sustainable ballina shire

November 2011
DRAFT

Ballina Shire Combined Development Control Plan

Chapter 1 - Urban Land

Policy Statement 11- Flood Risk Management

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Figures

Schedules

1 Preliminary

1.1 Introduction

1.1.1 Name

Ballina Shire Combined DCP 2006, Policy Statement No.11 Flood Risk Management.

1.1.2 Purpose

To outline planning controls directed towards the management of flood related risks associated with the development and use of land.

1.1.3 Notes

Notes are included to guide DCP interpretation. The Notes do not form part of the formal requirements of the DCP. To distinguish Notes from the DCP provisions they are contained within a shaded box as illustrated below.

> ***Note**: This is an example of the formatting of interpretative notes within this Chapter of the DCP.*

1.1.4 Land to Which the Plan Applies

The provisions of this Policy apply to all flood liable land within the Ballina Shire. A map showing the separate catchments within the Shire, and the general extent of existing catchment flood mapping is provided as **Figure 1**.

> ***Note**: Not all flood liable land (as defined by this DCP) has been mapped. Reduced copies of existing flood maps adopted by Council are included in **Schedules E and F** of this Plan. More detail should be obtained from Council. Where not mapped but the risk of flooding is suspected, a site specific flood study may be required to be provided with a development application.*

1.1.5 Date Adopted By Council

This Policy was adopted by Council on XX YYYYYY 2011

1.1.6 Effective Date

The Policy commenced on XX YYYYYY 2011

1.1.7 Amendments to this Policy

A schedule of amendments to this Plan is as follows

Amend No.	Main purpose of Amendment	Date of Adoption:	Effective From:

1.1.8 Related Policy / Technical Reports:

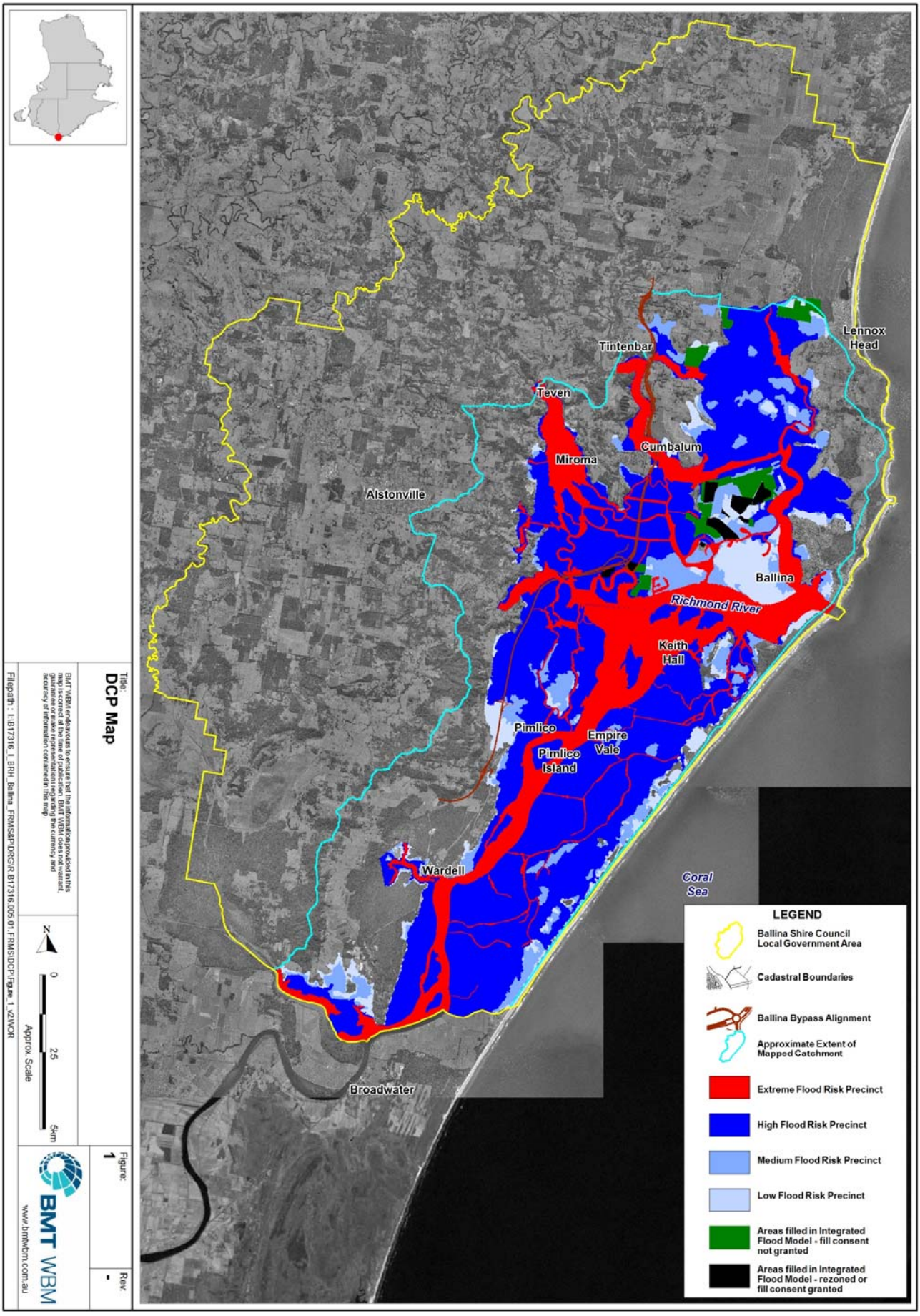
- NSW Coastal Rivers Flood Plain Management Studies - Richmond Valley, Sinclair Knight & Partners, Feb, 1980.
- Richmond Valley Flood Plain Atlas, Sinclair Knight & Partners, Feb, 1982.
- Lower Richmond River Flood Study, N.S.W. State Government, Dec, 1987
- Ballina Floodplain Management Study, WBM Oceanics Australia, 1997
- Floodplain Development Manual, NSW State Government, April 2005 (FDM)
- Wardell and Cabbage Tree Island Floodplain Risk Management Study, Patterson Britton & Partners Pty Ltd, Feb 2007
- Ballina Flood Study Update BMT WBM, March 2008
- NSW Sea Level Rise Policy Statement, DECCW, October 2009
- Ballina Floodplain Risk Management Study and Plan,, BMT WBM, Nov … 2011

1.1.9 Interpretation

The meanings of terms used are provided in the Dictionary at **Schedule A**.

