FLOOD MANAGEMENT REPORT

for

Raffertys Resort, Cams Wharf, NSW

Project Number 210828
Date 21/06/2023

Prepared for: Iris Capital

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1 INTRODUCTION

A Planning Proposal is to be prepared to request amendment to the Height of Buildings Maps within the Lake Macquarie Local Environmental Plan 2014, at a site at Wild Duck Drive, Cams Wharf.

1.1 THE SITE

The site is located at Wild Duck Drive, Cams Wharf and sits within the Rafferty's Resort development, in the Lake Macquarie City Council (LMCC) local government area. It is situated on the eastern side of Lake Macquarie between the suburbs of Nord's Wharf and Murrays Beach.

The subject site is Lot 30 and 31 in Deposited Plan 270043. The site is part of a Community Title Scheme.

The current zoning, being SP3 Tourist, together with Clause 7.14 -Development on certain land near Rafferty's Road, Cams Wharf, in the Lake Macquarie LEP 2014, permits a range of uses including dwellings, tourist and visitor accommodation and food and drink premises. The current maximum Height of Building's is 8.5 metres.

1.2 BACKGROUND

Raffertys Resort has been recently purchased by Iris Capital, with a view to redeveloping and reinvigorate the site to provide a distinctive village centre to be enjoyed by visitors and residences alike, and a landmark tourist facility for Lake Macquarie.

To drive and shape this vision a Concept Master Plan has been prepared to articulate the anticipated land uses and built form envisaged on the site.

The Concept Master Plan has at the heart of the village, a new Tavern (pub) and Function Centre incorporating a new pool resort facilities overlooking the lake, complimented by a new Hotel. Additional residential accommodation is proposed in the form of both residential apartments and multi dwelling housing to create a diversity of accommodation, providing alternative options to the current villas on the site.

The new buildings will be a uniquely "contemporary lakeside architecture", incorporating generous folding metal roofs, Australian hardwood timber structures, cladding and natural stone finishes. Buildings are sited to create view corridors and allow physical connections for the entire village to access and enjoy the foreshore reserve.

The proposed planning proposal will facilitate the development of this broader Concept Master Plan.

This report details the flood behaviour of Yalliwali Creek has been prepared in satisfaction of the requirements of the NSW Department of planning and Environment Biodiversity Conservation Division's 'BCD' recommendations.

1.3 THE PROPOSAL

Several proposed buildings significantly exceed the 8.5 metre building height limit that currently applies to the site. Consequently, a Planning Proposal is required to amend the Height of Buildings Map within Lake Macquarie Local Environmental Plan 2014.

The development of a new 8 storey hotel is proposed on Lot 31, consisting of approximately 141 rooms, business centre, basement Car Parking (2 Levels) with 118 car parking spaces and hotel pool, landscaped areas.

Also proposed as part of the Concept Master Plan is two apartment buildings, as follows:

- Construction of two four storey residential flat buildings containing 25 units with shared a basement carpark with 40 spaces, pool and the pool terrace, landscaping etc.
- Construction of a four storey residential flat building containing 21 units with shared a basement carpark with 28 spaces, driveway and Landscaping.

The Planning Proposal to amend the maximum height limit will facilitate the development of the new hotel and apartment buildings.

Figure 1 Proposed Site Masterplan, Raffertys Resort

1.4 FLOOD MANAGEMENT

The Pre-DA meeting minutes for the LEP amendments has requested a flood study compatible with the NSW Floodplain Development Manual for Yalliwali Creek to support the submission of the planning proposal.

This report details the flood behaviour of Yalliwali Creek and aims to identify the impacts of flooding and climate change on the study area and proposes a flood warning and evacuation strategy. The 5% AEP, 1% AEP and the PMF have been studied and flood levels, hazard categories and hydraulic categories have been mapped in accordance with the Floodplain Development Manual 2005.

It should be clarified that this study is not a site-specific analysis for any proposed sites within the masterplan. This report and analysis have been developed to support the LEP planning amendment. Any future Development Applications for the site areas (e.g. Site D) would be subject to a site specific analysis.

1.5 BACKGROUND

The Yalliwali Creek study area is located in Cams Wharf within Lake Macquarie City Council LGA on the Swansea Peninsula between Lake Macquarie to the west and the Pacific Ocean to the east.

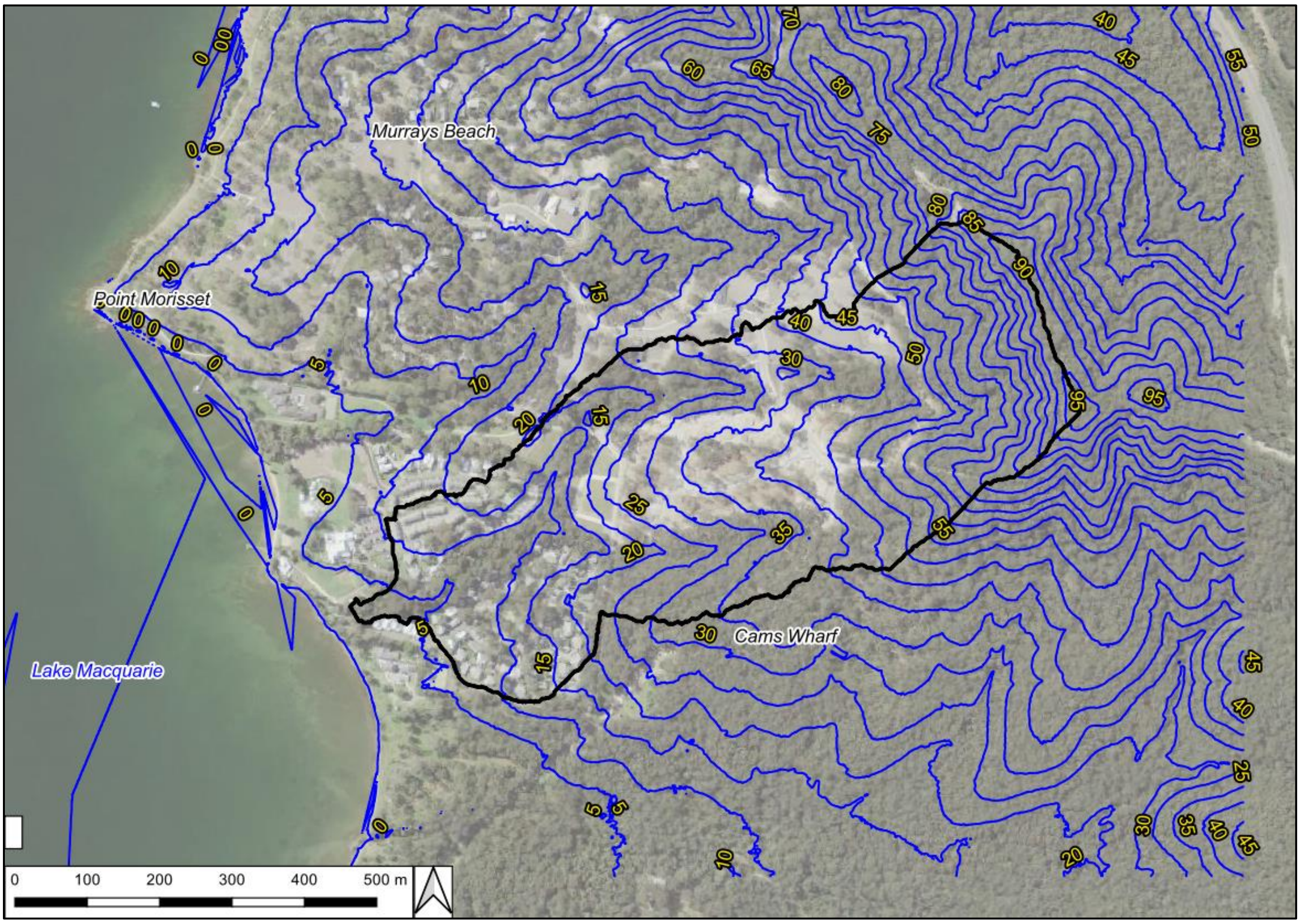


Figure 2 Site Topography and overall catchment

Yalliwali Creek flows from east to west with a catchment area of approximately 32 Hectares. The upstream extremity of the catchment lies in an undeveloped area zoned for conservation and has a dense tree cover. The creek proceeds to flow through a residential area with significant tree cover then through tourist accommodations with significant impervious areas before discharging into Lake Macquarie.

The topography of the catchment varies but is generally steep with the upstream end lying on an elevation of 95 mAHD featuring slopes exceeding 20% while the lower ends of the catchment feature slopes in the range of 2%-15%.

2 MODELLING APPROACH AND METHODOLOGY

2.1 SEA LEVEL RISE

It appears that no prior hydrological studies have been undertaken specifically for Yalliwali Creek, however, the Lake Macquarie Waterway Flood Study [1] by WMAwater was undertaken for the whole Lake Macquarie catchment (700 km^2) and did establish the lake's peak level for different design events. The study determined the 1990 baseline Lake Macquarie Level to be 0.1mAHD and included a sea level rise allowance of 0.4m due to climate change assumed to have taken place by the year 2050. A sea level rise of 0.9m has been adopted for the year 2100 by the study.

The Biodiversity Conservation Division 'BCD' of the NSW Department of planning and Environment was consulted in preparation of this report and BCD provided in their letter (Ref. DOC23/255758-39, Dated 13/04/2023) a list of comments to be implemented.
One of the recommendations (Recommendation 3) addresses the need to consider the 'AR6 Synthesis Report – Climate Change' [2] report released by the Intergovernmental Panel on Climate Change (IPCC). A copy of the BCD letter is included in Appendix D.

Sea Level Rise (SLR) in the AR6 Synthesis Report is now being modelled using Shared Socio-economic Pathways (SSPs) with projection out to 2150.
The SLR levels in the latest AR6 Synthesis Report therefore supersede the SLR levels derived from the WMAwater study. BCD have also recommended broadening the design horizon to beyond the year 2100, however no actual design year was specified.
LMCC Development Control Plan 2014 Part 6 Section 2.10 requires that mixed use medium and high density developments should use an assumed asset life of 100 years, therefore the year 2125 was selected for flood modelling purposes as it satisfies both LMCC DCP and BCD's recommendation.

In accordance with "Recommendation 3" of BCD's comments, The NSW Government does not stipulate what sea level rise should be used for modelling, only that the best available and most up-to-date science should be considered. The following excerpt has been taken from AR6 Synthesis Report:

"Relative to 1995–2014, the likely global mean sea level rise by 2050 is between 0.15–0.23 m in the very low GHG emissions scenario (SSP1-1.9) and 0.20–0.29 m in the very high GHG emissions scenario (SSP5-8.5); by 2100 between 0.28–0.55 m under SSP1-1.9 and 0.63–1.01 m under SSP5-8.5; and by 2150 between 0.37–0.86 m under SSP1-1.9 and 0.98–1.88 m under SSP5-8.5 (medium confidence)"

For the purposes of this report, the lower end of year 2150 SSP5-8.5 projection (0.98m) has been adopted as the SLR for the year 2125.

The Lake Macquarie still water level in 2125 can now be calculated as: 0.1 (Baseline Level) + (0.98 SLR) = 1.08 mAHD.

A wave setup component[1] has been added to account for the lake level during 5%, AEP 1% AEP and the PMP event. The Lake Macquarie water level during these events has been determined as:

- 2.18 mAHD for the 5% AEP Event.
- 2.40 mAHD for the 1% AEP Event.
- 3.35 mAHD for the PMP Event.

[1] The wave setup component is 1.10m, 1.32m and 2.27m for the 5%, AEP 1% AEP and the PMP event respectively based on the WMAwater flood study [1].

2.2 RAINFALL INTENSITY

In addition to sea level rise, climate change has the potential to alter the prevalence and severity of rainfall extremes, storm surge and floods [3]
The climate change factors available on the ARR Data Hub [4] estimating increases in rainfall intensities are presented in Table 1 below. These climate change factors have been estimated based on Representative Concentration Pathway (RCPs). This modelling methodology has now been superseded as the latest IPCC [2] report has now moved to using SSPs. The numbers in Table 1are therefore provided for reference only and were not used for flood modelling purposes.

Table 1 interim Climate Change Factors (ARR Data Hub)

	RCP 4.5	RCP6	RCP 8.5
2030	0.869 (4.3%)	0.783 (3.9%)	0.983 (4.9%)
2040	1.057 (5.3%)	1.014 (5.1%)	1.349 (6.8%)
2050	1.272 (6.4%)	1.236 (6.2%)	1.773 (9.0%)
2060	1.488 (7.5%)	1.458 (7.4%)	2.237 (11.5%)
2070	1.676 (8.5%)	1.691 (8.6%)	2.722 (14.2%)
2080	1.810 (9.2%)	1.944 (9.9%)	3.209 (16.9%)
2090	1.862 (9.5%)	2.227 (11.5%)	3.679 (19.7%)

At the time of writing this report, there was no guidance from ARR on the application of climate change factors based on the new SSPs , however, BCD has suggested the use of the 0.2% AEP event in lieu of an increase in rainfall for the 1%AEP Event but no further guidance was provided on factors to apply for the 5% AEP event.
For the purposes of this report, a 40% increase in rainfall was applied to the 5% AEP rainfall intensities for the year 2125. This factor was approximated by comparing the increase of intensities between the 0.2% AEP and 1% AEP event.

3 MODEL DEVELOPMENT

3.1 HYDROLOGIC MODELLING

A hydrological model was developed in DRAINS to generate hydrographs which were then input into the hydraulic model built in TUFLOW. A catchment area of 32 Hectares was determined for Yalliwali creek. This was further subdivided into 5 subcatchments.
The fraction Imperviousness was determined from satellite imagery and an ensemble of 10 storms was run in accordance with ARR 2019 Guidelines. The median hydrograph generated was selected and input into the hydraulic model for each catchment.

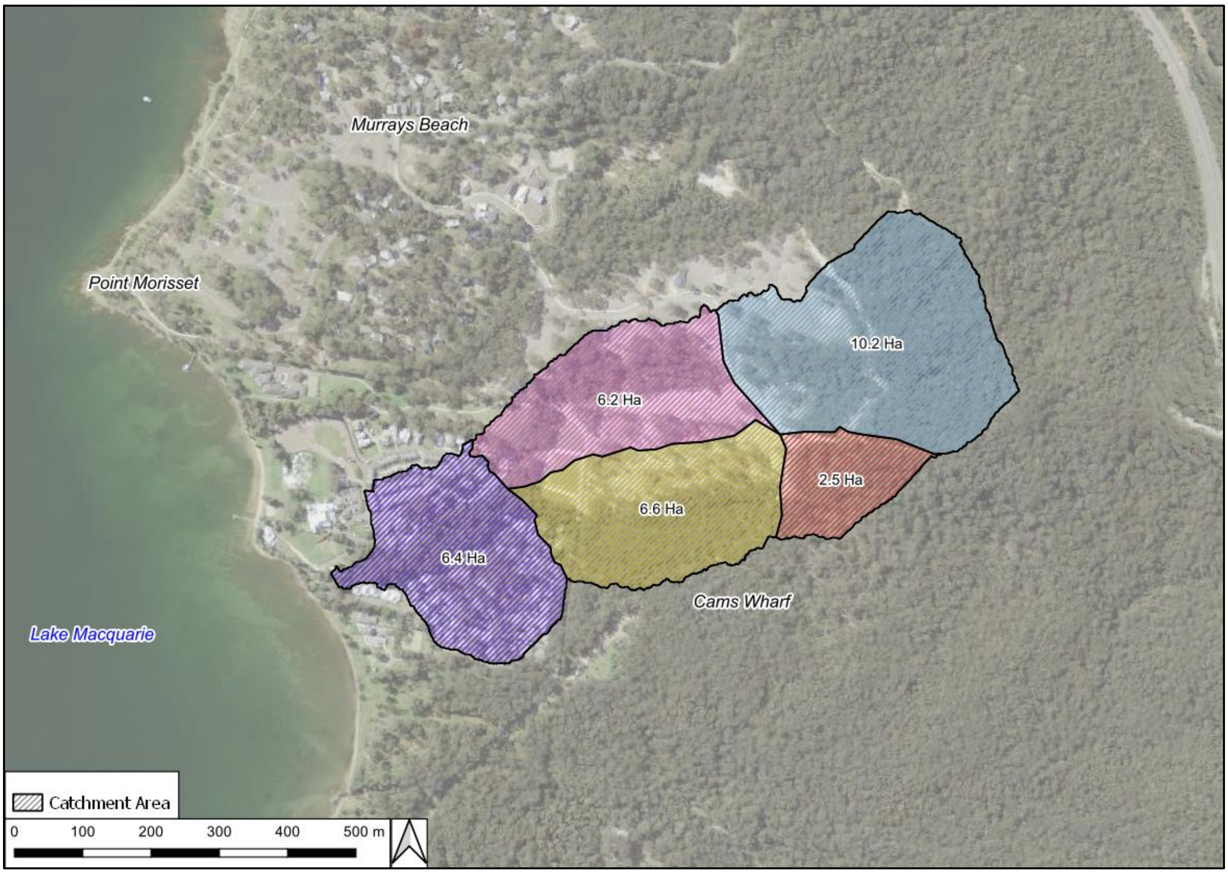


Figure 3 Subcatchment Areas

PMPs were calculated using the Generalised Short-Duration Method [5]. The following table represent rainfall depths adopted for PMP estimates. The critical duration for the site was found to be the 0.25 hours event.

