



Byron Shire Development Control Plan 2014

Chapter C2 Areas Affected by Flood



TRADITIONAL HOME OF
THE BUNDJALUNG PEOPLE

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Document History

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Glossary of Key Terms

- **annual exceedance probability** - The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. For example, if a peak flood discharge of 100 m³/s has an AEP of 1%, it means that there is a 1% chance of a peak flood discharge of 100m³/s or larger occurring in any one year.
- **average recurrence interval** - The long-term average number of years between the occurrence of a flood equal to or larger in size than the selected event.
- **Critical Facilities** - means development where any inundation or loss of function in an PMF would represent an unacceptable level of risk. It includes emergency service facilities (e.g. SES command centres, police stations, fire stations / RFS, ambulance stations, hospitals, public halls used as flood evacuation centres), intensive aged care, nursing homes, correctional facilities, telephone exchanges, telecommunication repeaters, flood evacuation centres and flood refuges, and critical service facility components (e.g. essential components of sewage treatment plants, essential water supply reservoirs).
- **defined flood event (NEW)** - is the flood event selected as a general standard for the management of flooding to a development type.
- **flood function (NEW)** - The flood related functions of floodways, flood storage and flood fringe areas within a floodplain. These functions are normally derived as part of a flood study based on a hydraulic categorisation. Floodways generally convey a significant discharge of water during floods, flood storage areas are normally outside floodways and generally provide for temporary storage of floodwater during the passage of a flood. Flood fringe areas are those remaining inundated areas not assessed as floodway or flood storage.
- **flood hazard** – generally defined as a combination of flood velocity and depth (i.e. velocity depth product). Higher flood hazards present a greater risk to loss of life, injury or economic loss.
- **flood planning area** – this is the area of land at or below the flood planning level. It is the area within which developments are subject to flood related development controls and can include future climate change parameters.
- **flood planning level** – is a combination of the flood level from the defined flood event and freeboard selected for flood risk management purposes.
- **flood prone lands** – lands at or below the probable maximum flood level. Also called flood liable land.
- **freeboard** – allowance applied to the defined flood event level to reach the flood planning level.
- **probable maximum flood (PMF) (NEW)**- The largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation (PMP), and where applicable, snow melt, coupled with the worst flood-producing catchment conditions. The PMF is also referred to as an extreme event.

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- **probable maximum precipitation (PMP) (NEW)** - The greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year.
- **projected 2050 Flood Planning Level** – This is the peak flood level for a 1% AEP event with 2050 climate change conditions plus 0.5m freeboard, as per s3.5 of Byron Shire Council's Climate Change Strategic Planning Policy.
- **projected 2100 Flood Planning Level** - This is the peak flood level for a 1% AEP event with 2100 climate change conditions plus 0.5m freeboard, as per s3.5 of Byron Shire Council's Climate Change Strategic Planning Policy.
- **Special Purpose Facility** - means development where inundation or loss of function at the typically accepted flood planning level may still present an unacceptable level of risk. Development in this category includes boarding houses, caravan parks, early education and care facilities, eco-tourist facilities, educational establishments, group homes, hazardous industries, hazardous storage establishments, hostels, information and education facilities, respite day care centres, seniors housing, tourist and visitor accommodation.

Note: items highlighted **Yellow** represent new or revised flood planning terms that will be included in Part A – Appendix 1 of DCP 2014

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C2.1 Introduction

C2.1.1 Purpose of this Chapter

The purpose of this Section is to identify requirements relating to development ~~on flood liable land that is appropriate to the degree of flood hazard on that land.~~ primarily within flood planning areas, and for specific developments and development types, to lands beyond the flood planning areas to the extent of the probable maximum flood (PMF).

Note, lands below the level of the PMF may also be referred to as 'flood prone lands'.

Refer to glossary of terms for further details of specific words.

C2.1.2 Objectives of this Chapter

The Objectives of this Chapter are to:

1. Support and implement the objectives and provisions of the Byron LEP 2014 relating to development on flood prone lands. ~~development on land at or below the relevant flood planning level.~~
2. Provide a holistic approach to managing development on flood prone lands; ~~flood liable lands.~~
3. Ensure development maintains the existing flood regime and flow conveyance capacity;
4. Consider the future projected impacts of climate change on the floodplain in accordance with Council's adopted Climate Change Strategic Planning Policy;
5. Reduce the impact of flooding and flood liability on communities, ~~and~~ individual owners and occupiers of flood prone lands;
6. Reduce public and private losses resulting from floods, using ecologically positive methods wherever possible;
7. Encourage the development of and use of flood prone land in a manner compatible with ~~the flood hazard.~~ its flood risk;
8. Development applications and proposals on flood prone lands to be individually considered with the objective of achieving a reasonable balance of land use and flood risk.

Note: An underlying principle of this Chapter is that any new development or modifications to existing development should always, as far as practical, result in an improvement to the existing flood risk and in no circumstances should the flood risk be made worse.

C2.1.3 Application of this Chapter

The planning provisions of this Chapter apply to flood prone lands, i.e. all land below the level of the PMF. ~~all land at or below the future flood planning level.~~ The flood planning matrix (Table C2.1) contains more specific information about the nature and types of development controlled by this DCP Chapter.

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This DCP is primarily applicable to development applications.

Planning proposals that enable future development in flood prone areas must consider the provisions of this DCP, in addition to the Local Planning Direction requirements, particularly 4.1 - Flooding.

C2.1.4 Planning Objectives and Development Controls

The provisions of this Chapter are based on a range of control measures in relation to particular development ~~and~~ building types. Development proposals must be consistent with the planning objectives ~~for the Chapter~~. Such consistency is typically demonstrated by compliance with the identified development controls, although there may be circumstances where an alternative to the application of a development control is consistent with the planning objectives. Such alternatives will be considered with regard to risk management principles.

C2.1.5 Relationship to Byron LEP 2014

This Chapter provides more detailed development controls to enable the effective implementation of the following clauses in Byron LEP 2014:

- ~~• Clause 6.3 Flood planning~~
- ~~• Clause 6.4 Floodplain risk management~~
- Clause 5.21 Flood planning
- Clause 5.22 Special flood considerations

C2.1.6 Climate Change and Flood Planning

The Byron Shire Council Climate Change Strategic Planning Policy ('Policy') sets out Council's accepted climate change parameters to inform the decision making process for strategic, infrastructure and operational planning. The flood planning provisions in this Chapter have been developed having regard to the overall framework of that Policy.

C2.1.7 Relationship to other Chapters in this DCP

This Chapter needs to be read in conjunction with the following Chapters (as applicable): D1 Residential Development in Urban and Special Purpose Zones, D2 Residential Accommodation and Ancillary Development in Rural Zones, D3 Tourist Accommodation, D4 Commercial and Retail Development, D5 Industrial Development and or D6 Subdivision, for development on ~~land at or below the future flood planning level~~. flood prone land.

The provisions in this Chapter prevail over the provisions of other Chapters, unless otherwise specified, where there is an inconsistency.

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C2.1.8 Background Information

Council has carried out a number of Flood Studies within its local government area as described further in Section 2.3.1.

The studies for the Belongil Creek, ~~Marshall's Creek~~, Brunswick River and Tallow Creek catchments have all ~~acknowledged~~ **considered** climate change as per Council's Climate Change Strategic Planning Policy. ~~but have been based on different climate change parameters.~~

~~The above studies~~ These flood studies and floodplain risk management studies/plans along with Council's Climate Change Strategic Planning Policy are the principal reference documents for implementing the provisions of this Chapter.