1.2 Background Information

The planning controls reflect the recommendations of Floodplain Risk Management Study Plans (FRMSPs) prepared in accordance with the State Government Flood Prone Lands Policy and Floodplain Development Manual (FDM). in areas where adopted. In areas where FRMS has Ps have not yet been adopted the planning controls reflect Council Policy and are considered to be consistent with the principles of the State Government Flood Prone Lands Policy and FDM.


Lennox Head
Tintenbar
Teven
Cumbalum
Miroma
Alstonville
Ballina
Richmond River
Keith Hall
Pimlico
Empire Vale
Pimlico Island
Wardell
Coral Sea
Broadwater
LEGEND
Ballina Shire Council Local Government Area
Cadastral Boundaries
Ballina Bypass Alignment
Approximate Extent of Mapped Catchment
Extreme Flood Risk Precinct
High Flood Risk Precinct
Medium Flood Risk Precinct
Low Flood Risk Precinct
Areas filled in Integrated Flood Model - fill consent not granted
Areas filled in Integrated Flood Model - rezoned or fill consent granted
Title:
DCP Map
Figure:
1
Rev.
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Approx. Scale
0
2.5
5km
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www.bmtwbm.com.au
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Figure 1: DCP Map

2 Development Controls

2.1 Introduction

This section of the DCP has been developed as an outcome of Floodplain Risk Management Plans prepared in accordance with the process outlined by the NSW Government Flood Prone Lands Policy and the NSW Floodplain Development Manual 2005. In areas where Floodplain Risk Management Plans have not yet been adopted the planning controls reflect Council Policy and are considered to be consistent with the principles of the State Government Flood Prone Lands Policy and Manual.

The controls provided in this section of the DCP have accordingly been formulated based on a merit approach that takes into consideration social, economic and environmental factors to determine the level of restrictions imposed on future development in the floodplain. This enables a balanced approach that allows some development in the floodplain where within acceptable levels of risk because of the relative severity of the flood hazard, the probability of flooding or the nature of the land use. This means that some developments that comply with the DCP might remain subject to some flood risk albeit relatively minor.

Council has a duty to ensure that future development is not subject to risks that exceed those determined acceptable through the process outlined by the NSW Flood Prone Lands Policy and Manual, and consequently reflected by the following development controls.

2.2 Planning Objectives

i. Increase public awareness of the hazard and extent of land affected by all potential floods, including floods greater than the 100 year average recurrence interval (ARI) flood and to ensure essential services and land uses are planned in recognition of all known flood risks.

ii. To inform the community of Council's policy for the use and development of flood prone land.

iii. Manage the risk to human life and damage to property caused by flooding through controlling development on land affected by potential floods.

iv. To minimise the extent to which emergency services and public infrastructure need to be relied upon in terms of evacuation or other flood responses; and

v. To take into account projected impacts arising from climate change when assessing the risk to human life and damage to property caused by flooding.

vi. Minimise the potential impact of development and other activity upon the aesthetic, recreational and ecological value of the waterway corridors.

2.3 Applying Development Controls

i. The planning provisions within this Policy have been formulated to ensure that development achieves the planning objectives outlined in Clause 2.1. The provisions comprise prescriptive measures and performance criteria, with the following purpose:

   a. The **prescriptive measures** are those which, when complied with, would be expected to satisfy the objectives of the Policy.

   b. The **performance criteria** represent a means of assessing whether a proposal which does not comply with the prescriptive measures can nonetheless achieve the desired outcomes. Where an applicant is reliant on the performance criteria, adequate documentation must be submitted to enable Council to determine that non-compliance with the prescriptive measures is justified in the circumstances of the case and that the performance criteria can be satisfied. The determination of

whether the performance criteria are satisfied is the subject of Council assessment.

ii. All development should seek to comply with the prescriptive standards. The performance criteria should only be relied upon where the circumstances of the case are such that:

a. the situation is distinguishable from the typical situation for which the measures are likely to apply; and

b. an equal or better planning outcome would occur; and

c. the planning objectives are satisfied.

2.4 Land Use Categories

Specific development types, as defined by the applicable Environmental Planning Instruments, are grouped into 6 land use categories and are listed in **Schedule B**.

2.5 Flood Risk Precincts

Each of the flood prone areas within the local government area can be classified based on different levels of potential flood risk. The Flood Risk Precincts (FRPs) for these areas are outlined below.

Flood Risk Precinct	Description
Extreme	This is a very dangerous part of the floodplain due to the potential velocity and depth of flood waters. It is not an appropriate place for all forms of development. Filling or any development within this area that partially blocks the flow of flood waters will adversely affect flood behaviour and is unlikely to be acceptable.
High	Areas outside of Extreme Flood Risk areas which, if completely filled or developed, would cause an unacceptable change in flood behaviour. Filling or development would not normally be acceptable. Dangerous flood conditions occur here.
Medium	These are the remaining areas below the 100 year flood level that are not subject to Extreme or High Flood Risk. In these areas the cumulative impacts associated with filling of land have been assessed and found to not result in unacceptable impacts across the broader floodplain.
Low	These are the remaining areas of the floodplain between the 100 year flood extent and the probable maximum flood (PMF). This precinct is where the likelihood of damages is low for most land uses.