Table 2 PMP Rainfall Depths

Duration (hours)	PMP Depth (mm)
0.25	180
0.50	260
0.75	330
1.00	390
1.50	510
2.00	600
2.50	680
3.00	740
4.00	850
5.00	930
6.00	990

3.2 RAINFALL LOSSES

ARR 2019 [3] Book 5 Chapter 3 recommends the use of the Initial Loss-Continuing Loss (IL-CL) model for estimating rainfall losses. The Lake Macquarie Waterway Flood Study [1] calibrated their hydrologic model to historical flood events. Utilising the calibrated model and recommendations from ARR 2019, the following parameters have been adopted for this study:

Table 3 IL-CL Loss Parameters

	Initial Loss (mm)	**Continuing Loss** (mm/h)
Pervious Areas	10	2.5
Impervious Areas	1	0

3.3 HYDRAULIC MODELLING

3.3.1 ELEVATIONS

The model's ground elevation was built from LiDAR and Survey Data.
A 1 metre LiDAR DEM was obtained from NSW Spatial Services covering the entire catchment that was used to represent the existing ground surface for the hydraulic model. The stated accuracy for the DEM was 0.3m (95% Confidence Interval) vertical and 0.8m (95% Confidence Interval) horizontal.
Additional survey data was available at the downstream end of the Yalliwali Creek [2]. The levels of the creek just South of Lot 30 were taken from this survey. At locations where both LiDAR and survey data was available, the accuracy of the DEM was checked against survey data by sampling random points across the site. as shown below and as presented in Figure 4 and Table 4 below:

Figure 4 DEM sampled points

[2] Survey information was obtained from "Daly Smith" drawing titled "35131 T01 Comparison Survey", Rev,0, dated 11.05.2021 and from "Positive Survey Solution" drawing titled "Plan of Detail & Levels over Lots 14, 26 & 27 in DP 270043, Rev. A, Dated 24.02.2022. Refer to Appendix B

Table 4 Comparison of DEM against Survey

Point No.	Elevation from DEM (mAHD)	Elevation from Survey (mAHD)	Difference (DEM-Survey) mAHD
1	9.026	9.140	-0.114
2	9.715	9.550	0.165
3	4.289	4.420	-0.131
4	1.265	1.310	-0.045
5	2.509	2.410	0.099
6	2.357	2.380	-0.023
7	3.926	4.100	-0.174
8	6.694	6.550	0.144
9	7.220	7.230	-0.01
10	3.081	3.090	-0.009
11	2.230	2.310	-0.08
12	5.356	5.360	-0.004

The greatest deviation between the survey and the DEM levels at the sampled points was 0.174m which is well within the 0.3m Vertical Accuracy of the DEM.

3.3.2 HYDRAULIC ROUGHNESS

Land use throughout the site has been determined through satellite imagery. The following roughness coefficients have been applied for different land use types in accordance with ARR Guidelines [6].
Most of the site has been mapped either as “Residential Areas” or “Open Areas-Thick Vegetation”.
A small portion of Yalliwali Creek at the downstream end was observed to be rock lined and was assigned the material accordingly. Refer to Figure 5 for the delineation of material around Lots 30 and 31.

Table 5 Manning's Roughness

Land Use	Manning’s n
Roads	0.02
Residential Areas	0.04
Open Areas-Thick Vegetation	0.08
Waterways/channels – Vegetated	0.08
Waterways/channels – Rock Lined	0.03

Figure 5 Material around Lot 30 and 31

3.3.3 BUILDINGS

Existing building footprints were determined from satellite imagery and have been modelled as ineffective areas.

3.3.4 EXISTING STORMWATER DRAINAGE INFRASTRUCTURE

ARR Project 11 [7] provides guidance on the selection of appropriate factors for the blockage of hydraulic structures. Table 3.16 of the suggests the following blockage conditions for various structures:

Project 11: Blockage of Hydraulic Structures

Table 3.16: Suggested 'design' and 'severe' blockage conditions for various structures

Type of structure		Blockage conditions: Design blockage	Blockage conditions: Severe blockage
Pipe inlets and waterway culverts	*Inlet height < 3 m, or width < 5 m:*		
	Inlet	20%	100% [2]
	Chamber (culverts)	[1]	
	Inlet height > 3 m and width > 5 m:		
	Inlet	10%	25%
	Chamber (culverts)	[1]	[1]
	Culverts and pipe inlets with effective [6] debris control features	As above	As above
	Screened pipe and culvert inlets	50%	100%
Bridges	Clear opening height < 3 m	[3]	100%
	Clear opening height > 3 m	0%	[4]
	Central piers	[5]	[5]
Solid handrails and traffic barriers associated with bridges and culverts		100%	100%

[1] Adopt 25% bottom-up sediment blockage unless such blockage is unlikely to occur.

[2] Degree of blockage depends on availability of suitable 'bridging' matter. If a wide range of bridging matter is available within the catchment, such as large branches and fallen trees, then 100% blockage is possible for such culverts.

[3] Typical event blockage depends on risk of debris rafts and large floating debris.

[4] Blockage considerations are normally managed by assuming 100% blockage of handrails and traffic barriers, plus expected debris matter wrapped around central piers.

[5] Typical event blockage depends on risk of debris wrapped around central piers. The larger the piers, the lower the risk normally associated with debris wrapped around piers.

[6] Whether a control feature is "effective" is hard to define, though monitoring trial measures may give some guidance.

The most downstream culvert on Yalliwali Creek is the 3x900mm culvert crossing 'Wild Duck Drive' just upstream of Lot 30. Assuming severe blockage conditions and inlet heights < 3m for all culverts within the catchment, 100% blockage was applied to the culvert crossing "Wild Duck Drive" and all upstream culverts.

3.3.5 UPSTREAM BOUNDARY CONDITION

The stormwater hydrographs extracted from the Hydrologic Model were used as inputs for the TUFLOW model. The hydrographs were applied using 2d QT (Flow vs. Time) boundaries.

3.3.6 DOWNSTREAM BOUNDARY CONDITION

The downstream boundary condition for Yalliwali Creek is the peak water level for Lake Macquarie.

"Peak water levels in the Lake Macquarie waterway result from a combination of rainfall over the catchment and elevated ocean levels. Thus the assumed design ocean level in conjunction with the design rainfall event over the catchment will affect the resulting design flood level in the Lake Macquarie waterway." [1]

Older approaches for modelling the coincidence of Rainfall and Ocean Levels was to combine the design rainfall and ocean event, such as the 1%AEP rainfall event occurring in conjunction with the 1% AEP ocean.

The Lake Macquarie Waterway Flood Study [1] used another approach that combines a design ocean event with a design rainfall event such as the following scenarios:

- 100 year ARI ocean flooding with 20 year ARI catchment flooding with coincident peaks,
- 20 year ARI ocean flooding with 100 year ARI catchment flooding with coincident peaks,
- neap tide cycle with 100 year ARI catchment flooding with coincident peaks.

For the purposes of this report a more conservative hybrid approach has been used. The 5% AEP rainfall event has been modelled with the 1% AEP ocean event while the 1% AEP rainfall event has been modelled with the same design event, i.e. the 1% AEP ocean event.

The downstream boundary conditions (peak Lake Macquarie level) used for the different design events therefore are:

5% and 1% AEP: 2.40 mAHD
PMP Event: 3.35 mAHD

4 RESULTS

The overall results from the Flood model are shown in Appendix A. The results show that, for all design events, flooding is conventional and mainly concentrated with Yalliwali Creek except for the downstream end of the study area where some overland flooding occurs due to the overtopping of Wild Duck Drive. Flooding due to Lake Macquarie level rise does not seem to be a major concern for the existing and proposed developments during the 5% and 1% AEP events, however, it will have an impact during a PMF event. It should be noted that culverts have been assumed to be completely blocked in all design events and including partially open culverts may alter the results.

4.1 FLOOD LEVEL AFFLUX

The effect of the proposed development on the upstream reaches of the catchment have been analysed to determine the changes (Afflux) in flood level. Afflux maps for the three modelled events are available in Appendix A.

It has been found that for all events modelled, there are no changes to the flood levels over the existing neighbouring properties. Increase in flood levels is limited between the proposed Lots 30 and 31 and Wild Duck drive.

Future site-specific flooding analysis as part of a Future DA for lots 30 and 31 should consider measures to compensate for the increase in flood level, such as proposing additional flood storage.

4.2 FLOOD PLANNING AREA AND LEVELS

The Flood Planning Area (FPA) identifies the land that is subject to flood related controls and the Flood Planning Level (FPL) is the minimum floor level applied to developments within the FPA.

The Floodplain Development Manual Appendix K generally recommends that the FPL to be the 1%AEP + 0.5m freeboard. However, it recognises that higher FPL may be required for critical infrastructure such as hospitals and emergency responses facilities.

As can be seen from the 1%AEP flood maps in Appendix A, flooding is mostly dominated by flooding within Yalliwali Creek with some overland flooding at the downstream end of the site.

In accordance with section 4.1 of this report, there are no flood level changes on the neighbouring properties, therefore as long as the future Lot 30 and 31 development footprint remains consistent with the footprint shown in the Planning Proposal .

The proposed developments on Lots 30 and 31 are affected by the 5% AEP event up to the PMF and are therefore subject to flooding controls.
Lake Macquarie City Council DCP Part 3 – Development within Residential Zones and Part 6 - Development in Recreation and Tourist Zones nominate the FPLs in the figures below for flood affected land. As these are in agreement with the Floodplain Development Manual, similar FPLs should be adopted within the study area:

Table 6 Flood Planning Levels

Development Type	Minimum Required Height
Dwellings	
Habitable rooms	1 in 100 year probable flood level + 500mm freeboard
Non-habitable rooms and garages	1 in 20 year probable flood level
Medium and High density residential development	
Habitable rooms	1 in 100 year probable flood level + 500mm freeboard
Non-habitable rooms and garages	1 in 20 year probable flood level
Basement car parking	Constructed to preclude entry of floodwater at levels up to the 1 in 100 year probable flood level + 500mm freeboard. Additional requirement for basement levels to implement a failsafe means of evacuation, and a pump-out
Commercial and Retail	
Internal floor height	1 in 100 year probable flood level + 500mm freeboard
Basement car parking	Constructed to preclude entry of floodwater at levels up to the 1 in 100 year probable flood level + 500mm freeboard. Additional requirement for basement levels to implement a failsafe means of evacuation, and a pump-out system to remove flood waters.
Mixed Use development	
Internal floor height	1 in 100 year probable flood level + 500mm freeboard
Basement car parking	Constructed to preclude entry of floodwater at levels up to the 1 in 100 year probable flood level + 500mm freeboard. Additional requirement for basement levels to implement a failsafe means of evacuation, and a pump-out system to remove flood waters
Sensitive Uses (Residential care facilities, hospitals, etc.)	
Internal floor height	Probable maximum flood level

Floor Planning Levels (FPLs) for Lots 30 and 31 will need to be defined in a site specific flood management report as part of a future DA for the lots.

4.3 GENERAL FLOOD HAZARD CATEGORISATION

General flood hazard vulnerability curves were determined in accordance with Section 4.1 of the Australian Disaster Resilience Handbook Collection Guideline 7-3 [8]

Provisional hydraulic hazard maps are presented in Appendix A

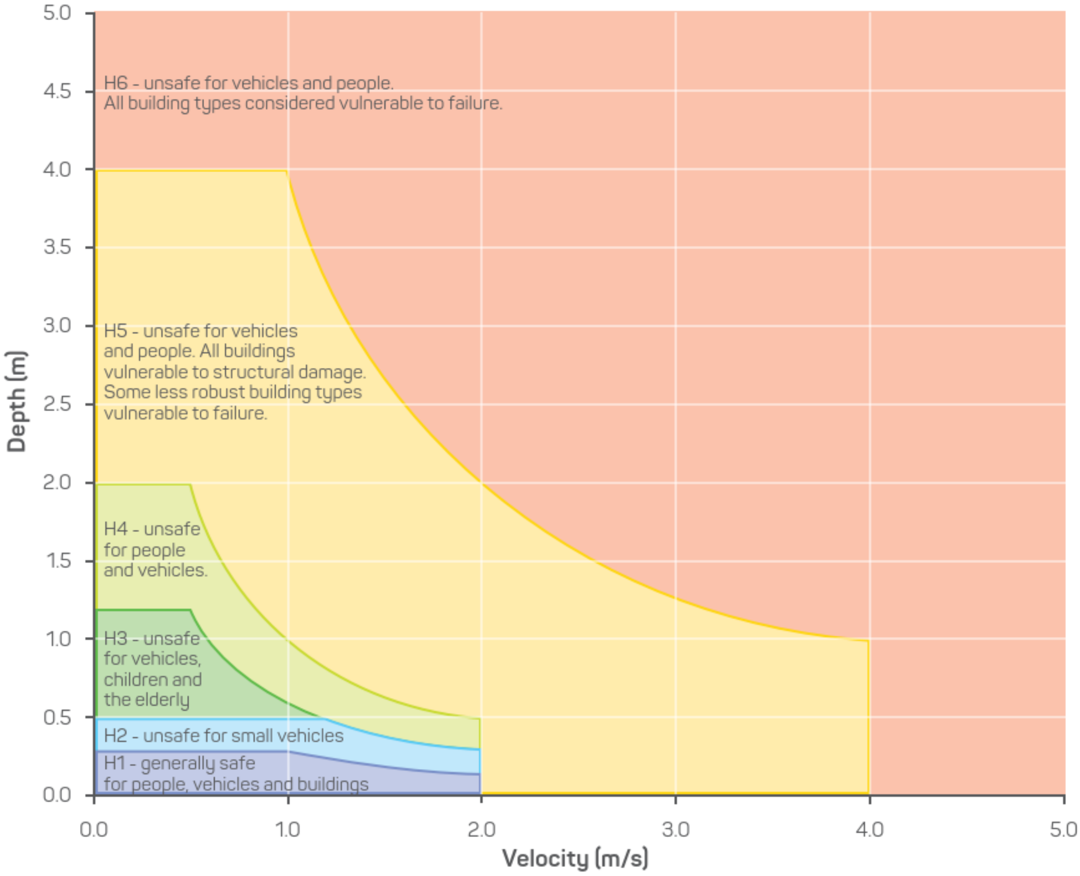


Figure 6 General flood hazard vulnerability curves

4.4 PROVISIONAL HYDRAULIC CATEGORISATION

The Floodplain Development Manual Appendix L [9] defines three hydraulic categories for flood prone land:

- Floodways;
- Flood Storage;
- Flood Fringe

Floodways are those areas where a significant volume of water flows during floods and are areas where even if partially blocked would cause a significant increase in flood levels. They are usually aligned with natural channels.
Flood storage areas are areas that provide for temporary storage of flood waters and if substantially filled may cause a significant increase in flood levels.
Flood fringe is usually defined as the area of the flood plain that are not categorised as floodways or flood storage areas and where development would not have a significant impact on flood flows or levels.

The Floodplain Development Manual provides no quantitative definition of these categories. Some approaches such as that of Howell et al. [10] suggest the use of the product of depth and velocity to establish hydraulic categories.
For the purpose of this report, hydraulic categories have been defined as per the criteria below:

Table 7 Hydraulic Category Criteria

Hydraulic Category	Criteria
Floodway	1% AEP Velocity x Depth > 0.30 m^2/s
Flood Storage	1% AEP Depth > 0.15 m, Not Floodway
Flood Fringe	1% AEP Depth <0.15 m, Not Floodway or Flood Storage

Hydraulic categorisation is presented in Appendix A. The majority of the study area is categorised as a flood way. This is due to the well defined Yalliwali Creek and the steep terrain which produces higher velocities. It is important to note that the hazard categorisation occurs in the pre-development state (existing) and in the post-development state and not worsened as a result of our development.

4.5 LOTS 30 AND 31 DP270043 FLOOD MAPS

The main purpose of this report is to be a supporting document for the purposed LEP amendment to increase the height limit for part of Lots 30 and 31 DP270043. A future DA for the development of these lots should include a detailed assessment and flood mitigation measures, however the following figures provide a high level overview of the flooding regime in the vicinity of lots 30 and 31.