C2.2 General Assessment Criteria

1. Council will not consent to any development on land **within** ~~at or below~~ the **flood planning area** if there is sufficient suitable area on that land ~~above~~ **outside** the **flood planning area** on which to carry out the development. Note that **flood planning area** is the area below the **flood planning level** in a given catchment.
2. Where the development is on land ~~below the flood planning level~~ **within the flood planning area**, floor levels of any buildings must be constructed at or the above the **flood planning level**. ~~Council will not support filling beneath the building footprint of the proposed development unless it is demonstrated that it will not adversely impact on the floodplain. Filling outside the building footprint generally will not be permitted, other than for driveways and/or pedestrian pathways immediately adjoining the walls of the building.~~ Depending on the development type, different **flood planning levels** may be applicable.
3. Some areas are restricted from filling for development purposes due to risks of cumulative flood impacts – refer to section C2.3.2. Where filling will not create an adverse impact on flood behaviour, filling should be limited to the access & parking areas and/or pedestrian pathways immediately adjoining the walls of the building.
4. Where extensive additions are proposed to lightweight buildings (e.g. **dwelling made primarily from timber, fibrous-cement materials, etc**) the applicant should consider redesigning the whole building to comply with current flood planning controls. **Alternatively, the applicant will need to demonstrate that the proposed alterations and additions satisfactorily minimises flood risk to life.**
5. The adaptability of the development in the face of climate change will be considered in the development approval process. Adaptable developments have the ability to be designed to the **Projected 2050 Flood Planning Level** instead of the **Projected 2100 Flood Planning Level** in most instances.
6. Byron Shire Council has adopted a nominal 500mm (0.5m) freeboard allowance on top of the Defined Flood Event peak flood level (incorporating allowance for climate change) to produce the Flood Planning Levels.

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C2.3 Development Controls

The following steps should be taken to ascertain the flood planning controls relating to development on lands within the flood planning area: ~~land at or below the future flood planning level:~~

- Step 1** Consider the applicable Flood Study and or Floodplain Risk Management Plan for the catchment in which the land is situated. These studies will provide information on flood planning levels and flood hazards (Section C2.3.1).
- Step 2** Consider the specific ~~Flood Planning~~ provisions for the type of development and flood hazard as set out in the flood planning matrix (Table C2.1 below).
- Step 3** Consider any special requirements or standard designs for particular localities (~~Section C2.3.5~~). (Section C2.3.4).

Note: If no applicable study exists (Step 1 above), applicants shall refer to the relevant flood planning requirements set out in Council's Climate Change Strategic Planning Policy and in Section C2.3.2 and Section ~~C2.3.5~~ C2.3.4 below (as applicable); then return to Step 1 upon completion of a study.

A flow chart illustrating the process for determining flood planning controls ~~on land at or below the future flood planning level~~ on flood prone land is included at the end of Section C2.3.1 below (Figure C2.1).

C2.3.1 Applicable Flood Study

The following catchment-based flood studies and floodplain risk management plans have been endorsed by Council:

~~2. Brunswick River Catchment~~

~~a) Brunswick River Flood Study (1986)~~

- ~~i) includes Mullumbimby and Brunswick Heads. The extent of the Brunswick River catchment is shown in Map C2.2.~~

~~Note: this document does not include a climate change assessment; refer to Council's Climate Change Strategic Planning Policy for flood planning level methodology and requirements.~~

~~b) North Byron Coastal Creeks Flood Study (in preparation)~~

- ~~i) includes Mullumbimby, Brunswick Heads, Ocean Shores, New Brighton, South Golden Beach and Billinudgel.~~
- ~~ii) the study area for the North Byron Coastal Creeks Flood Study combines the Brunswick River, Marshalls Creek and Simpsons Creek catchments. The extent of the North Byron Coastal Creeks catchment is shown in Map C2.3.~~

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- ~~c) North Byron Coastal Creeks Floodplain Risk Management Study & Plan (planned to commence in future)~~

APPLICATION:

Until such time as the ~~North Byron Coastal Creeks Flood Study~~ is adopted, the **Projected 2050 Flood Planning Level** applies as follows:

- ~~• where the site of the development is at or below 4m AHD, an additional 0.4m shall be applied to the estimated 1 in 100 year flood level, in addition to the normal 0.5m freeboard.~~
- ~~• where the site of the development is above 4m AHD, the estimated 1 in 100 year flood level shall be used, together with the normal 0.5m freeboard.~~

3. Marshalls Creek Catchment

- ~~a) Marshalls Creek Floodplain Management Plan (1997)~~

- ~~b) Tweed Byron Coastal Creeks Flood Study (2010)~~

- ~~c) Tweed Byron Coastal Creeks Flood Study BSC Climate Change Assessment (2010)~~

- ~~i) includes Ocean Shores, New Brighton, South Golden Beach and Billinudgel. The extent of the Marshalls Creek catchment is shown in Map C2.4.~~

- ~~d) North Byron Coastal Creeks Flood Study (in preparation)~~

- ~~i) refer to Brunswick River catchment~~

APPLICATION:

Until such time as the ~~North Byron Coastal Creeks Flood Study~~ is adopted, the following climate change scenarios shall apply:

- ~~• 2050 Climate Change scenario shall be used for the 2050 Climate Change planning horizon.~~
- ~~• 2100 Climate Change scenario shall be used for the 2100 Climate Change planning horizon.~~

North Byron

The study area for the North Byron Flood Study combines the Brunswick River, Marshalls Creek and Simpsons Creek catchments and includes the townships and localities of Mullumbimby, Brunswick Heads, Ocean Shores, New Brighton, South Golden Beach and Billinudgel. The extent of the North Byron catchment is shown in Map C2.1.

Further details can be found [here](#).

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Belongil Creek

Includes Byron Bay township, Arts and Industry Estate, and Sunrise estate. The extent of the Belongil Creek catchment is shown in Map C2.1.

Further details can be found [here](#).

1. ~~Belongil Creek Catchment~~

~~a) Belongil Creek Flood Study (2009)~~

- ~~i) includes Byron Bay township and industrial estate, West Byron and Sunrise estate. The extent of the Belongil Creek catchment is shown in Map C2.1.~~*

~~b) Belongil Creek Floodplain Risk Management Study & Plan (in preparation)~~

APPLICATION:

~~Until such time as the Belongil Creek Floodplain Risk Management Study & Plan is adopted, the following climate change scenarios in the Belongil Creek Flood Study (2009) shall apply:~~

- ~~• 2050 Climate Change scenario shall be used for the 2050 Climate Change planning horizon.~~
- ~~• 2100 Climate Change scenario shall be used for the 2100 Climate Change planning horizon.~~

Tallow Creek

Includes Suffolk Park, and the estates of Byron Hills and Baywood Chase. The extent of the Tallow Creek catchment is shown in Map C2.1

Further details can be found [here](#).

1. ~~Tallow Creek Catchment~~

~~a) Tallow Creek Flood Study (2002)~~

~~b) Tallow Creek Floodplain Risk Management Study and Plan (2009)~~

- ~~i) includes Suffolk Park, and the estates of Byron Hills and Baywood Chase. The extent of the Tallow Creek catchment is shown in Map C2.5.~~*

- ~~ii) applies until superseded by a more current flood study and management plan for this catchment:~~*

APPLICATION:

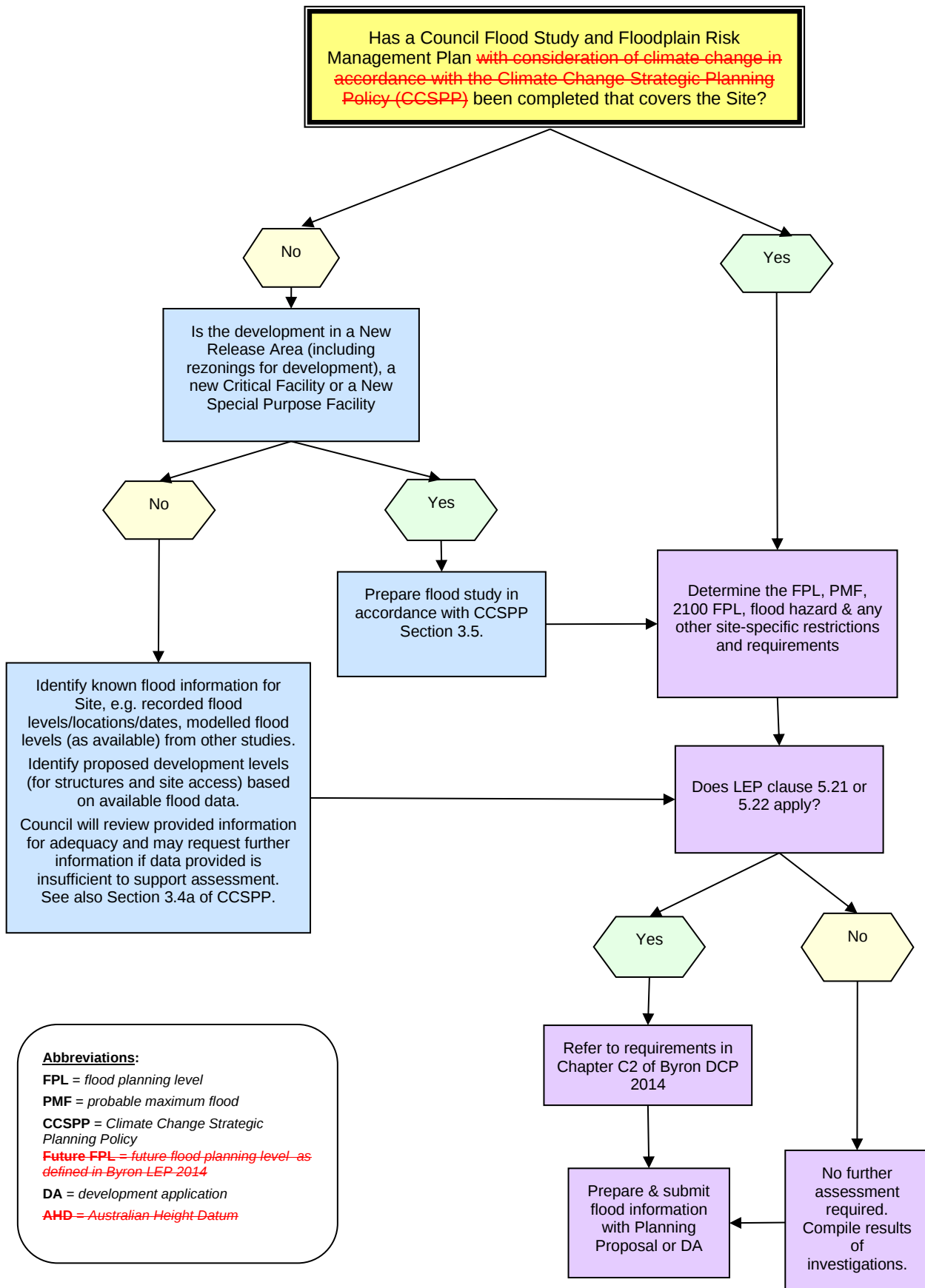
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~~In the absence of more updated flood mapping for this catchment, the following climate change scenarios in the *Tallow Creek Floodplain Risk Management Study and Plan* shall apply:~~

- ~~• 2050 Climate Change scenario shall be used for the 2050 Climate Change planning horizon.~~
- ~~• 2100 Climate Change scenario shall be used for the 2100 Climate Change planning horizon.~~

Figure C2.1 – Flow chart illustrating process for determining flood planning controls on flood prone land



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C2.3.2 Flood Planning Matrix

The **flood planning matrix** below sets out general planning considerations for development based on the following key elements:

1. Minimum Fill Levels
2. Minimum Floor Level
3. Building Components
4. Structural Soundness
5. Flood Effect
6. Flood Emergency

Elements are evaluated against differing flood hazard categories which are indicative of some aspects of flood risk.

~~The flood planning matrix below sets out general planning requirements for “low / intermediate” and “high” hazard flood categories. The flood affectation or hazard of a property or part of a property may change when considering climate change.~~

To satisfy the provisions of the LEP, developments must ~~not only~~ demonstrate compliance with the *Flood Planning Area Primary Constraints* in the **flood planning matrix**. ~~but must also demonstrate compliance with the Additional Constraints~~ The *Flood Planning Area Constraints* relate to land to which LEP clause 5.21 applies (i.e. land within the **flood planning area**) ~~(i.e. land at or below the flood planning level)~~, while additional constraints relate to land to which LEP clause 5.22 applies (i.e. all flood prone lands).

Clauses 5.21 (Flood Planning) requires Council to consider the effects of flooding on a development, and conversely the development's effects on flooding. Council needs to be satisfied that future developments are not adversely impacted by flooding, i.e. floods pose an acceptable risk to life and property, and that future occupants of a development can be evacuated or they can safely refuge in a nominated location.

In terms of flood effect, new developments can give rise to off-site impacts that can materially worsen flooding on adjoining lands and property, as such impacts of this nature need to be within acceptable limits. In considering flood effects, Council must not only consider impacts as likely to be experienced in the current climate, but also those that may be experienced in the future with climate change, and those resulting from likely future development, which is also known as 'cumulative' impact.

~~The flood planning matrix will not prevail over any special provisions set out in Section C2.3.5.~~

The **flood planning matrix** makes provision for these aspects, however it does not prevail over any special provisions set out in Section C2.3.4.

The following provides further context around the above flood planning elements and considerations.

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Minimum Fill Levels

1. Certain types of development e.g. **critical facilities** and are not recommended for filling and may need to be located outside of flood prone land.
2. Filling may not be suitable in some locations due to its flood function and or hazard.
3. Placement of fill can generate off-site flood impacts; these impacts may require assessment as part of a Planning Proposal and or Development Application.
4. Existing overland flow paths should not be obstructed by placement of fill without provision of suitable alternative drainage solutions.
5. Filling may not be possible in some locations due to the potential cumulative impacts of development in that region, reference should be made to [Council's Online Mapping Tool](#) for details of no-fill areas and Council's adopted flood studies and management plans. However, flood impacts associated with filling can be mitigated on some sites with approaches such as cut and fill balancing.
6. If filling is permissible in a location and flood impacts are acceptable, this element provides details of the minimum fill level applicable to the development.

~~C2.3.2 Minimum Floor Levels~~

- ~~7. The finished floor level of **habitable rooms** must be above the relevant level defined by the **flood planning matrix**. Analysis and certification by a suitably qualified structural engineer will be required where the finished floor level of enclosed 'non-habitable' rooms is more than 1.0 metre below the 1:100-year flood level.~~
- ~~8. Developments in **new release areas**, certain rezoning proposals, **critical facilities** and **special purpose facilities** requiring a longer flood planning horizon are generally required to achieve the **Projected 2100 Flood Planning Level**.~~
- ~~9. New dwellings in existing residential areas are generally required to achieve the **Projected 2050 Flood Planning Level**. Adaptable building design is encouraged so that dwellings on piers, posts, columns or piles can be raised in future to accommodate climate change. Where concrete slab on ground is necessary the slab level shall be finished at least 300mm above the surrounding ground, as well as achieve the **Projected 2050 Flood Planning Level**.~~
- ~~10. Commercial and Industrial floor levels are generally required to achieve the **Projected 2050 Flood Planning Level**. Where this cannot occur, Council will consider flood proofing and emergency storage above the **Projected 2050 Flood Planning Level** to minimise damage that may occur during flooding (refer to sections C2.3.4 Flood Proofing and C2.3.5 Special Provisions).~~

Minimum Floor Levels

1. The finished floor level of **habitable rooms** must be above the **relevant level flood planning level** defined by the **flood planning matrix**. Analysis and certification by a suitably qualified structural engineer may be required where the finished floor level of enclosed 'non-habitable' rooms is ~~more than 1.0 metre below the 1:100-year flood level~~ below the flood planning level. This will need to be consistent with the [National Construction Code](#) requirements for buildings in flood hazard areas.

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2. Developments in **new release areas**, certain rezoning proposals, **critical facilities** and **special purpose facilities** requiring a longer flood planning horizon are generally required to achieve the **Projected 2100 Flood Planning Level**.
3. New dwellings in existing residential areas are generally required to achieve the **Projected 2050 Flood Planning Level**. Adaptable building design is encouraged so that dwellings on piers, posts, columns or piles can be raised in future to accommodate climate change. Where concrete slab on ground is necessary the slab level shall be finished at least 300mm above the surrounding ground, as well as achieve the **Projected 2050 Flood Planning Level**.
4. Commercial and Industrial floor levels are generally required to achieve the **Projected 2050 Flood Planning Level**. Where this cannot occur, Council will consider flood proofing and emergency storage above the **Projected 2050 Flood Planning Level** to minimise damage that may occur during flooding (refer to sections **C2.3.3** ~~C2.3.4~~ Flood Proofing and **C2.3.4** ~~C2.3.5~~ Special Provisions).
5. Some **Critical Facilities** and **Special Purpose Facilities** will require minimum floor levels above the **Projected 2100 Flood Planning Level** to meet the requirements of LEP clause 5.22 Special Flood Considerations, which considers specific sensitive and hazardous development types.

