

29 September 2022

Our ref: RL-01-1741-02

Jane Gibbs  
Director, Regionally Significant Development  
Department of Planning and Environment  
6 Stewart Avenue  
Newcastle NSW 2302

Via email: [jane.gibbs@planning.nsw.gov.au](mailto:jane.gibbs@planning.nsw.gov.au)

Dear Jane,

**Multi Dwelling Housing Development Application, Yamba**

**Independent Peer Review – Flood Emergency Management Plan**

**1. Introduction**

In response to your request dated 8 August 2022 and our proposal dated 16 August 2022, Rhelm Pty Ltd (Rhelm) has prepared this independent review of the *Flood Emergency Management Plan* prepared by Bewsher Consulting Pty Ltd dated 30 June 2022 for the proposed multi-dwelling housing (manufactured home estate) and related facilities that is the subject of the development application (DA2021/0557) lodged 2 August 2021. The application is within the Clarence Valley Local Government Area and is being considered by the Northern Regional Planning Panel (PPSNTH129).

The site is located at 8 Park Avenue, Yamba NSW and the legal description of the land is Lot 101 on DP1228576.

The area of this site is approximately 6.7 hectares and is zoned (in its entirety) R3 Medium Density Residential under the Clarence Valley Local Environmental Plan 2011 (LEP). The site is also mapped as Coastal Environmental Area under the State Environmental Planning Policy (Resilience and Hazards) 2021.

---

This advice addresses the following matters:

- Overview of flood behaviour at the site and surrounds (**Section 2**)
- Summary of relevant planning controls and reference documents for flood emergency response (**Section 3**)
- Overview of proposed development (**Section 4**)
- Overview of regional demographic and health information and implications for flood emergency response (**Section 5**)
- Overview of potential post flood recovery duration and issues (**Section 6**)
- Review of the FEMP prepared to accompany the application (Bewsher Consulting, 2022) (**Section 7**)
- Fill Impacts and Stormwater Management (**Section 8**)
- Recommendations to Panel (**Section 9**).

## 2. Overview of Flood Behaviour at the Site and Surrounds

The land is located within the Clarence River floodplain (BMT WBM 2013). The ground level at the site is approximately 2.8 mAHD (with some areas below this level).

A review of information for the site on the Clarence Valley Council (Council) *Intramaps* system (sourced from BMT WBM, 2013) and supplemented by sourcing information directly from BMT WBM (2013) indicates that peak flood levels across the site itself are:

- 1 in 20 AEP                      2 mAHD (at Iluka)
- 1 in 50 AEP                      2.19 mAHD
- 1 in 100 AEP                      2.51 mAHD
- Extreme Flood                      3.56 mAHD

Note that these levels do not take into account any provision for climate change (sea level rise or rainfall intensity increase). The *Lower Clarence Flood Model Update* (BMT WBM, 2013) undertook a climate change assessment for the catchment. Under the scenario where climate change was assumed to cause a 10% increase in rainfall and 0.9 m increase in sea level, the increase for the 1 in 100 AEP (or 1% AEP) event at Iluka was 0.7 m. In the mapping of this event, it is shown that flood levels are expected to increase by between 0.6 to 0.9 m at the site. This means that the 1 in 100 AEP level is more of the order of 3.2 mAHD for the life of the development (assuming say up to a 100 year design life, to 2120). Note that a 20% increase in rainfall as per the guidance from Ball et al (2019) and the data provided on the ARR2019 data hub is a more consistent and accepted projection and this may result in a slightly higher design flood level for the 1%AEP with climate change allowances.

A conservative evaluation of the extreme event design flood level under a projected climate change scenario would see an additional 0.9 m of sea level rise<sup>1</sup> on the current extreme level estimate of 3.56 mAHD and therefore be of the order of 4.5 mAHD (assuming a 100 year design life, to 2120).

Evacuation of the site is via roads that are affected by floodwaters that are inundated in more frequent events, such as the 1 in 20 AEP flood.

Shores Road has a low point of approximately 1.3 mAHD. Under some climate change projections for sea level rise this road will be inundated even under some tidal conditions (mean high water springs is likely to increase from 0.6 mAHD for the Clarence River at Yamba gauge (OEH, 2012) to 1.3 mAHD in 2095 and 1.5 mAHD at 2110, Fox-Kemper et al (2021), based on medium confidence projections for Shared Socio-Economic Pathway 5 (SSP5-8.5)). It is unclear how this issue will be managed for the local area.

The *Yamba Flood Risk Management Study* (WMA, 2008) cites that the key issue with Yamba is the lack of emergency access to high ground during a flood, thus raising difficulties during evacuation. The study also states that any new development should have an appropriate evacuation plan to high ground.

### 3. Relevant Planning Controls and Reference Documents for Flood Emergency Response

A summary of the relevant planning controls and reference documents is provided below.

#### 3.1 Clarence Valley LEP 2011

Clause 5.21 of the Clarence Valley LEP 2011 sets out the flood planning provisions. Under this clause, consent for developments on land within the flood planning area must not be granted, unless the development:

- a) Is compatible with the flood function and behaviour on the land
- b) Will not adversely affect flood behaviour of other developments and properties
- c) Will not adversely affect the safe occupation and efficient evacuation of people or exceed the capacity of existing evacuation routes for the surrounding area**
- d) Incorporates appropriate measures to manage risk to life in the event of a flood**

---

<sup>1</sup> Garner, G. G., T. Hermans, R. E. Kopp, A. B. A. Slangen, T. L. Edwards, A. Levermann, S. Nowikci, M. D. Palmer, C. Smith, B. Fox-Kemper, H. T. Hewitt, C. Xiao, G. Aðalgeirsdóttir, S. S. Drijfhout, T. L. Edwards, N. R. Golledge, M. Hemer, R. E. Kopp, G. Krinner, A. Mix, D. Notz, S. Nowicki, I. S. Nurhati, L. Ruiz, J-B. Sallée, Y. Yu, L. Hua, T. Palmer, B. Pearson, 2021. IPCC AR6 Sea-Level Rise Projections. Version 20210809. PO.DAAC, CA, USA. Dataset accessed 28 August 2022, [https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool?psmsl\\_id=310](https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool?psmsl_id=310).

- e) Will not adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses,

and in deciding whether to grant development consent, the consent authority must consider:

- a) the impact of the development on projected changes to flood behaviour resulting from climate change
- b) the intended design and scale of buildings included in the development
- c) whether the development incorporates measures to minimise the risk to life and ensure the safe evacuation of people in the event of a flood
- d) the potential to modify, relocate or remove buildings in the development if the surrounding area is impacted by flooding or coastal erosion.

