Pittwater Data Services Pty Ltd
ABN 36098815537
27 Ashby Street
Dudley, 2290
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Our Reference: PDS15092019:43PITTW:MANLY

Mrs Anne Preece
43 Pittwater Road,
Manly, 2095
15/09/2019

Re: Flood Management Report for 43 Pittwater Road, Manly

Dear Anne,

EXECUTIVE SUMMARY

This report details an investigation into the potential flooding and the impact of a proposed development at 43 Pittwater Road, Manly (***site***). A summary of the key findings of this investigation are as follows:

1. The ***site*** is located in the west Manly catchment as shown in Figure 1. The ***site*** is exposed to flood inundation to a depth of approximately 0.5 metres during a 1% AEP event, peaking at 5.9 metres AHD. The PMF peak flood level is predicted to be 6.1 metres AHD (Appendix C).
2. The ***site*** is sheltered from flood flows and should be classified as Flood Storage.
3. The ***site*** is inundated when flood levels are greater than 5 metres AHD. These events have historically occurred as shown in Figure 2.
4. During a major event, flood levels at the ***site*** are generated by catchment runoff, not ocean surges. During a 1%AEP event the critical duration for 1%ARI rainfall to generate high flood levels is between 1 to 2 hours. The ***site*** is predominately inundated by the flooding processes of in Kangaroo Lane and to a lesser degree Pittwater Road.
5. During a 1%AEP event the ***site*** will be fully inundated to a peak level of 5.9m AHD in approximately 10 to 15 minutes after the floodwaters from Kangaroo Lane inundate the ***site*** (Figure3 and Appendix C page 4).
6. This report provides information on the flooding processes at the ***site.*** The residents of the ***site*** should aware of this information to prepare for any future flood events.
7. Severe flood warnings for the Northern Beaches and Manly in particular, predicted by the Bureau of Meteorology (BoM), should be the trigger to prepare for potential flooding at the ***site***. This information is broadcasted on radio and TV, and is available on BoM website. Typically, rainfall intensities in excess of 20mm/hour over a 1 hour period will generate flooding in the Manly area.

8. A flood level approaching 5m AHD will overtop the boundaries of the ***site***. If flood warnings continue, flood preparations should begin as this is a trigger for a major event to occur. Appendix A details a plan
9. Flood evacuation from the ***site*** is not recommended. The Attic Level as detailed in Figure 4, are above the PMF and should be used as a shelter in Place.
10. The proposed addition complies with NBC Manly DCP Section 5.4.3 as detailed in Appendix B.

1.0 INTRODUCTION

I refer to your Development Application (DA) at 43 Pittwater Road Manly (Lot 4 DP 233249) as discussed with C3D Design Pty Ltd. The proposed development is detailed in Figures 5 and 6. Northern Beaches Council (NBC) has identified the property as Medium Risk Princinct. Therefore, a Flood Management Report (FMR) of the design, flooding and evacuation process as detailed in Manly Development Control Plan (DCP Section 5.4.3) is required.

The following investigation was undertaken and submitted for both your and Councils consideration as part of the DA process. Note that 43 Pittwater Road Manly, will be referred to as the ***site.***

2.0 SITE INSPECTION

A ***site*** inspection was undertaken on the 16th September, 2019 by Mr. Stephen Wyllie. The ***site*** is located as shown in Figures 1 and 2. There are several features of the topography of the ***site*** and its location (proximity to Raglan Street and Manly Oval) that are important to the potential overland flooding processes and a flood evacuation plan. These are:

1. The ***site*** is located between Pittwater Road and Kangaroo Lane as shown in Figure 1.
2. Kangaroo Lane intersects at Raglan Street and is bounded by a major rock escarpment as shown in Figure 2.
3. Raglan Street connects the upper catchment potentially transporting overland flows to the lower catchments and into Kangaroo Lane and Pittwater Road.
4. The lowest level of Kangaroo Lane is 4.6 m AHD south of the ***site*** as shown in Figure 2.
5. The *site* ground level is approximately 5.5 AHD (Figures 2 and 4).
6. The existing house floor level (5.92 metres AHD) is approximately 0.5 metres above the surrounding ground levels. (Figure 6).

The ***site*** is exposed to flooding from a catchment as shown in Figure 3 during the 1%AEP flood event.

3.0 REVIEW OF EXISTING DATA

The ***site*** was surveyed by George Spyridakos Engineering Surveyors Referenoec N 1110 , dated 22nd November 2010. (Figure 4). The contours as shown in Figures 1 and 2 were generated from NSW Government Lidar Data using PDS GIS Global Mapper System.

The Manly flooding processes have been studied by an investigation commissioned by the NBC. This is:

1. Manly to Seaforth Flood Study, Cardno, February 2019 (Ref 1).

NBC has provided detailed flood information based on Ref 1 (Appendix C).

4.0 RESULTS OF INVESTIGATION

The flood study which is relevant to this report is the Cardno 2019 study (Ref 1). The key findings for the 1%AEP and PMF flood simulations that relate to Manly and the ***site*** specifically are:

1. The critical rainfall duration for 20 to 0.5%AEP events is between 90 and 120 minutes depending on the location. This equates (based IFD Bureau of Metrology curves Ref 2) to between 70 to 45 mm/hour rainfall intensities respectively. Numerical simulations of flows suggest from baseflow to peak is approximately 30 minutes (Ref 1 Figure 5-12 Catchment C1).
2. The predicted 1%AEP astronomical tide, ocean storm surge and associated setup adopted is 2.6m AHD. This ocean level including sea level predictions of 0.9 m (year 2100 Ref 1) will not inundate the ***site*** (5.4m AHD).
3. The rate of rise of the predicted flood level between 5 and 5.9m AHD (peak 1%AEP level) is approximately 30 minutes.
4. The combination of extreme catchment rainfall and ocean levels will result in the same predicted 1%AEP peak levels as the extreme catchment flooding alone.
5. The immediate area of the ***site*** and associated road network is inundated as shown in Figure 3.
6. At a peak flood level (5.9 metres AHD for the 1%AEP) velocities are low at the ***site***. The flood definition of the ***site*** is considered to be Flood Storage. The ***site*** is classified as Medium Flood Risk Precinct. (Appendix C page 8).
7. All access routes from the ***site*** will flood at approximately the same time.

5.0 IMPACT OF THE ADDITIONS

The proposed addition as detailed in Figures 5 and 6 include the following:

1. The existing ground floor level floor level 5.92m AHD. This is below Flood Planning Level (FPL) 6.33m AHD.
2. Extending west end of existing Dwelling by 1300mm. Total extended floor area is 3.5 square metres.

These additions would have minimal impact on the flooding characteristics of the area. This area is a Flood Storage area where it is predicted that the flood velocities are low in the vicinity of the ***site***.

An assessment is detailed in the development matrix (Appendix B).

6.0 FLOOD MANAGEMENT PLAN

The access to any flood free haven away from the ***site*** is not considered as a viable option: considering the rate of rise of the flood levels, general frequency of warnings from BoM and the low levels of surrounding access Roads. As such, the Dwelling should be used as a "Shelter- in-Place" (SiP) and be used as the ***only action*** for flood planning. Access is not available through either Pittwater Road or Kangaroo Lane.

