Sunshine Coast Council Flood Risk Assessment Methodology

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Synopsis: **Summary of Council's flood risk assessment methodology as prepared by BMT and presented in the Lower Maroochy and Mooloolah Floodplain Management Study and Pumicestone Floodplain Management Study.**

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Contents

List of Figures

List of Tables

1 Overview

Floods can create hazardous conditions which threaten lives and property through direct inundation, isolation and loss of services, such as electricity. Flooding is one of the most serious natural hazards in Australia, incurring the highest economic cost to the community and resulting in a small number of deaths most years. However, flooding is also a highly manageable hazard.

Flood risk describes the probability of flooding affecting people and properties and the consequences which may result. An understanding of flood risk, derived from flood models, land use and community characteristics, can be used to develop a plan to manage future floods. Flood risk is managed by first identifying the scale and nature of risk, determining a level of acceptable or tolerable risk (acknowledging that floodplains have multiple uses), then implementing measures to lower the flood risk to tolerable levels.

Sometimes flood risk is managed by changing flood behaviour, for instance through construction of dams, levees, stormwater drainage etc., however these types of solutions can worsen flooding in some locations, affect environmental flows and be very expensive to build. Where flood behaviour can't be changed, it is important to manage the residual flood risk through actions such as appropriate land use planning, community awareness measures and emergency management.

Sunshine Coast Council has undertaken a process of assessing and mapping the flood risk from rivers and creeks in the region. This document summarises that approach.

2 Flood Risk Assessment Methodology

2.1 Flood risk

Flood risk is made up of multiple factors:

- How likely a flood is to occur (bigger floods are rarer, smaller floods more common), referred to as flood likelihood
- How dangerous the flood water is, which is dependent on how deep the water is and how fast it is flowing, referred to as flood hazard
- What is being flooded, such as people or properties, and whether those people or land use types are more vulnerable to flooding, referred to as flood exposure and vulnerability.

The intersection of these risk factors is assessed using a risk matrix, similar to the approach that would be used in a health and safety risk assessment.

2.2 Flood likelihood

Flood likelihood is the probability of a flood occurring. In the past, flood probabilities have been described in terms of 'average recurrence intervals' (ARI) such as "100 years". However, due to the potential for misinterpretation of this descriptor (the assumption that a "100 year flood" will only happen once in every 100 years), the current approach is to describe flood probabilities in terms of the 'annual exceedance probability' (AEP). Using this language, the design flood size which was previously known as a "100 year flood" is now referred to as a "1% AEP flood", meaning that there's a 1% chance that a flood of this size or larger will occur in any given year.

Council's risk assessment process considers four flood likelihoods in the risk assessment process:

- **10% AEP** representing a relatively frequent flood event.
- **1% AEP (2100)** representing the standard design flood event (DFE) used for planning purposes.
- **0.05% AEP** representing an extreme flood event.
- **PMF** (probable maximum flood) representing the maximum extent of the floodplain.

2.3 Flood hazard

Hazardous flood conditions can be caused by deep flood water, fast flowing flood water, or water which is both deep and fast. Laboratory tests have investigated the combinations of depth and velocity which create dangerous conditions for people, cars and buildings. The results from these tests were used to develop the flood hazard categories listed in Table 2-1 and shown graphically on Figure 2-1, as used by Council and agencies across Australia:

Table 2-1 Flood Hazard Classifications

Flood Hazard Category	Description	Depth-Velocity Limit	Depth Limit	Velocity Limit
H1	Generally safe for vehicles, people and buildings	≤ 0.3 m^2/s	≤ 0.3 m	≤ 2.0 m/s
H2	Unsafe for small vehicles	≤ 0.6 m^2/s	≤ 0.5 m	≤ 2.0 m/s
H3	Unsafe for vehicles, children and the elderly	≤ 0.6 m^2/s	≤ 1.2 m	≤ 2.0 m/s
H4	Unsafe for vehicles and people	≤ 1.0 m^2/s	≤ 2.0 m	≤ 2.0 m/s
H5	Unsafe for vehicles and people All building types vulnerable to structural damage	≤ 4.0 m^2/s	≤ 4.0 m	≤ 4.0 m/s
H6	Unsafe for vehicles and people All building types considered vulnerable to failure	> 4.0 m^2/s	> 4.0 m	> 4.0 m/s

