Pittwater Data Services Pty Ltd
ABN 36098815537
15 Lloyd George Grove, Tanilba Bay, 2319
Mobile: 0422088032
Email: pittwaterdataservices@live.com.au
Our Reference:
PDS10092023:825PITTWATERRD:BAYVIEW

Mr Craig Pocklington
C/-Bayview Golf Club
1825 Pittwater Road,
Bayview, 2105
11th September 2023

Revised Flood Report for Bayview Golf Course Greens Upgrades

Dear Craig,

1.0 INTRODUCTION

I refer to your Development Application (DA2023/0718) for Bayview Golf Course greens upgrades (Lot 191 DP 1039481, Lot1 DP662920, Lot 1 DP19161 and Lot A DP339874), Pittwater Data Services Pty Ltd Report titled Flood Report for Bayview Golf Course Upgrades dated 28th April 2023 (PDS1) and Northern Beaches Council (NBC) Natural Environment Referral Response- Flood dated[11th] July 2023.

The PDS1 report in essence concluded that the lower green upgrades would have imperceptible impact during the peak of the predicted 1%AEP due to the predicted low velocities, flat flood profile and minor changes to the greens elevation. This conclusion was not acceptable to NBC without detailed modelling, as extensive residential development bordering around the lower area of the course may be impacted by the green upgrades during a 1%AEP flood event: flood levels and velocities. NBC also required flood data to be obtained at a number of locations as shown in Appendix A. This data was numerically simulated by Royal Haskoning DHV 2017; commissioned by NBC.

To address the potential impact of the green upgrades, BMT Commercial Australia Pty Ltd was commissioned by Pittwater Data Services Pty Ltd to numerical test the new topography created by the upgraded greens for the 1%AEP event. This event was selected as the 1%AEP peak levels determines the Flood Planning Level (FPL) for all developments. BMT report is in Appendix B.

4.0 RESULTS OF INVESTIGATION

BMT upgraded TUFLOW NBC existing model for the catchment, developed by Royal Haskoning DHV 2017, used the 2020 1 metre Lidar data. The upgraded topography incorporated any changes to the Course since 2014. The topography upstream of the pipes under Cabbage tree Road may have changed from 2014 to 2020. These changes are due to sediment and debris accumulation as shown in Figure 1. It should be noted that Course ground staff periodically clear this accumulation.

The flood data provided by NBC as detailed in Appendix A shows on the lower course (locations 1 to 5) the peak flood levels are all approximately equal (2.04 to 2.05m AHD). This result shows that the flood profile is flat as supported by the low velocities 0.08 to 0.16m/s. Location 4 was predicted to be 0.46m/s which is located in a flow channel.

The flood levels upstream of Cabbage Tree Road and Park Street reflex the impact of the road and the stormwater pipes, particularly the course crossing (Location 7). Location 7 is the low point of Cabbage Tree Road and location of the 3 x1200mm Pipes (Figure 1). The predicted 1%AEP flood level is 4.35 m AHD at a velocity of 0.79m/s. The road level is approximately 2.7mAHD (Figure 2). The depth of the 1%AEP at the peak is 1.6m at a velocity of 0.79m/s. This is a hazard category H5: unsafe for vehicles and people.

The BMT numerical results identified that the only impact of the green upgrades is the increase of peak 1%AEP flood level of 0.14m at the Cabbage Tree Road Crossing. As discussed there may have been changes to the topography due to debris and sediment accumulation. The Hazzard Category is already H5, an increase of 0.14m is not going change that category. The important result of this impact is there in no changes to the peak flood levels upstream and downstream of the crossing as shown in Appendix B Figure 1-2 particularly on the fringe of the 1%AEP where residential developments are located. The immediate changes upstream of the crossing are shown in Figure 3: no residential development is impacted.

The impact of the green upgrades at all other areas of the lower course are within +/-20mm shown as a grey scale (Appendix B Figure 1-2). +/-20mm accuracy is unmeasureable considering the accuracy of land surveys, flood level recording equipment combined with surging flood levels due to variable rainfall intensities. Royal Haskoning DHV 2017 study filtering criteria stated that differences less than 20mm were filtered from the predicted 1%AEP flood levels.

As stated in PDS1, the flood storage loss for the 1%AEP inundated greens is approximates 711cubic metres. Considering the total storage of the lower portion of the ***site*** is approximately 250,000 cubic metres this represents a small percentage from the storage system. The impact on the 1%AEP flooding processes would be imperceptible.

In conclusion the ***site*** green upgrades will have imperceptible impact (not measureable) on the flooding characteristics of the 1%AEP flooding processes in terms of peak flood levels. Flooding related controls have been essentially met (small storage loss) as required in NBC Development Control Plan B3.11

Yours Faithfully

Stephen Wyllie Bsc(Eng) FMA Member

Director 11/09/2023.

APPENDIX A

northern beaches council

FLOOD INFORMATION REPORT (COMPREHENSIVE)

Property: "1825 Pittwater Road BAYVIEW NSW 2104","52 Cabbage Tree Road BAYVIEW NSW 2104"
Lot DP: "Lot 1 DP 662920, Lot 1 DP 19161, Lot 5 DP 45114, Lot 7 DP 45114 and 1 more","Lot A DP 339874, Lot 1 DP 986894, Lot 2 DP 986894, Lot 3 DP 986894 and 3 more"
Issue Date: 22/08/2023
Flood Study Reference: McCarrs Creek, Mona Vale and Bayview Flood Study Review 2017, Royal HaskoningDHV

Flood Information[1]:

Map A - Flood Risk Precincts
Maximum Flood Planning Level (FPL) [2, 3, 4]: 13.03 m AHD

Map B - 1% AEP Flood & Key points
1% AEP Maximum Water Level [2, 3]: 12.53 m AHD
1% AEP Maximum Depth from natural ground level[3]: 3.70 m
1% AEP Maximum Velocity: 4.47 m/s

Map C - 1% AEP Hydraulic Categorisation
1% AEP Hydraulic Categorisation: Floodway, Flood Storage, Flood Fringe

Map D - Probable Maximum Flood
PMF Maximum Water Level (PMF) [4]: 19.62 m AHD
PMF Maximum Depth from natural ground level: 4.80 m
PMF Maximum Velocity: 6.44 m/s

Map E - Flooding with Climate Change
1% AEP Maximum Water Level with Climate change [3]: 19.60 m AHD
1% AEP Maximum Depth with Climate Change[3]: 3.96 m

Map F - Flood Life Hazard Category in PMF

Indicative Ground Surface Spot Heights
If required, please contact floodplain@northernbeaches.nsw.gov.au to discuss.