During the lead up to this event there are a number of flood prediction services available which should be used to ensure sufficient planning and action. The sequence of information available are:

1. This report provides information on the flooding processes of the ***site.*** The residents of the ***site*** should aware of this information and the Action Plan should be posted in a visible location: BoM warning process, inundation process of the ***site*** and the Action Plan. The Action plan is in Appendix A.
2. Severe flood warnings for the Northern Beaches predicted by the Bureau of Meteorology (BoM), should prepare for a potential flooding at the ***site***. This information is broadcasted on ABC radio and TV and is available on BoM website. Typically, rainfall intensities in an excess of 20mm/hr over a period of 1 hr may generate flooding in Manly and the ***site*** area.
3. Flood levels exceeding 5 metres AHD will inundate the ***site*** and should be a trigger to prepare. When rain is predicted to continue a major event may occur, particularly if flood warnings continue to be issued by BoM.
4. As discussed in Section 4, the 1%AEP flood will rise above 5 m to its peak value in 30 minutes. During that time the final preparations should be concluded to secure items on the ***site*** and ensure the safety of all persons on the Attic level of the Dwelling. The ground floor level area should be cleared of chemicals and any loose equipment stored on the Attic Level. Vehicles should be secured.

The basic requirements of a SiP which are met based on Figure 3 and 4 are:

1. The Dwelling has access to a Attic Level at or above the PMF flood peak level of 6.09 m AHD. The Attic level is 8.8m AHD.
2. Floor space has to be 2 square metres /person. The existing Attic is compliant with these guidelines.
3. Access to the Attic floor is via a staircase is provided.
4. There is sufficient storage for items that need to be raised above flood levels at the Attic level.

5. Hazardous materials that can be dislodged by floodwaters and should not be stored below PMF flood level.

In conclusion, considering the flooding processes at the ***site*** the design of the addittions to the Dwelling as detailed in Figures 5 and 6, it is my opinion the design and this flood Action Plan will satisfy NBC Manly DCP Section 5.4.3 requirements as detailed in Appendix B.

Yours Faithfully,

Stephen Wyllie Bsc (Eng) FMA Member

Director 15/9/2019

7.0 REFERENCES

1. Manly to Seaforth Flood Study, Cardno, February 2019.
2. Institute of Engineers, Australia 1987 and 1998, Australian Rainfall and Runoff, A Guide to Flood Estimation.

Appendix A

FLOODING WARNING

AWARENESS

- Heavy rain and Ocean storms predicted by the Bureau of Metrology (BoM) : flood warning /flash flooding for the Northern Beaches.
- Monitor media reports for flood warnings in the Sydney Metropolitan Area.
- Observe local rainfall and Kangaroo Lane flood levels .
- Check Predicted Fort Denison Tides.
- Kangaroo Lane overtopped triggers Action Plan.

ACTION BoM WARNINGS ISSUED

- Account for all residents and visitors. Inform all residents and visitors of the potential flood situation and this Action Plan.
- Any items transportable by flood waters move to the Attic Level.
- Secure the vehicles . Move essential items to Attic Level
- Observe inundation at ***site*** and state of tide.
- Continue to monitor BoM reports and tide.
- If rainfall is intense and warnings continue remain at AtticLevel.

POST FLOOD

- Inspect vehicles and ***site*** generally for safety particularly electrical problems.
- Account for all residents and visitors.
- Monitor BoM reports to ensure no further flood warnings and check on tide predictions.

Appendix B: Development Matrix for Medium Risk Residential Development

Flood Impacts	Design Standard	Description	Comment
A: Flood Effects caused by Development	A1 A3	Complies with Flood Standard Loss of flood storage compensated	Yes Loss of flood storage imperceptible not required Section 5
B:Drainage Infrastructure and Creek Works	B1 B2	Flood mitigation works Section 88B Notice	Not Applicable Not Applicable
C:Building Components and Structural	C1 C2 C3	Constructed of flood compatible materials Structural stability under flood loads Services flood proofed or above FPL	Yes Not Applicable Yes se Section 5
D: Storage of Goods	D1 D2	Hazardous stored above FPL Goods/ materials stored above FPL	Yes Section 6 Yes Section 6
E: Flood Emergency Response	E1 E2	Complies with NBC Planning Shelter In Place requirement and above PMF	Yes Section 6 Yes Section 6
F:Floor Levels	F1 F2 F3 F4 F6 F8 F9	New Floor levels above FPL Sub floor not impede flow Pursuant of S88B One off additions<30m2 below FPL Existing Ground Floor below FPL First Floor Additions above PMF Foyers	Not Applicable yes Not Applicable Not Applicable Yes Figure 6,Section 5 Yes Not Applicable Not Applicable
G: Car Parking	G1 G2 G3 G4 G5 G6 G7	Open carpark not in floodway Floor level above ground level Enclosed carparks protected from inundation Vehicle barriers for d >300mm Enclosed garages at 1%AEP Comply with flood standard Raised driveways no impact	Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable
H: Fencing	H1	Designed not to impede flow	Not Applicable
I:Pools	I1	Coping flush pumps and electrical	Not Applicable

Appendix C

northern beaches council

FLOOD INFORMATION REQUEST - BASIC

Property: 43 Pittwater Road, Manly
Issue Date: 05/09/2019
Flood Study Reference: Manly to Seaforth Flood Study 2019, Cardno

Flood Information for lot:

Flood Life Hazard Category – See Map A

1% AEP – See Flood Map B

1% AEP Maximum Water Level[3]: 5.86 m AHD

1% AEP Maximum Peak Depth from natural ground level[3]: 0.34 m

1% AEP Maximum Velocity: 0.24 m/s

1% AEP Hydraulic Categorisation: Flood Fringe **See Flood Map E**

Flood Planning Area – See Flood Map C

Flood Planning Level (FPL) [1, 2, 3 & 4]: 6.33 m AHD

Probable Maximum Flood (PMF) – See Flood Map D

PMF Maximum Water Level[2]: 6.09 m AHD

PMF Maximum Depth from natural ground level: 0.6 m

PMF Maximum Velocity: 0.26 m/s

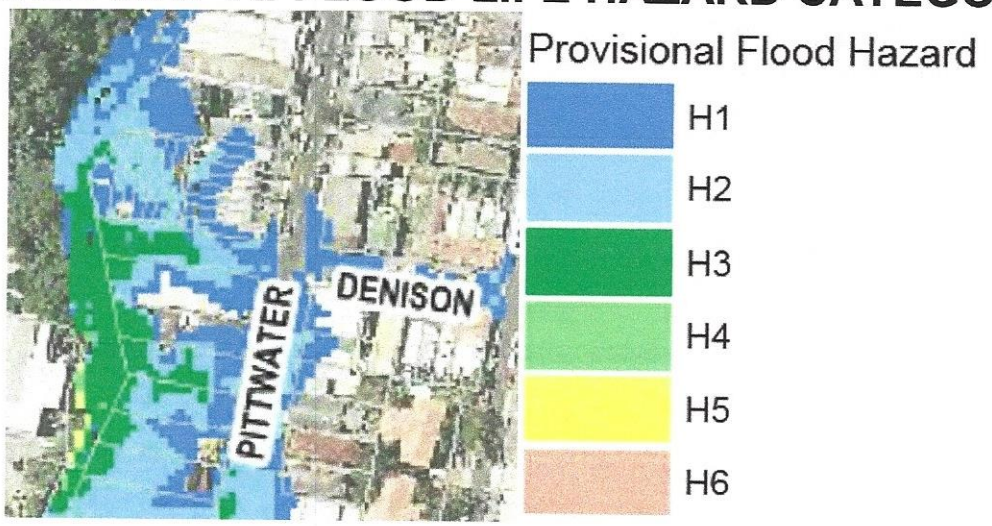
Flood Risk Precinct – See Map F

[1]The flood information does not take into account 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.
[3]Intensification of development in the former Pittwater LGA requires the consideration of climate change impacts which may result in higher minimum floor levels than those indicated on this flood advice.
[4]Vulnerable/critical developments require higher minimum floor levels using the higher of the PMF or Flood Planning Level

General Notes:

- 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 website.

