SECTION 13 – FLOODPLAIN MANAGEMENT

13.1 Introduction

The management of flood prone land in NSW is primarily the responsibility of councils by implementing the provisions in the NSW Government's *Flood Prone Land Policy* and the associated *NSW Floodplain Development Manual 2005*.

13.2 Application of this Part

This part applies to land within the Muswellbrook Council area which is flood prone or partially flood prone land.

Land is identified as flood prone:

- In flood studies prepared under the provisions of the *NSW Floodplain Development Manual 2005* and adopted by Council.
- In overland flow studies undertaken by or on behalf of Council, being the best available information at the time; or
- Where flood studies are not available, but the land contains an intermittent or permanent watercourse.

13.3 Objectives

The **objectives** of this part are to:

- Establish guidelines for the development of flood prone land that are consistent with the NSW Flood Policy and NSW Floodplain Development Manual (2005) and as updated by the associated Floodplain Risk Management Guides.
- Limit the intensification of residential uses and other inappropriate uses in flood affected areas.
- Promote flood compatible design and building that considers requirements for the development of flood prone land and does not adversely impact on adjoining properties or pose unnecessary risk or cost to the public or emergency services.
- Ensure measures are implemented to reduce private and public losses resulting from flooding and manage risks to property and life from flood events.
- Ensure that the development or use of floodplains waterways and riparian corridors does not adversely impact upon aesthetic, recreational and ecological values and takes into account potential changes resulting from climate change; and
- Provide guidance for assessing the LEP criteria for Development Consent, considering Council's responsibilities for floodplain management and flood related development standards as specified in other relevant legislation including the *Local Government Act 1993* and *Water Management Act 2000*.

13.4 Definitions and flood planning concepts

The terms that are used in this part are consistent with the *NSW Floodplain Development Manual 2005* and can be found in the Dictionary.

Flood Planning concepts are summarised in the following figure:

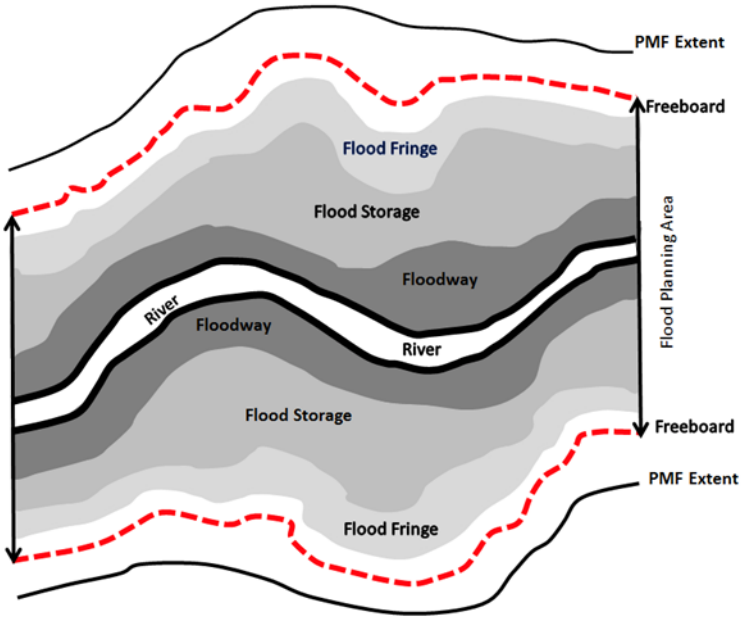

Figure 1: Plan of floodplain and hydraulic categories

Key terms

AEP - Annual Exceedance Probability

AHD means Australian Height Datum. A common national surface level datum approximately corresponding to mean sea level.

ARR means the publication - Australian Rainfall and Runoff.

Effective warning time means sufficient warning time to enable complete evacuation of people who could be expected on the site, to a non-flood affected area by a reliable access path.

FHA – Flood Hazard Assessment

FIRA – Flood Impact & Risk Assessment

FPA – Flood Planning Area

FPL – Flood Planning Level

FRM – Flood Risk Management

Greenfield v Brownfield – a greenfield site is typically vacant and lacks constraints imposed by:

- existing development on the site,
- proximity to development on adjoining land; or
- a small lot size that would make raising floor levels above the 1% AEP flood level impractical.