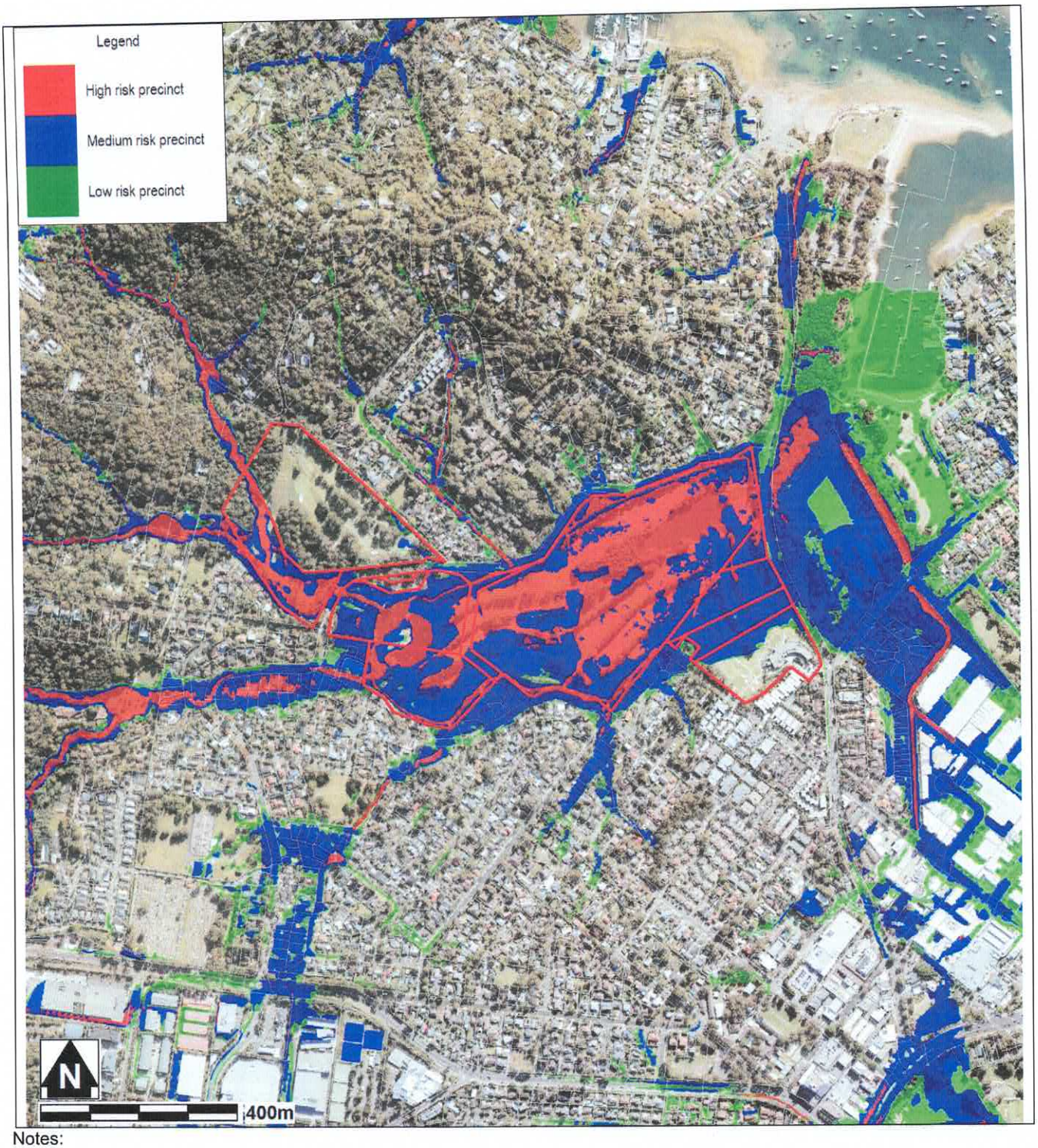
(1) The provided flood information does not account for any local overland flow issues nor private stormwater drainage systems.
(2) Overland flow/mainstream water levels may vary across a sloping site, resulting in variable minimum floor/ flood planning levels across the site. The maximum Flood Planning 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 FP

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.