***Note**:*

1. *Some future development scenarios have been considered when preparing the Flood Risk Precinct mapping shown in **Figure 1**. The filling of the lands subject to these scenarios has previously been investigated by Council and may not result in unacceptable flood impacts provided further investigations are carried out and additional flood mitigation measures are included. Within **Figure 1**, the Flood Risk classifications of these lands reflect the ultimate state of the land after filling. As a general rule, these lands will currently have higher flood risks.*
2. *Year 2050 flood conditions have been used to determine the Low, Medium and High Flood Risk Precincts. The Extreme Flood Risk Precinct has been based on Year 2100 flood conditions, as the risks in these areas are greater and accordingly a precautionary approach that considers an extended planning horizon is warranted.*

2.6 Factoring Climate Change into Flood Planning Levels (FPLs)

i. Climate change is expected to have effects upon sea levels and rainfall intensities, both of which may have a significant influence on flood behaviour at specific locations.

ii. The NSW Government has adopted sea level rise planning benchmarks (measured as an increase above 1990 mean sea levels) of 40 cm by 2050 and 90 cm by 2100. The Government will continue to monitor these predictions, but in the interim they are required to be considered in the assessment of flood risk.

iii. Scientific data regarding the effect of climate change on rainfall intensities is not sufficiently advanced to provide specific guidance for the assessment of flood risk. No relevant planning benchmarks have been adopted by Government related to rainfall intensity changes. However the State Government guidelines recommend the undertaking of a sensitivity analysis which assumes nominal increases in rainfall intensities.

iv. The sea level rise planning benchmarks adopted by the State Government and a sensitivity analysis assuming increases in rainfall intensities have been employed by Council to evaluate flood risks in the preparation of the Ballina Floodplain Risk Management Plan (FRMP).

v. The application of these mechanisms varies dependent on the nature of the development proposed. The aim is to take a precautionary approach to contain flood risks at those levels otherwise considered acceptable today where this can be practically achieved.

vi. Climate change effects, such as sea level rise, relate to points in the future. Accordingly flood planning levels (FPLs) which factor in climate change, are expected to have the same probability of being reached during a flood in the future as is the situation today. The points in the future for which FPLs have been reassessed factoring in climate change are the years 2050 and 2100, which coincide with State Government benchmarks. A 90 year time frame is considered to be a reasonable time horizon for making planning decisions.

vii. Predicted climate change effects are expected to influence flood levels gradually over time. Flood levels based on predicted climate conditions in 2100 will be reached gradually. The application of FPLs expected to be reached in 2100 is considered excessive for development for existing urban areas due to the practicality of raising land, site by site, if and as development occurs. The application of FPLs based on current climate conditions is also considered inappropriate having regard to the broadly accepted science of climate change and government policies and guidelines.

viii. Consequently, FPLs in this Policy are based on either 2050 or 2100 predicted climate change conditions, depending on the nature of development, as set out in the following **Table 2.1**:

Table 2.1 – Applicable Climate Change Conditions

Year at which climate change conditions are used to determine FPLs	Type or Location of Development
2100	Development on rural zoned land that is vacant at the date of commencement of this Policy
	Development on land rezoned to permit urban development after January 2010.
	New development in undeveloped areas within: • Southern Cross Industrial Estate, Ballina; • Ferngrove Estate, Ballina; • Pacific Pines Estate, Lennox Head; and • Ballina Heights Estate, Cumbalum.
2050	All other development

***Note**: Under a changing climate, FPLs adopted based on 2050 conditions maintain a similar flood immunity over a typical life span as would occur by adopting current flood conditions in the absence of climate change. Sensitivity analysis examining the differences in FPLs indicates that the 2050 levels should be reasonably manageable when developing in established urban areas. Applying a precautionary approach, 2100 climate changed conditions are adopted for new larger urban areas because further risk reduction could be practically achieved with minimal cost and inconvenience. A proponent may also choose to adopt a more cautious approach in the design of a development than prescribed by the minimum standards, where this would not result in any additional environmental impacts or additional impacts on neighbours.*

ix. Flood planning levels may include a separate factor of safety, referred to as freeboard, depending on the type of development.

***Note**: Freeboard is defined in the dictionary to this Plan (see Schedule A) in a manner consistent with the FDM. Freeboard is included in the determination of flood planning levels in accordance with FDM and previous Council flood policies.*

x. Council will continue to monitor and review this Plan having regard to Government policy and current information related to climate change flood risk.

2.7 Mapping and Application of Flood Risk Precincts (FRPs)

i. The mapping of FRPs should be based on the best available information. It is noted that the mapping is dependent on information such as site topography, sea level rise benchmarks and applicable rainfall intensities, and therefore, as this information is revised and improved, FRP maps may need to be revised.

ii. Where FRPs and other flood information are not available and in Council's opinion the site may be subject to flooding, a site specific flood study may be required with a development application. The requirements for site specific flood studies are set out below in clause 3.

iii. Filling of a site, if acceptable to Council, will alter the inundation depth on the site and may change its FRP classification.

> ***Note**: The initial FRP classification in part reflects whether filling is acceptable or not. Filling is likely to be acceptable on land in a Low or Medium FRP but not on land in a High or Extreme FRP. Land may have a different FRP classification after filling.*

2.8 Which Controls Apply to Proposed Developments

i. The controls apply to all development on flood liable land for which consent is required. The FRPs allow the type and stringency of controls to be graded relative to the severity, frequency and consequences of potential floods. As different land uses have different susceptibilities to flooding, the controls within each FRP also vary with the proposed land use.

ii. A range of FPLs apply to different land uses and building elements. The FPLs referred to in the prescriptive measures contained in **Schedule D** are specified in the following **Table 2.2**.