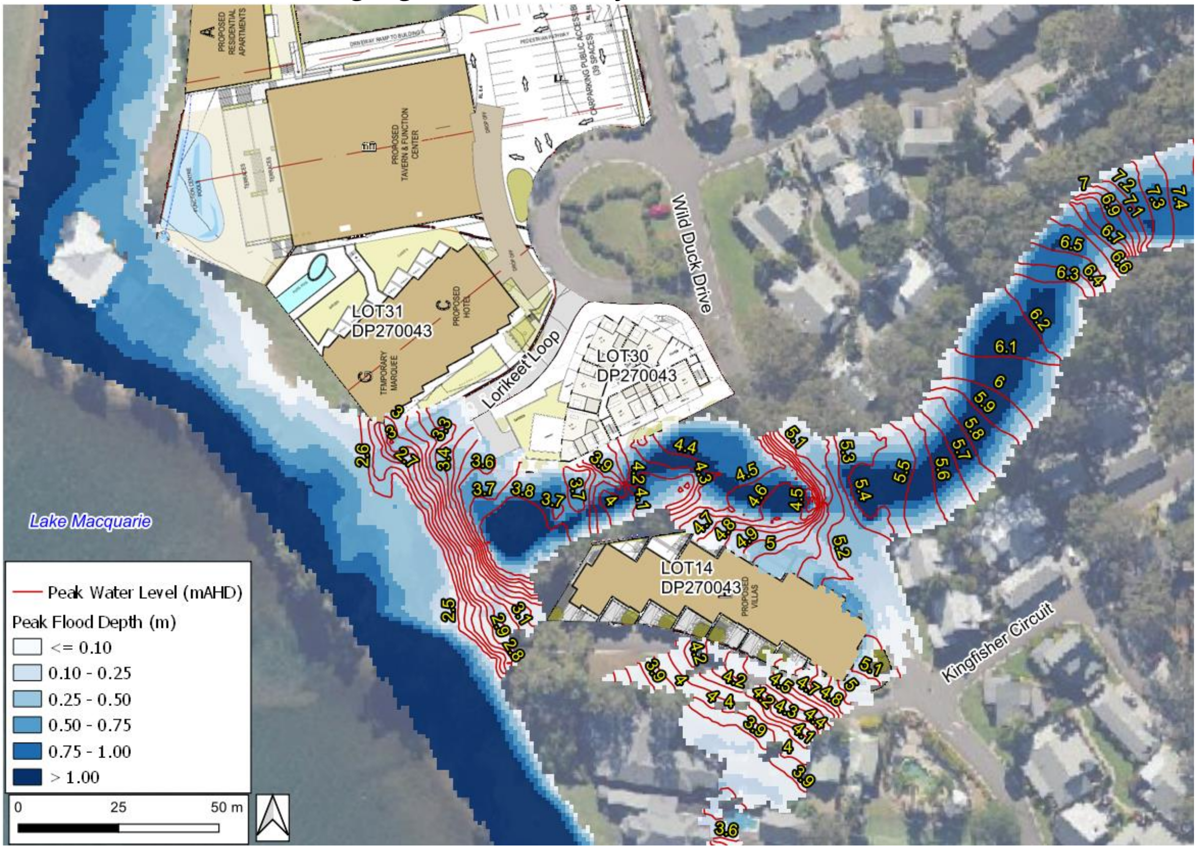


Figure 7 Lot 30 and 31 Flood Depths (1% AEP Event)

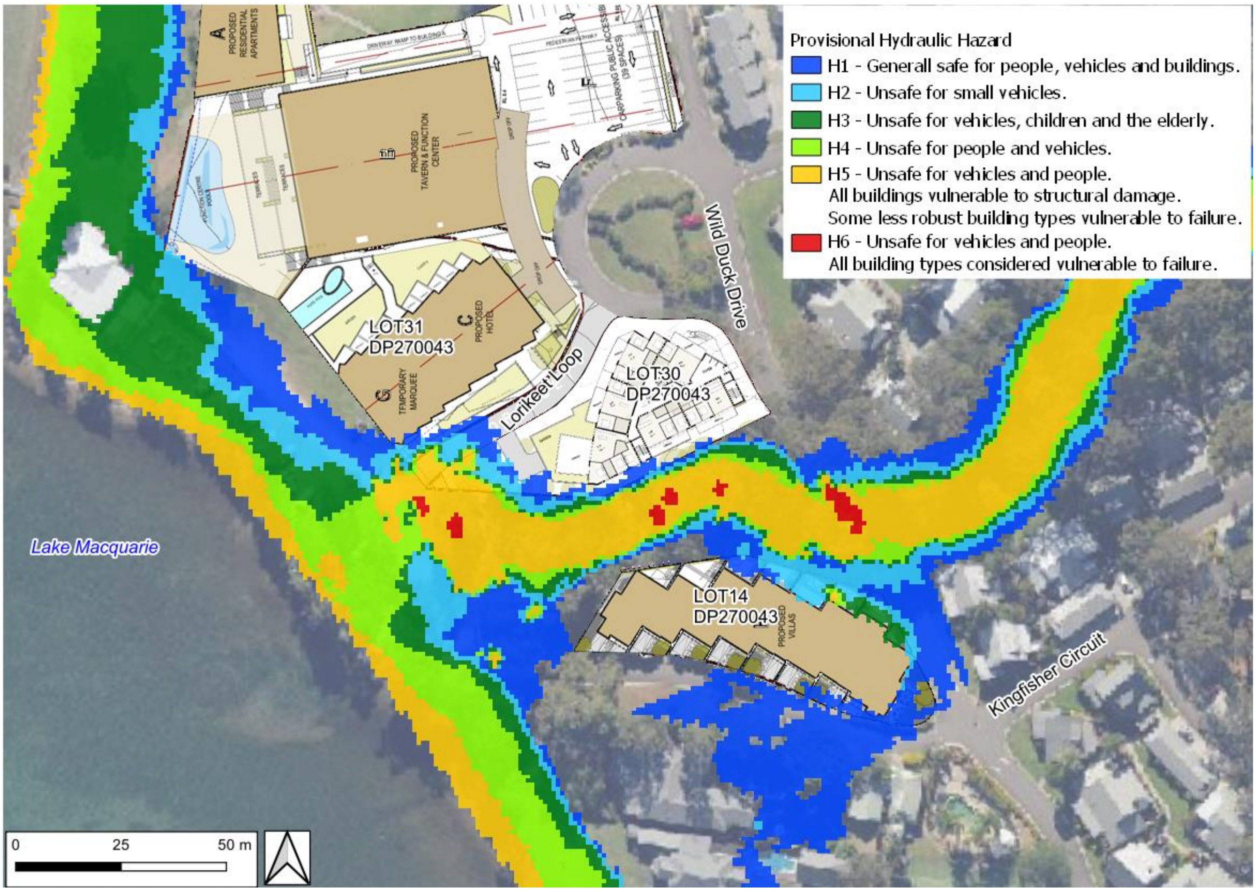


Figure 8 Lot 30 and 31 Flood Hazard Categories (1% AEP Event)

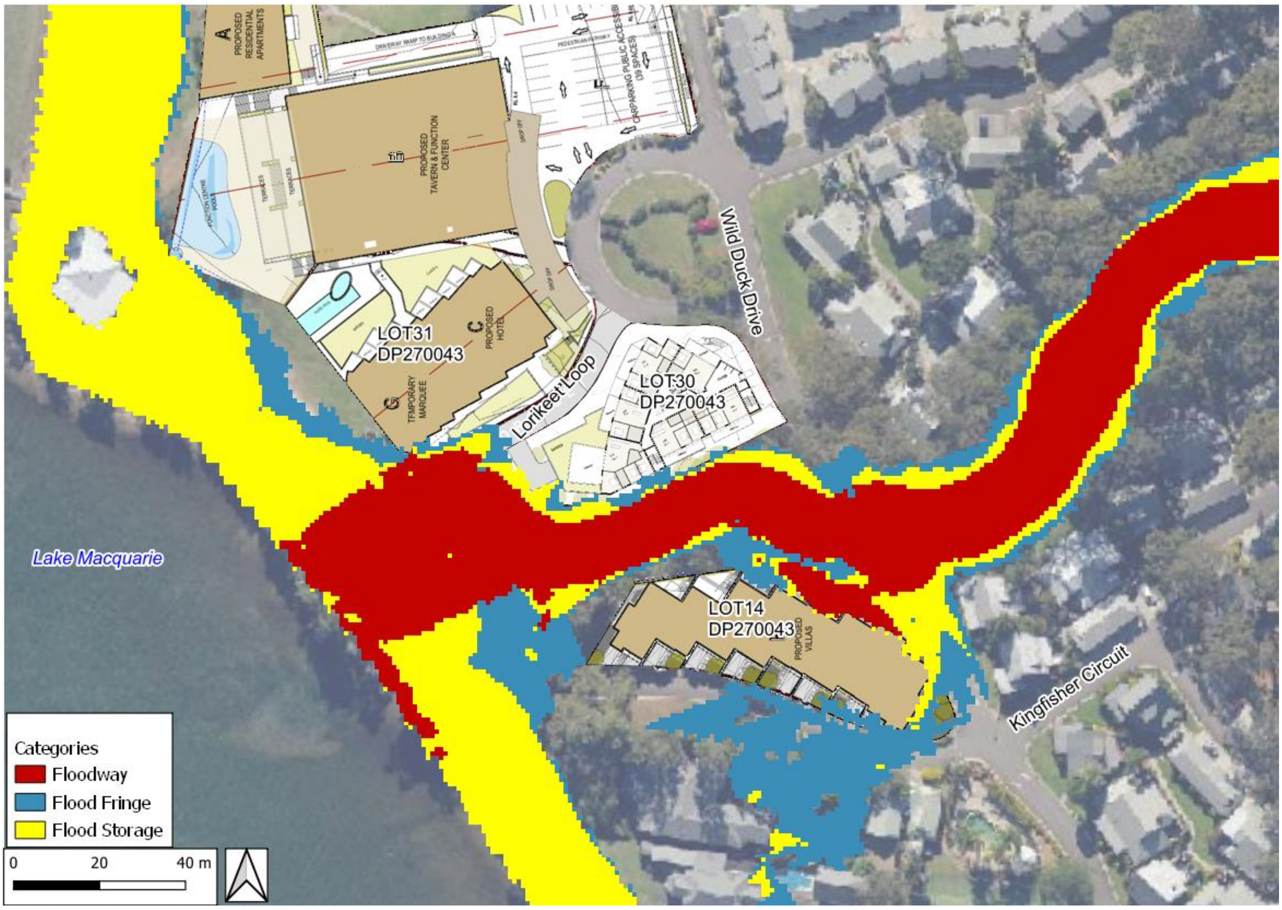


Figure 9 Lot 30 and 31 Flood Categories

The figures above indicate that Lots 30 and 31 are impacted by flood waters at their south western corner. Lot 30 is more affected by flooding with depths reaching about 0.3m at the south western setback. Hydraulic Hazard on Lot 30 area is mostly low with the exception of a corner to the south west which is experiences H5 category hazard. Flood categorisation within Lot 30 is mainly flood storage and floodway on the south western corner. It is therefore recommended that any development on the south western corner of Lot 30 should maintain a minimum impact on the flood regime.

The highest flood level contours impacting lots 30 and 31 during the 1% AEP events are 4.45 and 3.40 mAHD respectively.

Preliminary architectural plans shown in Appendix C demonstrate that the lowest habitable floor levels for both developments sit above the 1%AEP+500mm freeboard level. A site specific flood management report should be completed as part of a future DA once the architectural plans are further developed to demonstrate compliance with all the requirements for flood affected lots in accordance with Council's DCP.

5 LOTS 30 AND 31 DP270043 FLOOD EVACUATION

5.1 EVACUATION AND ACCESS

As can be seen in Figure 10 Wild Duck Drive provides the only access route to and from Lots 30 and 31. The road crosses Yalliwali Creek and during a PMF event which is subject to H5 and H6 category flood hazards.

Measures to mitigate the risk of evacuation hazard include, safe evacuation procedures as instructed by SES or Police well in advance of the predicted storm event, flood warning signage and flood depth indicators, evacuate to the nearby Tavern as it is not affected by the high hazard flood waters from Yalliwali Creek and its ground floor is sited above the PMF level.

"Recommendation 5" of BCD's comments states *"vertical evacuation (shelter in place) is not considered to be evacuation from an area of risk", however* It should be noted that the minimum habitable floor levels on both Lots 30 and 31 also sit above the PMF level therefore shelter in place does not require any residents to "evacuate" to higher floors and is therefore believed to be a viable last resort option in case evacuation to the Tavern is not possible.

Figure 10 Access to Lots 30 and 31

5.1 FLOOD WARNING

The Bureau of Meteorology (BOM) issues a severe weather alert that provides the State Emergency Services with a "heads-up" for potential action and, if specific rainfall thresholds are observed, the Bureau may issue a "Flood Watch" that includes the Lake Macquarie City area.

Adequate flood warning is to be provided to allow safe and orderly evacuation without increased reliance upon SES or other authorised emergency service personnel.

An on-site warning system should be installed to notify any person/s on the development site return to a place of safe refuge (within the proposed residence) and follow the directions as described and recommended in this Flood Evacuation Response Strategy. The system must include but not be limited to:

a) Loud siren so anyone person/s within 500m of the development site can hear clearly
b) Appropriate signage to alert people to the flood warning and to move a place of safe refuge
c) Flood warning signs flashing light at location of signage to alert people to the signage.

Flood warning sirens and flood level indicators are proposed to be placed in accordance with Figure 11. Examples for flood warning signs and indicators are provided in Figure 12 and Figure 13.

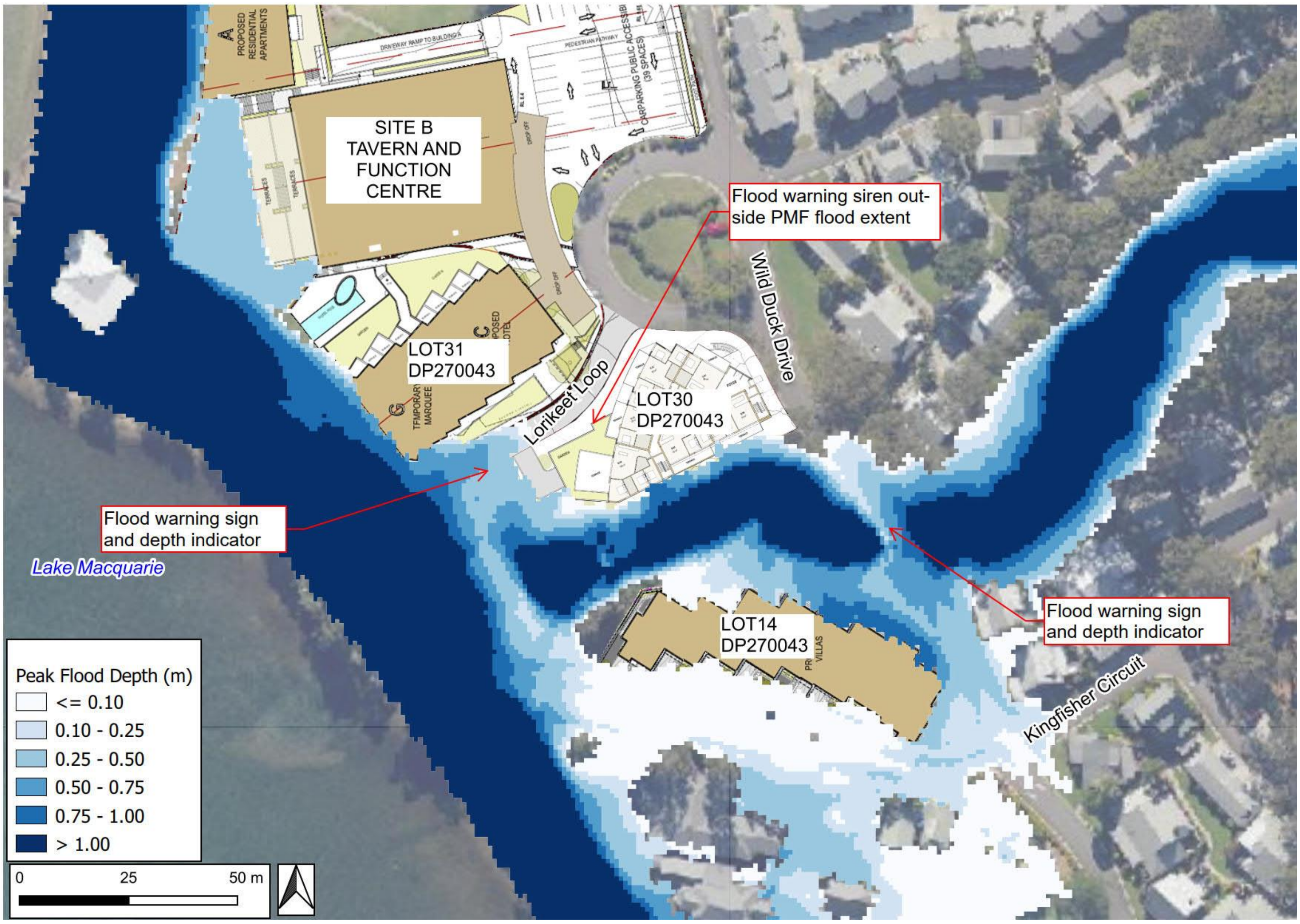


Figure 11 Proposed Flood Warning System

Figure 12 Example Flood Warning Sign

Figure 13 Example Flood Depth Indicator

5.2 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 FERS 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.

Flood indicators are to be located around the site to act as an early warning sign to potential rising floodwaters. If evacuation of the subdivision is required, do so early in the flood event.

If evacuation is necessary, a flood emergency siren (activated from a suitable location within the development site outside of the PMF flood extent) should be activated to warn all occupants on the premises. In addition, a SMS text message to the resident owners of the subdivision is another measure that should be implemented to advise what actions should be taken. The SMS text can in general be provided by State Emergency Services (SES) or other relevant Emergency Service providers.

The location of general flood warning signage, depth indicator and flood emergency sirens have been shown in Figure 11 above.

PROCEDURE IN CASE OF 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 RECEIVED BY STATE EMERGENCY SERVICES SHOULD GOVERN THE TRIGGER LEVELS OUTLINED BELOW.

5.2.1 BASIC PREPAREDNESS:

Issuing of Severe Weather Alert for Sydney metropolitan area by BOM. If it is anticipated that evacuation will be necessary, place any items of value (e.g. electrical goods, personal belongings, medical supplies) in an elevated area such as on top of desks/tables/benches.