In contrast, a brownfield site carries these constraints. An example of brownfield sites in Muswellbrook would be the employment zoned land along Maitland Street.

To avoid economic losses due to damage to stock, structures and fittings and an inability to trade, non-habitable development on brownfield sites should be designed to achieve the best flood protection levels possible.

Habitable room in a residential situation is a living or working area, such as a lounge room, dining room, rumpus room, kitchen, bedroom, or workroom. In an industrial or commercial situation, it is an area used for offices or to store valuable possessions susceptible to flood damage.

PMF - Probable Maximum Flood level

Reliable Access means a path of travel for people of all abilities to move from a flood affected area to a non-flood affected area

Non - urban use means a use more typically located on rural or environmental land, such as farm sheds, grain silos, greenhouses, stockyards and rural fire sheds.

Additional Guidance material:

- Section 9.1 Ministerial Direction on local planning direction on flooding
- Planning circular on flooding PS21-006
- Guideline: Considering Flooding in Land Use Planning
- State Environmental Planning Policy Amendment (Flood Planning) 2021
- The NSW Government's Floodplain Development Manual (2005) - https://www.environment.nsw.gov.au/topics/water/floodplains/floodplain-manual
- Floodplain risk management (FRM) guidelines - https://www.environment.nsw.gov.au/topics/water/floodplains/floodplain-guidelines
- Muswellbrook Floodplain Risk Management Study and Plan (2019)

These documents are updated from time to time, the most recent version should be considered.

13.5 Application Requirements

The extent of **flood related information** required to be submitted with an application depends on several factors, including:

1. the type of development proposed;
2. the scale of the development proposed;
3. the extent to which the site is affected by flooding; and
4. the amount of flood related information already held by Council regarding flood behaviour at that site and within its catchment.

Item	When required	Plans or information to be provided
A. Survey plans	All applications Note: some applications for ancillary development may not require survey details if certified by a structural engineer. This is at the discretion of Council.	A survey plan signed off by a registered surveyor indicating the following: 1. Existing ground levels at each corner of the proposed building envelope. 2. The floor levels of existing buildings or structures that are to be retained, as well as proposed finished floor levels for all new buildings and structures; and 3. The location of any existing buildings or structures. 4. Any earthworks proposed or filling of land; and 5. All contours to be minimum of 250mm. All levels must be relative to *Australian Height Datum (AHD).* Levels relating to an arbitrary assumed datum are not acceptable.
B. Flood Hazard Assessment (FHA)	Where the development site is not within the area of a Flood Study adopted by Council, but the development site: a) is within 40 metres of a defined watercourse; or b) is within 20 metres of a major drainage system or drainage easement; or c) has a history of flooding; and d) the development will result in intensification of development on potentially flood prone land. (NB. Intensification would not include minor development such as carports, garden	As specified in the section below titled **Flood Hazard Assessment**

		sheds, cattle yards, farm structures and farm sheds under 200sqm).	
C.	**Flood Impact & Risk Assessment (FIRA)**	When development will result in intensification of development: a) on land below the 1% AEP Flood level and is identified as Flood Hazard category H3, H4, H5 or H6 in a Council adopted Flood Study; or b) on land that a Flood Risk Assessment has identified is unsafe for vehicles, or wading by elderly people or children during a 1% AEP flood; or c) on land below the 1% AEP Flood level and the development includes land filling or solid structures that may increase local flooding during a 1% AEP flood by more than 100mm within 10m of the development. (NB. Intensification would not include minor development such as carports, garden sheds, cattle yards, farm structures and farm sheds under 200sqm).	As specified in the section below titled **Flood Impact & Risk Assessment**
D.	**Flood management compliance report**	All applications (NB. May be included in the Statement of Environmental Effects or Flood Impact & Risk Assessment rather than as a separate report).	An assessment prepared by a suitably qualified engineer, on how the proposed development will achieve the objectives (Section 13.3) and development controls (Sections 13.5 to 13.10). All relevant controls are to be listed and an explanation is to be given on how each control has been met.
E.	**Flood Evacuation plan**	Based on an assessed need by Council Officers, but generally: a) if vehicular access to the development uses public or private roads that are flood affected and identified as Flood Hazard category H3,	An evacuation plan prepared by a suitably qualified person, is to provide an outline of measures proposed for the timely, orderly, and safe evacuation of persons and companion animals from the site. It must take account of the effective warning time during periods of flood, any floodplain risk management plan, relevant

	H4, H5 or H6 in a Council adopted Flood Study, or b) where wading depths to evacuate the property during a 1% AEP flood event exceed 500mm.	state government disaster plan, advice received from the State Emergency Services (SES) or as determined by Council. It must be prepared in accordance with the principles of the *NSW Floodplain Development Manual 2005* or more recent versions of the Manual.