Table 2.2 – Flood Planning Levels

FPL	Where Year 2050 Climate Change Conditions Apply	Where Year 2100 Climate Change Conditions Apply
FPL1	$FPL1_{2050}$ = $20\ Year\ ARI_{2050}$	$FPL1_{2100}$ = $20\ Year\ ARI_{2100}$
FPL2	$FPL2_{2050}$ = $50\ Year\ ARI_{2050}$	$FPL2_{2100}$ = $50\ Year\ ARI_{2100}$
FPL3	$FPL3_{2050}$ = $100\ Year\ ARI_{2050}$	$FPL3_{2100}$ = $100\ Year\ ARI_{2100}$
FPL4	$FPL4_{2050}$ = $100\ Year\ ARI_{2050}$ + 0.2m	$FPL4_{2100}$ = $100\ Year\ ARI_{2100}$ + 0.2m
FPL5	$FPL5_{2050}$ = $100\ Year\ ARI_{2050}$ + 0.5m	$FPL5_{2100}$ = $100\ Year\ ARI_{2100}$ + 0.5m
FPL6	$FPL6_{2050}$ = PMF_{2050}	$FPL6_{2100}$ = PMF_{2100}

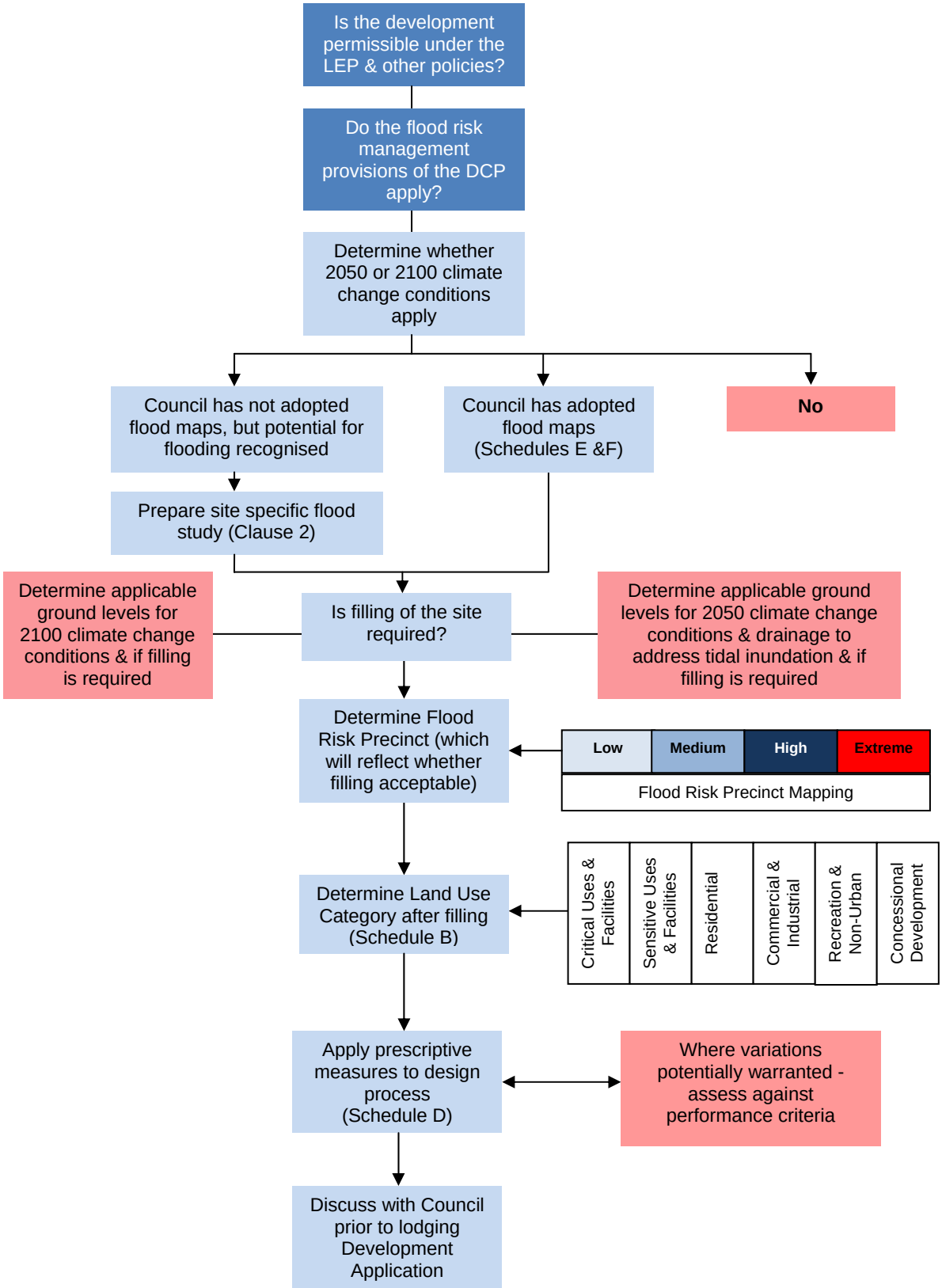
Notes:

1. Notation such as 100 Year ARI_{2050} refers to the 100 year ARI flood level based on 2050 climate conditions.
2. FPL1, FPL2, FPL3 and FPL6 have zero freeboard.
3. The design flood levels and FPLs in **Table 2.2** may be obtained from Council if available, or otherwise will be required to be determined by the proponent in accordance with Clause 3. These levels will normally be 'rounded up' to the nearest 0.1m and referred to AHD.

