): http://www.bom.gov.au/weather
Land, Weather and Flood Warnings, phone: 1300 659 215
Northern Beaches Council: .....
Manager: .....
Strata Manager: .....
Other: .....

Should you require any further advice or clarification of any of the above, please do not hesitate to contact us.

Yours faithfully
LINDSAY DYNAN
CONSULTING ENGINEERS PTY LIMITED

Scott Sharma
Senior Civil Engineer

APPENDIX A – FLOOD HAZARD MAPPING



NBC Flood Hazard Map
- High risk precinct
- Medium risk precinct
- Low risk precinct