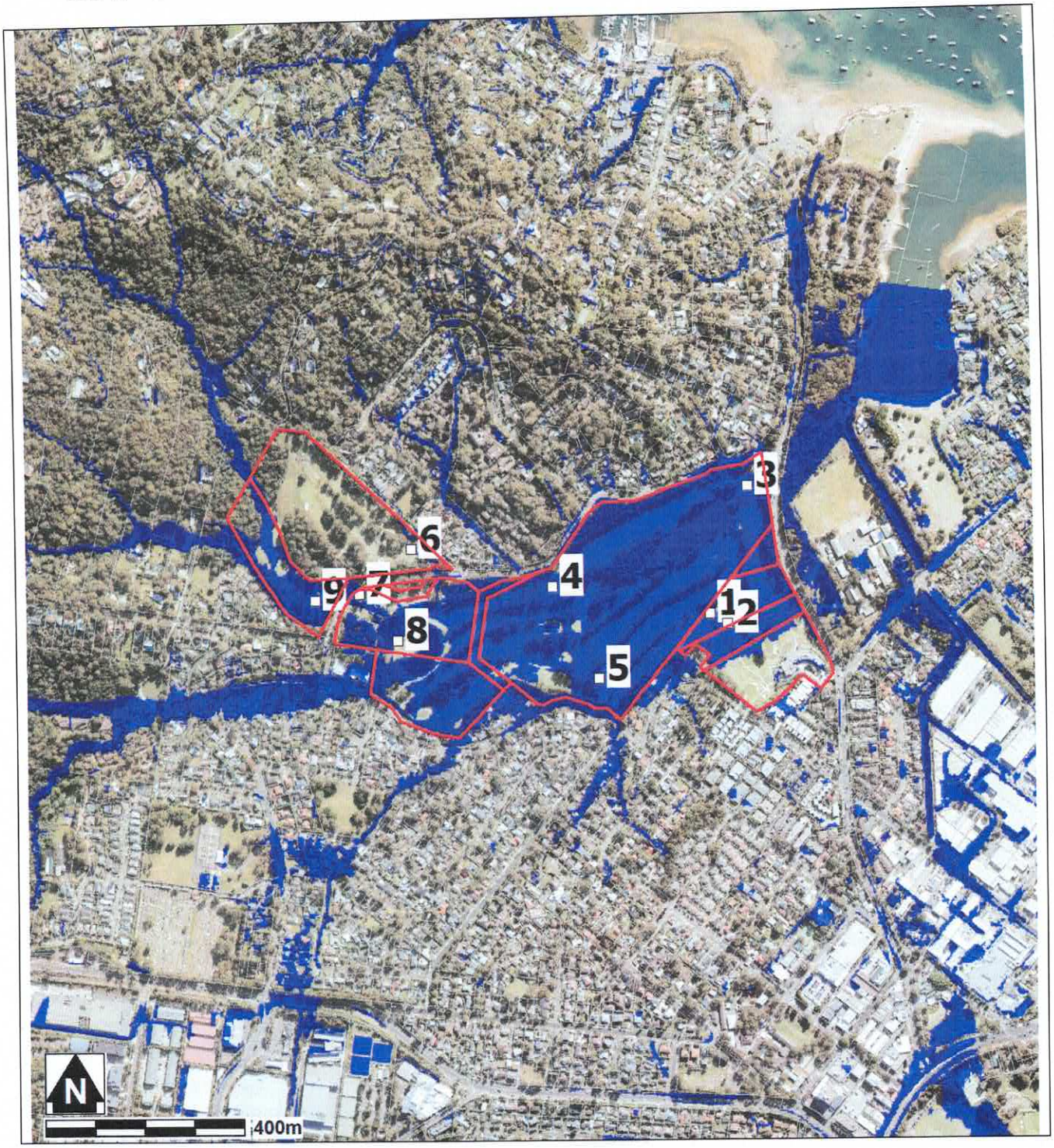
MAP A: FLOOD RISK PRECINCTS



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: McCarrs Creek, Mona Vale and Bayview Flood Study Review 2017, Royal HaskoningDHV) and aerial photography (Source: NearMap 2014) are indicative only.

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: McCarrs Creek, Mona Vale and Bayview Flood Study Review 2017, Royal HaskoningDHV) and aerial photography (Source Near Map 2014) are indicative only.

Flood Levels

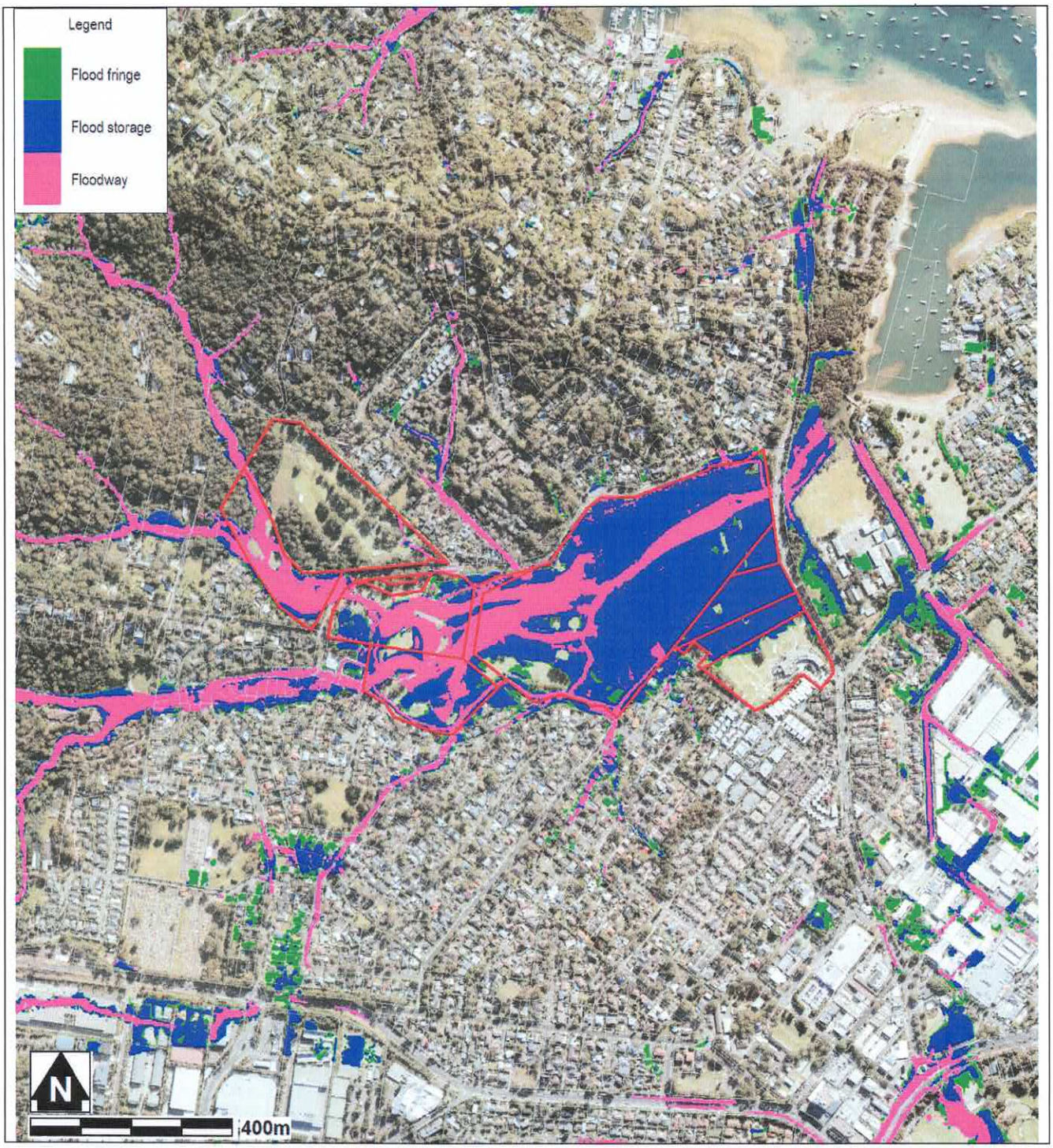
ID	5% AEP Max WL (m AHD)	5% AEP Max Depth (m)	1% AEP Max WL (m AHD)	1% AEP Max Depth (m)	1% AEP Max Velocity (m/s)	Flood Planning Level (m)	PMF Max WL (m AHD)	PMF Max Depth (m)	PMF Max Velocity (m/s)
1	1.79	0.49	2.05	0.75	0.24	2.55	3.14	1.85	0.38
2	1.79	0.49	2.05	0.75	0.12	2.55	3.14	1.84	0.33
3	1.78	0.54	2.04	0.80	0.16	2.54	3.12	1.88	0.54
4	1.79	0.92	2.05	1.17	0.46	2.55	3.15	2.28	0.90
5	1.79	0.19	2.05	0.45	0.08	2.55	3.16	1.55	0.38
6	8.71	0.38	8.75	0.43	0.34	9.25	8.91	0.59	0.57
7	N/A	N/A	4.35	0.27	0.79	4.85	5.10	1.02	1.35
8	N/A	N/A	2.76	0.28	0.19	3.26	3.39	0.91	0.41
9	N/A	N/A	4.57	0.31	0.95	5.07	5.31	1.06	1.79