FPL= Flood Planning Level.
ARI = Average Recurrence Interval.
PMF= Probable Maximum Flood.
AHD = Australian Height Datum.

iii. The manner in which the preceding provisions of this Plan operate together with the following provisions in guiding the preparation, assessment and determination of a development application is set out in the following flow chart.

Figure 2: Process for Applying This Policy



2.8.1 Prescriptive Measures

i. All development on flood liable land shall comply with the requirements of **Schedule D**.

2.8.2 Performance Criteria

i. The risk associated with the inundation of development comprising danger to life and damage to property is minimised or not increased beyond the level acceptable to the community.
ii. The additional economic and social cost which may arise from damage to property from inundation is not greater than that which can reasonably be managed by the property owner and general community. The cost of damages that may be incurred over the expected life of a development should be no greater than that which could be reasonably expected to be met by the occupants and/or the developer without Government assistance.
i. Effective warning time and reliable access is available for the evacuation of an area potentially affected by floods. Evacuation should be consistent with any relevant or flood evacuation strategy where in existence.
ii. Appropriate procedures (such as warning systems, signage or evacuation drills) for land use categories of “critical uses and facilities” and “sensitive uses and facilities” be in place, if necessary, so that people are aware of the need to evacuate personnel and relocate goods and motor vehicles during inundation, and are capable of identifying an appropriate evacuation route.
iii. Development does not detrimentally increase the potential flood affectation on other development or properties either individually or in combination with the cumulative impact of development that is likely to occur in the same floodplain. Development should not change the height or behaviour of flood waters elsewhere in the floodplain in a manner which is likely to materially and adversely impact other property or the environment. The assessment of these effects must include the potential for similar impacts that would arise as a consequence of other development in the floodplain that has the potential to occur in the future under current zoning and planning controls.
iv. Motor vehicles associated with the development are able to be practically relocated, undamaged, to an area with substantially less likelihood from inundation, within the effective warning time.
v. Development does not result in significant impacts upon the amenity of an area by way of unacceptable overshadowing of adjoining properties, privacy impacts (e.g. by unsympathetic house-raising) or by being incompatible with the streetscape or character of the locality.
vi. The design of car parking (enclosed or uncovered) and associated driveways should not result in unacceptable environmental or amenity impacts, such as visual intrusion from elevated driveways and parking structures and over shadowing of adjoining residential properties.
vii. The proposal must not have an unacceptable adverse impact upon the ecological value of the waterway corridors, and where possible, should provide for their enhancement. Proposed development must be consistent with ESD principles.
viii. Any geomorphic instability of a waterway corridor does not impose an unacceptable risk to human life or property.
ix. Development does not prejudice the economic viability of any Voluntary Acquisition Scheme, by significantly increasing the value of property above that which otherwise apply.

2.9 Filling of Flood Liable Allotments Prior to Constructing Buildings

i. Allotments within flood liable land on which buildings are proposed to be erected are to be filled wholly or partially (i.e. to provide a building pad) to a minimum level not less than:
a. 0.25m below the design floor level of the building where freeboard is required; or
b. the design floor level when freeboard is not required (refer to **Schedule D**).

> ***Note**: Filling of part or all an allotment will be required where the lot is vacant or the existing building is to be demolished. The need to fill an allotment where alterations and additions are proposed will depend on the scale of the development and the practicality of undertaking the partial filling of the allotment.*

ii. Design floor levels, and consequently fill levels, will be dependent on either climate change conditions at 2050 or 2100, as specified by clause 2.65 viii and Table 2.1.

iii. Not UsedWhere the allotment is not vacant, Council may not require filling, may allow filling to a lower level or may require only partial filling of an allotment, depending on circumstances and practicability.

iv.Where filling is undertaken, retaining walls and/or dish drains will be required to be provided along common boundaries to contain fill material and drain the site in a manner that minimises impact on adjoining properties. The typical requirements of Council are diagrammatically illustrated in **Schedule G**. The capping and sealing of cavities between walls for adjacent commercial and industrial buildings shall be specified.

iv.

v. Not UsedExcept for rural buildings or developments in the Extreme and High Flood Risk Precincts, all of an allotment is to be filled except where required for retaining walls, dish drains and access.

vi. Where filling is required, rural buildings shall be located on fill pads. The fill (at the required level) shall cover a minimum area comprising the building site plus a curtilage extending a minimum distance of 3 metres beyond the structure. FPL2 can be applied to and include any additional areas required for waste water storage and disposal. A proposed fill pad for rural buildings shall be separated a minimum of 100 metres from an existing or approved fill pad.

> ***Note**: Rural buildings relate to buildings for all development types permitted in non-urban zones, such dwelling houses and ancillary buildings, farm sheds, rural industries and the like. Council may not require fill pads for very minor ancillary structures where these are not critical to satisfying the objectives of this Policy.*

vii. Filling in the Extreme and High Flood Risk Precincts will not normally be permitted but in those cases where it is, the extent of fill will need to be reduced to the minimum practical extent and the fill must satisfy the requirements of Section 2.10.

viii. In circumstances where part or all of an allotment is not required to be filled under this clause, Council may still require the land to be filled to facilitate drainage (see Section 2.10).

2.10 Filling of Flood Liable Allotments to Facilitate Drainage

i. Development may also require the filling of low lying land in existing urban areas to address drainage problems resulting from the regular inundation of land due to predicted rising sea levels.