Whilst relevant only to specific types of development (not specifically multi-dwelling housing/manufactured home estate, but does apply to caravan parks), it is noted that Clause 7.4 states the additional local provisions relating to floodplain risk management under the LEP. The objective of this clause is to enable evacuation of land subject to flooding in events exceeding the flood planning level where the land has particular evacuation or emergency response issues, and to protect the operational capacity of emergency response facilities and critical infrastructure during extreme flood events. This clause states that development consent must not be granted to relevant developments where a flood event exceeding the flood planning level will affect safe occupation and evacuation.

### 3.2 Clarence Valley Council Residential Zones DCP 2011

Part D of the Clarence Valley Council Residential Zones DCP 2011 provides floodplain management related development controls for the residential zones within the LGA. Clause D3.1 of the DCP specifies the performance criteria whereby all development requiring Council consent must comply. These, as relevant to the proposed development are as follows:

- D3.1(a) The proposed development should not result in any increased risk to human life.
- D3.1(c) The proposal should only be permitted where effective warning time and reliable access is available for evacuation from an area potentially affected by floods to an area free of risk from flooding. Evacuation should be consistent with any relevant flood evacuation strategy.
- D3.1(e) Motor vehicles are able to be relocated, undamaged, to an area with substantially less risk from flooding, within effective warning time.
- D3.1(f) Procedures would be in place, if necessary, (such as warning systems, signage or evacuation drills) so that people are aware of the need to evacuate and relocate motor vehicles during a flood and are capable of identifying an appropriate evacuation route.

Schedule D4 of the DCP specifies the prescriptive controls for development within the Lower Clarence River Floodplain and Yamba Floodplain, for which the proposed development is within (refer **Table 1**).

*Table 1 Prescriptive controls under Schedule D4 of the DCP (CVC, 2011)*

	Floodplain Management Area									
	General Floodplain					Floodway				
	Critical Uses & Facilities	Sensitive Uses & Facilities	Urban Residential & Associated Uses	R5 Zone & Associated Uses	Concessional Development	Critical Uses & Facilities	Sensitive Uses & Facilities	Urban Residential & Associated Uses	Rural Residential & Associated Uses	Concessional Development
Planning Consideration										
Floor & Pad Levels		1,5	1,2		1,2,4					1,3
Building Components		1	1		1					1
Structural Soundness		1	2		2					1
Flood Effects		2	2		2					2
Evacuation		1,2 or 3,5	1,3 or 3,5		1,3 or 2,3					1,3 or 2,3 or 3,4,6
Management & Design		1,2,3,4	1,2		1,2					1,2

COLOUR LEGEND:  Controls specifically applicable to this DCP  Unsuitable Land Use

The *Grafton and Lower Clarence Floodplain Risk Management Plan* (Bewsher, 2007) defines the two floodplain management areas as:

- General floodplain – areas of the floodplain, up to the PMF, other than floodways,
- Floodways – areas where significant discharge of water occurs based on water way areas and other areas of the floodplain where the velocity depth product exceeds 1.0.

As such, the site falls within the general floodplain management area. Under Schedule D2 of the DCP, facilities such as community facilities, residential care facilities and seniors housing are categorised as ‘sensitive uses and facilities.’ Residential dwellings including multi dwelling housing are categorised as ‘urban residential and associated uses.’ Thus, for the majority of the site, the prescriptive controls relating to ‘urban residential and associated uses’ within the general floodplain apply, and to the proposed community facilities, the prescriptive controls relating to ‘sensitive uses and facilities’ within the general floodplain apply as specified below.

For the proposed community facilities:

- Unless otherwise specified all floor levels are to be no lower than the 5-year flood level plus freeboard unless justified by a site-specific assessment
- Habitable floor levels are to be no lower than the 100 years flood level plus freeboard
- All structures are to have flood compatible building components below the design level of the primary habitable floor level

- Applicants must demonstrate that the structure can withstand forces of floodwater, debris, and buoyance up to and including the 100-year flood plus freeboard, or a PMF if it is required to satisfy evacuation criteria
- The flood impact of the development must not increase flood effects elsewhere, having regard to loss of flood storage, changes in flood levels and velocity, and the cumulative impact of multiple potential developments in the floodplain.
- With regards to evacuation:
  - Reliable access for pedestrian or vehicles is required during a 100-year flood to a publicly accessible location above the PMF and reliable access for pedestrians and vehicles is required from the building commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF level, or a minimum of 20% of the gross floor area of the dwelling to be above the PMF level. Or,
  - The development is to be consistent with any relevant flood evacuation strategy, flood plan or similar plan adopted by Council, and safe and orderly evacuation of the site in any size flood is to be demonstrated in a regional evacuation capability assessment prepared to the satisfaction of Council and the SES. Where such an assessment has not been prepared, development is only permitted where, in the opinion of Council, safe and orderly evacuation can occur.
- Engineer's report to certify that potential development as a consequence of subdivision can be undertaken in accordance with the DCP
- Site Emergency Response Flood Plan is required where floor levels are below the design floor level
- Applicants are to demonstrate that area is available to store goods above the 100-year flood level plus freeboard
- No storage of materials below the design floor level which may cause pollution or be potentially hazardous during any flood.

Note that any proposed future dwellings would otherwise have more intensive controls on them than those under the provisions of the relevant Local Government Regulation (2021):

- Unless otherwise specified all floor levels are to be no lower than the 5-year flood level plus freeboard unless justified by a site-specific assessment
- Primary habitable floor levels are to be no lower than the 100-year flood level plus freeboard
- All structures are to have flood compatible building components below the design level of the primary habitable floor level
- Applicants must demonstrate that the structure can withstand forces of floodwater, debris, and buoyance up to and including the 100-year flood plus freeboard, or a PMF if it is required to satisfy evacuation criteria whereby an engineer's report may be required

- The flood impact of the development must not increase flood effects elsewhere, having regard to loss of flood storage, changes in flood levels and velocity, and the cumulative impact of multiple potential developments in the floodplain.
- With regards to evacuation:
  - Reliable access for pedestrian or vehicles is required during a 100-year flood to a publicly accessible location above the PMF and the development is to be consistent with any relevant flood evacuation strategy, flood plan or similar plan adopted by Council.
  - Or,
  - The development is to be consistent with any relevant flood evacuation strategy, flood plan or similar plan adopted by Council, and safe and orderly evacuation of the site in any size flood is to be demonstrated in a regional evacuation capability assessment prepared to the satisfaction of Council and the SES. Where such an assessment has not been prepared, development is only permitted where, in the opinion of Council, safe and orderly evacuation can occur.
- Engineer's report to certify that potential development as a consequence of subdivision can be undertaken in accordance with the DCP
- Site Emergency Response Flood Plan is required where floor levels are below the design floor level

Under Schedule D4, freeboard is defined as an additional height of 500mm.