5.2.2 EVACUATION:

1. The following evacuation route is most ideal for evacuation, refer to Figure 14 and the architectural concept plans below for reference;
    - Lot 30: Exit the building from the ground floor to Wild Duck Drive and travel in a northwest direction towards the Tavern.
    - Lot 31: Exit the building from the side entrance leading directly to the tavern.
2. 2. Shelter within the Ground Floor and Level 1 of the tavern
3. 3. In case the tavern is inaccessible at the time of evacuation, resident are advised to shelter in place within Lots 30 and 31 as a last resort.

Figure 14 demonstrates that Lots 30 and 31 are not surrounded by floodwaters during a PMF event but only the southern and western boundaries are affected. If warning sirens are heard and the residents are unable to evacuate, sheltering in place is believed to provide a safe option as all habitable floors are located above the PMF and no egress is provided from Lots 30 and 31 towards hazardous floodwaters. Residents are able to safely shelter in place until flood waters reside, and further support can be provided by emergency authorities.

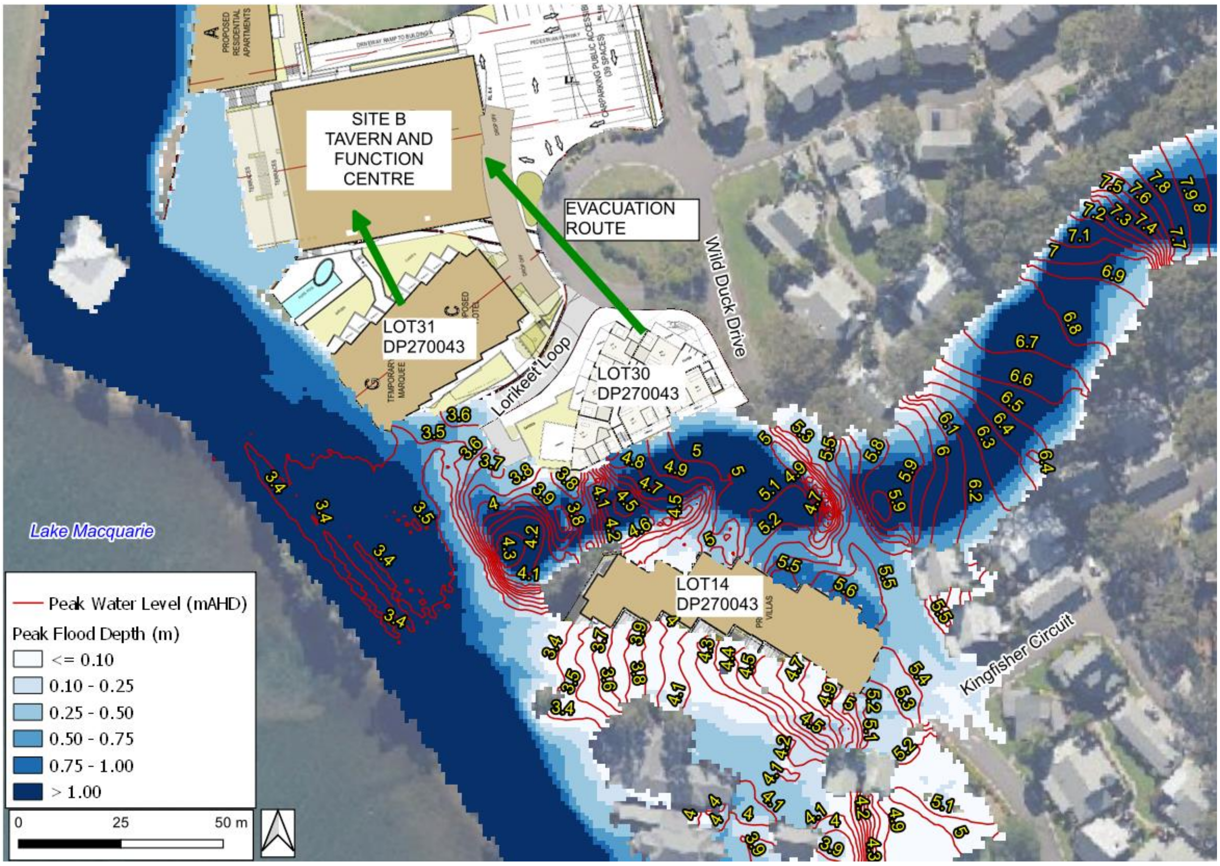


Figure 14 Evacuation from Lot 30 and 31 - Overview (PMF Event)

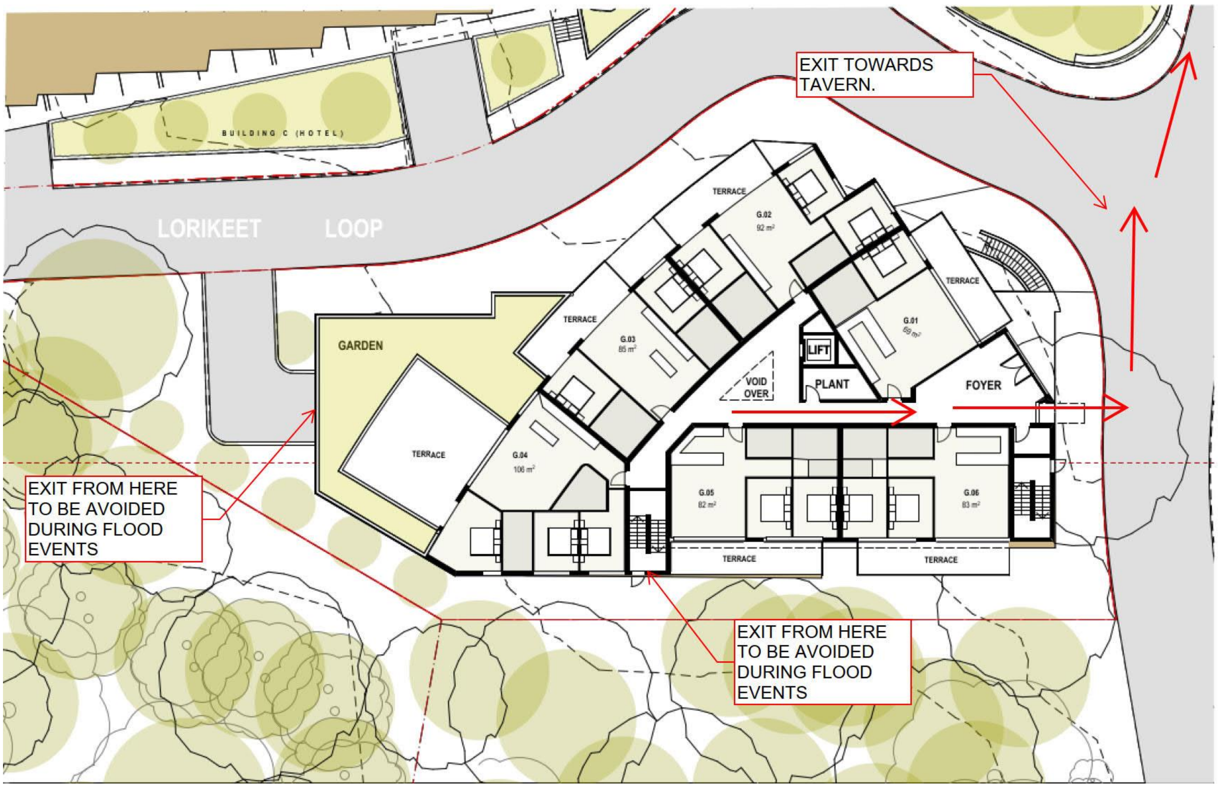


Figure 15 Evacuation from Lot 30 (Architectural Concept Plan)

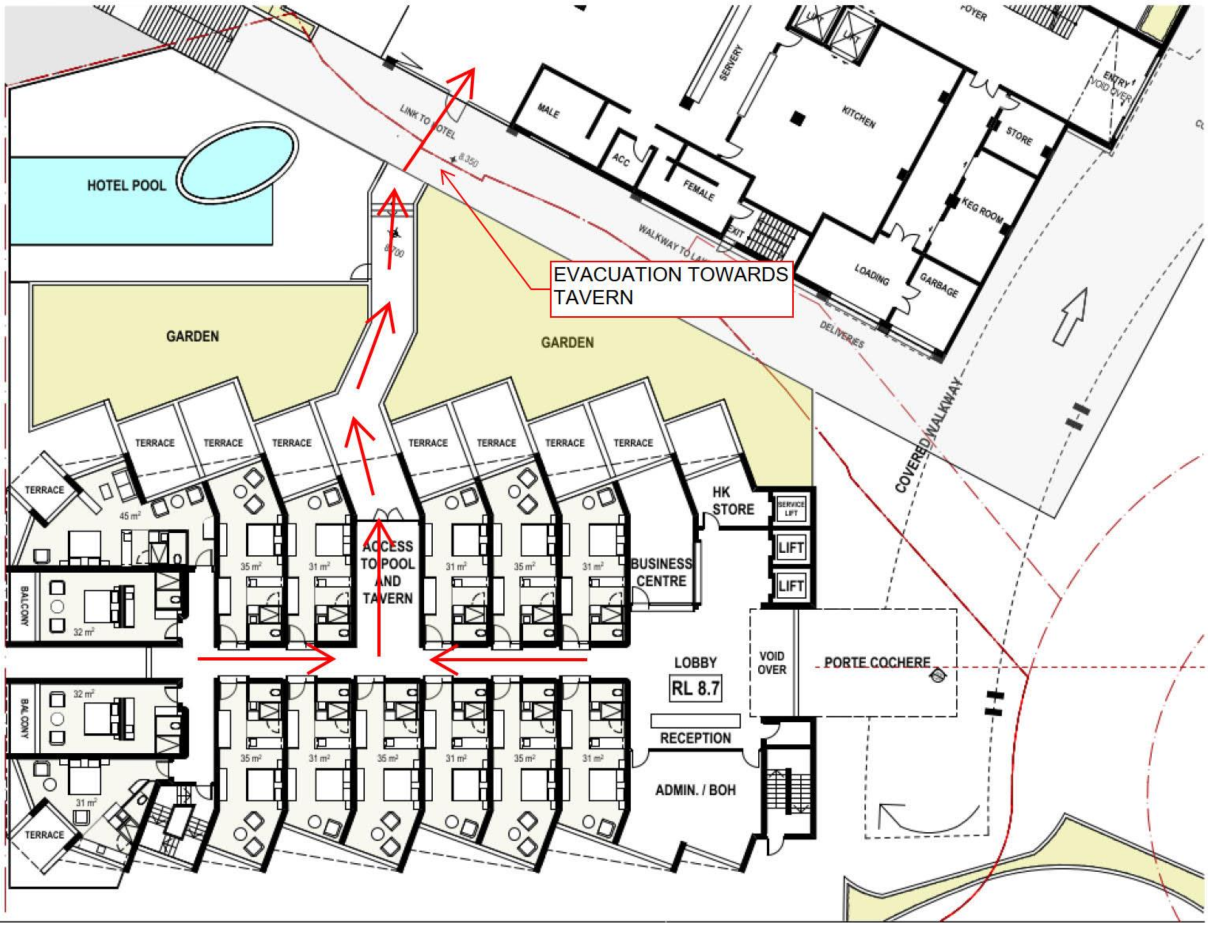


Figure 16 Evacuation from Lot 31 (Architectural Concept Plan)

ADDITIONAL FACTOR RISKS

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 to stay within the evacuation centres as much as practical as this is the safest option.

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 your local ABC Radio station 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		1300 659 215
Lake Macquarie City Council		02 4921 0333
Manager		
Strata Manager		
Other		

6 CONCLUSION

This flood management report has been prepared as a supporting document for the proposed amendment to the LEP to increase the building height limit on parts of Lots 30 and 31 DP270043.
The report delineated the catchment for Yalliwali Creek and hydrologic and hydraulic models were developed to assess the 5% AEP, 1%AEP and PMF flooding events.

Sea Level Rise (SLR) in the AR6 Synthesis Report are now being modelled using Shared Socio-economic Pathways (SSPs) with projection out to 2150. The year 2125 was used as the modelling year to satisfy both the requirements of BCD and LMCC DCP.

Flood modelling results indicated that flooding within the study area is usually conventional and confined to Yalliwali Creek except at the downstream end where some overland flooding occurs. Flow through the creek is characterised by high velocities due to the steepness of the channel.

Flood Planning Areas and Levels were assessed in accordance with the Floodplain Development Manual and Lake Macquarie City Council DCP.
It is recommended that all habitable floors be designed to the 1%AEP flood level + 0.5m freeboard.

Lots 30 and 31 DP270043 were further assessed for existing flooding in the 1% AEP event. It was found that Lot 31 is only minimally affected while Lot 30 is impacted by flooding on its southwestern corner. It is recommended that any proposed development on the southwest corner of Lot 31 should not impact the existing flood regime.

Measures to mitigate the risk of evacuation hazard include, evacuation sirens, safe evacuation procedures as instructed by SES or Police well in advance of the predicted storm event. During any potential flood event, it is advised that any occupants on Lots 30 and 31 should evacuate to the nearby Tavern and Functions Centre (Site B), this is supported by flood warning signage and flood depth indicators,. In case the Tavern is closed, it is recommended that residents shelter in place with Lots 30 and 31. At this stage, further advice should be sought from relevant authorities.

It should be clarified that this study is not a site-specific analysis for any proposed sites within the masterplan. This report and analysis have been developed to support the LEP planning amendment. Any future Development Applications for the site areas (e.g. Site D) would be subject to a site specific analysis.

7 REFERENCES

[1] WMAwater, Lake Macquarie Waterway Flood Study, June 2012.

[2] IPCC, “Climate Change 2023: Synthesis Report. A Report of the Intergovernmental Panel on Climate Change”.

[3] Australian Ranfall and Runoff - A Guide to Flood Estimation, 2019.

[4] “ARR Data Hub,” [Online]. Available: https://data.arr-software.org/.

[5] BoM, The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method, June 2003.

[6] C. B. Mark Babister, Australian Rainfall & Runoff Project 15: Two Dimensional Modelling in Urban and Rural Floodplains - stage 1&2 report, November 2012.

[7] W. Weeks, A. Barthelmess, E. Rigby, G. Witheridge and R. Adamson, Australian Rainfall Project 11: Blockage of Hydraulic Structures.

[8] Australian Institute for Disaster Resilience, Guideline 7-3, “Australian Disaster Resilience Handbook Collection,” 2017.

[9] N. Government, Floodplain Development Manual, New South Wales , 2005.

[10] M. D. C. G. L. N. Howell L, ‘Defining the Floodway – Can One Size Fit All?’, 43rd Annual NSW Floodplain Management Association Conference, 2003.

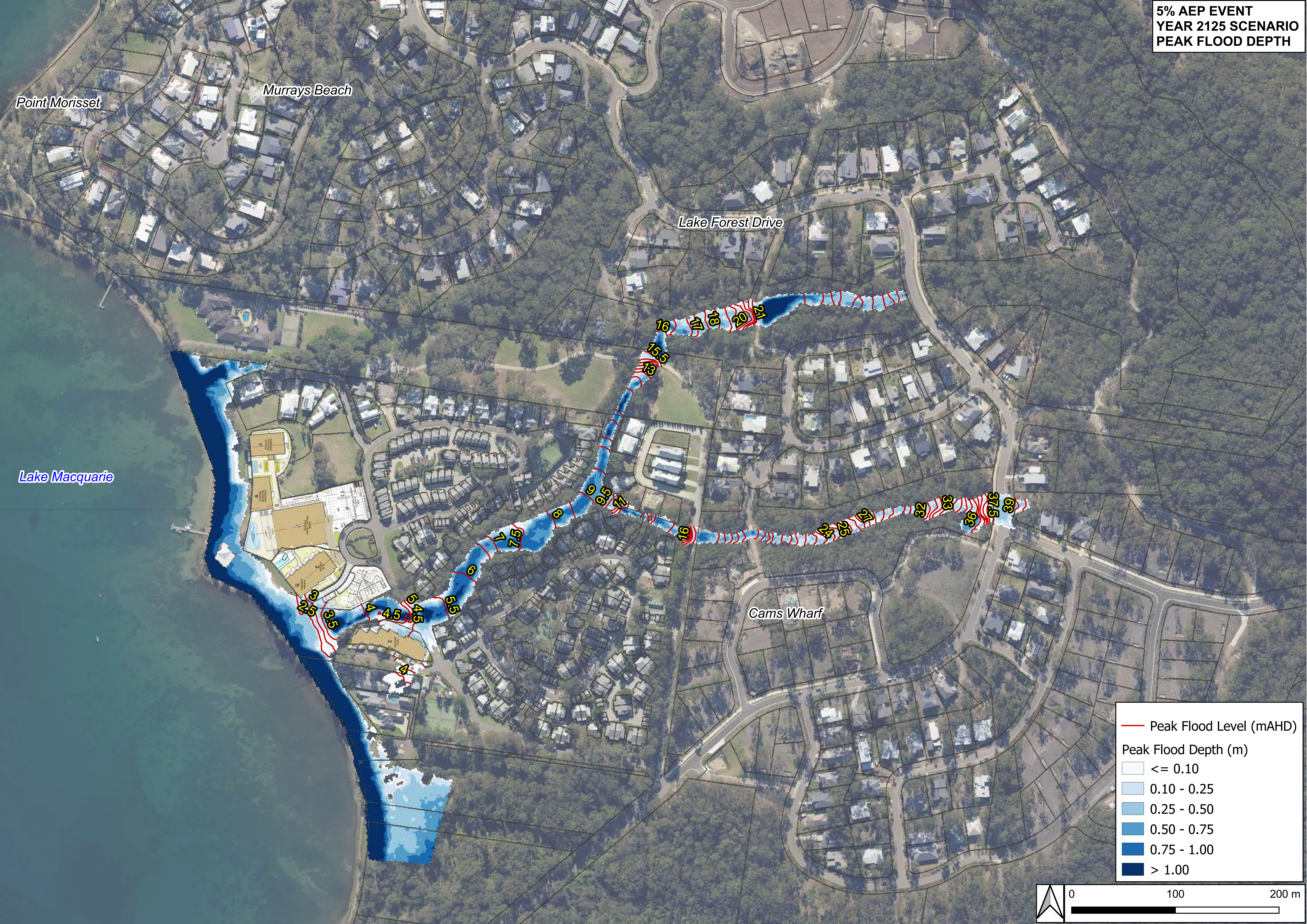
Disclaimer

Xavier Knight Consulting Engineers gives notice that the particulars set out in this report are for the exclusive use of Client and that no responsibility or liability is accepted as a result of the use of this report by any other party. This report shall not be construed as a certificate or warranty.