> ***Note**: Council is preparing a policy to address the requirements for filling of flood liable land in established urban areas to facilitate drainage, which will set appropriate levels and standards. The policy will include maps of the minimum levels of land to facilitate drainage at progressive intervals over future decades. Until this further policy is adopted Council will advise of these requirements based on the circumstances of individual applications. Sea levels are expected to rise 400mm by 2050 and 900mm by 2010 (approximately 100mm per decade) which could result in king tide levels of around 1.8m AHD by 2100. Ground levels at or higher than 1.8m AHD may be required to allow for sites to drain. The relationship of a site with adjoining land will be taken into consideration. These fill levels required for drainage purposes may be higher than those required to address flood risk.*

ii. The purpose of this filling is to provide sufficient grades for land to be effectively drained by gravity after rainfall. The ability to allow for satisfactory drainage will be assessed on the basis of predicted 2100 climate change conditions.

iii. This filling may be complemented by filling and/or raising public infrastructure including roadways. Council may require these associated works to be undertaken in full or part in conjunction with the development if practical and critical to the acceptability of the development. Some utilities and services within the road corridor (power, telecommunications, water sewerage and drainage), could remain at existing levels but would gradually be at increasing depths below ground level.

> ***Note**: The raising of public infrastructure is integral to Council's strategy to address sea level rise issues associated with ensuring the acceptable amenity and functioning of both existing and future development. Council will normally be responsible for the raising of public infrastructure as this would typically be required across an area larger than that which would relate to a single development site. Council may seek Development Contributions for the costs of such works apportioned to new development. Where larger scale developments are proposed that would allow for such works to be undertaken in an efficient and practical manner, Council may impose a condition of consent requiring the raising of public infrastructure.*

2.11 Third Party Impacts of Development on Flood Liable Land

i. Development of any flood prone land has the potential to create adverse flooding impacts on other properties.

ii. Filling of land in Low and Medium Flood Risk Precincts in areas already mapped by Council has been examined generally. Applicants for development within these Precincts may not be required to assess flood impacts on third parties.

> ***Note**: The FRP classification determined by a site specific flood study should reflect whether filling is acceptable or not.*

iii. Filling in the High and Extreme Flood Risk Precinct will normally not be acceptable because of the adverse impacts on other properties.

iv. In special circumstances where filling in High and Extreme Flood Risk Precincts is necessary, it will only be permitted (subject to consideration of other relevant planning and infrastructure matters) where a report from a suitably qualified flood engineer is submitted to Council that certifies that the development will not increase flood affectation elsewhere. The report must include consideration of cumulative effects of similar filling of developable sites in the floodplain (except where such

cumulative effects have previously been evaluated in a Council FRMS or other Council study).

v. In addition the report must include calculations of the volume of flood water and conveyance effects which demonstrate that as a result of development:
   a. the volume of flood storage will not be decreased;
   b. the conveyance of flood waters will not be decreased; and
   c. where conveyance characteristics change, this results in no unacceptable scouring, environmental or geomorphological impacts.

2.12 Special Considerations

i. When assessing proposals for development or other activity within the area to which this Plan applies, Council will take into consideration the following specific matters:

   a. Irrespective of whether development is proposed to mitigate the potential impact of flooding (e.g. house raising) it must be undertaken in a manner which minimises the impact upon the amenity and character of the locality.

   b. The proposal must not adversely impact upon the recreational, ecological, aesthetic or utilitarian use of the waterway corridors, and where possible, should provide for their enhancement, in accordance with ESD principles.

   c. Proposals for house raising must provide appropriate documentation including a report from a suitably qualified engineer to demonstrate the raised structure will not be at risk of failure from the forces of floodwaters. Details such as landscaping and architectural enhancements must be provided to ensure that the resultant structure will not result in significant adverse impacts upon the amenity and character of an area.

ii. Filling and alterations to site land forms must have regard to drainage and inundation from local catchment runoff, both within the site and external to the site.

3 Information Required With an Application

i. Applications must include information which addresses all relevant controls listed above, and the following matters, as applicable.

ii. Development Applications affected by this Plan shall be accompanied by a survey plan showing:-

   a. The position of the existing building(s) and proposed building(s);

   b. The existing ground levels to AHD around the perimeter of the building and contours of the site; and

   c. The existing or proposed floor levels to AHD.

iii. Applications for earthworks, filling of land and subdivision shall be accompanied by a survey plan (with a contour interval of 0.25m or similar) showing relative levels to AHD.

iv. For large scale developments, or developments in critical situations, including where an existing catchment based flood study is not available, a flood study using a fully dynamic one or two dimensional computer model may be required. For smaller developments consideration may be given to the use of an existing flood study if available and suitable (e.g. it contains sufficient local detail), or otherwise a flood study prepared in a manner consistent with the “Australian Rainfall and Runoff” publication, Council’s Stormwater Design Code and the Floodplain Development Manual, will be required. From this study, the following information shall be submitted in plan form for the pre-developed and post-developed scenarios:

   a. Water surface contours;

   b. Velocity and depth information;

   c. Delineation of Flood Risk Precincts relevant to individual floodplains for both prior to and after filling (if filling is acceptable); and

d. Flood profiles for the full range of events for full development including all structures and works (including revegetation).

v. Where the controls for a particular development proposal require an assessment of structural soundness during potential floods, the following impacts must be addressed having regard to the likely depths and velocities of flood waters:

a. Hydrostatic pressure;

b. Hydrodynamic pressure;

c. Impact of debris; and

d. Buoyancy forces.

Foundations need to be included in the structural analysis.

Schedule A - Dictionary

Australian Height Datum (AHD) means the common national plane of level corresponding approximately to mean sea level.

Average Exceedance Probability (AEP) means the chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. E.g., if a peak flood discharge has an AEP of 5%, it means that there is a 5% chance (that is one-in-20 chance) of this peak flood discharge or larger events occurring in any one year (see ARI).