Building Components and Structural Soundness

1. Relates to the design and material requirements for differing types of structures located in different flood hazard categories. Noting that requirements increase for buildings subject to increased depths and velocities of inundation.

Flood Effect

1. Development in flood prone areas has the potential to impact on flood behaviour in locations external to the development itself.
2. The degree of impact varies based on a number of factors including the scale of the development, its location in a catchment and the magnitude of the flood event.
3. In instances a Flood Impact Assessment study may be required to define the location and degree of impact expected as a result of the development.

Flood Emergency Management

1. Flood emergency considerations are important in determining land use suitability. There is a requirement to ensure that the intended land uses and associated infrastructure, such as access and egress routes, can ensure the safe occupation and efficient evacuation of persons in the event of a flood.
2. Flood emergencies must be considered for all new developments on flood prone lands.
3. Applicants may be required to provide information to support their development.
4. Information requirements may increase for larger developments, particularly those catering to vulnerable community and development located in locations likely to be inundated or isolated for extended periods during flood.
5. Elements of flood emergency information may be available in the Local Flood Plan for existing urban areas, other data will be available in flood studies and flood plain risk management studies.

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6. Council will be responsible for assessing many types of development, however, some developments may be referred to State government agencies (including the SES) which may have alternative or additional flood emergency planning requirements.

EXPLANATORY NOTE – Using Table C2.1 Flood Planning Matrix

The aim of the flood planning matrix is to enable users to identify the relevant flood management elements to guide development form. The matrix will provide a unique set of guidance for individual and diverse developments.

Use the matrix to identify the relevant requirements for each element type. Requirements identified for each element add context to the degree of flood management effort that will be required to support different types of development in differing locations through the Shire.

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Table C2.1 – Flood Planning Matrix

(continued overleaf)

ELEMENTS	DEVELOPMENT / BUILDING TYPE	Flood Planning Area Constraints ¹		
		Existing Climate Flood Hazard Categories		
		No Hazard	Low/Intermediate Hazard	High Hazard
Land Use Suitability & Minimum Fill Level	Development in New Release Areas, unless separately defined below	N/A	SF2	
	Development in New Release Areas , unless separately defined below	N/A	SF2	
	Development in all other areas unless separately defined below	N/A	SF1	
	Non-habitable building or room (e.g. shed, carport, garage, toilet, laundry, shelter, etc)	N/A	SF1	SF1
	Emergency Services New Critical Facilities Site (Hospitals, etc) → see glossary for definition	N/A	SF3a	
	New Special Purpose Facilities → see glossary for definition	N/A	SF3b	
Minimum Floor Level	Development in New Release Areas unless separately defined below	FL3	FL3	
	Development in all other areas unless separately defined below	FL2	FL2	
	Dwelling additions, except in New Release Areas	N/A	FL4	
	Non-habitable building or room (e.g. shed, carport, garage, toilet, laundry, shelter, etc)	N/A	FL1	
	New Critical Facilities (Hospitals, etc.) or Special Purpose Facilities (School, etc.)	FL3a	FL3a	
	New Special Purpose Facilities	FL3	FL3	

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ELEMENTS	DEVELOPMENT / BUILDING TYPE	Flood Planning Area Constraints ¹		
		Existing Climate Flood Hazard Categories		
		No Hazard	Low/Intermediate Hazard	High Hazard
Building Components	All	N/A	BC1	
Structural Soundness	Ancillary Building (e.g. shed, carport)	N/A	SS1	SS1
	Other Building	N/A	SS1	SS2
Flood Effect	Development in New Release Areas , unless separately defined	N/A	FE2	
	Development in all other areas unless separately defined below	N/A	FE2	
	Alterations and additions, non-habitable building or room (e.g. shed, carport, garage, toilet, laundry, shelter, etc)	N/A	FE1	
	Other developments (road raising, etc)	N/A	FE3	FE3
Flood Emergency Management Evacuation & Access	Development in all other areas unless separately defined below	N/A	EA1	
	Development in New Release Areas , unless separately defined	N/A	EA2	
	Critical Facilities	N/A	EA3a	
	Other Special Purpose Facilities	N/A	EA3b	

Legend to above table:

¹ Refer to relevant flood study for definition of hazard categories. Generally flood studies reference a low, intermediate and high hazard category definition. The North Byron Floodplain Risk Management Study references a six-band (H1-H6) hazard categorisation as per the *Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia AIDR 2017*. Council generally regards Low Hazard as H1 and H2, Intermediate as H3 and High Hazard as H4 to H6, although this is an approximation only.

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ELEMENTS	DEVELOPMENT / BUILDING TYPE	Flood Planning Area Constraints ¹		
		Existing Climate Flood Hazard Categories		
		No Hazard	Low/Intermediate Hazard	High Hazard

N/A = Element Not Applicable

 = Unsuitable Land Use - Not considered suitable for development

Table C2.1 – Flood Planning Matrix (continued from previous page)

CONTROL MEASURES	
SF1	MINIMUM FILL LEVEL
	Consider for development subject to the controls below. No minimum fill level required.
SF2	Consider for development subject to the controls below. For new residential, commercial and industrial release areas, the minimum fill level to be greater than or equal to the 1 in 100 ARI (average recurrent interval) flood event plus projected climate changes allowances for the year 2100.
SF3a	Consider for development subject to the controls below. Where possible Emergency Services should be located on land currently flood free during the PMF event. Minimum fill level should be greater than or equal to the existing climate PMF flood level.
	Where practical the minimum fill level should be greater than or equal to the existing climate PMF flood level.
SF3b	Consider for development subject to the controls below. Council to give consideration on the benefits of using the development during and after a flood emergency Minimum fill level to be greater than or equal to the 1 in 100 ARI flood event plus projected climate changes allowances for the year 2100. Higher fill levels may be required to further reduce risk depending on site use and specifics.
	existing climate PMF flood level.

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	MINIMUM FLOOR LEVEL
FL1	All floor levels to be greater than or equal to the 5% AEP flood level. 20 year ARI flood level plus 0.3m.
FL2	All floor levels to be greater than or equal to the Projected 2050 Flood Planning Level. (FPL2).
FL3	All floor levels to be greater than or equal to the Projected 2100 Flood Planning Level. (FPL3).
FL3a	If practical, all floor levels to be greater than or equal to the Projected 2100 Flood Planning Level (FPL3), so that these buildings will be available for accommodation / storage during and after a flood emergency. If practical, all floor levels to be greater than or equal to the existing climate PMF flood level.
FL4	Floor levels to be as close to the <i>minimum floor level</i> above (FPL2) as practical and not less than the floor level of the existing building being extended if the existing floor level is less than or equal to the minimum floor level. If the extended weatherproof area ¹ exceeds 50% of the existing weatherproof area, the extension is treated as a new building. The extended weatherproof area is measured as the cumulative area of any previous extensions plus the proposed extension. Temporary flood protections to be considered for dwellings that have a residual flood risk that could reasonably be mitigated with such approaches, e.g. sandbagging or other barriers to limit flood water ingress. If building is identified as being suitable for voluntary house raising scheme, Council to discuss potential house raising with owner.
	BUILDING COMPONENTS
BC1	Buildings to have flood compatible material below the relevant flood planning level according to development/building type. Refer to Flood Proofing Section 2.3.3.
	STRUCTURAL SOUNDNESS
SS1	No structural soundness requirements for the force of floodwater, debris & buoyancy. Must still comply with the National Construction Code (formerly BCA) requirements. If structure is to be used for Shelter in Place refuge during flood events, engineers report will be required to considered structural integrity is maintained up to and including the PMF event.
SS2	Engineers report to prove that structures subject to a flood up to the 100-year event can withstand the force of floodwater, debris & buoyancy. PMF can withstand the force of floodwater, debris & buoyancy provided the structure serves no role in providing safe refuge during a flood event (i.e. shelter in place). If structure is to be used for Shelter in Place refuge during flood events, engineers report will be required to consider structural integrity is maintained up to and including the PMF event.
	FLOOD EFFECT
FE1	No action required.

¹ Weatherproof Area is defined as 'gross floor area of habitable rooms with floor levels below the 2050 flood planning level'.