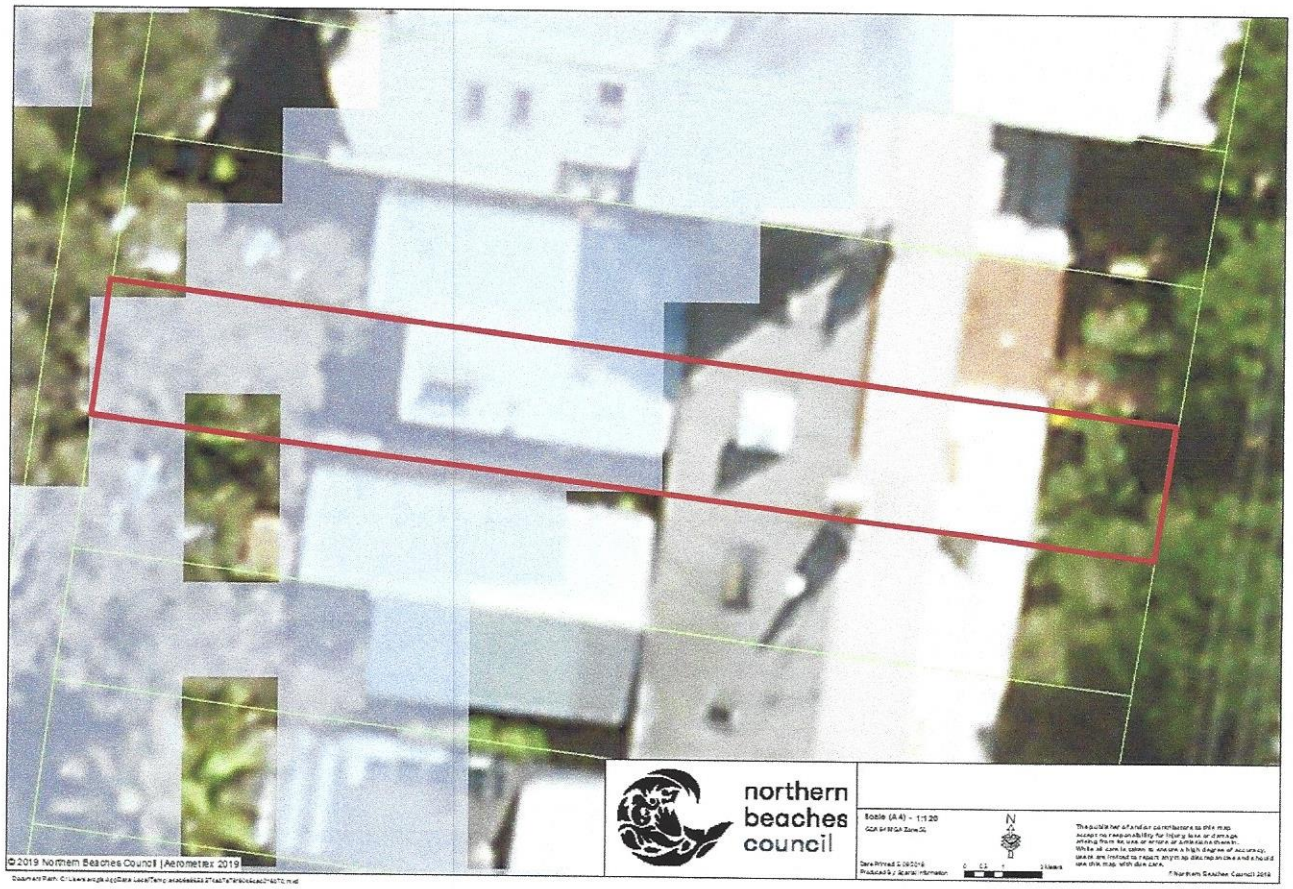
FLOOD MAP A: FLOOD LIFE HAZARD CATEGORY



Notes:

- Refer to 'Flood Emergency Response Planning for Development in Pittwater Policy' for additional information on the Flood Life Hazard Categories and Pittwater 21 DCP Control B3.12.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source:) and aerial photography (Source: NearMap 2014) are indicative only.