Flood Hazard Assessment

The Flood Hazard Assessment shall:

1. Clearly demonstrate the flood hazards associated with the development site.
2. Be undertaken and certified by a suitably qualified Civil/Hydraulic Engineer. A suitably qualified professional is a member of a recognised organisation and has experience, education, qualifications, and indemnity insurance to undertake the work competently.
3. Provide all spot levels relative to Australian Height Datum (AHD).
4. Clearly set out the methodology adopted and provide enough detail to enable easy checking of calculations and validity of assumptions used.
5. Present available historical rainfall and flood height data if available.
6. Present complete model results including those for sensitivity testing.
7. Include maps/figures of the catchment, site, model layout and cross section locations.
8. Include tabulations and/or figures model parameters and results.
9. Identify appropriate access routes and emergency management procedures over the full range of floods up to the PMF.
10. Provide survey data including Digital Terrain Model (in a format compatible with Council's GIS) and model data files arranged in an orderly file structure.
11. Provide topographic levels with an accuracy of 100mm, structures and the like shall be to an accuracy 10mm.
12. Use Rainfall intensity/frequency/durations determined from Australian Rainfall and Runoff (ARR) 2019 or later.
13. Assess flows using a rainfall-runoff hydrologic model and compared to peak flows using the Rational Method from ARR for urban or rural catchments as appropriate.
14. Consider the effects of climate change on rainfall and flood patterns.
15. Assess the 1% AEP and the PMF flood events using a steady state backwater analysis technique (or better) with a sensitivity analysis on assumed or assessed parameters.
16. Provide flood heights in metres to two (2) decimal places, while flood velocity shall be reported in metres per second to one (1) decimal place.
17. Compare assessed flood levels to historic flood levels in the vicinity, if available.
18. Not extrapolate anecdotal data and assessments based on levels or flows from other parts of the catchment or adjacent catchment unless it can be demonstrated that such an assessment is clearly conservative and results in an upper bound design level.
19. All data is to be made available electronically to Council free of cost, to form part of a local government area database.

Flood Impact & Risk Assessment

Flood Impact Assessments shall:

1. Clearly demonstrate the flood impacts and risks associated with the development and that the development is consistent with the current version of the NSW Floodplain Development Manual, any relevant local flood study, floodplain management study or Flood Risk Assessment applying to the land.
2. Identify compliance with the flood controls in Section 13.6 to 13.10 of the DCP (below) or justify non-compliance.
3. Be undertaken and certified by a suitably qualified Civil/Hydraulic Engineer. A suitably qualified professional is a member of a recognised organisation and has suitable experience, education, qualifications, and indemnity insurance to undertake the work competently.
4. All levels shall be relative to Australian Height Datum (AHD).
5. Topographic levels shall be to an accuracy of 100mm, structures and the like shall be to an accuracy of 10mm.
6. Describe the watercourse, creek or drainage system that is relevant to the flood characteristics of the site, whether located on, adjacent to or remote from the development site.
7. Clearly set out the methodology adopted and provide enough detail to enable easy checking of calculations and validity of assumptions used.
8. Present complete model results including flood heights (levels), flow distributions, velocities and flood storage variations for all calibration, validation and design events demonstrating the change in hydraulic behaviour due to proposed site filling and/or structures, within 10m of the development and all sites across the floodplain affected by the development.
9. Include tabulations and/or figures depicting the spatial distribution of model parameters, flow and velocity at each section.
10. Identify appropriate access routes and emergency management procedures over the full range of floods up to the PMF.
11. Provide survey data to Council in an electronic format, including Digital Terrain Model data and model data files.