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FE2	The flood impact of the development to be considered by Council, with Council having the right to request an engineer's report (see FE3 below).
FE3	Engineers report required to prove that the development will not result in adverse flood impact elsewhere. Engineers report required demonstrating development achieves an acceptable level of flood impact external to development site (e.g. afflux or increase in peak flood level) in the current climate and also as a result of climate change . In urban areas afflux must be limited to no more than 10mm. Refer to Flood Impact and Risk Assessment guidelines for example (include link) .
EA1	FLOOD EMERGENCY MANAGEMENT Council to provide information on flood evacuation strategy. Provide flood emergency information as per Section C2.3.5 'Infill Development and Redevelopment'.
EA2	Site specific Flood Evacuation Strategy be developed consistent with Council / SES overall Flood Evacuation Strategy. Provide information as per Section 2.3.5 'Greenfield developments, rezonings and new communities'. If the location is outside the current coverage of the Local Flood Plan, an Evacuation Capability Assessment may also be required.
EA3a	Emergency service site – should have good access up to the PMF and preferably not cut-off from the main residential area(s). Generally Critical Facilities should be at or above the PMF level, however, further information may be required in respect of access and egress routes to and from the Site during flood events.
	Council to evaluate suitability of site in this respect.
EA3b	If site to be used during and after a flood emergency (see FL3a above), should have good access up to the PMF and preferably not cut-off from the main residential area(s). Provide flood emergency information as per Section C2.3.5 'Infill Development and Redevelopment'.

~~C2.3.4~~ C2.3.3 Flood Proofing

1. Flood Compatible Material

Materials located below the relevant level defined by the **flood planning matrix** must be capable of resisting damage, deterioration, corrosion or decay taking into account the likely time the material would be in contact with flood water and the likely time it would take for the material to subsequently dry out. The following guidelines may provide further details of flood proofing of buildings undergoing construction or retrofit:

- Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas (2006), Hawkesbury-Nepean Valley Floodplain Management Steering Committee
- Flood Resilient Building Guidance for Queensland Homes (2019), State of Queensland (Queensland Reconstruction Authority)

2. Services

Services and related equipment, other than electricity meters, must not be located below the relevant **flood planning level** defined by the **flood planning matrix** unless they have been designed specifically to cope with flood water inundation. The location of electricity meters is regulated by the electricity supply authority.

Unless the electricity supply authority determines otherwise, electrical switches must be placed above the relevant level defined by the **flood planning matrix**. Electrical conduits and cables installed below the relevant level defined by the **flood planning matrix** must be waterproofed or placed in waterproof enclosures.

3. Enclosures

Any enclosure located below the relevant level defined by the **flood planning matrix** must have openings to allow for automatic entry and exit of floodwater for all floods up to the relevant level defined by the **flood planning matrix**.

~~C2.3.5~~ C2.3.4 Special Provisions

1. CBD infill development

For infill development in a commercial centre, change of use and additions to existing commercial premises, the current floor level (compatible with the footpath level) can be retained. However buildings must comply with section ~~C2.3.4~~ C2.3.3 Flood Proofing.

For car parking, there may be instances where it is not possible to comply with minimum floor level for parking space (ie due to gradients), especially in Mullumbimby, New Brighton, Ocean Shores, Billinudgel. Variation/s under such circumstances will be considered on their merits.

2. Cumulative Development and No-fill (or No Development) Zones

Due to the potential effects of ongoing catchment development, particularly in highly sensitive areas, no-fill zones and other development restrictions have been identified across the Shire based on assessments completed as part of the Floodplain Risk Management Studies. Reference should be made to [Council's Online Mapping Tool](#) for details of no-fill areas.

Development in no-fill zones may be possible in certain instances where impacts of flooding have been mitigated through an appropriate design response.

2.3. New Brighton, South Golden Beach and Billinudgel

Dwellings in this area are subject to frequent low level flooding.

~~Refer to Councils Marshalls Creek Floodplain Management Plan (1997) for land that cannot be filled.~~ Preferable building type is on piers, with car parking located under, and with under floor area to remain clear of infill construction. The area shall not be used for storage, nor infilled at a later date.

For the Billinudgel town centre, it is recommended that development should comply with the following:

- Maximum development footprint of 50% of the total lot area,
- Maximum fill level set to the 1% AEP + 0.5m freeboard, although minimum habitable floor levels greater than this may still apply.

The restrictions are suggested to reduce the impact of development on flood behaviour, but are not expected to entirely mitigate it.

3. 4. Tallow Creek Flood Study Catchment ~~(Map C2.5)~~

This study found that buildings / dwellings should be 0.5m above the 2100 Climate Change flood levels.

~~Refer to the Tallow Creek Floodplain Management Plan (2009) for land that cannot be filled.~~
Preferable

For future development in 'no fill' areas, building type should be on piers, with car parking located under, and with under floor area to remain clear of infill construction. The area shall not be used for storage, nor infilled at a later date.

4. 5. Bangalow

Council does not currently have any adopted flood studies or management plans for Bangalow. Where development is proposed on land that is or may be considered ~~at or below the flood planning level~~ within a flood planning area, the applicant will be required to submit a report using local flood information to satisfy the provisions in the flood planning matrix. In some instances a professional Civil / Hydraulic Engineer (with qualifications suitable for admission as a corporate Member of Engineers Australia) will be required to prepare this report or a flood study (Refer to Section B3.2.3 of Chapter B3 Services for further guidance).

Local flood information could be anecdotal flood heights (i.e. highest recorded flood height) or flood studies carried out for previous rezoning or large development applications.

5. 6. Basement Car Parks

Any basement car park shall incorporate design elements (e.g. ramps etc) or automatic mechanisms (e.g. hydraulic barriers etc) to prevent the ingress of flood waters. The design elements or mechanisms are to comply with at a minimum the Projected 2050 Flood Planning

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Level. The basement shall also include facilities for the pumping of water in the event of failure, or larger flood events.

6. 7. Rural Areas

Council does not hold plans or records for flooding in most rural areas, other than in the defined catchments (refer to Section C2.3.1 and Map C2.1). Flood models do exist in some rural areas and discussion with Council's flood planning staff should occur prior to their use to ascertain their applicability and limitations. For instance the models developed for the major catchments discussed in Section C2.3.1 have been developed in accordance with the procedures outlined in the NSW Floodplain Development Manual (now known to as the Flood Risk Management Manual). ~~In certain rural areas, floodplains may be steep and narrow, and are liable to rapid flood inundation with little warning.~~

In the absence of current flood information, persons proposing new developments in rural areas near rivers, streams and gullies that could be subject to flood inundation should seek out and use reliable local historical information on peak flood levels experienced during prior flood events as an initial guide. ~~Catchment flood studies may be required to establish design flood levels, flow rates for structural design, and to assess the potential impact of the development on local flood behaviour. Refer to Section B3.2.3 of Chapter B3 Services for further guidance.~~

A catchment based flood study may be required to establish **flood planning levels**, flow velocity and depths for structural design, and resultant flood impacts resulting from development, , e.g. generation of flood afflux or changes in flow velocity and direction, etc.

Where development is proposed on **flood prone** rural land ~~that may be considered flood liable land~~, the applicant will be required to submit a report using local flood information, establishing the levels on the site ~~equivalent to the Projected 2050 Flood Planning Level in relation to any dwelling, residential, tourist or commercial project~~ appropriate to the development type as per the **flood planning matrix**. In some instances a professional Civil / Hydraulic Engineer (with qualifications suitable for admission as a corporate Member of Engineers Australia) will be required to prepare this report or a flood study.

The floor level of any **dwelling** shall be at or above the **Projected 2050 Flood Planning Level** while the floor level for other types of development will be determined on a case-by-case basis.

8. Rural Crossings

Within upper catchment areas there are many minor road crossings. And typically, flood runoff rises and falls quickly in these parts of the catchment in response to rainfall. As such these crossings need to be designed to provide a reasonable level of service (i.e. trafficability) having regard to the extent of upstream development they service, and the nature of inundation experienced at the crossing location, i.e. peak flood levels and duration of inundation, etc.

Access roads and driveways servicing more than three (3) dwellings are to provide flood crossings with an immunity in accordance with Council's adopted engineering standards. Where less than three (3) dwellings are serviced and Council's adopted engineering standards are too onerous, the access or driveway is not to be inundated by more than 200mm depth with a velocity x depth ratio of less than 0.6 m²/s during a 20% AEP flood and a time of closure not exceeding 6 hours. Appropriate warning signage and depth indicators must be provided. Variations must be supported with a report prepared by a suitably qualified engineer demonstrating the safety of people and vehicles during a flood.