Kind Regards,
Scott Sharma

Principal Civil Engineer
BE (Civil) BE (Environmental) MIEAust

APPENDIX A – FLOOD MAPS



5% AEP EVENT
YEAR 2125 SCENARIO
PEAK FLOOD DEPTH
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
2.5
3
3.5
4
4.5
5
5.5
6
7
7.5
8
9
9.5
13
15.5
16
17
18
20
21
24
25
27
32
33
36
37.5
39
Peak Flood Level (mAHD)
Peak Flood Depth (m)
<= 0.10
0.10 - 0.25
0.25 - 0.50
0.50 - 0.75
0.75 - 1.00
> 1.00
0
100
200 m

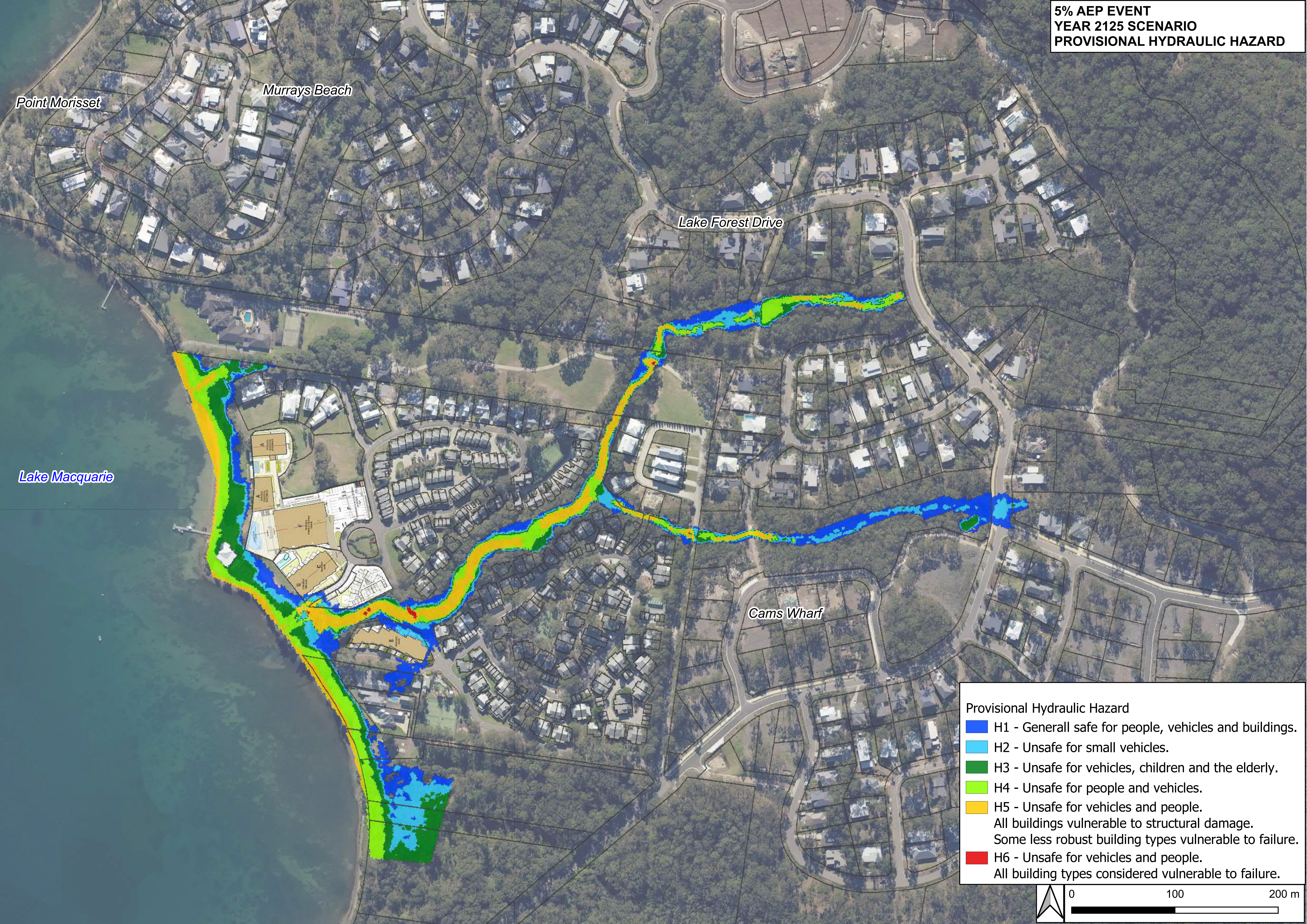

1% AEP EVENT
YEAR 2125 SCENARIO
PEAK FLOOD DEPTH
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Peak Flood Level (mAHD)
Peak Flood Depth (m)
<= 0.10
0.10 - 0.25
0.25 - 0.50
0.50 - 0.75
0.75 - 1.00
> 1.00
0
100
200 m

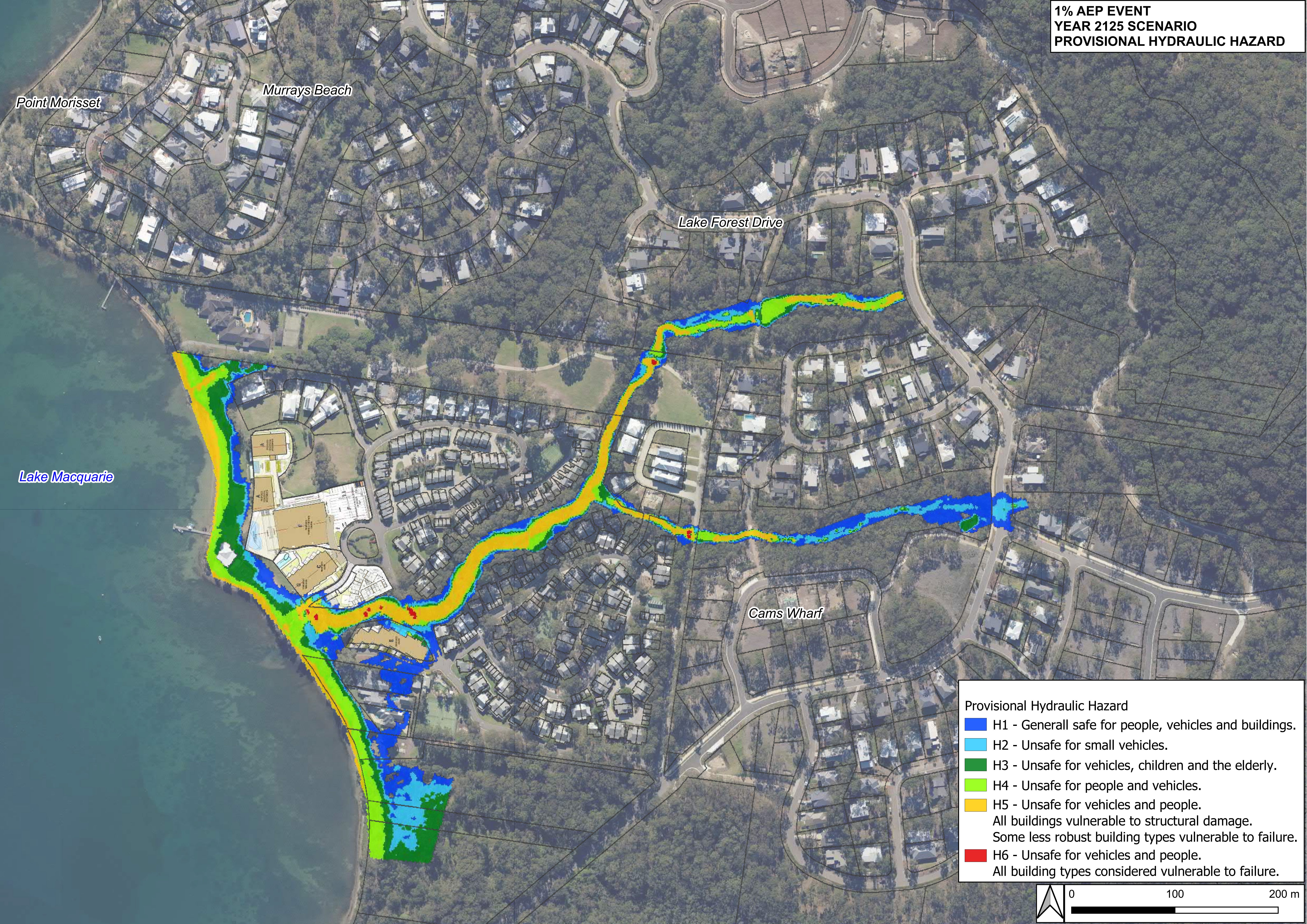

PMF EVENT
YEAR 2125 SCENARIO
PEAK FLOOD DEPTH
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Peak Flood Level (mAHD)
Peak Flood Depth (m)
<= 0.10
0.10 - 0.25
0.25 - 0.50
0.50 - 0.75
0.75 - 1.00
> 1.00
0
100
200 m


5% AEP EVENT
YEAR 2125 SCENARIO
PEAK VELOCITIES
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Peak Velocity (m/s)
<= 0.25
0.25 - 0.50
0.50 - 0.75
0.75 - 1.00
> 1.00
0
100
200 m

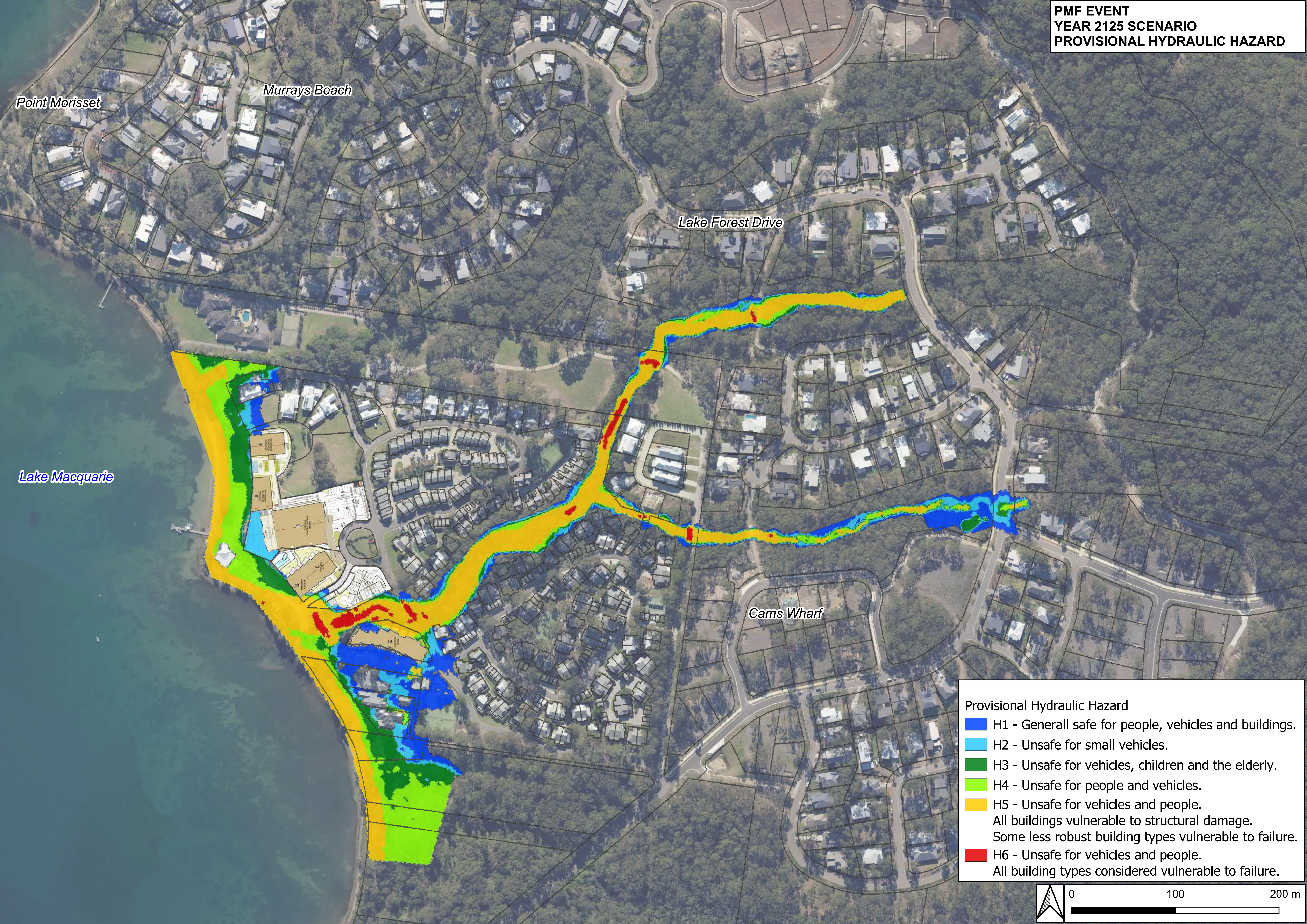

1% AEP EVENT
YEAR 2125 SCENARIO
PEAK VELOCITIES
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Peak Velocity (m/s)
<= 0.25
0.25 - 0.50
0.50 - 0.75
0.75 - 1.00
> 1.00
0
100
200 m


PMF EVENT
YEAR 2125 SCENARIO
PEAK VELOCITIES
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Peak Velocity (m/s)
<= 0.25
0.25 - 0.50
0.50 - 0.75
0.75 - 1.00
> 1.00
0
100
200 m

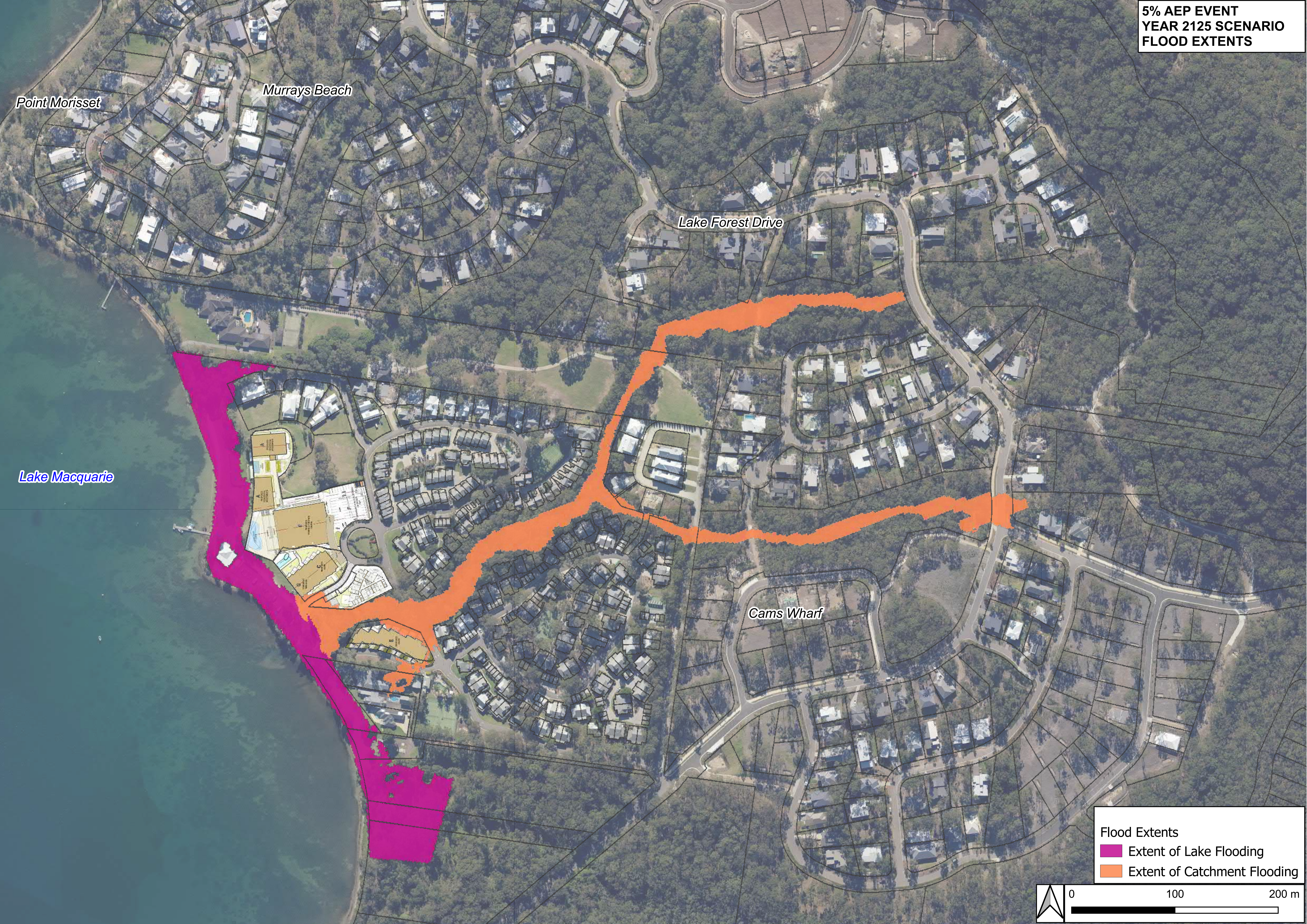

5% AEP EVENT
YEAR 2125 SCENARIO
PROVISIONAL HYDRAULIC HAZARD
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Provisional Hydraulic Hazard
H1 - Generall safe for people, vehicles and buildings.
H2 - Unsafe for small vehicles.
H3 - Unsafe for vehicles, children and the elderly.
H4 - Unsafe for people and vehicles.
H5 - Unsafe for vehicles and people.
All buildings vulnerable to structural damage.
Some less robust building types vulnerable to failure.
H6 - Unsafe for vehicles and people.
All building types considered vulnerable to failure.
0
100
200 m