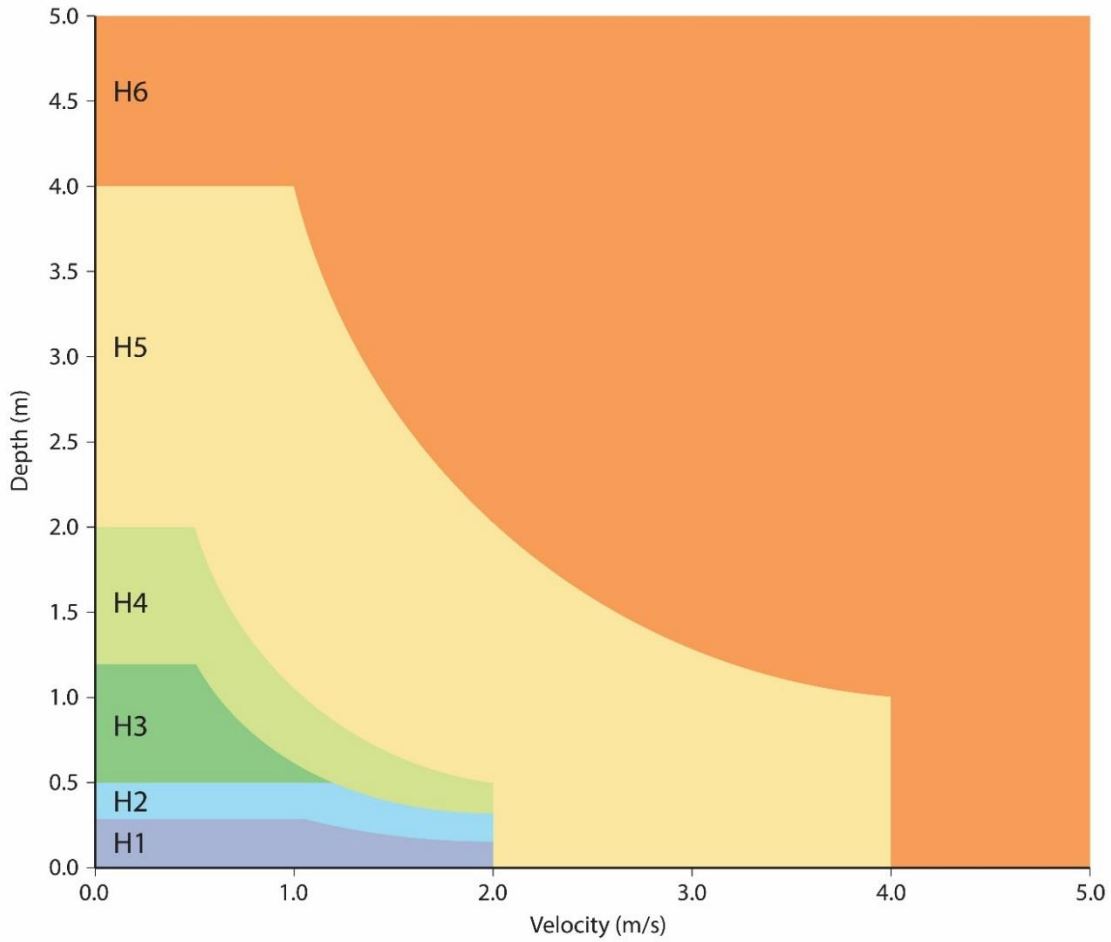

Figure 2-1 Flood Hazard[1] Curves

Flood hazard has been mapped using these categories for each of the four flood likelihoods used in Council's risk assessment.