### 3.3 Local Government Act, 1993 and Local Government (Manufactured Home Estates, Caravan Parks, Camping Grounds and Moveable Dwellings) Regulation 2021

Section 68 of the LG Act identifies that the proposed multi-dwelling housing will require approval in the future by Council and Section 75 of the LG Regulation listed above are the relevant sections for dwellings on flood liable land. Whilst the development does not involve actual dwellings, approval will be required for dwellings in the future.

#### *75 Installation on flood liable land*

*(1) In deciding whether to approve the installation of a relocatable home, rigid annexe or associated structure on flood liable land in a caravan park or camping ground, the council must consider the principles set out in the Floodplain Development Manual.*

*(2) It is a condition of an approval to install a relocatable home or associated structure on flood liable land that the relocatable home and associated structure is designed, constructed and installed in accordance with Division 4.*

*(3) It is a condition of an approval to install a rigid annexe on flood liable land that the rigid annexe is designed, constructed and installed in accordance with Division 5.*

### 3.4 Floodplain Development Manual (2005)

The Floodplain Development Manual (2005) supports the NSW Governments Flood Prone Land Policy in providing for the sustainable development strategies to manage the use of floodplains. The Manual provides councils with a framework for which they can implement the policy.

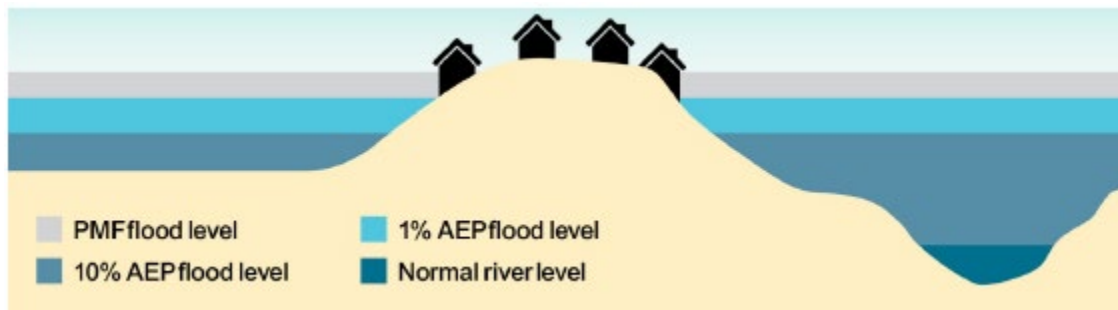
Appendix J of the Manual details Floodplain Risk Management Options. Development controls are the appropriate means of implementing the detailed aspects of Council's floodplain risk management plan. In the assessment of suitability of a site for development, access to the site during a flood event needs to be addressed. A requirement might be that access for vehicles is available until floodwaters reach a particular level, and that pedestrian access is available until the flood waters reach some other particular level. Section J2.5 states that in areas where floodwaters rise and fall within the window of a few hours, isolation may be acceptable. However, it is more frequently the case that isolation during a flood is not acceptable, if there is not a route available to allow egress from the floodplain.

### 3.5 Support for Emergency Management Planning (2022)

The document entitled *Support for Emergency Management Planning* (DPE, 2022) provides advice on how flood emergency management can be considered as part of the flood risk emergency management framework as described in the Draft *NSW Flood Risk Management Manual* (DPE EES, 2022). This document, when adopted, is expected to supersede the *Floodplain Development Manual*.

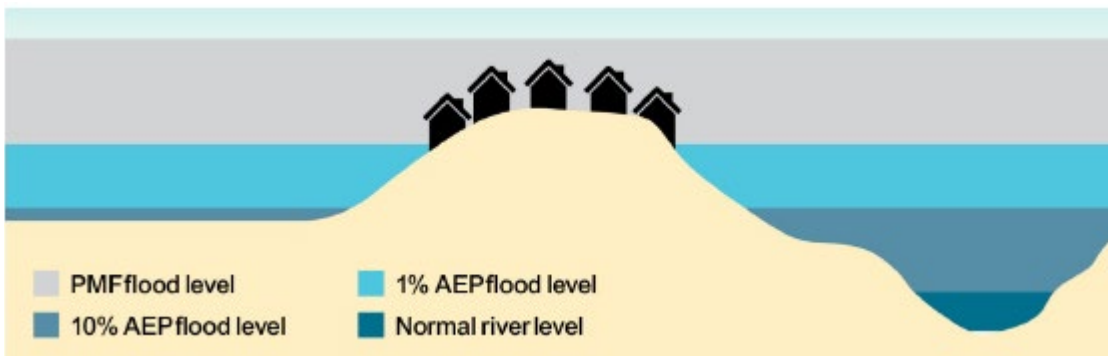
The support document defines flood emergency response community classifications. Under section 2.9.4 of the Clarence Valley Local Flood Plan (NSWSES, 2017), Yamba is broadly classified as a 'high flood island.' Despite this, flood mapping within the Local Flood Plan also shows that areas of Yamba are inundated in flood events as frequent as the 5% AEP. Given the definitions provided in the Support for Emergency Management Planning 2022 document, much of Yamba would rather be considered a 'low flood island,' including where the existing site is situated. The proposed development's flood refuge would act as a 'high flood island' which is defined as an area of higher ground within a floodplain which is isolated in an extreme flood event, providing an opportunity for people to retreat to thus reducing the direct risk to life. A high flood island may require resupply via boat or air and may need to be provided with adequate support such as medical facilities during the period of isolation. Without this support people are more likely to interact with floodwaters increasing the likelihood of injuries and fatalities (DPE, 2022). A high flood island is conceptualised in **Figure 1**.





**Figure 1 High flood island (DPE, 2022)**

A low flood island initially becomes isolated, with access to and from the island being cut by floodwaters. If floodwaters continue to rise, the island becomes inundated (**Figure 2**). On a low flood island, evacuation of the community is required before evacuation routes are inaccessible.



**Figure 2 Low flood island (DPE, 2022)**

Table 12 of the document recommends emergency management issues for councils to consider in strategic decision making. In relation to proposed future communities such as what the proposed development would result in, for an emergency management response strategy of evacuation it is recommended to consider the feasibility of evacuation on a community scale without detriment to the existing community's ability to evacuate and should have supporting evidence of an evacuation capability assessment considering the vulnerability of the proposed development type and land uses. A shelter in place strategy is generally not supported by the NSW SES (DPE, 2022, pp.65).

Additional risk management considerations recommended in the table include:

- Addressing secondary risks of fire and medical emergencies during floods where shelter in place is the management strategy. It is recommended that the NSW SES, Ambulance NSW, the relevant Health functional area and the fire agency servicing the area be consulted by council to determine the appropriate risk management measures.