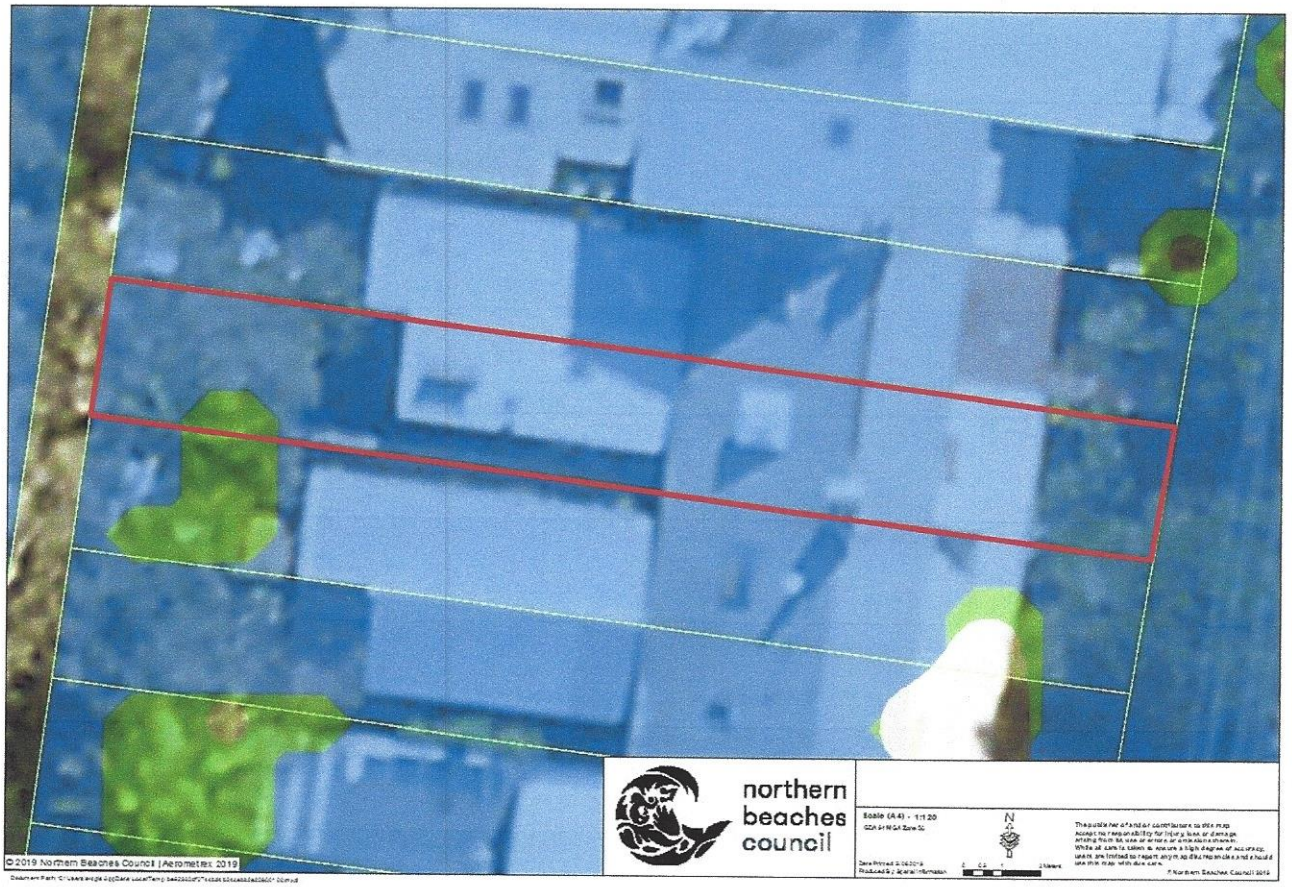
FLOOD MAP B: FLOODING - 1% AEP EXTENT



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:) and aerial photography (Source: NearMap 2014) are indicative only.

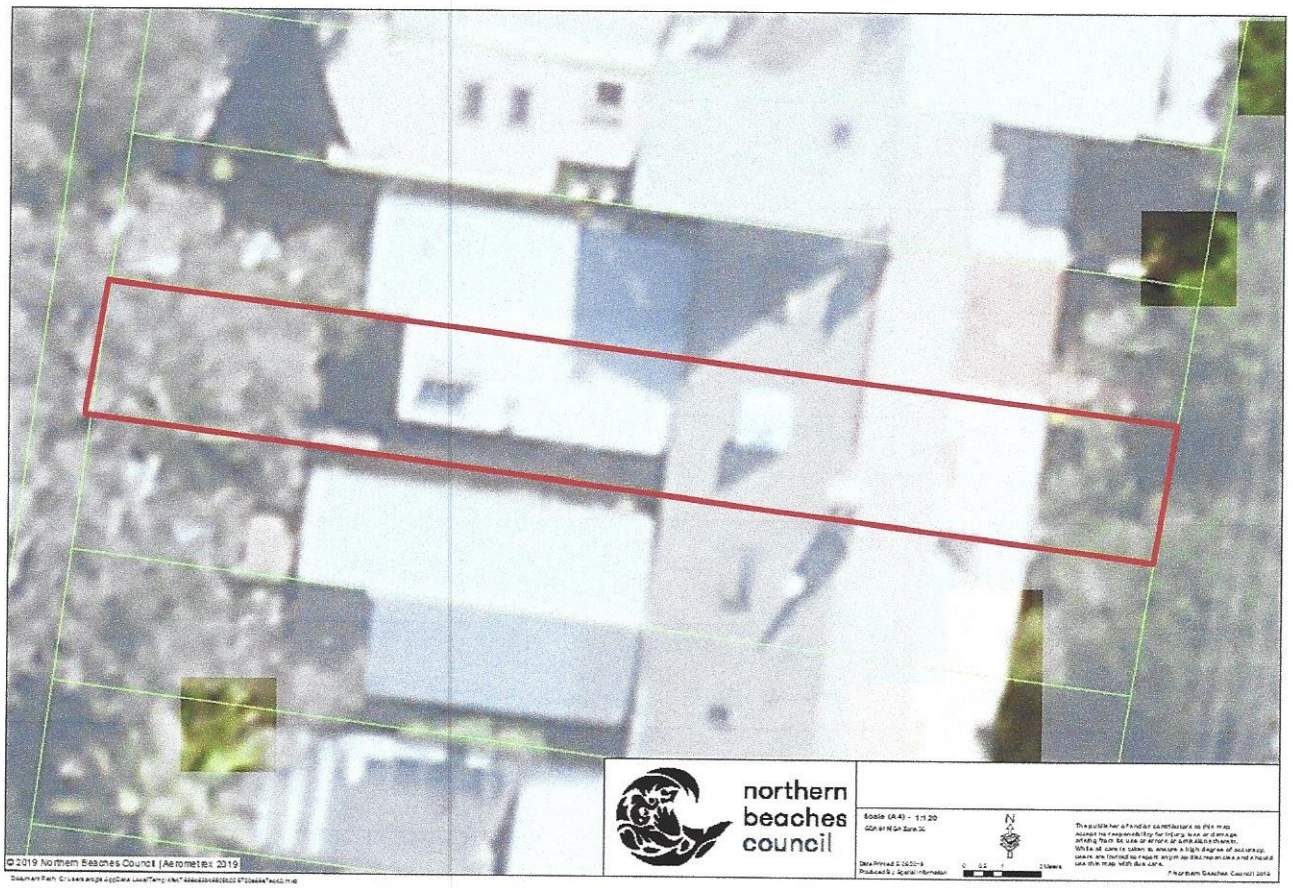
FLOOD MAP C: FLOOD PLANNING AREA EXTENT



Notes:

- Blue extent represents the 1% annual Exceedance Probability (AEP) flood event + freeboard.
- Extent does not include climate change.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source:) and aerial photography (Source: NearMap 2014) are indicative only.