It is likely a professional Civil / Hydraulic Engineer (with qualifications suitable for admission as a corporate Member of Engineers Australia) will be required to prepare a flood study to provide this information.

~~Deleted~~ ~~Insert deleted maps if necessary~~

~~Map C2.1 — Belongil Creek Flood Study Area Locality Plan~~

~~Map C2.2 — Brunswick River Flood Study Area Locality Plan~~

~~Map C2.3 — North Byron Coastal Creeks Flood Study Area Locality Plan~~

~~Map C2.4 — Marshalls Creek Flood Study Area Locality Plan~~

~~Map C2.5 — Tallow Creek Flood Study Area Locality Plan~~

C2.3.5 Flood Emergency Management

Introduction

The SES is the lead agency for flood emergency management and flood combat in NSW. Within the Byron Shire, the SES has prepared the Byron Local Flood Plan (LFP) as the lead document to be applied during a flood event.

The Byron LFP (external link [here](#)) has been prepared to cover all relevant flood threats to community and strategies available to emergency managers to these minimise risks where information has been available to inform it.

The Byron LFP has been prepared to account for the variability of flood events, their severity and available information to predict their evolution. Currently, the Byron LFP reflects flood knowledge compiled by Byron Shire Council in its available flood studies and floodplain risk management plans. Hence, there are some limitations in the extent of detailed coverage within the LFP as not all portions of the Byron Shire are covered by Council flood studies.

Currently, the SES recommends evacuation as the primary response to flooding. This involves evacuation of the community that is likely to be flood affected, to an area outside of the effects of flooding that has adequate facilities to maintain the safety of the evacuated community for the duration of the event.

In locations where there is a fast response to flooding, i.e. the time to peak flooding is up to or less than six hours, there is likely to be a reduced ability to evacuate community in these areas due the likely rapid onset of the flood event, and an inability to mobilise an effective evacuation in such a limited timeframe. In these locations a potentially suitable response is to seek refuge in a dwelling, also known as 'shelter-in-place'. This is where community reside in structurally sound buildings that are resistant to flood flows, that also provide refuge above the **probable maximum flood (PMF)** level.

NSW Government is currently considering potentially acceptable conditions for 'shelter in place' to be adopted. These will need to balance the benefits of this action, versus the risks. There are

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many unknown risks that can present to those sheltering in place during flood events, e.g. medical emergencies, fire, loss of communication, impact of isolation on mental health, etc. These potential emergencies may result in rescue attempts that place both the occupants and rescuers in danger.

It is possible that shelter-in-place requirements will become more accepted and standardised across NSW, however, evacuation is the SES's preferred outcome. Accordingly greenfield habitable (i.e. residential) development should not recommend shelter-in-place as a primary response to flooding.

The SES also does not support the adoption of individual development-specific flood emergency response plans as a means to support development approval. These plans are considered ineffective in the strategic management of flood risks across a community during a flood event.

Infill Development and Redevelopment

Byron Shire Council will generally be responsible for determining new development applications that may be considered to be infill or redevelopment in nature.

This is where the proposed development is largely consistent with existing zoning, however, if within the **flood planning area**, the applicant may need to demonstrate to Council that flood risks have been appropriately considered.

Generally, infill development and redevelopment in the major urban centres of the Shire (i.e. Byron Bay, Mullumbimby, Brunswick Heads, Suffolk Park, etc) will be covered under existing flood emergency arrangements outlined in current the Local Flood Plan. For locations outside of existing Local Flood Plan coverage, Figure C2.2 below provides a flowchart of flood emergency considerations.

The applicant in working through the flowchart would necessarily provide the following types of information to Council for consideration:

- Proposed use and tenure of the land (tenure may be body corporate)
- Number and demographic of occupants, noting if future users of the site will be known to have increased vulnerability to flood risks (e.g. child-care, or aged-care, mobile homes, etc)
- Identification of flood characteristics including flood hazard and peak flood levels for the **Projected 2050 Flood Planning Level** and **Projected 2100 Flood Planning Level** and **PMF** flood events across the development area noting that for some large rural sites, these may vary over the property.
- Provide details of likely type of flooding to be experienced at the site (e.g. rapid flooding, riverine, etc) and associated time to onset of flooding and likely duration of flooding (for 100 year **ARI** event and **PMF**).
- Identify if self-evacuation of the Site is possible (noting that this is preferred), and if so what is the intended mode of transport, evacuation route and intended evacuation location.
- If shelter in place is proposed, identify specifics of the refuge (elevation, size, facilities, etc) and its suitability as a refuge identifying any contingencies in place for complete loss of services.

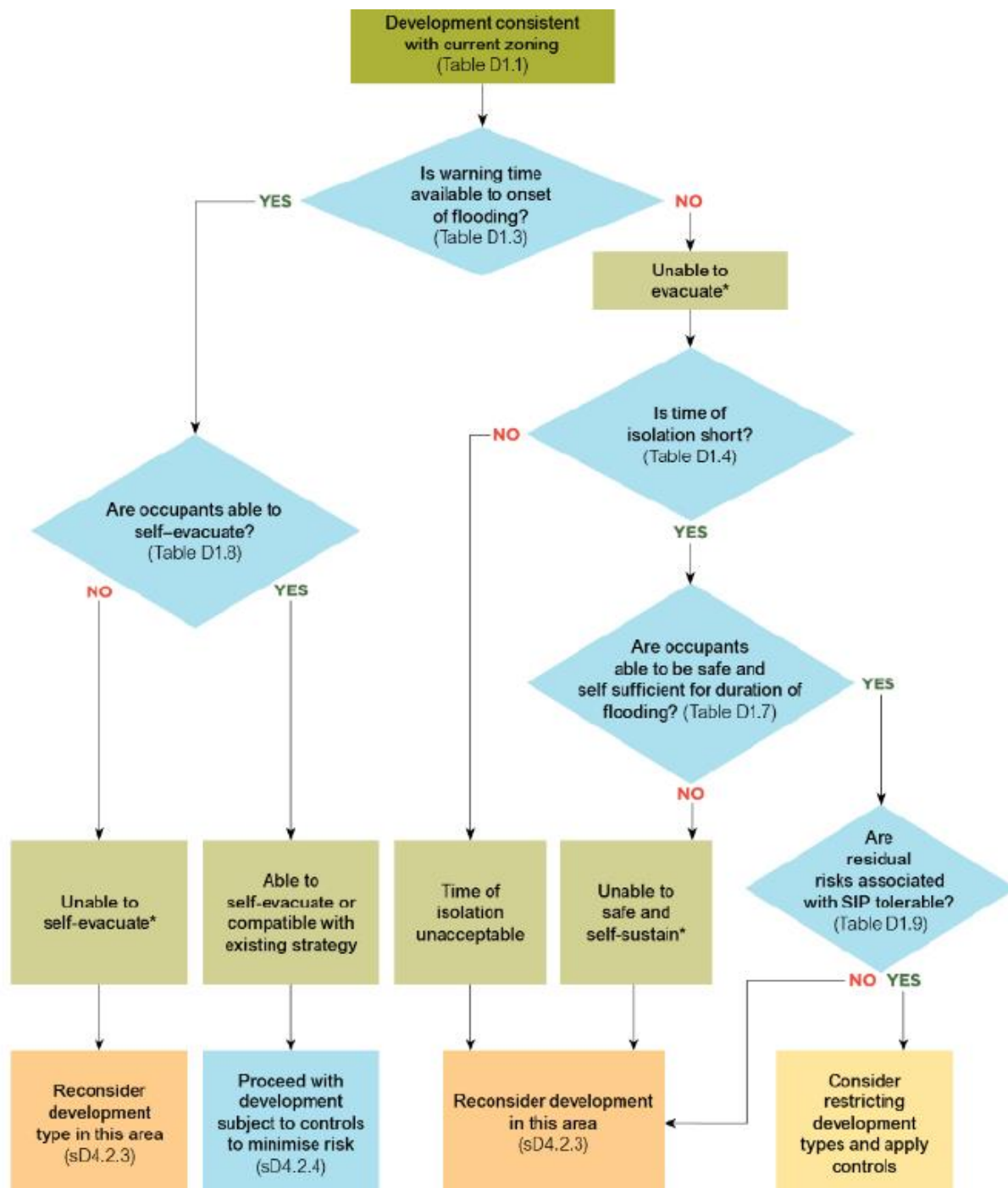
Evacuation routes should not involve egress along roads also subject to inundation above the 1% AEP event unless it can be demonstrated that the inundation of the egress routes will remain safe and provide ample time for evacuation prior to this inundation occurring.