- Limiting exposure of people to floodwaters, which should be considered as part of the evacuation strategy and by providing accessible habitable floor levels above the PMF where people can shelter in place.
- Provision of publicly accessible space for the inherent population, which should also be considered as part of the evacuation strategy and to provide publicly accessible space above the PMF that can be accessed 24/7 and is clearly identified.
- Providing adequate services so people are less likely to enter floodwaters, which would include providing access to ablutions, water, power and basic first aid equipment. Further consideration should be given to provide for on-site water, power and sewage services for the likely flood duration plus additional time to allow for restoration of external services.

#### 4. Proposed Development

The development application is for 136 manufactured home style dwellings, one display home, and community facilities including a clubhouse, swimming pool, gym and cinema. It is anticipated to have a permanent population of approximately 272 residents. It is possible that the site may have more persons present at any one time, with parking available for up to 68 visitors.

Vehicle access to the site is provided through Park Avenue to the east and pedestrian access is proposed via Park Avenue to the east and west.

The site has previously been filled to a level of approximately 2.8m AHD such that the majority of the site is located above the existing climate 1% Annual Exceedance Probability (AEP) flood level of 2.51m AHD (i.e., above the 1 in 100 AEP flood level, but with no allowance for climate change). As such, the site is mostly mapped as outside of this level however Council's mapping indicates that it is within the Extreme Flood extent (noting this also does not have an allowance for climate change) (**Figure 3**).

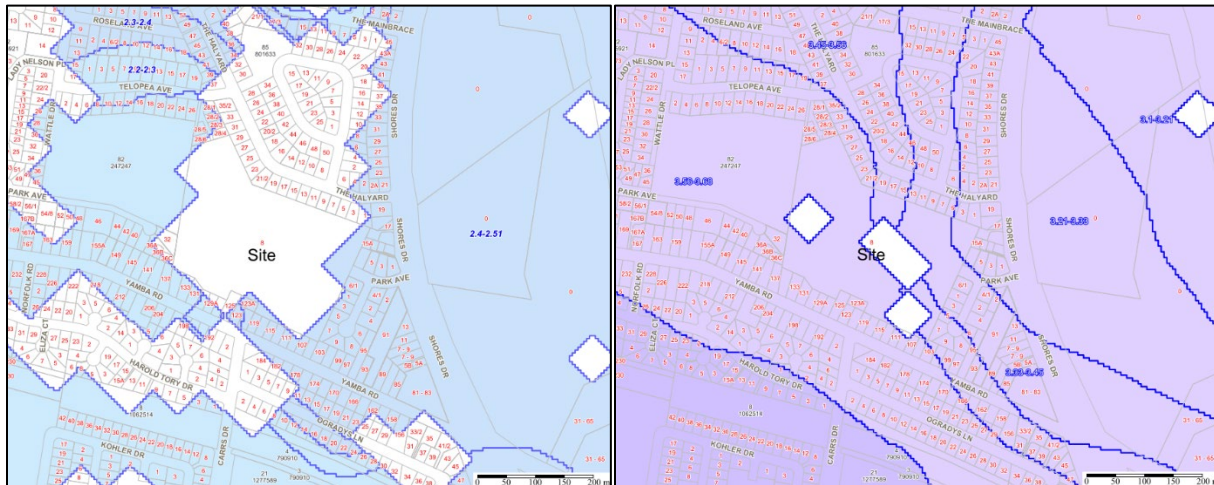


Figure 3 Clarence Valley Council flood mapping for 1 in 100-year flood (left) and the 'Extreme Flood' (right) (Note: Mapping is not inclusive of the effects of climate change)

The development application is supported by a suite of documents, including (as relevant to this review):

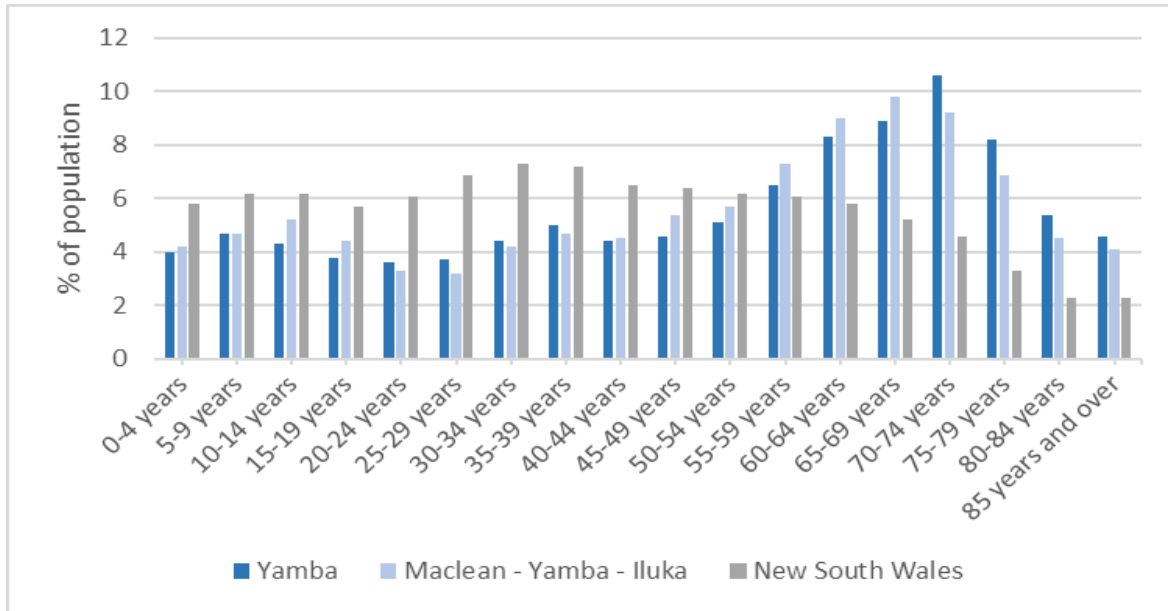
- The Flood Emergency Management Plan and Flood Risk Assessment, prepared by Bewsher Consulting dated 30 June 2022; and
- The Statement of Environmental Effects (SEE), prepared by Hometown Australia amended 1 October 2021 and 16 June 2022.