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	2.31	1.02
2	2.31	1.02
3	2.31	1.07
4	2.31	1.44
5	2.31	0.71
6	8.80	0.47
7	N/A	N/A
8	2.72	0.25
9	4.50	0.25

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

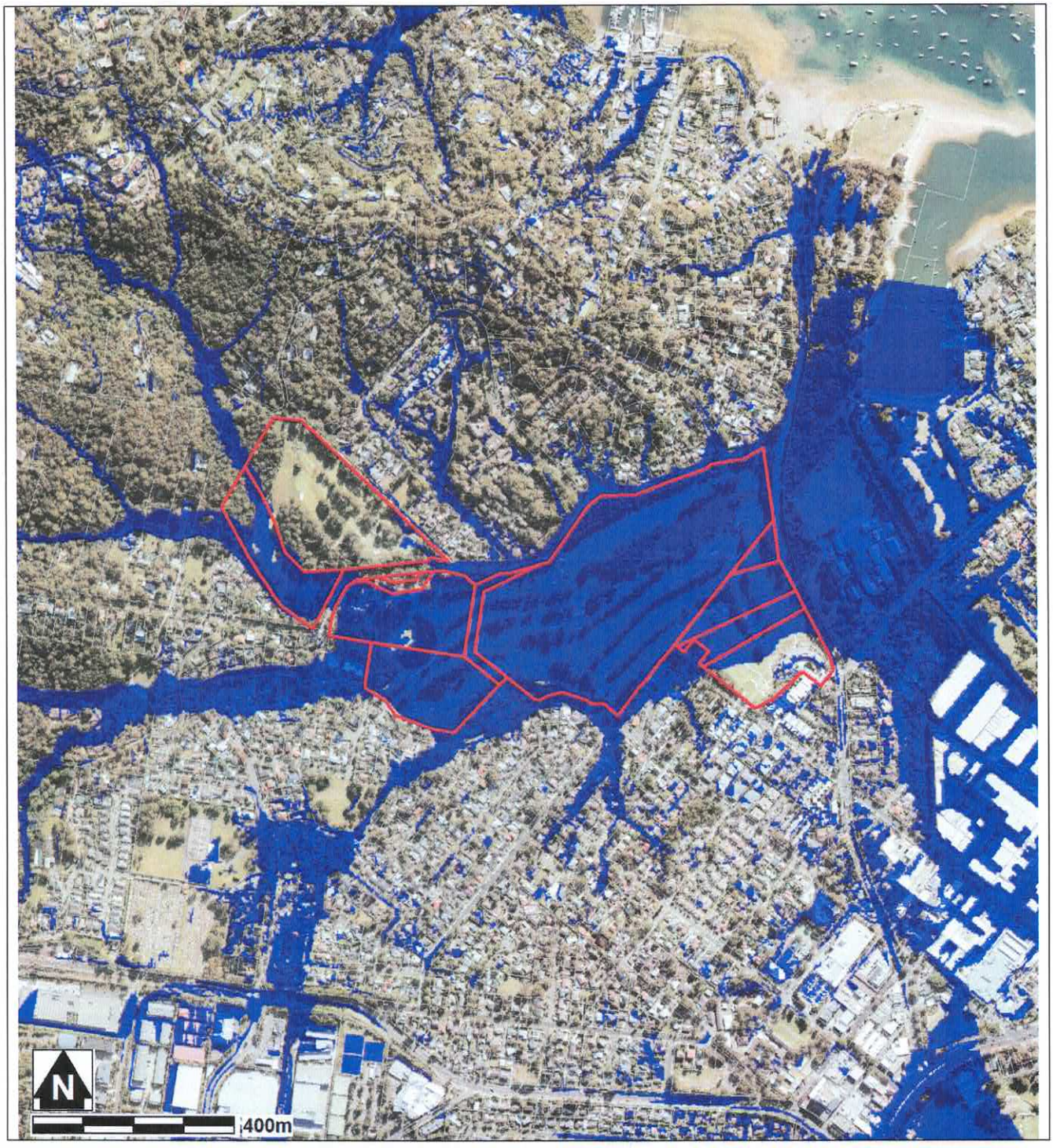
MAP C: 1% AEP FLOOD HYDRAULIC CATEGORY EXTENT MAP



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: McCarrs Creek, Mona Vale and Bayview Flood Study Review 2017, Royal HaskoningDHV) and aerial photography (Source: NearMap 2014) are indicative only