Average Recurrence Interval (ARI) is the long-term average number of years between the occurrence of a flood as big as (or larger than) the selected event.

Design floor level **or** ***ground level*** means the minimum floor level or ground level that applies to the development. If the development is concessional development, this level is determined based on what land use category would apply if it was not categorised as Concessional Development.

Ecologically sustainable development (ESD) is using, conserving and enhancing natural resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be maintained or increased. A more detailed definition is included in the Environmental Planning and Assessment Act 1979 and Protection of the Environment Administration Act 1991.

Effective warning time is the time available after receiving advice of an impending flood and before the floodwaters prevent appropriate flood response actions being undertaken. The effective warning time is typically used to raise furniture, evacuate people and transport their possessions.

Enclosed car parking means car parking which is potentially subject to rapid inundation, which consequently increases danger to human life and property damage (such as basement of bunded car parking areas). The following criteria apply for the purposes of determining what is enclosed car parking:

a. Flooding of surrounding areas may raise water levels above the perimeter which encloses the car park (normally the entrance), resulting in rapid inundation of the car park to depths greater than 0.8m, and

b. Drainage of accumulated water in the car park has an outflow discharge capacity significantly less than the potential inflow capacity.

Flood is a relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage as defined by the FDM before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.

> ***Note****: Consistent with the Floodplain Development Manual, this section of the DCP does not apply in the circumstances of local drainage inundation as defined in the Floodplain Development Manual and determined by Council. Local drainage problems can generally be minimised by the adoption of urban building controls requiring a minimum difference between finished floor and ground levels.*

Flood awareness is an appreciation of the likely effects of flooding and knowledge of the relevant flood warning and evacuation procedures.

Flood compatible building components and methods means a combination of measures incorporated in the design and/or construction and alteration of individual buildings or structures subject to flooding, and the use of flood compatible materials for the reduction or elimination of flood damage.

Flood compatible materials include those materials used in building which are resistant to damage when inundated. A list of flood compatible materials is attached in **Schedule C**.

Flood evacuation strategy means the proposed strategy for the evacuation of areas within effective warning time during periods of flood as specified within any policy of Council, the FRMP, the relevant State government disaster plan, by advices received from the State Emergency Services (SES) or as determined in the assessment of individual proposals.

Floodplain (being synonymous with ***flood liable*** and ***flood prone land***) is the area of land which is subject to inundation by the probable maximum flood (PMF).

Floodplain Development Manual (FDM) refers to the document published by the New South Wales Government and entitled *"Floodplain Management Manual: the management of flood liable land"* dated April 2005.

Floodplain Risk Management Plan (FRMP) means a plan prepared for one or more floodplains in accordance with the requirements of the FDM or its predecessor.

***Floodplain Risk Management Study (FRMS*)** means a study prepared for one or more floodplains in accordance with the requirements of the FDM or its predecessor.

Flood Risk Precincts (FRPs) are a categorisation of a site's flood risk for land-use planning purposes. Three classifications of flood risk into 'low', 'medium' and 'high' flood risk precincts are provided for in this Plan.

Flood Planning Levels (FPLs) are the combinations of flood levels (derived from significant historical flood events or floods of specific ARIs or AEPs) and freeboards selected for floodplain risk management purposes, as determined in FRMSs and incorporated in FRMPs. Under the influences of climate change, flood levels and FPLs may change with time (see Epoch).

Floodway areas mean those areas, often aligned with obvious, naturally defined channels, where a significant passage of water flows during floods. They are often the deepest area where the highest velocities occur. Also, they are areas which, even if only partially blocked, would cause a significant redistribution of flood flow, which may in turn adversely affect other areas.

Freeboard provides reasonable certainty that the risk exposure selected in deciding on a particular flood chosen as the basis for a FPL, is actually provided. It is a factor of safety typically used in relation to the setting of flood levels, levee crest levels, etc. (as specified at Section K5 of the FDM). Freeboard is included in flood planning levels (although in some circumstances, zero freeboard may be appropriate).

Habitable floor area means:

a. In a **residential situation**: a living or working area, such as a lounge room, dining room, rumpus room, kitchen, bedroom or workroom;

b. Not UsedIn an **industrial or commercial situation:** an area used for offices or to store valuable possessions susceptible to flood damage in the event of a flood.

Note: Separate considerations are specified for the car parking area of a development irrespective of the land use with which it is associated.

Hazard is a source of potential harm or a situation with a potential to cause loss. In relation to this plan, the hazard is flooding which has the potential to cause harm or loss to the community.

Local drainage refers to small scale overland flow including areas generally where depths are less than approximately 0.3m and are beyond the floodplains of original watercourses (which may now be piped, channelised or diverted). There is little risk to personal safety or property damage in these areas. This type of inundation is not referred to as 'flooding' and normal building controls are used to manage the inundation risks in these areas rather than the flood-related controls in this Plan.

Local overland flooding means inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.

Outbuilding means a building which is ancillary to a principal residential building or commercial/industrial building and includes sheds, garages, car ports and similar buildings.

Overland flow flooding means inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.

Probable maximum flood (PMF) is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation.

Probable maximum precipitation (PMP) is 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. Under climate change, PMP may change with time (see 'Epoch'). PMP is the primary input to the estimation of the probable maximum flood.

Probability is a statistical measure of the expected chance of flooding now or at a particular year in the future (see 'Epoch'). Probability is usually expressed as ARI or AEP.

Rebuilt dwelling refers to the construction of a new dwelling on an allotment where an existing dwelling is demolished.

Refuge area means an onsite refuge or reliable access to ground that is located above the PMF that provides reasonable shelter for the likely occupants of the development commensurate with the period of time that refuge is likely to be required in floods up to the PMF.