2.4 Assessment of flood risk

Council has developed a framework which combines the various flood risk factors using a standard risk management approach. Risk assessment processes assess the intersection of likelihood and consequence, such that events which are more frequent and with greater (worse) consequences are considered to be a bigger risk than events which are less frequent and with smaller (milder) consequences. Flooding can produce a range of consequences, with varying severity, depending on the flood hazard and what is being flooded. Risk assessments for flooding therefore involve a multiple-step process:

(1) Prepare a risk assessment matrix (similar to those used for other types of risk assessments) which looks at combinations of flood likelihood and flood hazard. The flood hazard categories (H1 to H6) used in the matrix are related to flood consequences through the laboratory experiments which identified effects of flooding on people, cars and properties.

[1] Extracted from Managing the Floodplain Handbook, Australian Institute for Disaster Resilience 2017

(2) Group bands of similar risk, i.e. a frequent flood with low hazard is an equivalent risk to a rarer flood with higher hazard. These bands of similar risk are the colours shown in a risk matrix.

(3) Use flood hazard mapping from each of the flood likelihoods used in the matrix to create a single map which captures the risk groupings and prioritisations in the risk matrix. The original flood risk matrix is shown in Table 2-2.

Table 2-2 Original Flood Risk Matrix

		Flood Hazard Category					
		H1	H2	H3	H4	H5	H6
Likelihood	PMF						
	0.05%						
	DFE						
	10%						

The four bands of risk shown in the original matrix and mapping are:

- **Low risk** – individuals and society can generally live with this risk, without feeling the need to reduce the risk any further.
- **Moderate risk** – society can live with this risk but as much as is reasonably practical should be done to reduce the risks further (note that individuals may find the risk unacceptable and choose to take steps to reduce personal risk).
- **High risk** – individuals and society will not accept this risk and measures must be put in place to lower the risks to at least a tolerable level.
- **Very High risk** – individuals and society will not accept this risk.

(4) Refine risk band titles and colours. Council elected to use the risk band categories and colour scheme of the *Brisbane River Catchment Regional Guideline for Flood Awareness Mapping and Communication (2020)*, with the intent of applying a consistent flood risk mapping communication approach with other South-East Queensland local governments. The final flood risk matrix developed is in Table 2-3 and has been used to map flood risk across the region.

Table 2-3 Final Flood Risk Matrix

Likelihood	Flood Hazard Category					
	H1	H2	H3	H4	H5	H6
PMF						
0.05%						
DFE						
10%						

The four bands of risk shown in the matrix and mapping are:

Low risk – Flood risk is low and meets contemporary community standards. If it becomes possible to reduce this risk at either an individual or community level, it is recommended that the opportunity to do so is given consideration.

Medium risk – Flood risk does not meet contemporary standards. However, it is expected that the urban renewal of coastal lots, over time, will deliver an acceptable risk outcome.

High risk – These areas present a high and unacceptable flood risk to life and property.

Other areas of the floodplain – These areas present a very low risk to life and property.

2.5 Design of flood risk matrix

The flood risk assessment methodology, including the flood risk matrix, is consistent with requirements in *The State Planning Policy (SPP) 2017, Natural Hazards Risk and Resilience state interest*, which requires a fit-for-purpose risk assessment prepared in accordance with the International Risk Standard (AS/NZS ISO 31000:2009). The methodology reflects best-practice approaches recommended in national floodplain management guidelines (Australian Disaster Resilience Handbook Collection) and was co-designed by a team which included subject matter experts in engineering (from BMT) and land use planning (from Meridian Urban). Members of the consultant team authored the Queensland Reconstruction Authority's guideline, *Planning for Stronger, More Resilient Floodplains* (2012) and Department of Natural Resources and Mines *Guide for Flood Studies and Mapping in Queensland* (2017).

The flood risk matrix adopted by Council for their flood risk assessment process was developed in consultation with Council stakeholders from Disaster Management, Strategic Planning, Development Services, Flooding and Stormwater Policy and Planning, Stormwater Service, Sustainability Policy, and Environmental Operations. Consultation considered the broader approach to flood risk assessment and the selected risk matrix, including distributions of the risk bands in the matrix.

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