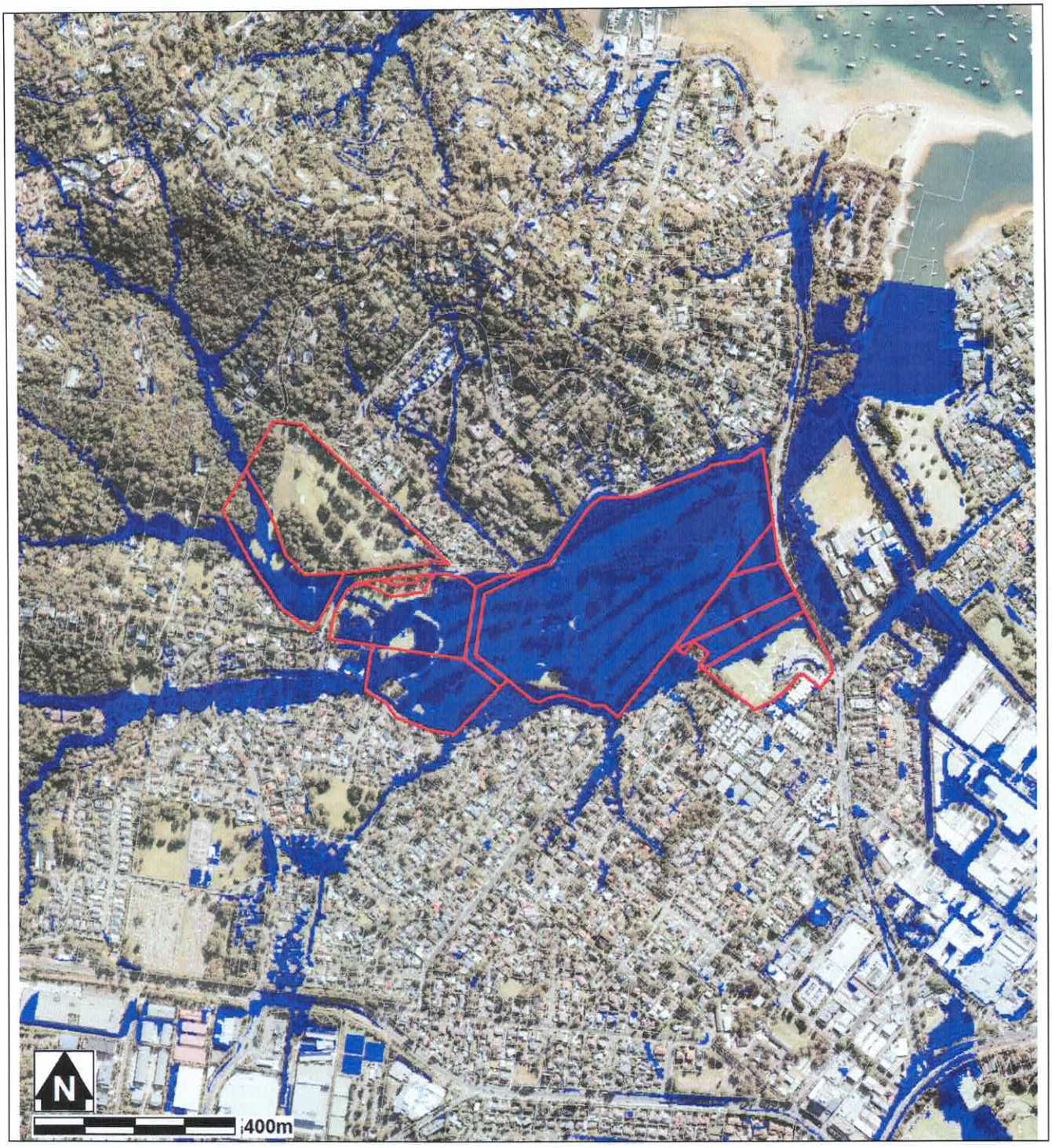
MAP D: PMF EXTENT MAP



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: McCarrs Creek, Mona Vale and Bayview Flood Study Review 2017, Royal HaskoningDHV) and aerial photography (Source: NearMap 2014) are indicative only

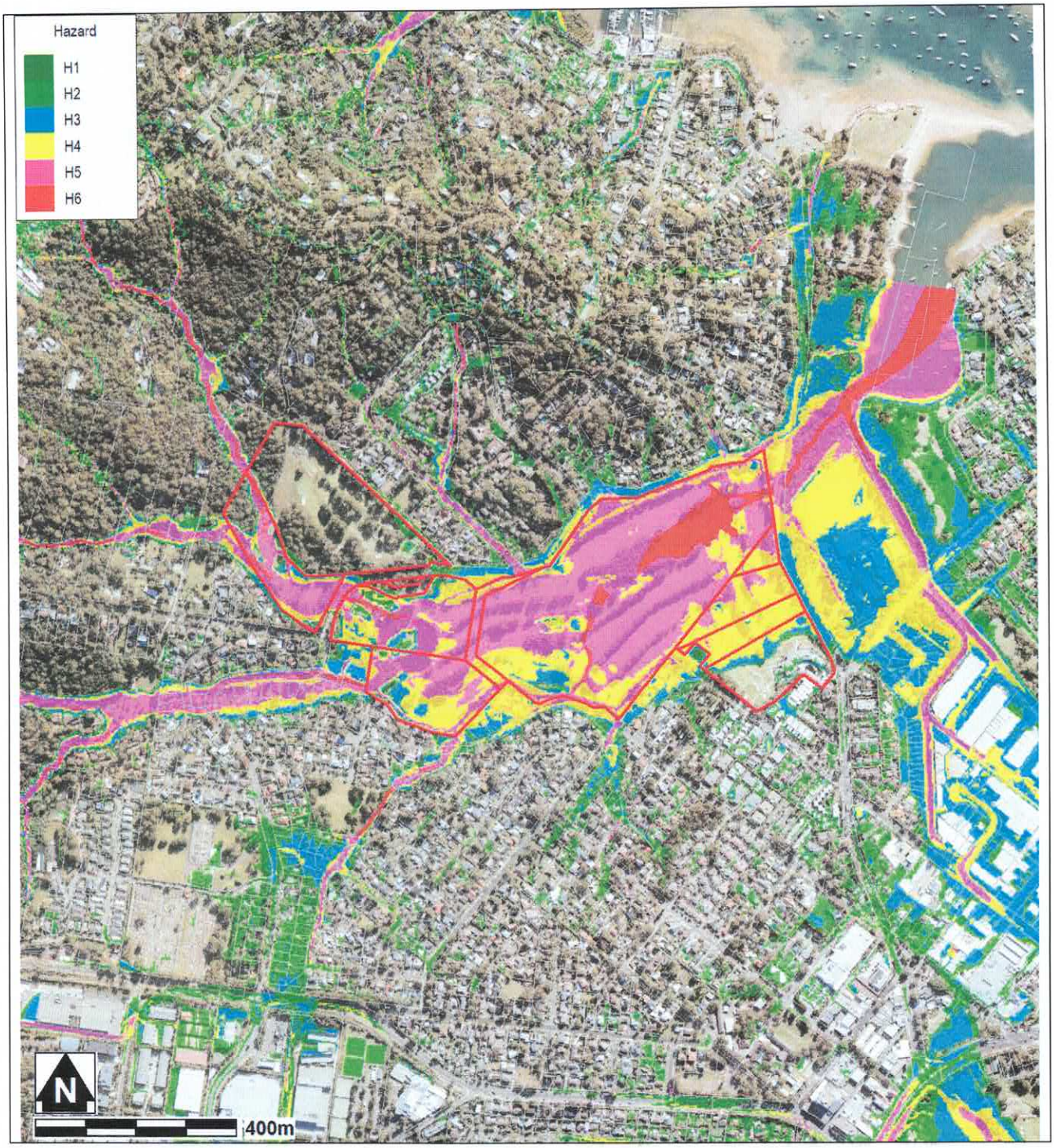
MAP E: FLOODING – 1% AEP EXTENT PLUS CLIMATE CHANGE