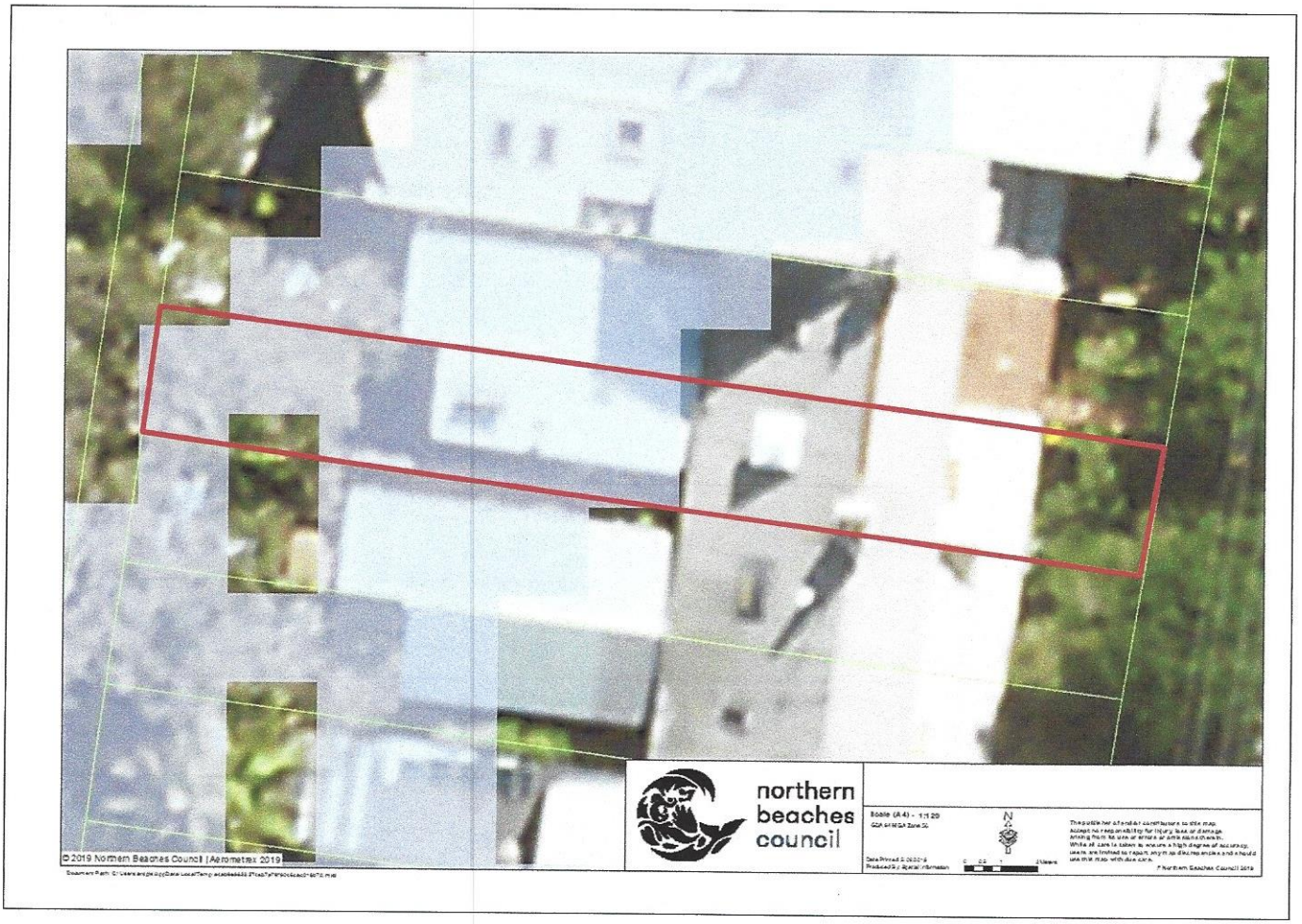
FLOOD MAP D: PROBABLE MAXIMUM FLOOD EXTENT



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:) and aerial photography (Source: NearMap 2014) are indicative only.

FLOOD MAP E: 1% AEP FLOOD HYDRAULIC CATEGORY EXTENT MAP

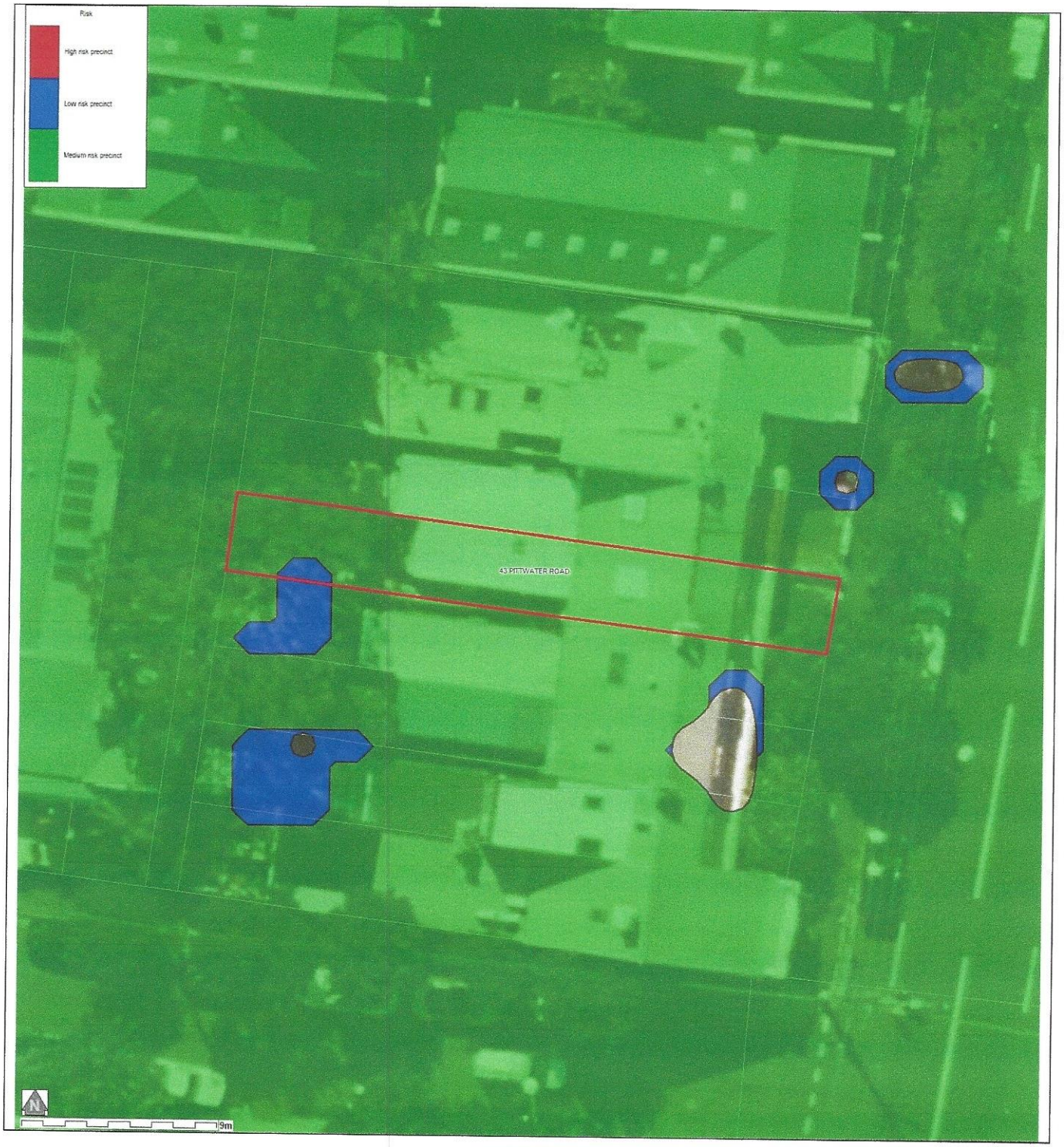


Flood Fringe

Notes:

- Red = Floodway
- Yellow = Flood Storage
- Blue = Flood Fringe
- 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:) and aerial photography (Source: NearMap 2014) are indicative only.