## 5. Regional Demographic and Health Information and Implications for Flood Emergency Response

Figure 4 summarises and compares the age breakdown as obtained from the 2021 Census data of the populations of:

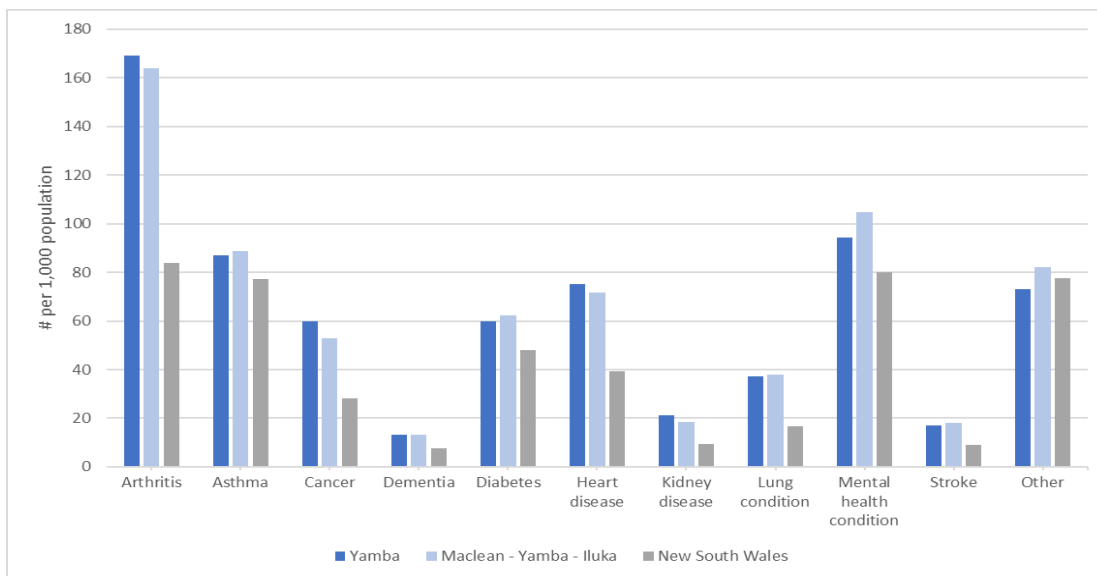
- Yamba,
- The Maclean-Yamba-Iluka statistical areas (known as SA2); and
- NSW.

As can be seen, the age groups greater than 60 years old are more predominant in Yamba and the wider SA2 area compared to NSW as a whole. The median age for Yamba and the SA2 area is 57 years and 55 years respectively, whereas for NSW, the median age was just 38 years old.

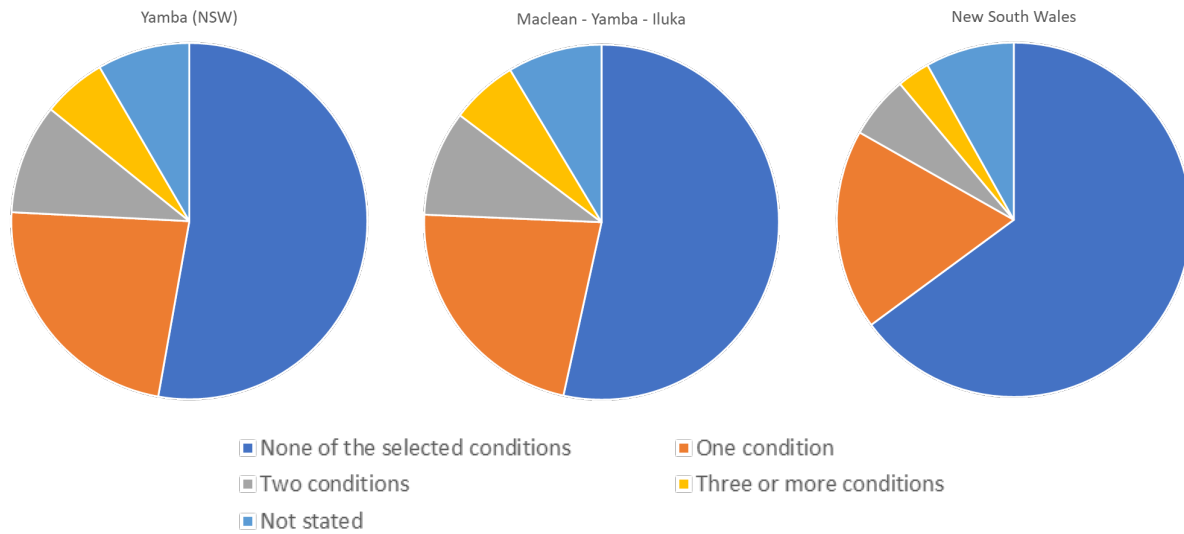


**Figure 4 Population by age group (ABS, 2022)**

The 2021 Census also collected data on long-term health conditions which is presented in **Figure 5**. This data reveals that a disproportionate amount of Yamba residents have long-term health conditions compared to the state and national average, and nearly 40% of the population with one or more health conditions (of those conditions stated, see **Figure 6**). In NSW this is only 27%. If this is narrowed to conditions where there is a need for medical attention in a hospital (heart, stroke, kidney, etc) then it would be of the order of 15%.



**Figure 5 Long-term health condition frequency per 1,000 residents (ABS, 2022)**



**Figure 6 Count of long-term health conditions (ABS, 2022)**

Additionally, the NSW Planning Portal has published population projections for the Clarence Valley LGA for 2021-2041 which predict an ageing population in the LGA, with an increase in age groups over 75 years (Table 2).

*Table 2 NSW Planning Portal population projections for Clarence Valley Council (NSW Planning Portal, 2022)*

Age Group	2021	2041	% Change
<b>85+</b>	1,785	3,562	100%
<b>80-84</b>	1,799	3,215	79%
<b>75-79</b>	2,799	3,625	30%
<b>70-74</b>	3,844	3,842	0%
<b>65-69</b>	4,203	3,906	-7%
<b>60-64</b>	4,320	3,522	-18%
<b>55-59</b>	3,835	3,512	-8%
<b>50-54</b>	3,234	3,362	4%
<b>45-49</b>	3,048	3,069	1%
<b>40-44</b>	2,508	2,758	10%
<b>35-39</b>	2,364	2,477	5%
<b>30-34</b>	2,292	2,403	5%
<b>25-29</b>	1,937	2,149	11%

Age Group	2021	2041	% Change
<b>20-24</b>	2,401	1,995	-17%
<b>15-19</b>	2,765	2,682	-3%
<b>10-14</b>	3,271	2,944	-10%
<b>5-9</b>	2,850	2,805	-2%
<b>0-4</b>	2,588	2,523	-3%

Based on the current population data for Yamba and the wider SA2 area, as well as DPE’s population projections (**Table 2**), it is anticipated that the likely residents of the proposed development will be of an older demographic and therefore more vulnerable and potentially at greater risk from suffering from a medical emergency, such as heart attack or stroke. It is also likely that residents of the proposed development will have one or more health issues and thus evacuation for medical reasons (due to or concurrently with a flood) is likely to be relevant to a larger number of people in the proposed development than would otherwise be the case in other localities. Using the available census information is estimated that 15-20% of residents of the proposed development might require early evacuation for medical reasons, which could be of the order of 40 – 60 persons.