13.6 Flood Controls

1. Development must be consistent with the current version of the NSW Floodplain Development Manual, any relevant local flood study, floodplain management study and plan applying to the land that has been endorsed by Council, or the recommendations of a Flood Impact & Risk Assessment completed for the development.
2. Generally, buildings and other structures, including fences, must be designed so as not to impede the flow of floodwaters or entrap debris.
3. Filling within the floodplain must be supported by a detailed flood risk & impact assessment certified by a suitably qualified consulting engineer that can adequately demonstrate:
    a) Filling is not within a core riparian zone.
    b) Filling will not substantially impede the flow of floodwater and not contribute to flooding or ponding of water on any other property; and
    c) For a dwelling pad in a rural area, filling is minimal and is balanced by a borrow pit on the same site, and neither are situated in high hazard floodwaters (H3 or higher in a 1% AEP flood).

4. New structures are to meet the flood planning levels and floor heights specified in the Table 2 below.
5. Flood planning levels and floor heights for additions or alterations to existing residential development will be assessed on the merits of the situation, having regard to meeting an acceptable level of risk to life and flood damage. In general, additions that will increase the existing floor area by more than 20% as it existed on 1 January 2022 will be required to meet the floor heights in Table 2.
6. The construction methods and materials that form part of the development that will be below the flood planning level, including filling, must be capable of withstanding the force of flowing floodwaters, including debris and buoyancy forces and immersion for a prolonged period.
7. Development on land below the 1% AEP will only be permitted where effective warning time and reliable access is available for evacuation to an area free of risk from flooding. Evacuation should be consistent with any relevant flood evacuation strategy.
8. Evacuation Plans, when required, are to be prepared to Council's satisfaction demonstrating the Plan provides for:

    a) Low flood hazard emergency vehicle road access (NSW SES, NSW RFS) during a 1% AEP flood event; and
    b) Failsafe, comprehensive flood-alert measures.

Alternative shelter in place arrangements will need to be justified and comply with guidance issued by NSW SES, DPIE or equivalent agencies.

9. No Torrens Title subdivision that may result in intensification of development is to occur on land wholly inundated by flooding during the PMF event, unless it is demonstrated that:
    a) The risk of flooding can be effectively and appropriately mitigated without impacting the adjacent floodplain or unnecessary risk or cost to the public or emergency services.
    b) There is adequate flood free land above the 1% AEP flood level suitable for the development, vehicle parking and effluent disposal (if applicable); and
    c) There is flood free access to each lot or a satisfactory Flood Evacuation Plan.

Table 2 - Flood Planning Levels and floor height requirements in areas affected by flooding

(see section 13.7 for development protected by a levee)

Type of Development	When required	Minimum Floor Height Requirements
Residential	Habitable rooms	1% AEP flood level + 500mm freeboard
	Non-habitable rooms and garages.	5% AEP flood level
	Carports, open area parking, Garden sheds and other ancillary structures (excluding garages)	No requirement
	Basement car parking	Constructed to preclude entry of floodwater at levels up to the 1% AEP flood level + 500mm freeboard. Additional requirement for basement levels to implement a means of evacuation, and a pump-out system to remove flood waters.
	Unsealed electrical installations	To be located above the 1% AEP flood level + 500mm freeboard
Tourist and Visitor Accommodation on a greenfield site (other than caravan parks and camping grounds).	Internal floor height of habitable elements of the development	1% AEP flood level + 500mm freeboard
	Unsealed electrical installations	To be located above the 1% AEP flood level + 500mm freeboard
Tourist and Visitor Accommodation on a brownfield site (other than caravan parks and camping grounds).	Internal floor height of habitable elements of the development	1% AEP flood level + 500mm freeboard or an alternative solution that precludes floodwater up to the 1% AEP flood level unless it is demonstrated that this would be impractical.
	Unsealed electrical installations	To be located above the 1% AEP flood level + 500mm freeboard
Tourist and Visitor Accommodation on a brownfield site	Internal floor height of habitable elements of the development	1% AEP flood level + 500mm freeboard or an alternative solution that precludes floodwater up to the 1% AEP flood level unless it is demonstrated that this would