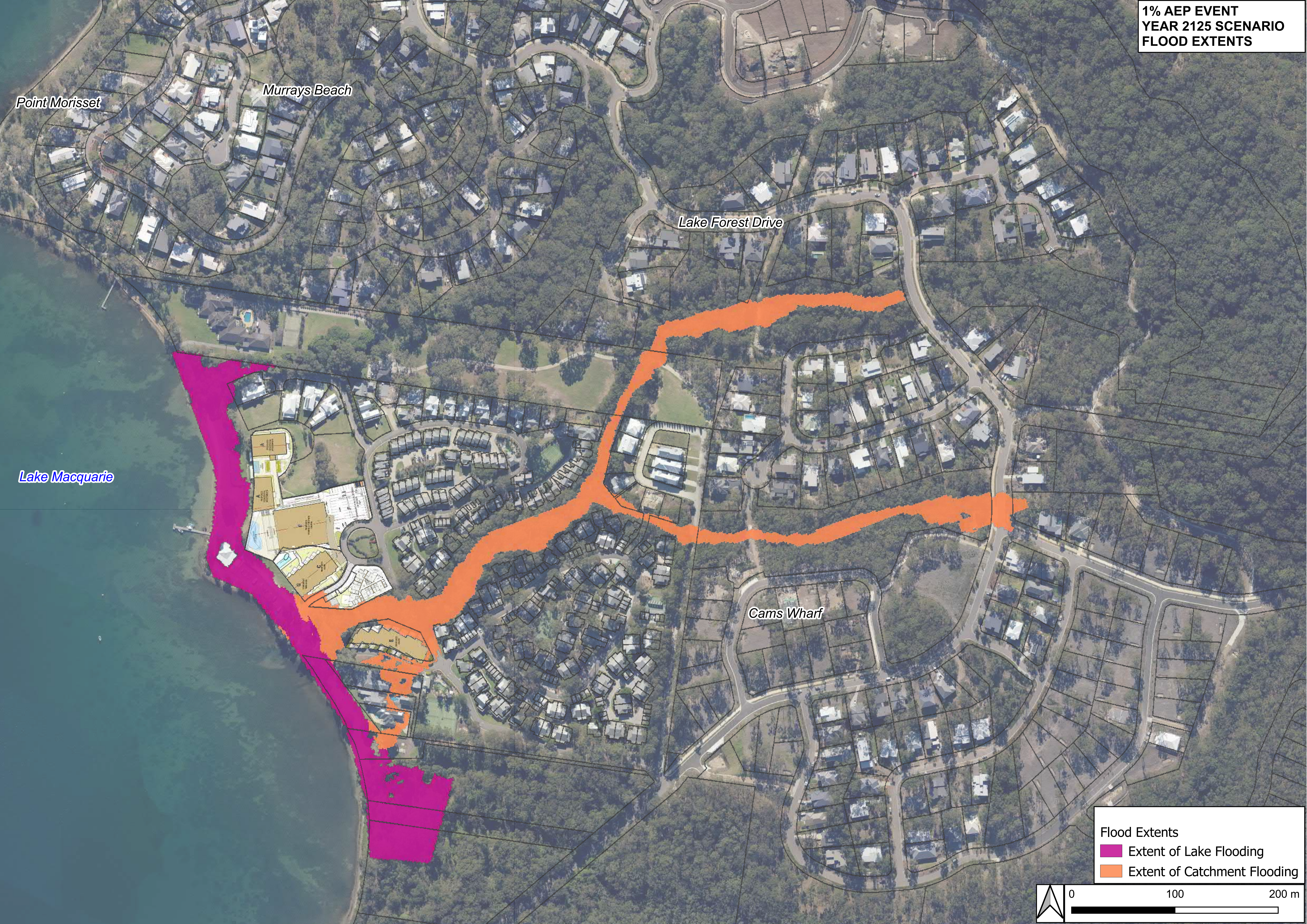


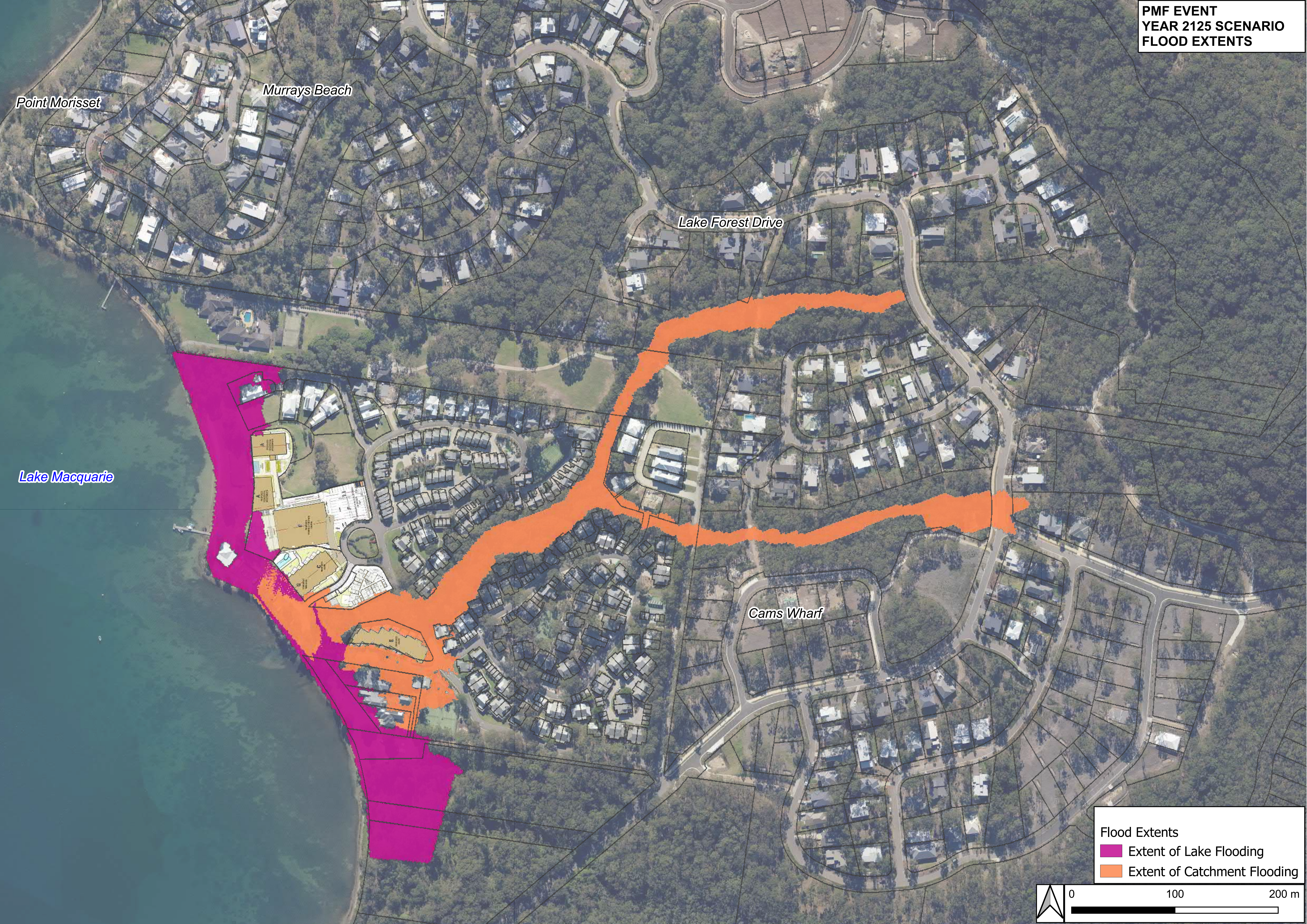
1% AEP EVENT
YEAR 2125 SCENARIO
PROVISIONAL HYDRAULIC HAZARD
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Provisional Hydraulic Hazard
H1 - Generall safe for people, vehicles and buildings.
H2 - Unsafe for small vehicles.
H3 - Unsafe for vehicles, children and the elderly.
H4 - Unsafe for people and vehicles.
H5 - Unsafe for vehicles and people.
All buildings vulnerable to structural damage.
Some less robust building types vulnerable to failure.
H6 - Unsafe for vehicles and people.
All building types considered vulnerable to failure.
0
100
200 m



PMF EVENT
YEAR 2125 SCENARIO
PROVISIONAL HYDRAULIC HAZARD
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Provisional Hydraulic Hazard
H1 - Generall safe for people, vehicles and buildings.
H2 - Unsafe for small vehicles.
H3 - Unsafe for vehicles, children and the elderly.
H4 - Unsafe for people and vehicles.
H5 - Unsafe for vehicles and people.
All buildings vulnerable to structural damage.
Some less robust building types vulnerable to failure.
H6 - Unsafe for vehicles and people.
All building types considered vulnerable to failure.
0
100
200 m

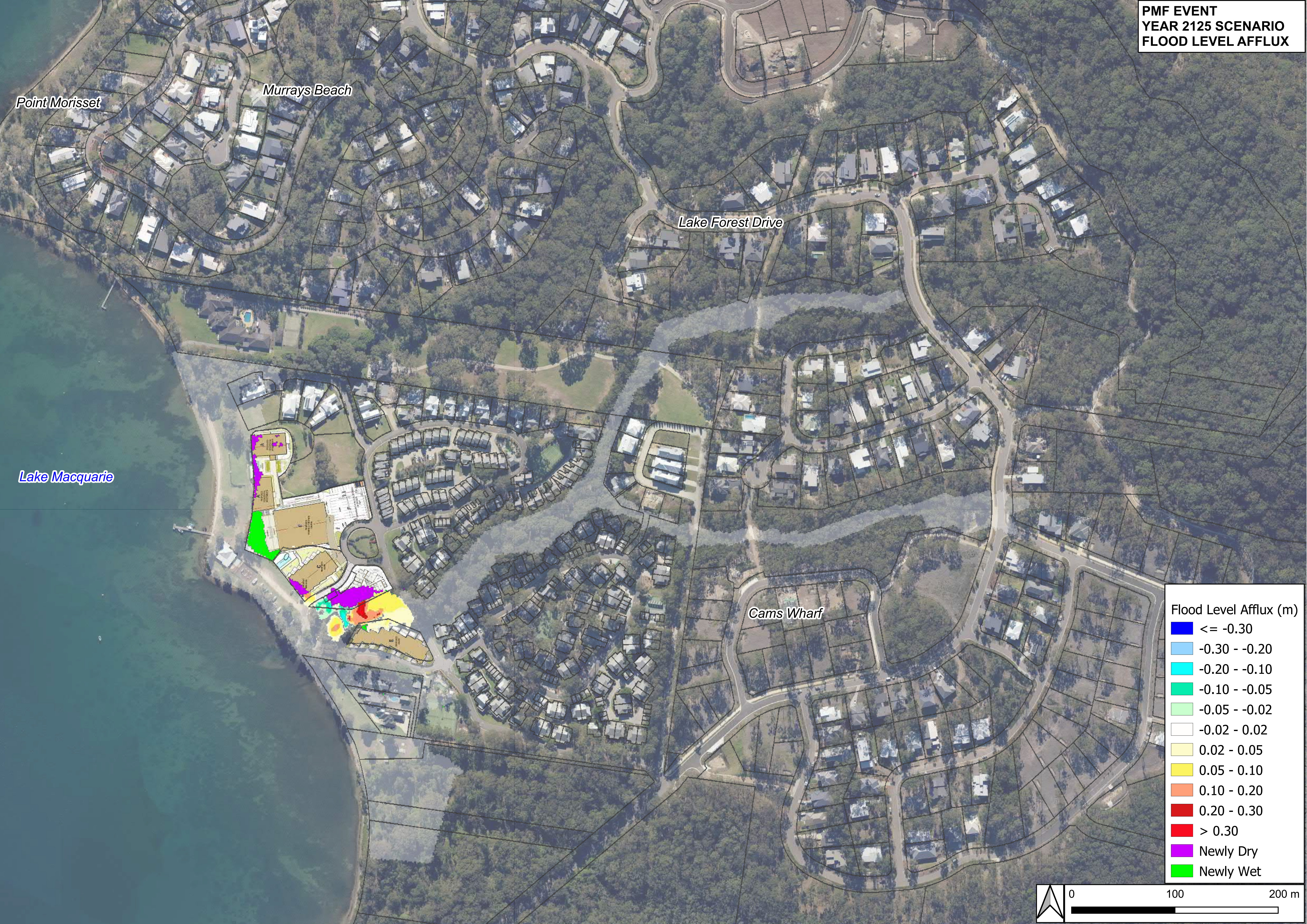

5% AEP EVENT
YEAR 2125 SCENARIO
FLOOD EXTENTS
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Flood Extents
Extent of Lake Flooding
Extent of Catchment Flooding
0
100
200 m

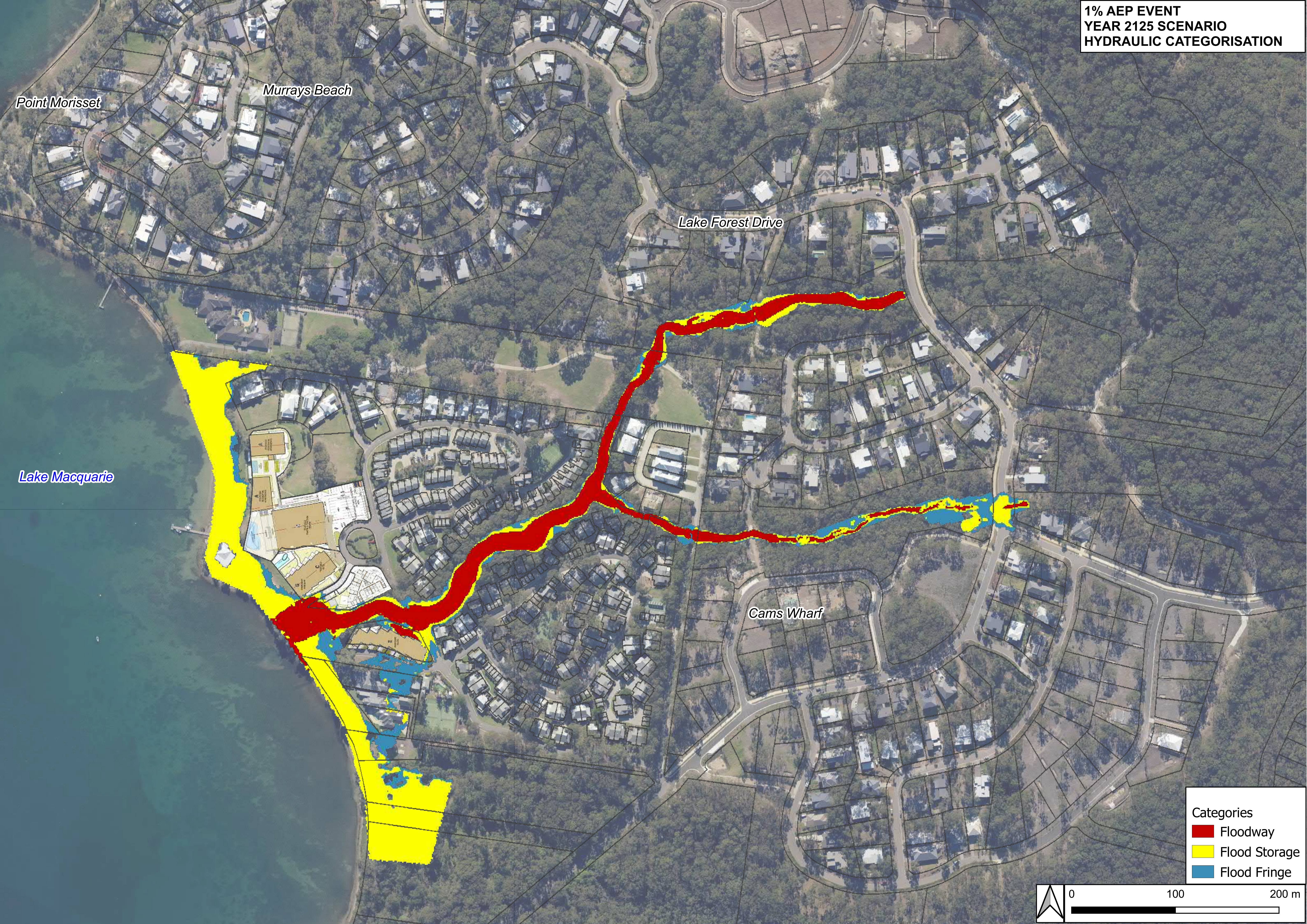

1% AEP EVENT
YEAR 2125 SCENARIO
FLOOD EXTENTS
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Flood Extents
Extent of Lake Flooding
Extent of Catchment Flooding
0
100
200 m