## 6. Post Flood Recovery Duration and Issues

Based on Rhelm observations of the post flood conditions after the Northern Rivers event of February/March 2022, a dwelling may not be habitable for some months after being inundated in a flood event. It is noted that there is currently no requirement for flood-compatible building materials for those portions of multi-dwelling housing that might be inundated in rare and extreme events under the LG Act and associated Regulation.

It is likely that utilities (electricity, sewerage, water) will be unavailable for a portion of the time after a flood event. For example, the application proposes that the majority of the site be provided with gravity sewer connections and five lots in the north east corner of the site require pressure sewer systems that will be connected to the internal gravity sewer network. The sewage network will be connected to the existing pump station to the west of the site opposite 54 Park Avenue. This station appears to be set at ground level 2.3 mAHD and thus would be expected to become inoperable during the 1 in 100 AEP event and events of greater magnitude. It is unknown how long it would take for sewage utilities to be restored after a flood event and this would hinder post-flood recovery efforts. It is noted that water will be supplied from a dedicated rainwater tank, but the duration this will be operable will be finite.

## 7. Review of the FEMP (Bewsher Consulting, 2022)

The FEMP (Bewsher Consulting, 2022) for the proposed development is in three parts:

- Part A – Emergency Contacts
- Part B – Flood Risk Summary, which provides a history of significant floods in the region as well as nearby water level gauge recordings, a summary of potential flood levels for gauges in the area and levels for the site, a summary of the level of exposure of the proposed site, and a summary of the flood response strategy for the site.
- Part C – Flood Action Plan For ‘Parkside’ Manager, which provides the relevant trigger levels and actions to be taken by the community manager at each trigger level as well as their monitoring and liaison requirements.

Under the FEMP, the proposed development will have an appointed ‘Community Manager’ who is to be available 24/7 to oversee emergency management procedures and take responsibility for the safety of residents. The actions that the Community Manager is to take and oversee during a flood emergency is defined in Part C of the FEMP, however there is limited information on the wider role of the Community Manager provided. It is unclear if the Community Manager will reside at the proposed development which may pose an issue with respect to availability to respond to flood emergencies at the site at any time and in person, or availability to respond to emergencies remotely or via phone (noting that telecommunications may not be operational during a flood event).

In a flood, the key role of this Community Manager is to advise residents on when it is appropriate to evacuate, based on a range of possible triggers described in the FEMP. Depending on any one resident’s personal circumstances, if a shelter in place management strategy is unfeasible or unsafe, the FEMP identifies are directed to evacuate to Maclean, where they may have access to a hospital (noting Maclean Hospital is a small rural hospital, with an emergency department and 33 beds for acute, sub-acute and rehabilitation patients<sup>2</sup>). However, there is no details of **where** any person directed to evacuate would actually take shelter in Maclean in the event that an evacuation centre (such as at Maclean Showground, identified in the SES Local Flood Plan) had not yet been opened. Maclean is also a flood prone locality, and the evacuation centre would be largely expected to service people evacuated from that locality. Using the current demographic and health information above, it is estimated that up to 60 persons may need to be evacuated early. This may change with an ageing population.

Other residents, for which the FEMP describes as “most” of the 272 residents, could remain at the site as habitable floor levels at the site are to be 0.5m above the 1 in 100 AEP flood event. In the case that flood conditions worsen, the Clubhouse (with a proposed finished floor level of 3.63 mAHD, noting this

---

<sup>2</sup> <https://nswlhd.health.nsw.gov.au/sites/default/files/inline-files/MDH%20Patient%20Information%20Guide%20-%202021.pdf> , accessed 9 September 2022

is below the future estimated extreme flood level of 4.5 mAHD) would then serve as a high flood island with enough water, power and food where residents should shelter in place until flood waters recede. It is important to note here that a shelter in place emergency management response strategy is generally not supported by the NSW SES for proposed future greenfield developments under the *Support for Emergency Management Planning* (DPE, 2022, pp. 65).

Although it is stated that the community shelter is to be stocked with essentials, it is also stated in the FEMP's flood action plan that at "Respond 6" phase, remaining residents will be advised to gather their food and medications and evacuate to the clubhouse.

The triggers proposed in the FEMP are:

- For catchment and river derived flooding.
  1. A severe weather warning for very heavy rain in the area is issued by the Bureau of Meteorology (BoM)
  2. A Flood Watch warning for moderate or major flooding in the Clarence River is issued by the BoM
  3. A flood warning for moderate flooding or predicted heights of 2.1m or higher at Maclean is issued, at this level inundation of Yamba Road is expected
  4. River heights at Maclean and/or Palmers Island Bridge gauges reach 1.9m and 1.6m respectively
- And for ocean derived flooding.
  5. A severe weather warning for abnormally high tides or waves, expected to exceed the highest astronomical tide for the area is issued
  6. Local observation of tides.

The FEMP deems these as acceptable triggers to enact flood emergency management procedures. Triggers 1, 2, 3 and 6 rely on information and coordination with NSW Government agencies and the NSW SES.

It is noted that the Clarence Valley Council submission to the NSW Independent Flood Inquiry<sup>3</sup> identified that response activities in the region during the February/March 2022 flood event were hindered by coordination and resourcing constraints at the local SES level.

Further, the Clarence region experienced poor or no telecommunications reception in some areas<sup>2</sup> meaning that notification, updates and social media posts were inaccessible. In the event of a flooding emergency, the possibility of the Community Manager having to act without access to telecommunications is a real prospect that would restrict their ability to act upon any of the six triggers