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Contingencies that flood refuges need to consider include provision of food supplies, clean water, sanitation, backup power and communication (if feasible) and sufficient space, especially in the event of expected longer periods of isolation.

Flood risks typically increase for larger flood events and flood levels can exceed adopted flood planning levels, and hence there may be a need to consider flood events up to the PMF.



*'Evacuate' or 'Evacuation' means self evacuation based on flood triggers to an area outside of floodwaters with adequate services to sustain evacuees

Figure 21 Considering emergency management in redevelopment or infill development compatible with existing zoning

Figure C2.2 Redevelopment and Infill Development (DPE, 2022)

This document is available on the Council's [website](#)

Greenfield developments, rezonings and new communities

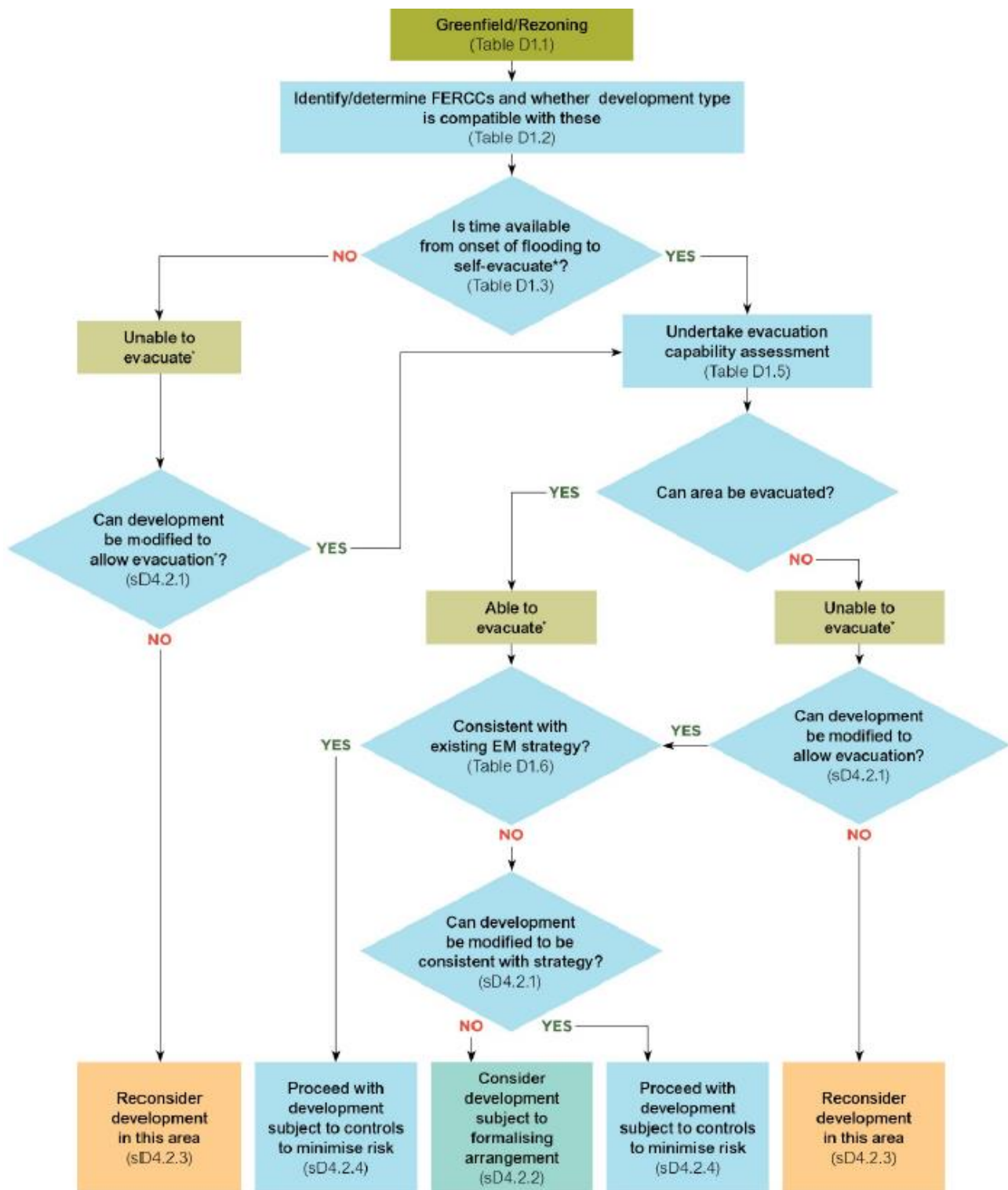
Planning proposals seeking to amend a Local Environment Plan to permit habitable uses and/or intensified residential development in flood prone areas will need to consider a variety of criteria in respect of acceptability as administered by the relevant State agency responsible for the approval. These may include a variety of specifics in respect of flood function² and flood hazards present at the intended location of the development, in addition to the potential effects of the proposal in terms of flood impact.

Other developments such as greenfield developments or new communities on existing zoned lands (i.e. **new release areas**) may also need to be considered by Council. Figure C2.3 below, provides a flowchart of flood emergency management considerations for these types of developments and rezonings.

Key details include to be provided by the applicant include:

- Identification of the flood emergency response classification of communities (FERCC) at the location of the development for the 1% **AEP** and **PMF** flood events (see Annexure 1 for further information on FERCCs)
- Provision of an evacuation capability assessment (see below for further information)
- Relationship of the proposed development to existing evacuation measures proposed under the Byron Local Flood Plan, noting that new developments have the ability to impact on the evacuation capacity of existing community areas (e.g. additional use of evacuation routes, centres and other limited resources).

² Floodway, flood storage or flood fringe – see also Glossary



*"Evacuate" or "Evacuation" means self-evacuation based on flood triggers to an area outside of floodwaters with adequate services to sustain evacuees

Figure 20 Considering emergency management in greenfield developments, rezoning and creating new communities

Figure C2.3 Greenfield Developments, Rezoning and New Communities (DPE, 2022)