Type of Development	When required	Minimum Floor Height Requirements
(other than caravan parks and camping grounds).		be impractical.
	Unsealed electrical installations	To be located above the 1% AEP flood level + 500mm freeboard
Commercial, Retail, Industrial, Service Station, Mining and Quarry related development	Greenfield sites - Offices, storerooms, retail floor spaces and facilities providing safe storage for chemicals	1% AEP flood level.
	Brownfield sites - Offices, storerooms, retail floor spaces and facilities providing safe storage for chemicals	1% AEP flood level unless it is demonstrated that this would be impractical. Unsealed electrical installations to be located above the 1% AEP flood level.
Recreation facilities and Emergency Facility buildings (e.g. Fire Stations)	Offices, storerooms, retail floor spaces and facilities providing safe storage for chemicals	1% AEP flood level unless it is demonstrated that this would be impractical. Unsealed electrical installations to be located above the 1% AEP flood level.
Caravan Parks and Camping Grounds	Habitable rooms in structures with a slab or fixed foundation flooring system	1% AEP flood level
	Non-habitable rooms and garages	5% AEP flood level
	Carports, garden sheds and habitable structures that are mounted on skids, wheels or other non-fixed foundations and can be moved within effective flood warning times.	No requirement
	Unsealed electrical installations	1% AEP flood level + 500mm freeboard
Sensitive Uses identified in the Special Flood Considerations clause in MLEP 2009 (e.g. residential care facilities, hospitals, respite care, child care centres etc.) that are difficult to evacuate.	Habitable floor height	Probable Maximum Flood level
	Non-Habitable rooms/areas	Probable Maximum Flood level
	Parking areas	1% AEP flood level
	Vehicular access between a flood free public road and the Development	Probable Maximum Flood level unless an alternative solution is approved as part of an evacuation plan

Type of Development	When required	Minimum Floor Height Requirements
	Unsealed electrical installations	Probable Maximum Flood level

13.7 DEVELOPMENT PROTECTED BY A LEVEE

In addition to achieving the objectives of Section 13.3 and Flood Planning Controls in section 13.6 (other than Flood Planning Levels and Floor Heights in Table 2), development protected by a levee must achieve the following:

1. Minimum floor levels for all developments in the township of Denman protected by the levee shall be 107.25m AHD (Australian Height Datum).
2. Minimum floor levels for all developments in the township of Muswellbrook protected by the levee shall be 146.3 AHD (Australian Height Datum).
3. Where new buildings or additions are proposed within 40m of an existing levee an engineer's certificate shall be submitted certifying that the proposed structure has been designed to withstand flood pressures, including debris and buoyancy forces, imposed in the event of an adjacent levee failure. Loads imposed will be assessed from the velocity/depth data indicated in **Table 3**.

Table 3: Velocity and depth of flood waters due to a levee breach

Height of Adjacent Levee	Distance from Levee							
	5.0		10.0		20.0		30.0	
	V (m/s)	D (m)	V (m/s)	D (m)	V (m/s)	D (m)	V (m/s)	D (m)
1.0	2.6	0.25	1.0	0.3	*	*	*	*
2.0	5.0	0.4	3.7	0.35	2.0	0.5	*	*
3.0	6.4	0.6	5.5	0.5	4.0	0.5	3.2	0.7

Note: V = velocity of flow; D = depth of flow; * = values not determined

13.8 INTEGRITY OF THE HUNTER VALLEY FLOOD MITIGATION SCHEME

Development on and within the vicinity of structures (including levees, floodgates, spillways and drains) operated by Council, but constructed under the *Hunter Valley Flood Mitigation Scheme*, will be managed by Council under the *Water Management Act* to ensure the continuing integrity of those structures.

The Guidelines in the NSW Office of Environment and Heritage document '*Guidelines for Development within the Hunter Valley Flood Mitigation Scheme'*, as updated from time to time, shall be applied to land in and around the towns of Denman and Muswellbrook where the structures are placed.

13.9 FENCING IN HIGH HAZARD FLOODWAYS

Fencing in high hazard floodways shall be an open type of fencing, such as 5 strand wire fences and post and rail fences that do not restrict the flow of flood waters or increase flood hazards or flood damage to other properties or increase afflux by more than 100mm. The

fencing design should be resistant to blockage or designed to be collapsible under heavy flood loadings.

13.10 CONSIDERATION OF FLOOD MITIGATION MEASURES

The Muswellbrook Floodplain Risk Management Study and Plan (2019) identifies options for flood mitigation works in Muswellbrook. New development is not to preclude the delivery of these mitigation works.