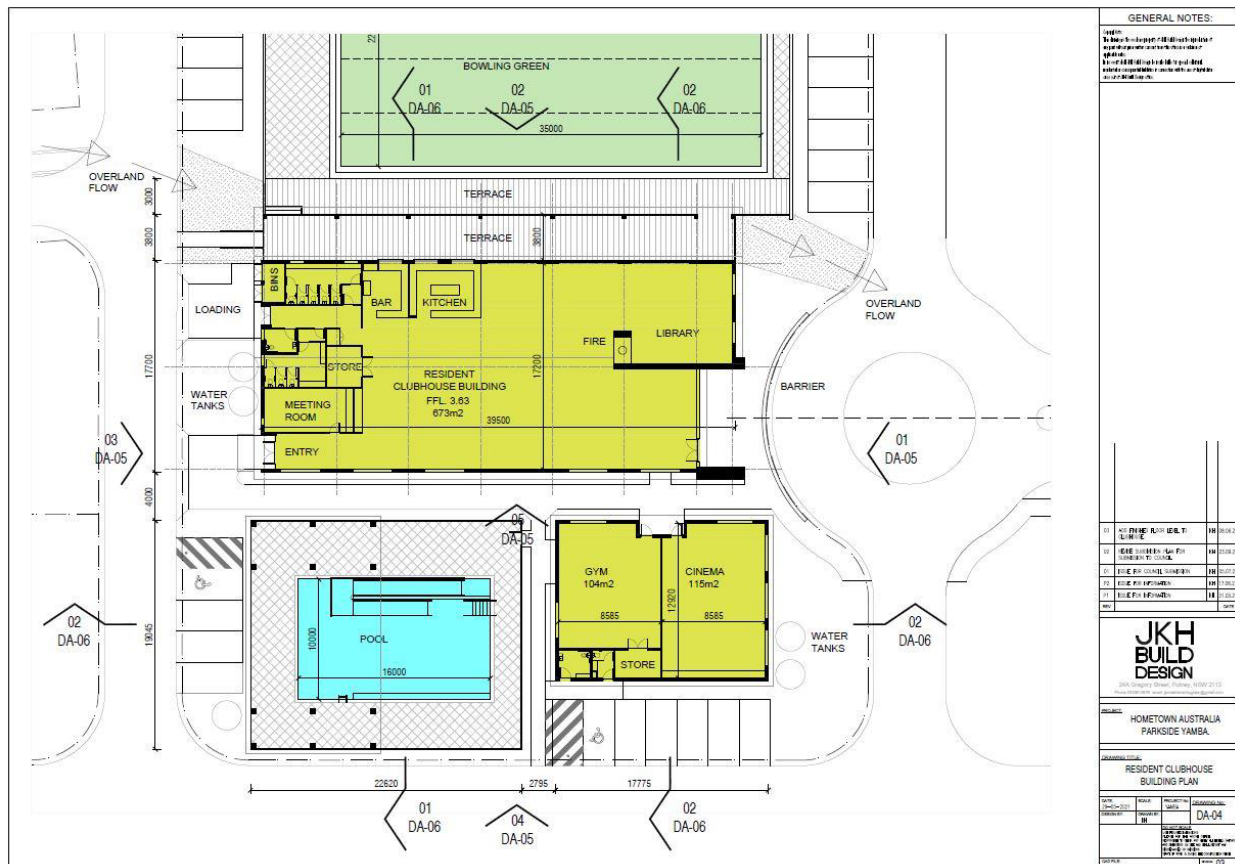
---

<sup>3</sup> L Black, Clarence Valley Council, 2022, 'Submission to the NSW Independent Flood Inquiry,' dated 19 May 2022.



thus undermining the entire FEMP. The six possible triggers proposed in the FEMP are likely based on the best available data in the event of a flood emergency and there is a concern that this may not be sufficient to ensure the safety of residents.

Despite being proposed to be built above the reported extreme flood levels, the suitability of the proposed community clubhouse as an evacuation shelter is another matter in and of itself. The FEMP puts forward that the clubhouse serve as an evacuation shelter for “most” of the development’s residents (i.e., those that have no need to evacuate early) as well as some members of the local community. A plan view of the clubhouse is provided in Attachment C to the FEMP and is reproduced in **Figure 7**.



**Figure 7 Proposed community clubhouse plan (Source JKH, 2022)**

As can be seen, the clubhouse’s footprint is 673 m<sup>2</sup>. In the event of a major flood, the entire township of Yamba would be cut off, and residents would need to be able to survive without outside assistance for at least 2-3 days (Yamba Floodplain Risk Management Study, WMA, 2008). However, in the floods of

February and March 2022, access to Yamba was cut off for almost an entire week<sup>4</sup>. Although a specific capacity is not provided, the FEMP proposes to accommodate a significant number of people plus their pets (say 272 people, the proposed population of the development) in building whose footprint is 673 metres squared, for up to seven days. This would equate to a maximum space per person of 2.5 square metres, if none of the persons identified for medical evacuation departed the site. This is considered to be an insufficient space for the potential duration required for shelter during a flood event.

As can be seen in the floorplan in **Figure 7**, there are no showering facilities visible in the proposed community clubhouse. The FEMP states that the clubhouse would be stocked with adequate food, water, pet food, medications, power and other necessities to provide the residents' potential week long refuge. With the possibility of the flood refuge being in operation for up to a week temporary bedding and other relevant items would need to be provided at the shelter. There are insufficient bathroom facilities (only 8) on the floorplan of the clubhouse, including a single accessible stall. As stated in the Support for Emergency Management (DPE, 2022), consideration must be given to the availability of on-site sewage services, yet the FEMP provides no indication that this will be available at the site. The proposed gravity sewer is to connect to existing sewer infrastructure via the existing station to the west of the site. This station appears to be set at 2.3 mAHD and would be expected to become inoperable in a 1 in 100 AEP flood event and events rarer than this.

The FEMP makes reference to the provision for water supply in tanks. These is only limited detail on the proposed arrangements and any tanks would need to be flood-proofed up to the PMF level. It would be anticipated that at least 50L of water per person per day might be required, which would equate to the need for a tank of nearly 95kL of water, which would be expected to have a substantial footprint (say 5 x 20 kL water tanks).

## **8. Fill Impacts and Stormwater Management**

In terms of level of filling at the site, the site was previously filled in the early 2000s such that most of the site is at approximately 2.8m AHD (i.e., above the 1 in 100-year flood event under existing climate conditions). It is proposed that all primary habitable floor levels be located at 3.01m AHD at minimum, positioning all dwellings 0.5m above the 1 in 100-year event. According to the FEMP, the flood level of a 1 in 100-year flood at the site is between 2.2m and 2.5m AHD. A habitable floor level of 3.01m AHD as proposed is reasonable for the existing climate scenario but does not incorporate any provision for climate change.

Stormwater quality and attenuation modelling was undertaken and is documented in the development's Engineering Services Report (NDC, 2021). The results of this modelling is briefly discussed in the report,

---

<sup>4</sup> Bewsher Consulting, 2022, 'Draft Flood Emergency Management Plan Proposed Multi-Unit Housing 'Parkside' 8 Park Avenue, Yamba,' 'Attachment B Closure of Yamba Road – Feb/Mar 2022 Flood.'

and it is stated that pre-development peak flows are greater than those in the post-development scenario. The report is further supported by a letter dated 9/7/22 (NDC, 2022) addressing community concerns regarding stormwater drainage. Neither of these documents provide a quantitative assessment (for example, in the form of local two-dimensional flood modelling) of whether the development will have flood impacts to neighbouring sites due to the proposed fill and retaining walls on the conveyance of stormwater flows within the existing or proposed perimeter stormwater drains or any potential effects on existing adjacent properties.

The community clubhouse, which is intended to act as a flood refuge in the event of an extreme flood, is to be set at 3.63m AHD minimum according to the FEMP. The most extreme flood levels expected at the site are between 3.3m and 3.6m AHD but, as outlined earlier in this letter, could potentially be up to 4.5 mAHD in the life of the development when considering projected climate change.