PMF EVENT
YEAR 2125 SCENARIO
FLOOD EXTENTS
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Flood Extents
Extent of Lake Flooding
Extent of Catchment Flooding
0
100
200 m

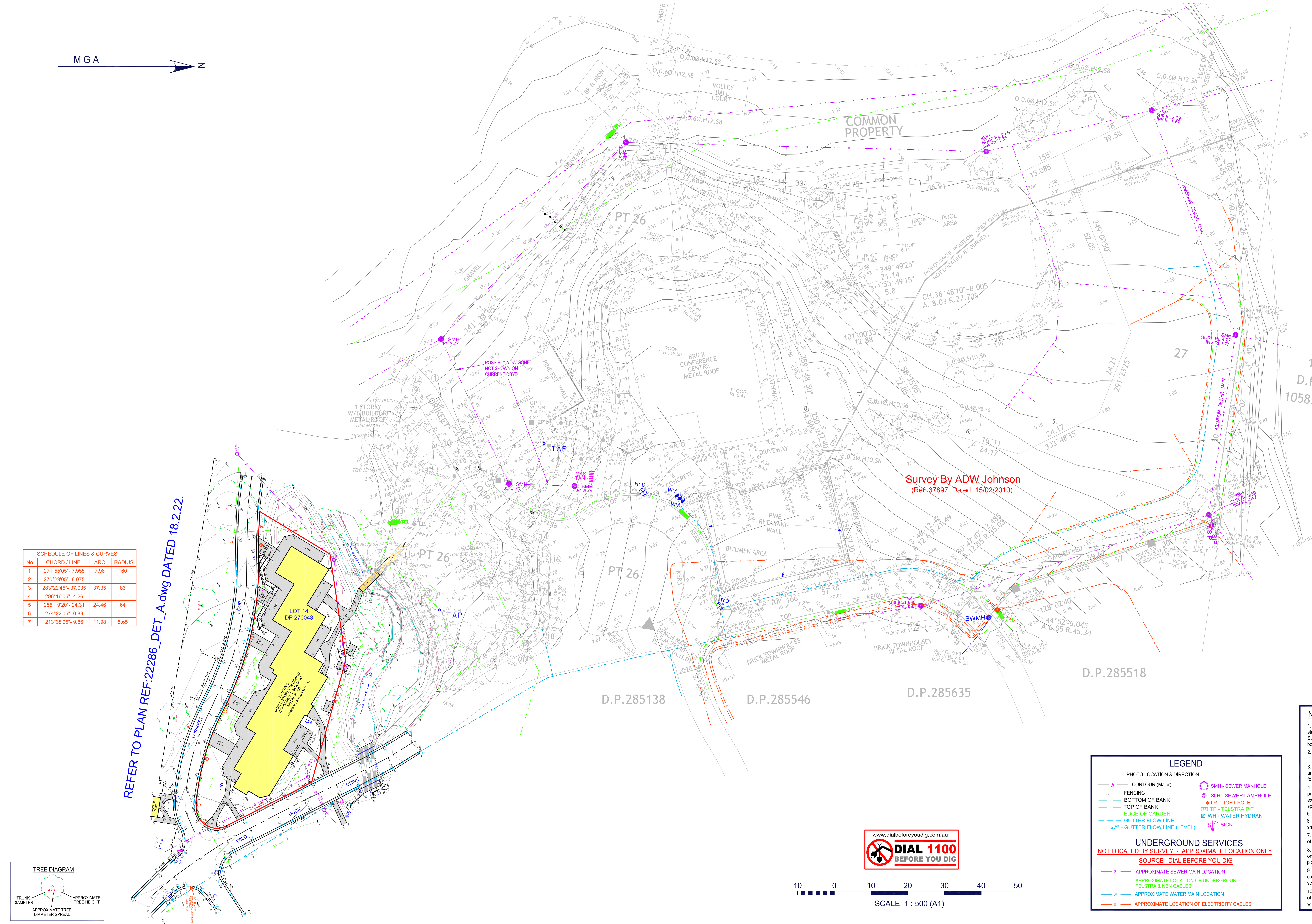
5% AEP EVENT
YEAR 2125 SCENARIO
FLOOD LEVEL AFFLUX
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Flood Level Afflux (m)
<= -0.30
-0.30 - -0.20
-0.20 - -0.10
-0.10 - -0.05
-0.05 - -0.02
-0.02 - 0.02
0.02 - 0.05
0.05 - 0.10
0.10 - 0.20
0.20 - 0.30
> 0.30
Newly Dry
Newly Wet
0
100
200 m


1% AEP EVENT
YEAR 2125 SCENARIO
FLOOD LEVEL AFFLUX
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Flood Level Afflux (m)
<= -0.30
-0.30 - -0.20
-0.20 - -0.10
-0.10 - -0.05
-0.05 - -0.02
-0.02 - 0.02
0.02 - 0.05
0.05 - 0.10
0.10 - 0.20
0.20 - 0.30
> 0.30
Newly Dry
Newly Wet
0
100
200 m


PMF EVENT
YEAR 2125 SCENARIO
FLOOD LEVEL AFFLUX
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Flood Level Afflux (m)
<= -0.30
-0.30 - -0.20
-0.20 - -0.10
-0.10 - -0.05
-0.05 - -0.02
-0.02 - 0.02
0.02 - 0.05
0.05 - 0.10
0.10 - 0.20
0.20 - 0.30
> 0.30
Newly Dry
Newly Wet
0
100
200 m


1% AEP EVENT
YEAR 2125 SCENARIO
HYDRAULIC CATEGORISATION
Point Morisset
Murrays Beach
Lake Forest Drive
Lake Macquarie
Cams Wharf
Categories
Floodway
Flood Storage
Flood Fringe
0
100
200 m

APPENDIX B – SURVEY



SCHEDULE OF LINES & CURVES			
No.	CHORD / LINE	ARC	RADIUS
1	271°55'05"- 7.955	7.96	160
2	270°29'05"- 8.075	-	-
3	283°22'45"- 37.035	37.35	83
4	296°16'05"- 4.26	-	-
5	285°19'20"- 24.31	24.46	64
6	274°22'05"- 0.83	-	-
7	213°38'05"- 9.86	11.98	5.65

TREE DIAGRAM

TRUNK DIAMETER — APPROXIMATE TREE HEIGHT — APPROXIMATE TREE DIAMETER SPREAD

CURVED & SHORT BOUNDARIES				
No.	Chord	Distance	Arc	Radius
1	51°46'10"	9.21	9.25	30
2	45°03'30"	12.25	12.4	22.9
3	25°39'10"	9.49	9.5	70
4	21°46'	1.0		
5	351°03'45"	8.17	8.57	8
6	29°42'35"	41.47	53.25	22
7	279°03'	0.525		
8	43°01'	7.465	8.8	4.5
9	50°53'	8.085	8.13	24
10	60°35'10"	23.03		
11	46°04'	15.04	15.21	30
12	27°33'	7.06	7.07	50.61
13	23°33'	1.435		
14	31°25'	5.48	5.5	20
15	67°55'	3.72	3.88	3.88
16	96°33'	1.29		
17	90°56'	13.68	13.7	70
18	116°38'	10.39	10.93	10
19	147°56'	2.645		
20	152°04'	2.31	2.31	16
21	149°54'	15.43	15.46	70
22	243°05'35"	45.305		
23	273°40'55"	41.475		
24	322°31'35"	6.305		

www.dialbeforeyoudig.com.au
DIAL 1100 BEFORE YOU DIG

10 0 10 20 30 40 50
SCALE 1 : 500 (A1)

LEGEND

- PHOTO LOCATION & DIRECTION
- 5 CONTOUR (Major)
- FENCING
- BOTTOM OF BANK
- TOP OF BANK
- EDGE OF GARDEN
- GUTTER FLOW LINE
- 4.51 - GUTTER FLOW LINE (LEVEL)
- SMH - SEWER MANHOLE
- SLH - SEWER LAMPHOLE
- LP - LIGHT POLE
- TP - TELSTRA PIT
- WH - WATER HYDRANT
- S SIGN

UNDERGROUND SERVICES

NOT LOCATED BY SURVEY - APPROXIMATE LOCATION ONLY

SOURCE : DIAL BEFORE YOU DIG

- S APPROXIMATE SEWER MAIN LOCATION
- T APPROXIMATE LOCATION OF UNDERGROUND TELSTRA & NBN CABLES
- W APPROXIMATE WATER MAIN LOCATION
- E APPROXIMATE LOCATION OF ELECTRICITY CABLES

NOTES :

1. The cadastre shown on this plan has been located to a standard of accuracy in accordance with Regulation 10 of the Surveying and Spatial Information Regulation 2017. The boundaries have not been marked by this survey.
2. Datum shown in the title block denotes the date of information sourced from SCIMS.
3. This plan displays information suitable for detailed planning and design at the scales stated only. The plan may not be used for any other purpose or at any scales other than those stated.
4. Spot levels and contours shown hereon are for design purposes only and may require confirmation prior to any excavation or construction. Contours have been derived from the spot levels shown and as such are indicative only.
5. Major trees shown only, not all trees located by survey.
6. Only visible surface features have been surveyed and are shown to scale accuracy only.
7. Services shown hereon have been located by field survey of visible features only, unless otherwise noted.
8. Any underground services shown on this plan are indicative only and do not represent the number, size or depth of cables, pipes or conduits, unless otherwise noted.
9. Prior to and during any demolition, excavation or construction the designer and/or contractor must obtain a current search from "Dial Before You Dig".
10. These notes are an integral part of this plan. Reproduction of this plan, or any part of it, without these notes included in full will render the information invalid and not suitable for use.

TITLE: PLAN OF DETAIL & LEVELS OVER LOTS 14, 26 & 27 IN DP 270043

LOCATION: RAFFERTY'S CAMS WHARF

CLIENT: IRIS - Att : Mr Warwick Bower

POSITIVE SURVEY SOLUTIONS

- LAND & PROPERTY SURVEYS
- PROJECT MANAGEMENT
- LAND DEVELOPMENT
- 3D LASER SCANNING
- ENGINEERING & INFRASTRUCTURE SURVEYS
- STRATA & COMMUNITY TITLE SURVEYS
- VOLUMETRIC SURVEYS & MODELLING
- DRONE SURVEYS & IMAGERY

49 BROADMEADOW ROAD, BROADMEADOW NSW 2292 T 02 4960 1111 W www.psurveys.com.au
PO BOX 1273, NEWCASTLE NSW 2300 E enquiry@psurveys.com.au

Revision	Amendment	Date
A	INITIAL ISSUE	24.2.2022
B		
C		
D		
E		

SCALE: A1 - 1:500, A3 - 1:1000 | ORIGINAL SIZE: A1

DO NOT SCALE

SURVEYOR: LT DRAWN: SD

BRETT WHITE
REGISTERED SURVEYOR

HORIZ DATUM: MGA SSM 79146 E 370 822.138 N 6 334 448.524 SOURCE SCIMS 16.2.22

VERT DATUM: AHD SSM 79146 RL RL 8.950 SOURCE SCIMS 16.2.22

CONTOUR INTERVAL: 0.25m

CAD REF: 22286_DET_COMBINED_A.dwg

JOB / REF NO. 22286

SHEET NO. 1 OF 1

DATE: 24.2.2022

REVISION: A

Plotted: 17/2/2022 8:32 AM

APPENDIX C – ARCHITECTURAL PLANS

Legend

SITE A - NEW RESIDENTIAL
25 Apartments
15 - 3 Bed & 10 - 2 Bed
47 Car Spaces
(40 residential owners + 7 visitor spaces)

SITE B - NEW TAVERN & FUNCTION CENTRE
Ground Floor Tavern
Level 1 Function Centre
Terraced outdoor areas
Community pools & facilities
39 Car Spaces (existing)

SITE C - NEW HOTEL
141 Rooms Over 8 Levels
Basement Car Parking (2 Levels) - 118 Spaces
Hotel Pool & Landscaped Areas
118 Car Spaces

SITE D - NEW RESIDENTIAL
21 Apartments
6 - 3 Bed, 14 - 2 Bed & 1 - 1 Bed
36 Car Spaces
(27 residential owners + 6 visitor spaces + 3 hotel staff parking)

SITE E - NEW RESIDENTIAL (Currently Conference & Café)
8 - 3 Bed Attached Dwellings
8 Garages
8 Visitor (6 in driveways of Villa Lots,
2 spaces opposite the Villa's along Lorikeet Loop)
25 Public Accessible Spaces

SITE F - CAR PARKING
39 Public Accessible Car Spaces

SITE G - TEMPORARY MARQUEE LOCATION
USED DURING CONSTRUCTION OF
NEW FUNCTION CENTRE

SITE H - MARINA (FUTURE POTENTIAL)
14 permanent berths
14 visitor berths

RAFFERTYS RESORT

A05 MASTERPLAN

SCALE 1:1000@A3

0 10mm 50mm 100mm ON ORIGINAL A3

REV	DATE	COMMENTS	DRN	CHKD	VRFD
A	10/02/2022	PRELIMINARY CONSULTANT ISSUE	FV	MR	
B	28/02/2022	CONSULTANT RE-ISSUE	FV	MR	
C	23/06/2022	ISSUE FOR CONSULTANTS	FV	MR	

iris

EJE ARCHITECTURE
ACN 002 912 843 | ABN 82 644 649 849
Nominated Architect - Bernard Collins
NSW Architects Registration No.4438
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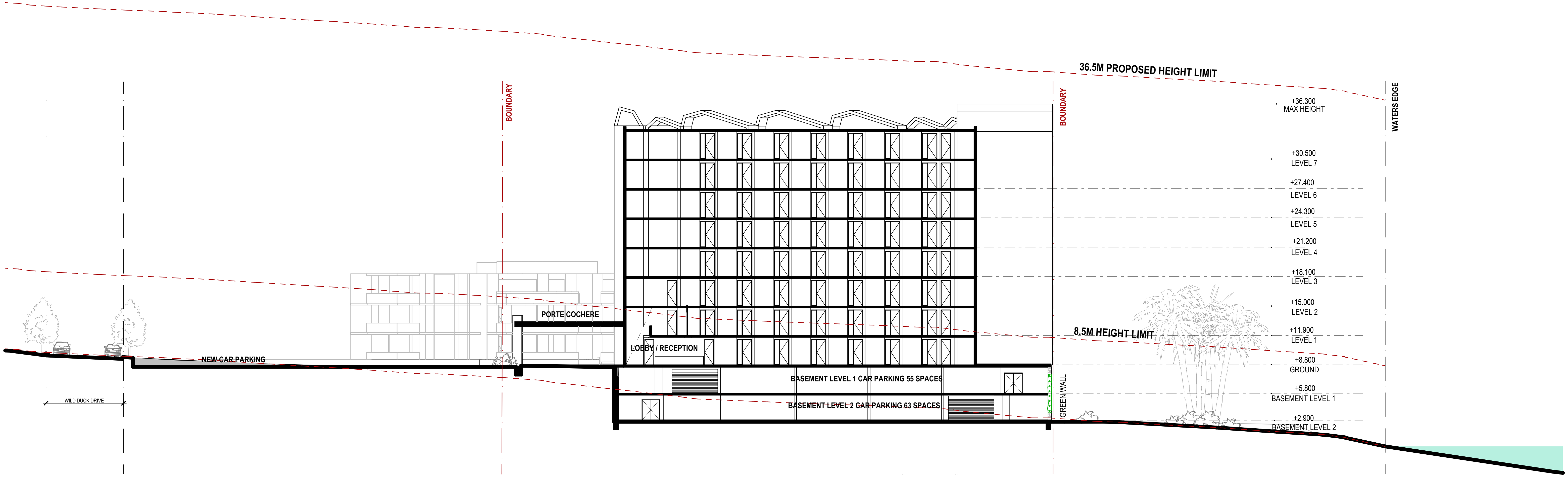
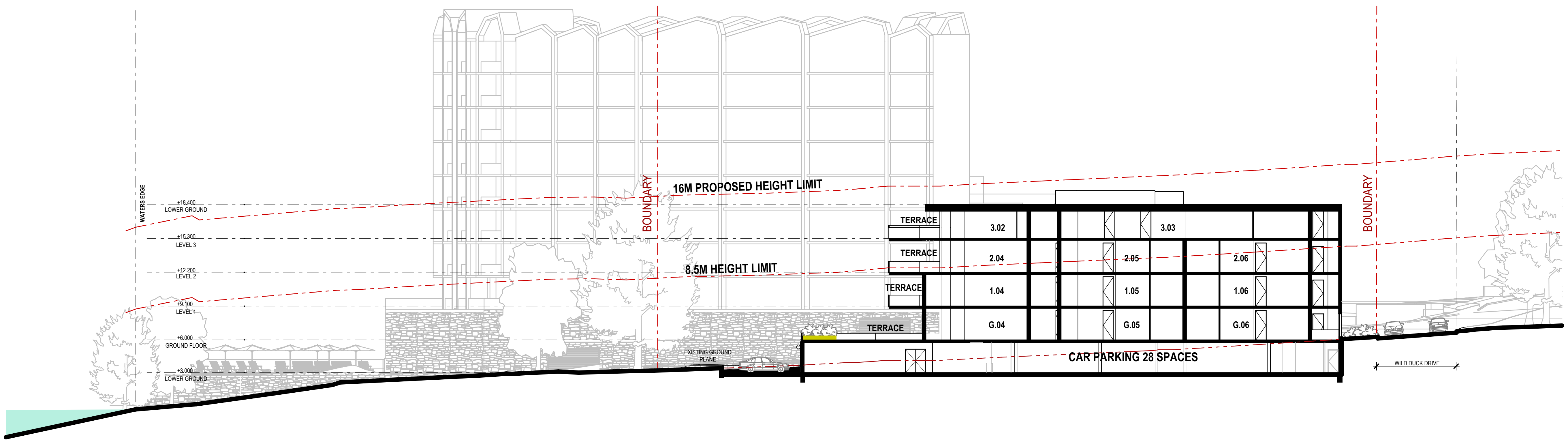
Quality Management · ISO 9001 Global-Mark.com.au® Environmental Management · ISO14001 Global-Mark.com.au® WHS Management · AS/NZS 4801 Global-Mark.com.au® Global-Mark.com.au®