FLOOD MAP F: FLOOD RISK PRECINCT MAP



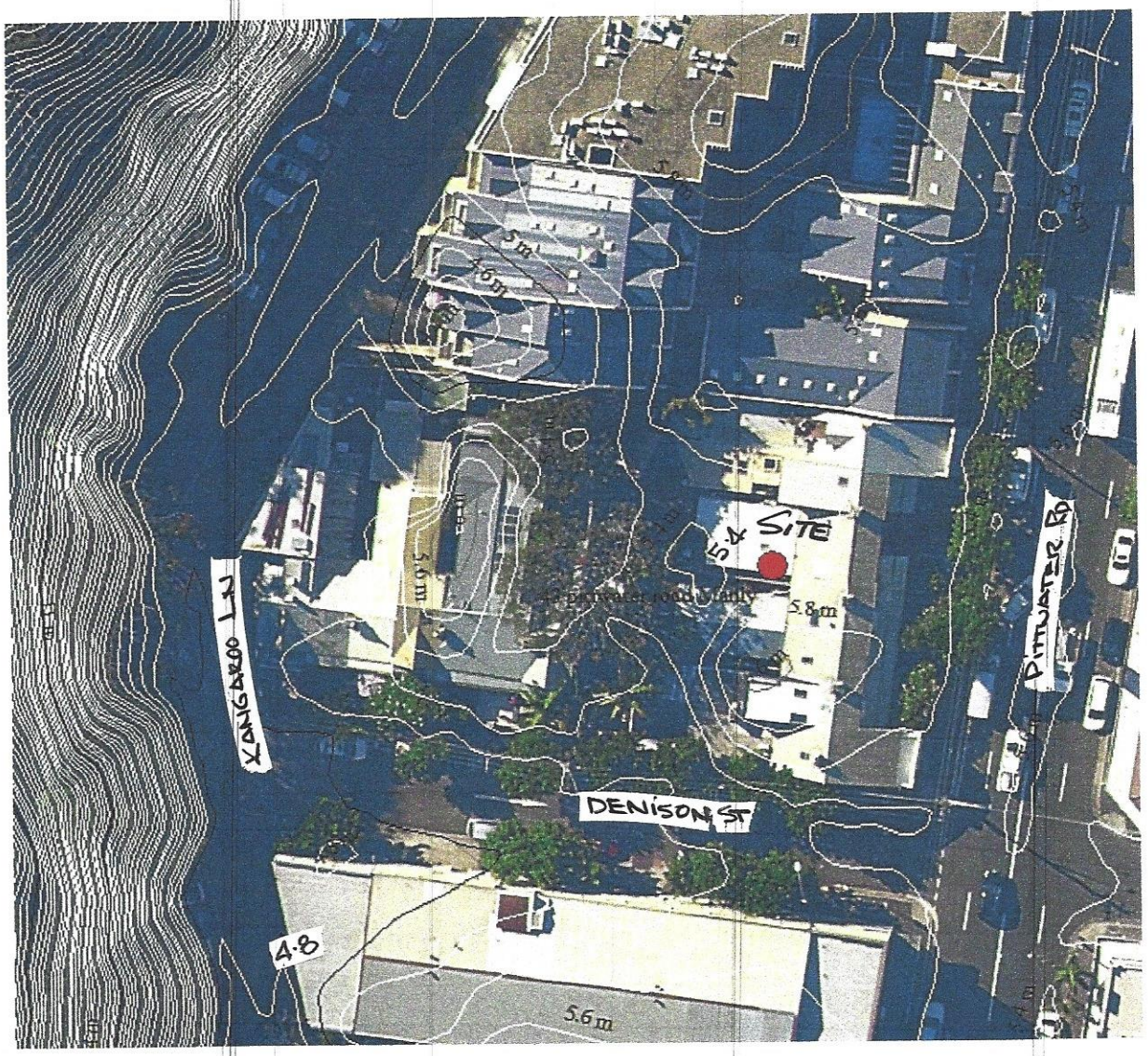
Notes:

- **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 and or H6 Life Hazard Classification)

LEGEND

- Site
- Part of Catchment Boundary

FIGURE 1



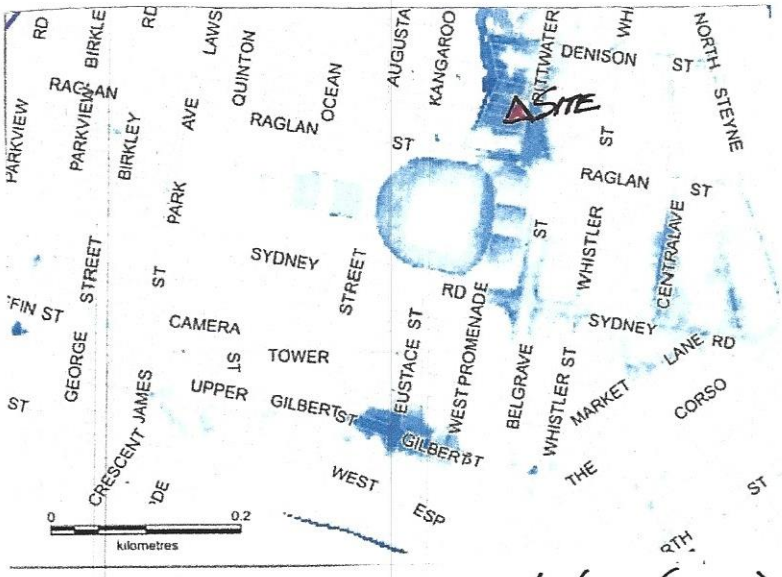
+4.6m AHD

2012 FLOODING IN KANGAROO LANE

FIGURE 2

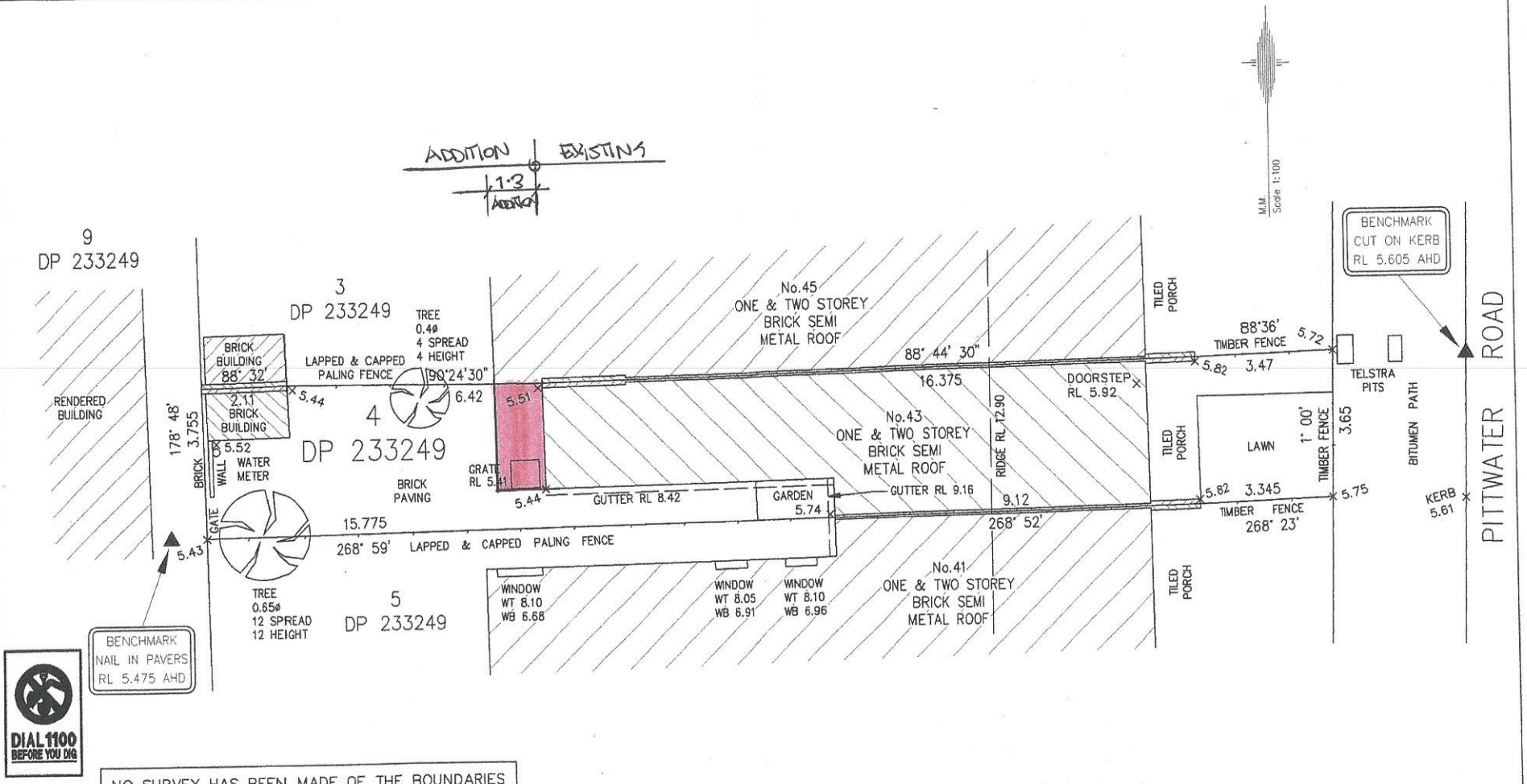
1%AEP INUNDATION (REF 1)