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: McCarrs Creek, Mona Vale and Bayview Flood Study Review 2017, Royal HaskoningDHV) and aerial photography (Source: NearMap 2014) are indicative only

MAP F: FLOOD LIFE HAZARD CATEGORY IN PMF



Notes:

- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: McCarrs Creek, Mona Vale and Bayview Flood Study Review 2017, Royal HaskoningDHV) and aerial photography (Source Near Map 2014) are indicative only.

APPENDIX B

BMT Commercial Australia Pty Ltd
Level 4, 4-14 Foster Street, Surry Hills, NSW 2010
Australia

ABN: 54 010 830 421

Our ref: L.002948.001.00_BayviewGolfCourse_FIA.docx

11 September 2023

Pittwater Data Services
15 Lloyd George Grove
Tanilba Bay 2319

Attention: Steve Wyllie

Dear Steve,

RE: FLOOD IMPACTS MODELLING FOR PROPOSED BAYVIEW GOLF COURSE GREENS UPGRADES

Flood impact assessment modelling has been undertaken by BMT Commercial Australia Pty Ltd (BMT) for the proposed greens upgrades at Bayview Golf Course at 52 Cabbage Tree Road and 1825 Pittwater Road, Bayview (the "Site"). The proposed development involves re-profiling of multiple green areas within the Site.

The methodology and findings of the modelling are outlined in the following sections.

Background

Broad-scale flood behaviour across Bayview, including the area of the proposed works, is defined by a rainfall-on-grid TUFLOW model originally developed for the *'McCarrs Creek, Mona Vale and Bayview Flood Study'* (Royal HaskoningDHV, 2017) and refined and updated as part of the *'McCarrs Creek, Mona Vale and Bayview Floodplain Risk Management Study and Plan'* (BMT, in preparation) (hereafter referred as the "Mona Vale TUFLOW model"). This model has been used as the basis for this assessment.

No updates to the hydrologic model have been made as part of this assessment. The Mona Vale TUFLOW model has been updated and refined at the Site to provide a better estimate of overland flow potentially affecting the golf course. This updated model has been used to determine design flood behaviour for the 1% Annual Exceedance Probability (AEP) event under both "existing" and "post-development" conditions. Details regarding updates made to the TUFLOW model to represent these scenarios can be found in the following sections.

Model Updates for Existing Conditions

The Mona Vale TUFLOW model was refined to provide improved representation of local features and flood behaviour within the Site. As there was no available recent survey for the Site, the ground level within the vicinity of the Site has been updated using 2020 1m LiDAR downloaded from ELVIS website. No changes were made to the remainder of the TUFLOW model outside of the Site boundary.

Model Updates for Post-development Conditions

The updated TUFLOW model for existing conditions was subsequently modified to incorporate the proposed development by including a proposed terrain design provided by Pittwater Data Services (reference: *"230829_23082 Bayview Golf Greens - Design Export with Boundaries.dwg"*). The locations of the proposed green upgrade and changes in ground elevations are shown in Figure 1.1.

The updated TUFLOW models for existing and post-development conditions were used to simulate 1% AEP floods in order to define existing localised flood behaviour. The model was run for the Critical 120 minute and 540 minute storm events.

Flood Impact Results

The relative impacts of the green upgrades within the golf course have been considered in terms of the potential for the works to impact on existing flood behaviour. Flood level difference mapping was prepared by subtracting peak existing flood levels from peak post-works flood levels. The resulting flood level and velocity impact maps are provided in Figure 1.2 and Figure 1.3.

The change in peak flood level/velocity maps provide a visual representation of the difference in flood levels/velocities between the developed and existing conditions. The maps identify areas where:

- Flooding previously occurred in the existing scenario model but no longer occurs in the developed scenario model (referenced "was wet now dry");
- Flooding now occurs in the developed scenario model which was previously not flooded in the existing scenario model (referenced "was dry now wet"); and
- Extent and degree of change in the peak water levels/velocities.

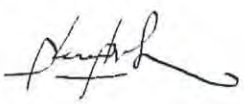
It is noted that although the TUFLOW results for the *'McCarrs Creek, Mona Vale and Bayview Floodplain Risk Management Study and Plan'* (in preparation, 2020) are filtered based on a depth cut-off of 150 mm and removal of flood islands less than 200 m^2, the results for this assessment were based on filtering depths below 100 mm. This was to allow the visualisation of shallow overland flow paths.

There are localised increases in flood levels in the modelled 1% AEP event within the golf course, specifically in areas where green upgrades are proposed. A flood level increase of up to 0.14 m along Cabbage Tree Road is predicted as a result of the green modifications along the flow path in this area.

As per Pittwater Data Services' requests, BMT has not provided any commentary regarding the development against flood-related development controls for the Site. We trust that this report meets your requirements. Further information or clarification regarding any aspect of this work can be obtained by contacting the undersigned (nam.nguyen@apac.bmt.org).