Runoff from the development is intended to be managed by capture and attenuation in an underground tank under the proposed Bowling Green as described in the Engineering Services report (Newton Denny Chapple, 2021). The proposed tank is 865 m<sup>3</sup> for a 6.7 ha site. Without detailed analysis of the calculations completed it is not possible to fully evaluate that the size of the tank is adequate, however, it is noted that the tank sizing only provides a storage rate of 129m<sup>3</sup>/ha, which is considered to be quite low when compared with site storage rates for other localities in NSW (which can range from 200 – 400 m<sup>3</sup>/ha). Additionally, the southern drainage system as proposed has a very low grade of 0.4% which poses potential long term maintenance issues (acceptable grade is usually 1%) and the lower portions of the drain are set at mean high water spring tide level, which over time will increase (as outlined earlier in this letter). A portion of the drainage capacity will be lost over time with the increase in sea level.

## **9. Recommendations to Panel**

### *Fill and Future Habitable Floor Levels*

The proposed development is not sufficiently filled to be above the 1 in 100 AEP level in a climate scenario and thus there are two possible solutions:

- additional filling to 3.7 mAHD account for future flood levels under climate change (to allow for at-grade dwellings) (noting that this may have an impact that would need to be assessed)
- Retain the existing fill arrangement and a covenant be placed on the title to ensure that all future manufactured homes be installed on piers such that the minimum habitable floor level is at 3.7 mAHD.

A flood impact assessment is required of the effects of the proposed fill and retaining walls on the conveyance of stormwater flows within the existing perimeter stormwater drains or any potential effects on existing adjacent properties.

### Emergency Management

The emergency response management strategy directing most residents to shelter in place in a location that can be isolated for a number of days is divergent from state guidance and practice. The proposed evacuation of residents with medical issues is also complex, has too short a time to be able to allow for suitable preparation, relies on information that may not be available during the course of a flood event and does not account for potential temporary accommodation requirements in Maclean for up to 60 persons. It also does not account for the degradation of evacuation route access over time with climate change.

Residents sheltering in place are unlikely to have sufficient space or amenities and therefore likely to impose an additional pressure on the NSW SES with respect to the need for resupply and also with respect to potential medical evacuation requirements.

Additionally, the proposed floor level of the shelter area would need to be further elevated to 4.5 mAHD to allow for projected climate change, otherwise there is potential for the refuge itself to be inundated.

Based on these findings, the current proposal is unsatisfactory from a flooding and emergency management perspective. For the proposal to be satisfactory, it is recommended that adjustments be made to address the issues identified in this review.

Should you have any queries regarding this review, please do not hesitate to contact me on 02 9098 6998 or [louise.collier@rhelm.com.au](mailto:louise.collier@rhelm.com.au).

Sincerely,



Louise Collier B.E. MEngSc FIEAust CPEng  
Director/Principal

### *References*

*AIGIS group, 2021, 'Multi-dwelling Housing Development 'Parkside,' 8 Park Avenue, Yamba NSW Social Impact Assessment,' prepared for Hometown Australia Communities, September 2021.*

*Australian Bureau of Statistics (ABS), 2022, Census Quickstats for Yamba, Maclean-Yamba-Iluka, and NSW, accessed 8 September 2022 at <https://www.abs.gov.au/census/find-census-data/search-by-area>.*

*Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, 2019, Australian Rainfall and Runoff: A Guide to Flood Estimation*

*Bewsher Consulting, letter dated 30 June 2022 addressed to the Acting Coordinator Development Services Clarence Valley Council, re: DA2021/0558 – Proposed ‘Parkside’ Development 8 Park Avenue Yamba, Flood Emergency Management Plan & Flood Risk Assessment.*

*Bewsher Consulting, 2007, ‘Grafton and Lower Clarence Floodplain Risk Management Plan,’ June 2007, (incorporating addendum for flood management actions for Brushgrove Village prepared by GHD, 2014).*

*BMT WBM, 2013, ‘Lower Clarence Flood Model Update 2013,’ prepared for Clarence Valley Council, September 2013.*

*Clarence Valley Council, 2011, ‘Clarence Valley Local Environmental Plan 2011.’*

*Clarence Valley Council, 2011, ‘Residential Zones Development Control Plan 2011,’ in force from 23 December 2011.*

*Clarence Valley Council, 2022, online intramaps, accessed 8 September 2022 at <https://maps.clarence.nsw.gov.au/intramaps97/>.*

*Clarence Valley Local Emergency Management Committee, 2020, ‘Clarence Valley Local Emergency Management Plan 2020,’ November 2020.*

*Department of Infrastructure, Planning and Natural Resources, 2005, ‘Floodplain Development Manual,’ April 2005.*

*Fox-Kemper, B., H. T. Hewitt, C. Xiao, G. Aðalgeirsdóttir, S. S. Drijfhout, T. L. Edwards, N. R. Golledge, M. Hemer, R. E. Kopp, G. Krinner, A. Mix, D. Notz, S. Nowicki, I. S. Nurhati, L. Ruiz, J-B. Sallée, A. B. A. Slangen, Y. Yu, 2021, Ocean, Cryosphere and Sea Level Change. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In press.*

*Hometown Australia, 2021, ‘Statement of Environmental Effects ‘Parkside’ 8 Park Avenue, Yamba,’ dated 7 July 2021, amended 1 October 2021 and 16 June 2022.*

*JKH, 2021, ‘Hometown Australia Parkside Yamba Proposal 8 Park Avenue, Yamba,’ Architectural Design drawings, dated 23 September 2021.*

*Newton Denny Chapelle, 2021, ‘Engineering Services Report Development Application for Multi-Dwelling Housing,’ prepared for Hometown Australia, October 2021.*

*Newton Denny Chappelle, 2022, letter addressed to The General Manager Clarence Valley Council from C. Pickford, 'Re: Stormwater Drainage – Proposed Manufactured Home Estate – 8 Park Avenue, Yamba,' dated 9/7/2022.*

*NSW Department of Planning and Environment (DPE), 2022, 'Support for Emergency Management Planning, Flood Risk Management Guide EM01.'*

*NSW Planning Portal, Projections Explorer, accessed 7 September 2022 at <https://www.planningportal.nsw.gov.au/populations>.*

*NSW State Emergency Service, 2017, 'Clarence Valley Flood Emergency Sub Plan,' June 2017.*

*Webb, McKeown & Associates, 2008, 'Yamba Floodplain Risk Management Study,' prepared for Clarence Valley Council, October 2008.*

*Webb, McKeown & Associates 2009, 'Yamba Floodplain Risk Management Plan,' prepared for Clarence Valley Council, February 2009.*