LEGEND
▲ SITE



FLOOD EXENT 28/10/2013 (REF 1)

FIGURE 3



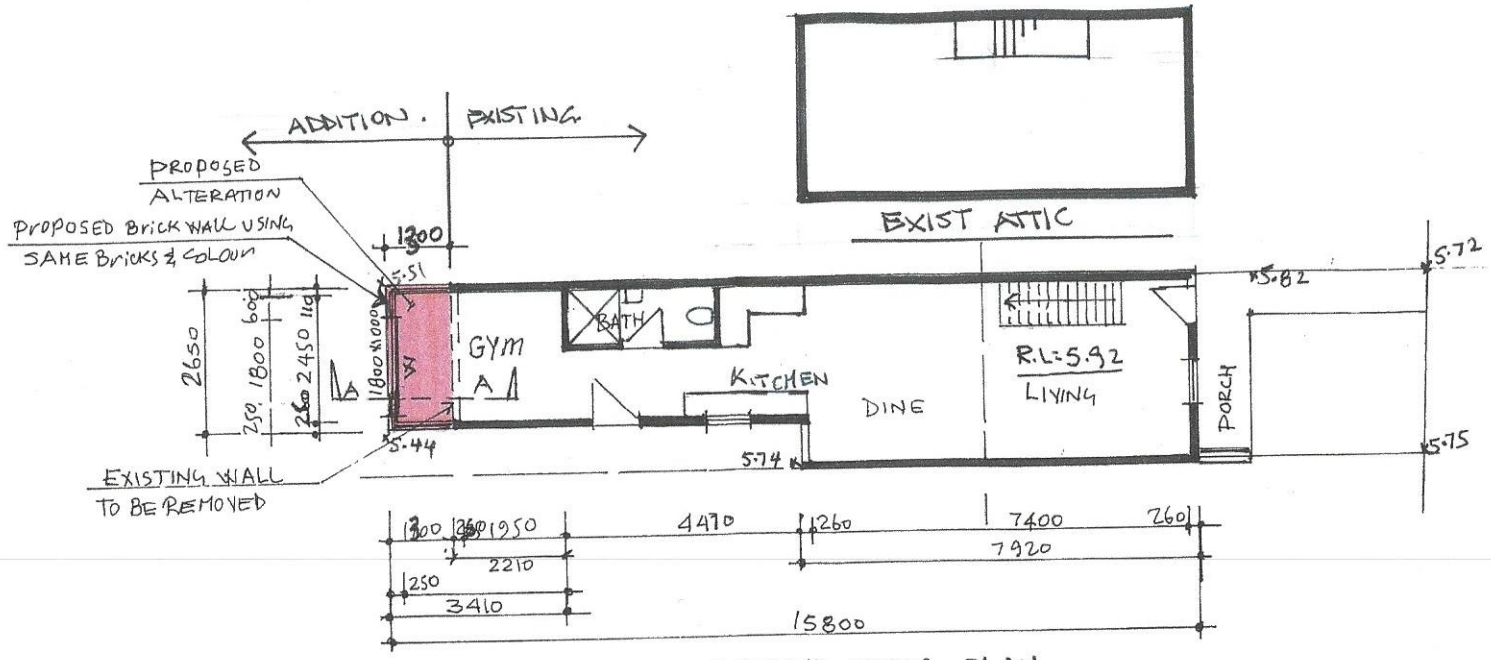
NO SURVEY HAS BEEN MADE OF THE BOUNDARIES

ORIGIN OF LEVELS: PM 790
RL 5.394
SOURCE: DEPARTMENT OF LANDS (SCIMS)
DATE: 22 November 2010

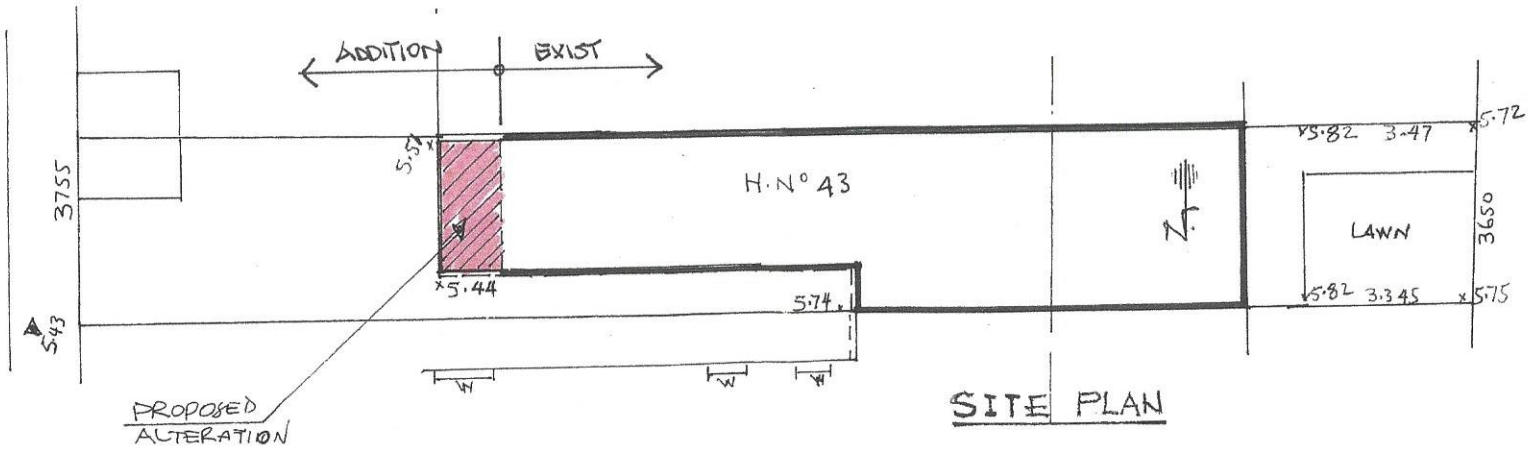
0 1 2 3 4 5 10m
BAR SCALE
PLOTTED SCALE 1:100 (A3 SIZE SHEET)