COMPLETION OF THE QUALITY ASSURANCE CHECKS IS VERIFICATION THAT THE DOCUMENT CONFORMS WITH THE REQUIREMENTS OF THE QUALITY PROJECT PLAN. WHERE THE QUALITY ASSURANCE CHECK IS INCOMPLETE THIS DOCUMENT IS PRELIMINARY FOR INFORMATION PURPOSES ONLY, OR SUCH PURPOSES AS STATED IN THE REVISION COLUMN.

EJE architecture



SECTION C



SECTION D

RAFFERTYS RESORT

A27 SITE SECTION - BUILDING C & D

SCALE 1:400@A3

0 | 10mm | 50mm | 100mm ON ORIGINAL A3

REV	DATE	COMMENTS	DRN	CHKD	VRFD
A	9/08/2021	RE-ISSUE FOR INFORMATION	FV	MR	
B	23/06/2022	ISSUE FOR CONSULTANTS	FV	MR	

iris

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EJE architecture

APPENDIX D – BCD LETTER

Department of Planning and Environment

Your ref: REF-2075
Our ref: DOC23/255758-39

Ms Abigail Hawtin
Strategic Land-use Planner
Lake Macquarie City Council
Box 1906
Hunter Regional Mail Centre, NSW, 2310

By email: ahawtin@lakemac.nsw.gov.au

Dear Ms Hawtin

Planning Proposal for Raffertys Resort at 1 Wild Duck Drive and 2 Lorikeet Loop Cams Wharf

I refer to your request of the 29 March 2023, seeking comments on the planning proposal for the Raffertys Resort at Cams Wharf. The Local Environment Plan (LEP) amendment seeks to increase the height limit on part of Lot 31 DP270043 from 8.5 metres to 36.5 metres and on part of Lot 30 DP270043 from 8.5 metres to 16 metres. This planning proposal was referred to us for comment on whether the planning proposal is consistent with Ministerial Direction 2.2 (Coastal Management).

Biodiversity and Conservation Division's (BCD) recommendations are provided in **Attachment A** and detailed comments are provided in **Attachment B.** If you have any further questions about this matter, please contact Karen Thumm, Senior Conservation Planning Officer, on 4927 3153 or at huntercentralcoast@environment.nsw.gov.au

Yours sincerely

Joe Thompson
Director
Hunter Central Coast Branch
Biodiversity and Conservation Division
13/4/23

Enclosure: Attachments A and B

BCD’s recommendations

Raffertys Resort Planning Proposal – Advice on proposed development and rezoning of Raffertys Resort, Cams Wharf.

1. BCD recommends that the scale and height of proposed development is reconsidered to ensure that it conforms with the provisions of the Resilience and Hazards (RH) SEPP with regards to visual amenity and scenic qualities.

2. BCD recommends that the scale and height of proposed development is reconsidered to ensure that it conforms with the mandatory provisions of the draft Coastal Design Guidelines with respect to Outcome B.2 "Respond to and protect elements which make the place special”.

3. The flood model should be revised to ensure that it reflects current and future flood risk.

4. Flood modelling should reflect an appropriate design horizon (post 2100) for determining future risk to the development.

5. The proponent should demonstrate safe evacuation routes from each of the sites where an increase in residential or visitor occupation is requested. For evacuation purposes floods up to the Probable Maximum Flood (PMF) should be considered. Vertical evacuation (Shelter In Place, SIP) is not considered to be evacuation from an area of risk.

6. The proponent should demonstrate how the proposal is consistent with the special flood consideration or Section 4.1.4 of the Local Planning directions with respect to land between the flood planning area and the PMF.

7. Further detail would be required to consider any proposal for shelter in place.

Attachment B

BCD’s detailed comments

Raffertys Resort Planning Proposal – Advice on proposed development and rezoning of Raffertys Resort, Cams Wharf.

Coastal Management

1. The proposed development is not consistent with the provisions of State Environmental Planning Policy (Resilience and Hazards) 2021 with regard to visual amenity and scenic qualities.

The proposed development site is located within the mapped Coastal Use Area defined by the State Environmental Planning Policy (Resilience and Hazards) 2021 (RH SEPP). The RH SEPP states that development should not adversely impact the visual amenity and scenic qualities of the coast, including coastal headlands. The height and scale of the proposed development is not considered consistent with these provisions.

Recommendation 1

BCD recommends that the scale and height of proposed development is reconsidered to ensure that it conforms with the provisions of the RH SEPP with regards to visual amenity and scenic qualities.

Response: Refer to Barr Planning for Response

2. The scale and height of the proposed development is not consistent with the mandatory requirements of the draft Coastal Design Guidelines

The draft Coastal Design Guidelines state that development should not adversely impact foreshores and the natural beauty of coastal areas. Outcome B.2 "Respond to and protect elements which make the place special" states that it is mandatory to:

a) Integrate development within the natural topography of the site and ensure building type, scale and height responds sympathetically to coastal landforms; and

b) Avoid development that dominates coastal elements, including foreshores, public spaces and other areas of natural beauty.

It is considered that the proposed development is of a scale and height that is not consistent with this mandatory requirement.

Recommendation 2

BCD recommends that the scale and height of proposed development is reconsidered to ensure that it conforms with the mandatory provisions of the draft Coastal Design Guidelines with respect to Outcome B.2 "Respond to and protect elements which make the place special”.

Response: Refer to Barr Planning for Response

3. The flooding report requires revisions and clarification for flood risk to be assessed

The flood report by Xavier Knight, Flood Management Report Project 210828 dated 30/6/22 Issue C, has been reviewed. Additional information and clarification are required before this report can be used to determine the flood risk at the location of the proposed LEP change.

Matters which require clarification/review are listed below:

(A) A "Mannings n" roughness of 0.08 has been used for the whole of the creekline. This may be suitable for vegetated waterways however the constructed waterway through the existing site is noted as rock lined in other documents provided with the proposal. "Mannings n" should be verified by site visit to ensure that appropriate values are used for each section of waterway.

Response: Manning's Roughness for the rock lined channel is now included in Revision E of our report and figure 5 has been included (Rev E) to show its extents.

(B) The Digital Elevation Model (DEM) which underlies the model has been obtained from LiDAR. This is standard practice however some verification against state survey marks or work as executed drawings should take place.

Response: Section 3.3 has been updated (Rev E) to include a cross check between the DEM and the survey and it was found that the DEM are within the 0.3m stated vertical accuracy. The survey was used to define the levels of Yalliwali creek between Lot 30 and Lot 14 as it provides a more accurate representation of the creek bed levels.

(C) No stormwater drainage has been included in the model. As a minimum the waterway crossing at Wild Duck Road should be included together with appropriate blockage assessment.

Response: Stormwater drainage has been assumed to be 100% blocked. Section 3.3 has been updated (Rev E) to include a reference to AR&R 2019 specifying 100% blockage for a "Severe Blockage" scenario.

(D) The flood mapping provided gives a flood extent however it does not show the flood planning area
Response: The flood afflux maps provided in (Rev E) Appendix A show that there have been no changes in flood levels upstream of Lots 30 and 31, therefore, the Flood Planning Area currently adopted by council has not been affected as long as the future Lot 30 and 31 development footprint remains consistent with the footprint shown in the Planning Proposal.

(E) The maps for the 1% flood and the Probable Maximum Flood (PMF) show the hazard for the 1% flood to be higher than the PMF. This is considered unlikely and more explanation is required.
Response: Flood hazard maps have been updated (Rev E) to show H1 to H6 hazard categories.

(F) The site is impacted by flooding from Yalliwai Creek and by flooding from Lake Macquarie. The extent of both floods should be shown on plans.
Response: The extents of Lake and Creek flood extents have been delineated in Appendix A (Rev E).

(G) Flood hazard has used low and high hazard rather than the H1 to H6 hazard categories which are now considered best practice.

Response: Flood hazard maps have been updated (Rev E) to show H1 to H6 hazard categories.

(H) The report states that it is not a site-specific report. No analysis of the impact of proposed development of the bulk and scale proposed on flood levels and velocities has been made. The flood report should include both pre and post development scenarios to determine if off site impacts occur.

Response: Flood afflux maps have been prepared showing no changes to the flood regime upstream of lots 30 and 31.

Recommendation 3

The flood model should be revised to ensure that it reflects current and future flood risk.

4. The flood model has not considered the appropriate climate change scenario

The Lake Macquarie Development Control Plan (DCP) 2014 Part 6 Section 2.10 requires that mixed use medium and high density development should use an assumed asset life of 100 years for climate change assessment. The flood report has used a mid-range 2050 scenario and requires updating to meet the DCP requirements and NSW guidance. A flood event equivalent to 0.2% event can be used in lieu of an increase in rainfall.

The NSW Government does not stipulate what sea level rise figure should be used in the modelling, only that the best available and most up-to-date science should be considered in determining an appropriate scenario and risk profile. The Intergovernmental Panel on Climate Change (IPCC) has recently released the AR6 Synthesis Report - Climate Change 2023. The IPCC have now moved to a different modelled suite in AR6 known as Shared Socio-economic Pathways (or SSPs) with projections out to 2150. These figures should be considered in the modelling.

Recommendation 4

Flood modelling should reflect an appropriate design horizon (post 2100) for determining future risk to the development.

Response:
This has been addressed in Section 2 of the report (Rev E).

The requirements of Lake Macquarie DCP for a design life of 100 years has been considered and rainfall events equivalent to 0.2% event have been used in lieu of an increase in rainfall.

The latest flood model (Rev E) has been modeled to show a future scenario in the year 2125. This year has been chosen as it achieves both the DCPs requirement for a 100-year design life and BCD's recommendation for considering a design horizon post 2100.

As mentioned by BCD, *"The NSW Government does not stipulate what sea level rise figure should be used in the modelling"*. The flood model has been updated (Rev E) to reflect the latest available data in AR6 Synthesis Report - Climate Change 2023. This includes updated Sea Level Rise projections based on new "Shared Socio-economic Pathways (or SSPs)"

A Sea Level Rise of 0.98m under SSP-8.5 has been chosen for the following reasons:

- **SSP5-8.5 represents a very high Green House Gas emission scenario and is therefore a conservative design.**
- **The predicted Sea Level Rise under SSP5-8.5 in the year 2150 is (0.98–1.88 m) we have chosen 0.98m as we are designing for the year 2125 and not 2150.**

5. The proposed change to the LEP is not consistent with Local Planning Directions Focus Area 4 Resilience and Hazards

The planning proposal has requested significant increase in the allowable height of buildings on the site to enable more residential development and more visitor accommodation. Lot 14 is within the flood planning area and entirely surrounded by flood water in a 1% event. Increase in building height in this location is not supported because it is a significant variance to clause 3.1 3d by promoting a significant increase in development density on that land. The current proposal is to increase height limit from 8.5m to 16m. The degree to which lot 30 is within the flood planning area cannot be determined until the flood study is updated. At present at least a portion of the lot and the area facing the creek line is impacted. The architectural drawings do not give sufficient information to determine if egress from a building sited on lot 30 is possible during a flood event.

The flood report indicates a critical storm duration of 0.25hours in a PMF event and no flood warning system is in place.

Building height on lot 31 is proposed to be increased from 8.5m to 36.5m which is a substantial increase. The extent to which lot 31 may be impacted by flood will be reviewed after update of the flood information. The proposed development on lot 31 has also been suggested as a possible evacuation site for the other lots. Suitability of this site would need to be demonstrated together with whether this is supported by proposed staging.

Shelter in place above the flood level has been suggested as a method of protecting occupants in the developments. Shelter in place is not an option currently supported by the SES. BCD agrees that shelter in place may be safer than moving through flood water in flash flood circumstances however the ability to shelter in place should not be used to justify increased development of a site.

Recommendation 5

The proponent should demonstrate safe evacuation routes from each of the sites where an increase in residential or visitor occupation is requested. For evacuation purposes floods up to the PMF should be considered. Vertical evacuation (SIP) is not considered to be evacuation from an area of risk.

Response:

- **Lot 14 is not part of the Planning Proposal and is therefore not relevant.**
- **Flood maps have been updated for Lots 30 and 31 showing the latest flood levels (Rev E).**
- **Section 5.1 has been updated to include a flood warning system in cases of flooding (Rev E). This included items such as flood depth indicators and Sirens installed outside lots 30 and 31 to alert the residents of rising flood water.**
  More detailed assessment of warning systems will be installed for lots 30 and 31 and will be shown on the site-specific flood reports that will accompany future Development Applications.
- **BCD has stated that Vertical Evacuation (Shelter in Place) is not considered to be an evacuation. The PMF levels around lot 30 and 31 are below the lowest habitable floors levels for these two developments therefore, there is no need to vertically evacuate but residents can remain in all habitable areas in the building as a last resort to the evacuation measures outlined in the report. It is important to note that only the southern and western faces of buildings 30 and 31 respectively are affected by the PMF but the whole building is not landlocked and occupants of these building can exit without being at risk of the PMF extents and hazards. Section 5.1 has been expanded to include the above.**

6. Special flood consideration LEP clause has not been considered

The proposal has indicated that the special flood consideration clause should not apply because Council has not adopted this clause. Following the NSW flood enquiry, it has been recommended that the special flood consideration clause become mandatory, or it be considered as part of the resilience and hazards SEPP.

Recommendation 6

The proponent should demonstrate how the proposal is consistent with the special flood consideration or Section 4.1.4 of the Local Planning directions with respect to land between the flood planning area and the PMF.

Rev E flood report has been undertaken with reference to the guidance material document in the NSW Flood Prone Land Policy and the Floodplain Development Manual 2005. Refer to Section 7 in Rev E report for reference material adopted to prepare report.

7. Further flood information would be required if shelter in place is to be considered

Shelter in place may leave people within a hazardous area and may also put emergency services personnel and residents in danger if it becomes necessary to evacuate once buildings are surrounded by hazardous flood waters. Resupply and medical issues can be more difficult to manage when people are encouraged to stay in a flooded area which is cut off. For shelter in place to be considered it is necessary to demonstrate the duration of the likely shelter, how the building will be constructed to ensure it is structurally sound and how essential services such as power and sanitation will be provided during a flood.

The ability to shelter in place can reduce risk in short flash flood situations and reduce losses if habitable spaces are located above the PMF level. Shelter in place may be an acceptable method of managing flood risk for existing land uses however is not supported as a method of increasing the population at risk.

Recommendation 7

Further detail would be required to consider any proposal for shelter in place.

Response:

In case of a major flood event is for the residents to evacuate to the Tavern as the Tavern is outside of the PMF extent, does not border Yalliwali creek and is therefore not subject to hazardous flow conditions.
In case residents are not able to access the Tavern (for example it might be closed), we have recommended the residents to shelter in place as a last resort as we believe it is a safe alternative for the reasons described in section 5 above.
The habitable floor in Lots 30 and 31 sits above the PMF and should therefore be safe if they decide to shelter in place. Lots 30 and 31 are also not surrounded by water as Wild Duck Drive as not affected by the PMF flood other than the portion over the culvert as shown in figure 11, therefore, Lots 30 and 31 are not completely isolated by floodwaters and residents can safely exit if need be.
The fact that the lots are above the PMF and that a warning system is being implemented means that the residents should be safe until flood waters reside and further assistance can be provided by the emergency Authorities.