Yours Sincerely,

BMT



Nam Nguyen
Engineer

Legend

Lot

Site

Title:

PROPOSED DESIGN EXTENT CHANGES IN GROUND LEVELS

Drawing: 1-1

Rev:

BMT endeavours to ensure that the information provided in this map is correct at the time of publication. BMT does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

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BMT

www.bmt.org

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Legend

- Lot
- Site
- Modification Extent

Title:

PEAK FLOOD LEVEL IMPACTS
1% AEP EVENT

Drawing: 1-2

Rev:

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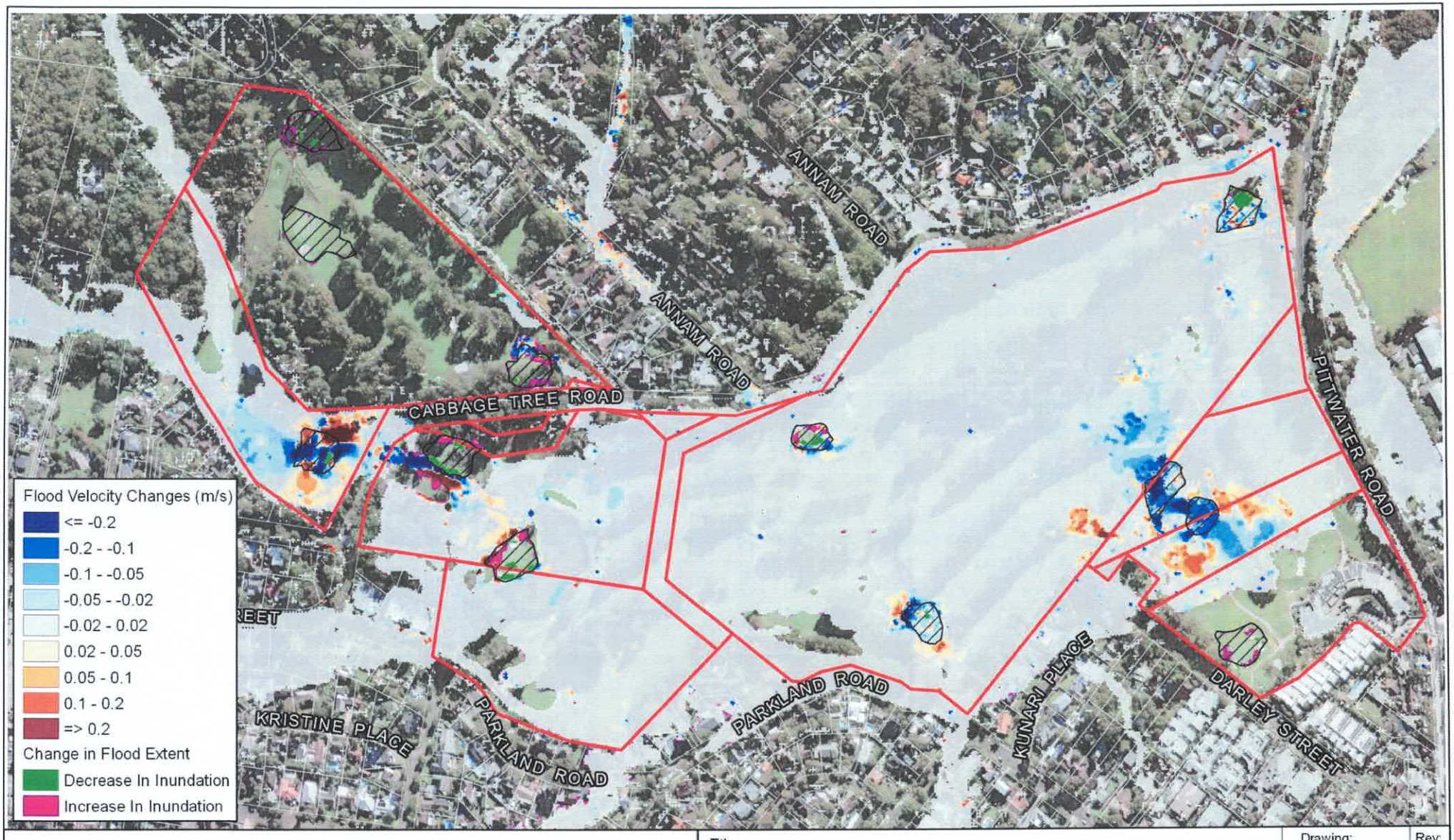

Legend

- Lot
- Site
- Modification Extent

Title:

PEAK FLOOD VELOCITY IMPACTS
1% AEP EVENT

Drawing: 1-3

Rev:

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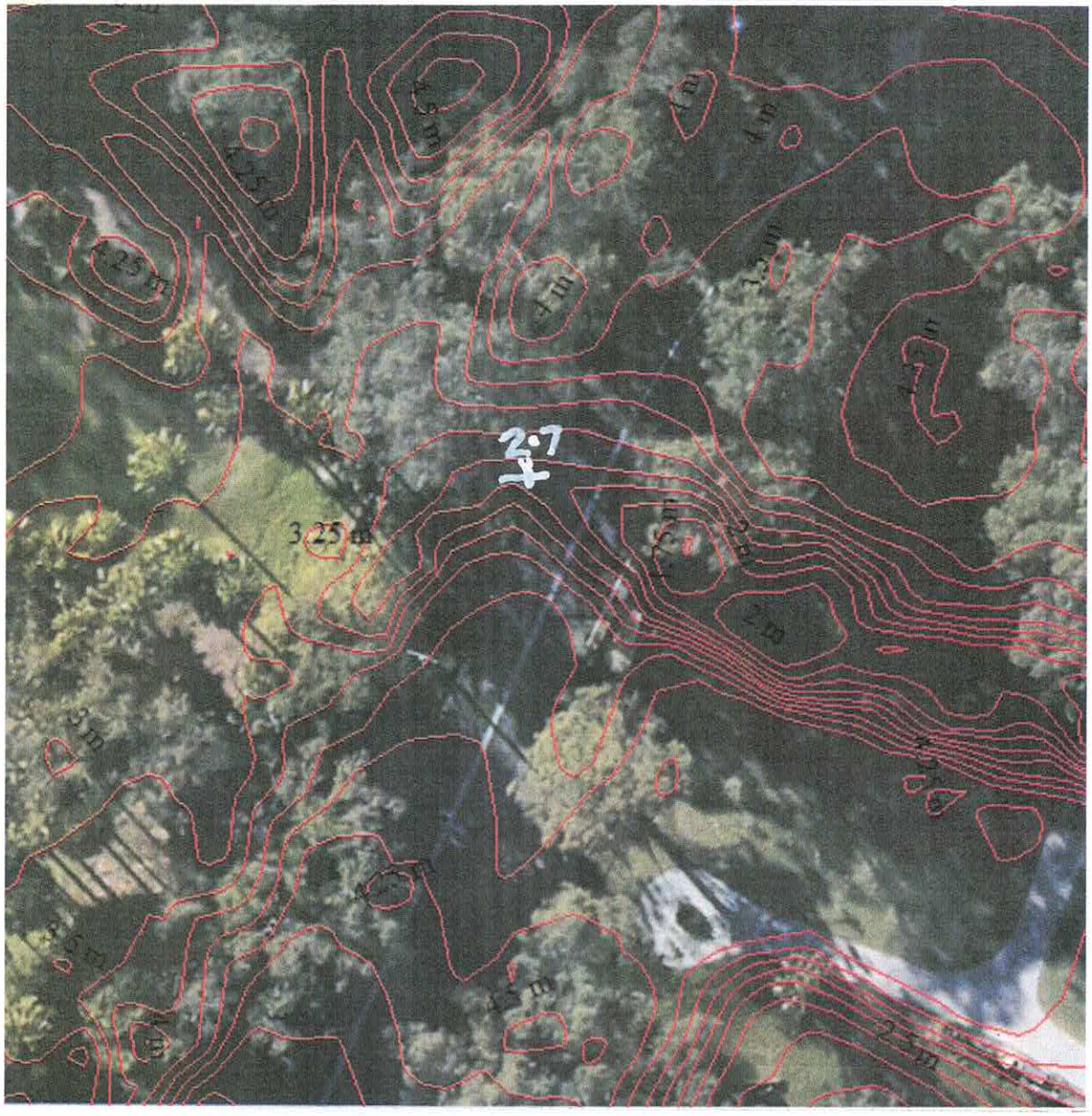
FIGURES

UPSTREAM DEBRIS

FIGURE 1



2010 LIDAR CONTOURS

FIGURE 2

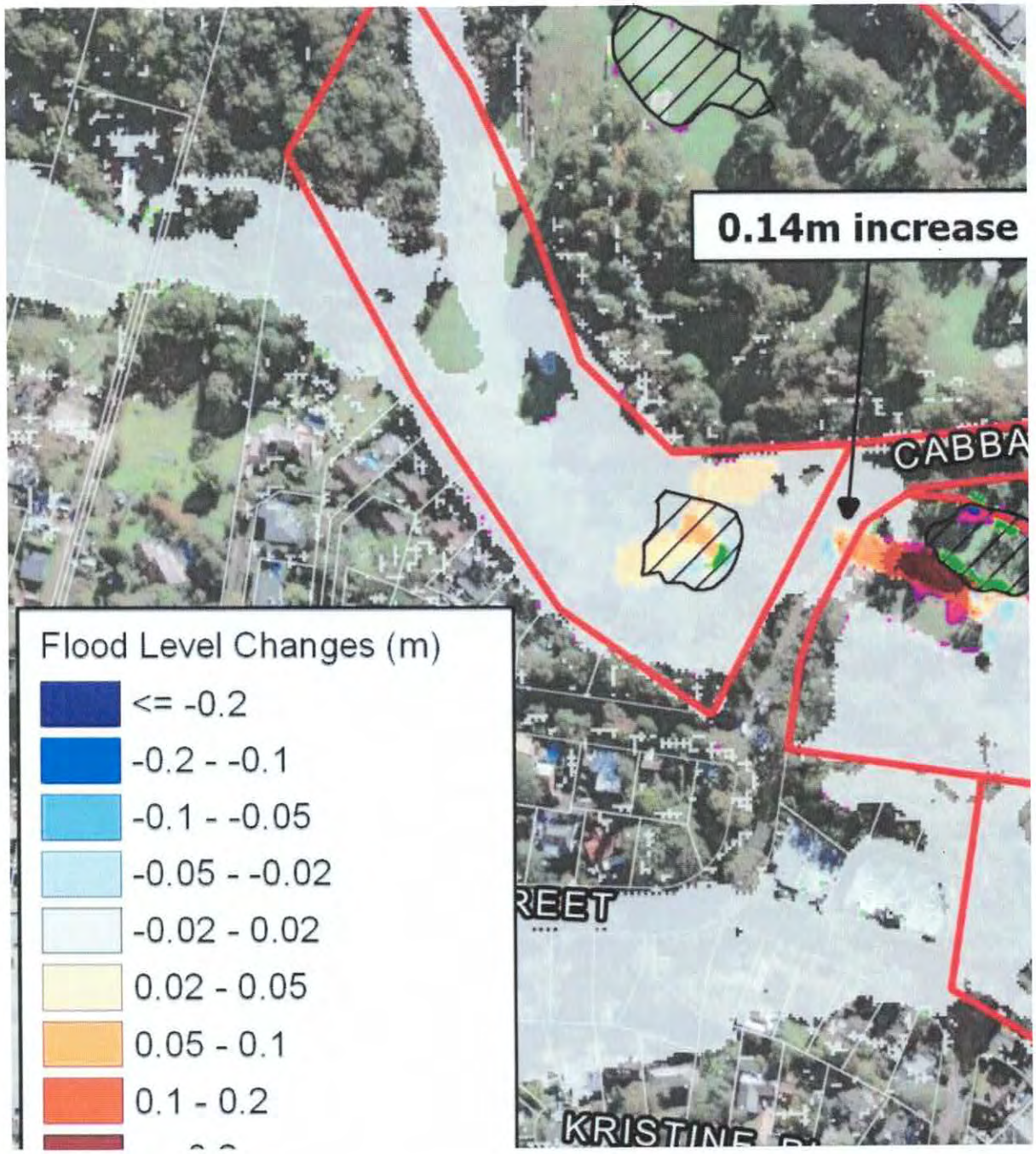

0.14m increase
CABBA
REET
KRISTINE
Flood Level Changes (m)
<= -0.2
-0.2 - -0.1
-0.1 - -0.05
-0.05 - -0.02
-0.02 - 0.02
0.02 - 0.05
0.05 - 0.1
0.1 - 0.2

FIGURE 3