REFERENCE: 1110	**GEORGE SPYRIDAKOS** **ENGINEERING SURVEYORS** **25 WILLIAM STREET, NORTH MANLY NSW 2100** **PH/FAX: 9400 9257**	**DATE:** 22–11–2010 **SCALE:** 1/100 **DATUM:** A.H.D. **SITE AREA:** 103.6m² **SHEET 1 OF 1 SHEETS**
PROJECT: PLAN SHOWING LEVELS & FEATURES LOCATED LOT 4 IN DP 233249 43 PITTWATER ROAD MANLY		
LGA: MANLY		

FIGURE 4



GROUND FLOOR PLAN



SITE PLAN

CALCULATION

SITE AREA =	103.00m²
EXISTING AREA =	46.61 m²
PROPOSED AREA =	3.18M²
TOTAL BUILD. AREA =	49.79 m²

ARCHITECTURAL

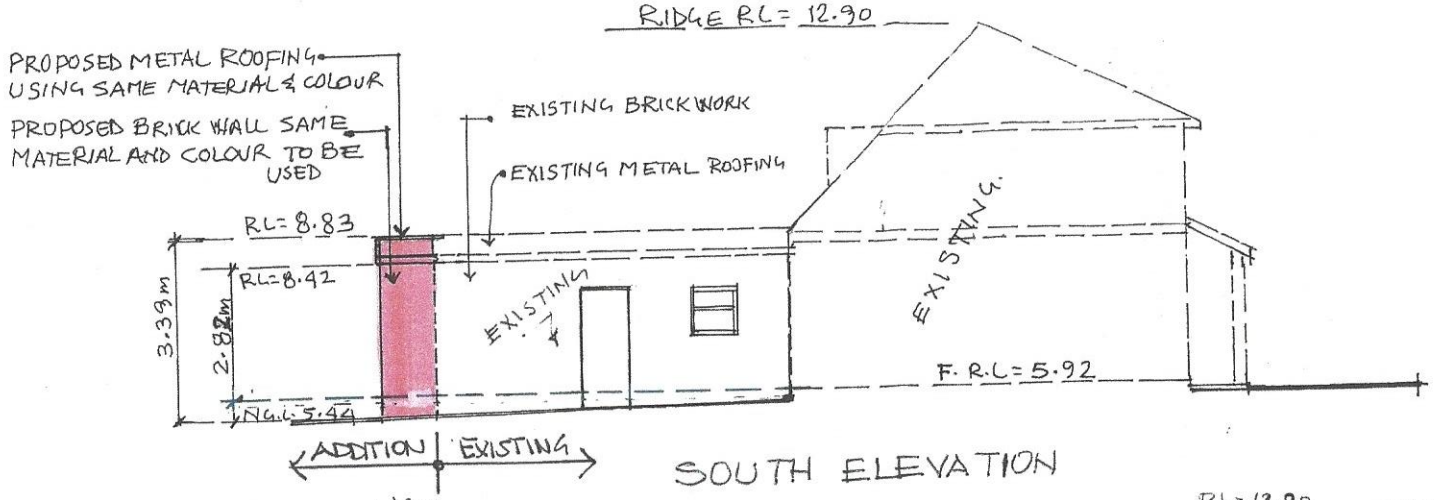
PROPOSED ADDITION TO EXISTING DWLG AT 43 PITTWATER RD MANLY

FOR Mrs PAMELA D. PREECE

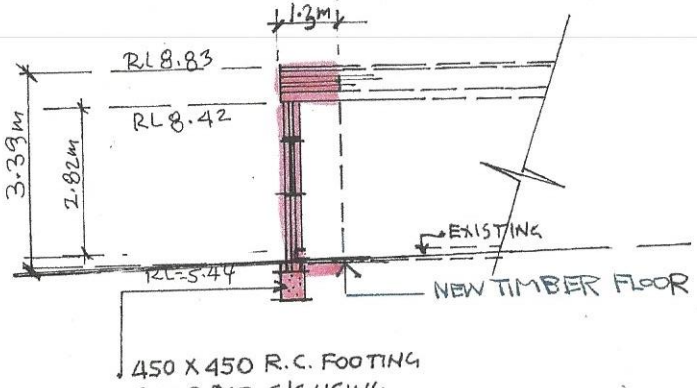
MUNICIPALITY OF MANLY

DESIGNED BY	DRAWN BY	SCALE :	01-11
GEORGE ABDALLAH MOB:0415 223 223	GEORGE ABDALLAH MOB:0415 223 223	1:100 , 200	

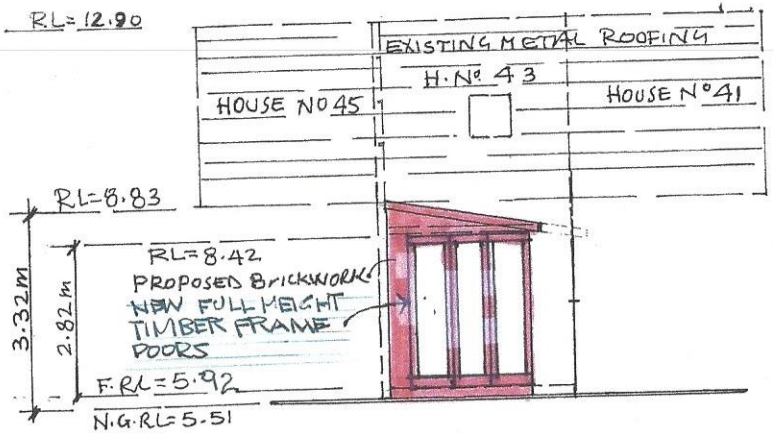
FIGURE 5



SOUTH ELEVATION



SECTION A-A



WEST ELEVATION

ARCHITECTURAL

PROPOSED ADDITION TO EXISTING DWLG AT 43 PITTWATER RD MANLY

FOR Mrs PAMELA D. PREECE

MUNICIPALITY OF MANLY

DESIGNED BY	DRAWN BY	SCALE :	Q.T.T
GEORGE ABDALLAH MOB:0415 223 223	GEORGE ABDALLAH MOB:0415 223 223	1:100 , 200	2/2

FIGURE 6

Attachment A

NORTHERN BEACHES COUNCIL STANDARD HYDRAULIC CERTIFICATION FORM

FORM A/A1 – To be submitted with Development Application

Development Application for

Address of site: 43 PITTWATER RD MANLY

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

I, STEPHEN WYLLIE on behalf of PITTWATER DATA SERVICES PTY LTD
(Insert Name) (Trading or Business/ Company Name)

on this the 18TH SEPTEMBER 2019 certify that I am engineer or a
(Date)

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 FOR 43 PITTWATER ROAD, MANLY

Report Date: 15TH SEPTEMBER 2019

Author: STEPHEN WYLLIE

Author's Company/Organisation: PITTWATER DATA SERVICES PTY LTD

I: STEPHEN WYLLIE
(Insert Name)

Please tick all that are applicable (more than one box can be ticked)

☑ have obtained and included flood information from Council (must be less than 12 months old) **(This is mandatory)**

☑ have followed Council's Guidelines for Preparing a Flood Management Report

☐ have requested a variation to one or more of the flood related development controls. Details are provided in the *Flood Management Report*.

Signature ..... BSC(ENG) FMA MEMBER

Name STEPHEN WYLLIE