Evacuation Capability Assessment

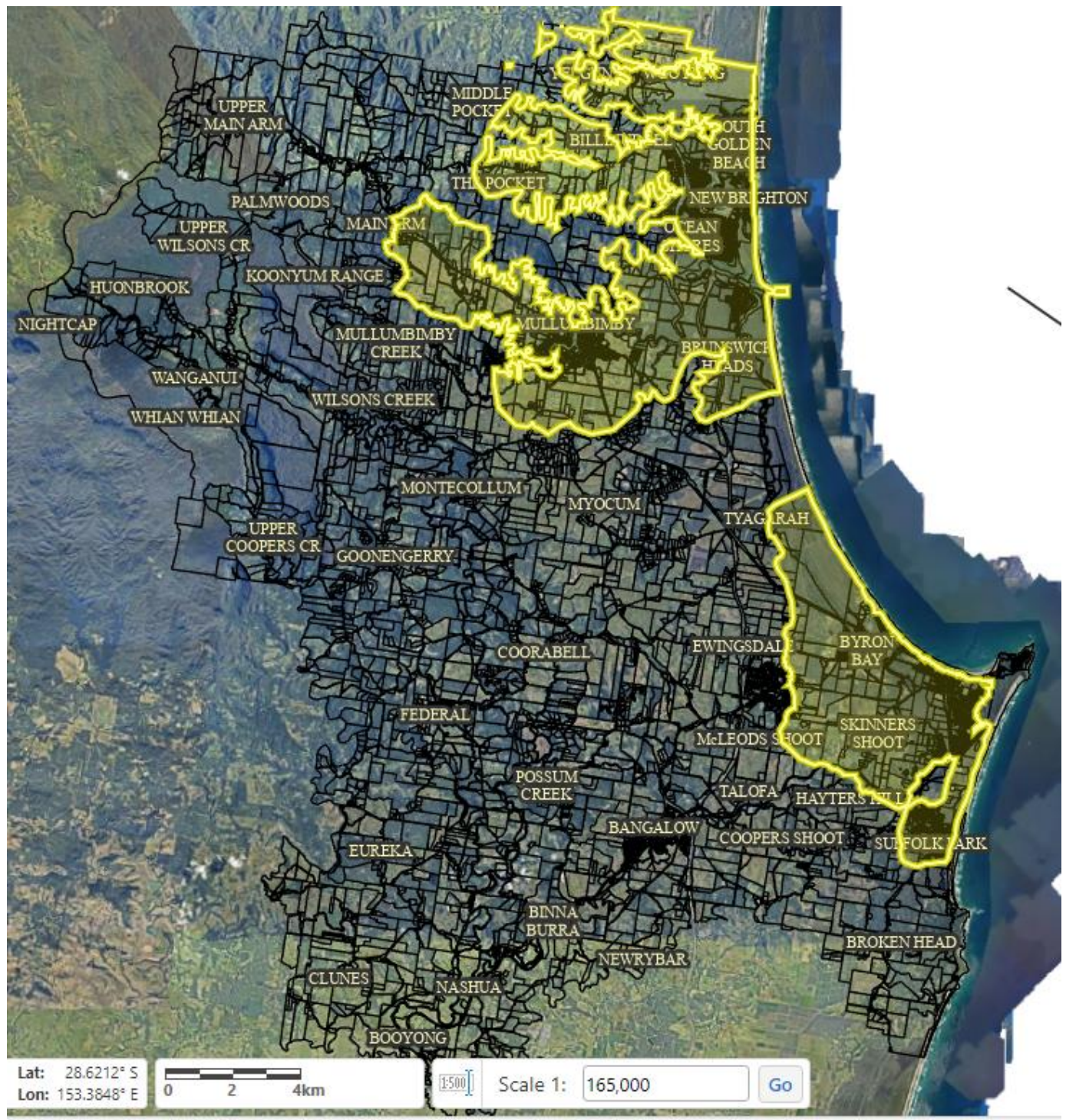
Greenfield developments and or new community areas outside of locations detailed under an existing Local Flood Plan should complete a detailed evacuation capability assessment. The assessment will consider in detail the specifics of a proposal and its relationship to existing community features (e.g. evacuation routes and centres).

The assessment would consider a variety of factors that describe the size, nature, design and setting of the development in its existing environment. Particularly the assessment may consider the proposed land use change, development density/populations and likely demographics (and associated vulnerability of these demographics). Internal development layouts, proposed topography and relationship to surrounding topographic features (if relevant). The assessment may identify the locations of internal roads and their linkages to existing road networks.

Details of evacuation strategies, such as dedicated transport or self-drive options should be identified. Details of available flood warning systems relevant to the proposal should be outlined. Examples of flood warning systems may include presence of nearby rainfall and water level gauges (particularly those with real-time systems updating via the internet). Note, some water level gauges (such as those on the Bureau of Meteorology website) have flood classes associated with water levels indicating the current status of flooding as either minor, moderate or major which can be of assistance. Some catchments may have specific and dedicated flood warning systems already which can be accessed for information or relied upon to some extent for evacuation purposes.

Overall, the evacuation capability assessment should be able to identify that if site evacuation were required there would exist sufficient time for those required to evacuate to safely travel via the identified means of transport and evacuation route(s) to the nominated evacuation centre or area, allowing for contingencies and uncertainties. Shelter in place is not likely to be a suitable option for a greenfield habitable (i.e. residential) development or new community. Temporary sheltering in place may be acceptable for non-habitable development types provided the refuge is of a suitable design and is sufficiently equipped for the emergency.

Map C2.1 – Byron Shire Flood Studies Locality Plan



ANNEXURE 1 – Additional Information

Relationship of Average Recurrence Interval (ARI) and Annual Exceedance Probability (AEP)

The Australian Rainfall and Runoff Guidelines (2019) have recently adopted alternative terminology to describe the flood probability of a design flood event. 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. The following are common interchangeable terms:

- 18% AEP – 5 year ARI
- 10% AEP - 10 year ARI
- 5% AEP - 20 year ARI
- 2% AEP - 50 year ARI
- 1% AEP - 100 year ARI
- 0.2% AEP - 500 year ARI

Flood Emergency Response Classification of Communities (FERCCs)

The flood emergency response classification of communities (FERCCs) is a classification of regions within flood prone areas that distinguishes differences based on isolation or inundation by floodwaters and surrounding topography and its ability to support evacuation.

FERCCs are useful in support of emergency management planning and management of actual flood risks as the classification provides an understanding of isolation and potential risks and associated consequences for certain flood events.

FERCCs are also useful in land use and infrastructure planning as they can be used to inform development patterns. Ideally new development and communities will avoid expansion into increasingly isolated areas and or those exposed to higher flood risk. Infrastructure provision can also consider FERCCs in locating essential or support infrastructure.

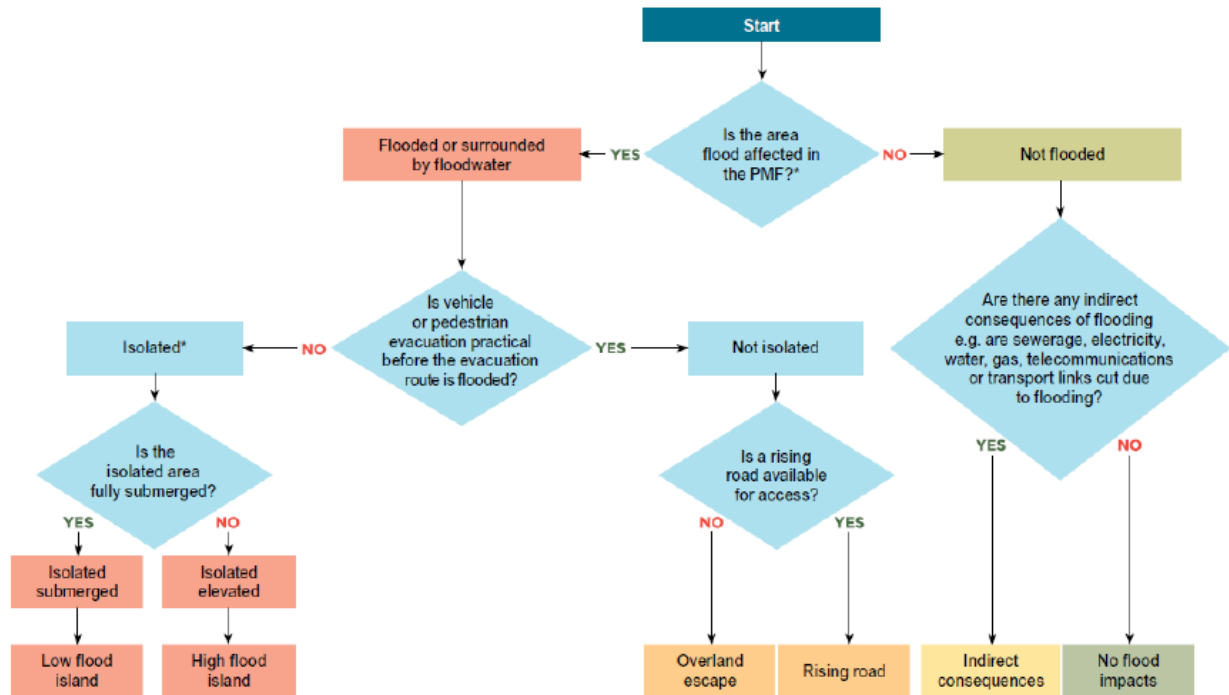
Classifications typically used are detailed below and are based on consideration as to whether the area is flooded, isolated and the consequence of flooding in that area. The following are examples of types of FERCCs that may be identified in a catchment.

- Flood Island – High and low flood islands, high and low trapped perimeter areas
- Areas with rising access out of the floodplain, areas with rising road access and areas with overland escape route
- Indirectly affected areas
- Overland refuge area

FERCCs have been mapped for the parts of the Byron Shire, with some classifications such as low flood islands and low trapped perimeter areas being identified as potentially requiring further

detailed planning and development control due to their inherent risks topographic challenges in times of flood.

If not mapped already, the FERCCs can be determined by reference the following flowchart



Note:

*This is either the PMF, equivalent or the event being used to determine the Flood Emergency Response Classification

Figure 17 Flowchart for determining flood emergency response classifications for flood and flood risk management studies