Reliable access during a flood means the ability for people to safely evacuate an area subject to imminent flooding to a refuge area within effective warning time, having regard to the depth and velocity of flood waters, the suitability of the evacuation route, and without a need to travel through areas where water depths increase.

Risk means the chance of something happening and its impact. It is measured in terms of consequences and probability (likelihood). In the context of this plan, it is the likelihood of consequences arising from the interaction of floods, communities and the environment.

Site Flood Emergency Response Plan (not being an SES Flood Plan) is a management plan that demonstrates the ability to safely evacuate persons and includes a strategy to move goods above the flood level within the available warning time. This Plan must be consistent with any relevant flood evacuation strategy, flood plan or similar plan.

Survey plan is a plan prepared by a registered surveyor which shows the information required for the assessment of an application in accordance with the provisions of this Policy.

Suitably Qualified Civil Engineer is a civil engineer who is included in the National Professional Engineers Register, administered by the Institution of Engineers Australia.

Schedule B - Land Use Categories

Critical Uses and Facilities	Sensitive Uses and Facilities	Residential
Emergency services facilities; public administration building that may provide an important contribution to the notification or evacuation of the community during flood events (e.g. SES Headquarters and Police Stations); Hospitals.	Community facility; telecommunications facility; institutions; educational establishments; liquid fuel depot; public utility undertaking (including electricity generating works; sewerage treatment plant; sewerage system; telecommunications facility; utility installations and water treatment facility) which are essential to evacuation during periods of flood or if affected would unreasonably affect the ability of the community to return to normal activities after flood events; residential care facility; school and seniors housing.	Affordable housing; attached dwelling; backpackers accommodation; bed and breakfast accommodation; boarding house; canal estate development; caravan park (with permanent occupants i.e. other than short term sites)(see Note 1); child care centre; dual occupancy; dwelling; dwelling house; exhibition home; farm stay accommodation, group home; home based child care centre; home business; home industry; home occupancy; home occupation (sex services); hostel; hotel or motel accommodation; moveable dwelling; multi dwelling housing; neighbourhood shop; permanent group home; residential accommodation; residential flat building; rural worker's dwelling; secondary dwelling; semi-detached dwelling; seniors housing; serviced apartment; tourist and visitor accommodation and transitional group home.; Additions or alterations to existing dwellings greater than 50m^2 of the habitable floor area which existed at the date of commencement of this Plan; and Garages or outbuildings with a floor area exceeding 50m²

Note:

(1) As defined by the Local Government (Manufactured Home Estates, Caravan Parks, Camping Grounds and Moveable Dwellings) Regulation 2005

(2) Where the Environmental Planning Instrument (EPI) land use definition is not used, the bracketed text refers to the EPI land use definition.

Schedule B: Land Use Categories (cont.)

Commercial or Industrial	Recreation or Non-urban Uses	Concessional Development
Agricultural produce industry; air transport facility; airport; amusement centre; brothel; bulky goods premises; business premises; car park; cellar door premises; community facility (other than critical and sensitive uses and facilities); correctional centre; crematorium; depot; entertainment facility; exhibition village; feed lot, food and drink premises; freight transport facility; function centre; funeral chapel; funeral home; hazardous industry; hazardous storage establishment; health care professional; health consulting rooms; health services facility; heavy industry; heliport; highway service centre; industrial retail outlet; industry; light industry; liquid fuel depot; livestock processing industry; market; medical centre; mixed use development; mortuary; offensive industry; offensive storage establishment; office premises; passenger transport facility; place of public worship; pub; public administration building (other than critical uses and facilities); recreation facility (major); registered club; restaurant; restricted dairy; restricted premises; retail premises; rural industry; rural supplies; sawmill or log processing works; self-storage units; service station; sex services premises; shop; shop top housing; storage premises; take away food or drink premises; timber and building supplies; transport depot; truck depot; vehicle body repair workshop; vehicle repair station; vehicle sales or hire premises; veterinary hospital; warehouse or distribution centre; waste disposal facility; waste management facility; waste or resource management facility; waste or resource transfer stations; and wholesale supplies.	Agriculture; airstrip; animal boarding or training establishment; aquaculture; biosolid waste application; biosolids treatment facility; boat launching ramp; boat repair facility; boat shed; Camp site and caravan site – short term sites (see Note 1); caravan park (with non permanent occupants); cemetery; charter and tourism boating facility; dairy (pasture based), environmental facility; environmental protection works; extensive agriculture; extractive industry; farm building: horticulture; helipad: information and education facility; intensive livestock agriculture; intensive plant agriculture; kiosk; jetty; landscape and garden supplies; marina; mine; mining; natural water-based aquaculture; port facilities; pond-based aquaculture; public utility undertaking (other than critical uses or facilities); recreation area; recreation facility (indoor); recreational facility (outdoor); research station; resource recovery facility; restriction facilities; roadside stall; stock and sale yard; tank-based aquaculture; turf farming; utility installations (other than critical uses and facilities); viticulture; water recreation structure; water recycling facility; and water storage facility.	Redevelopment for the purposes of substantially reducing the flood risk to the existing building and its occupants, or in relation to an existing dwelling: (i) additions or alterations to the dwelling; and/or (ii) garages or outbuildings; and/or (iii) decks; provided that the total of: • the gross floor area from (i); and • the area of garages and outbuildings from (ii); and • the area of decks from (iii), approved since the date of commencement of this plan, does not exceed: • 50m² in the Low, Medium and High Flood Risk Precinct; or • 25m² in the Extreme Flood Risk Precinct. . (Note that for the purposes of this clause, the areas of garages, outbuildings and decks referred to above mean the plan areas measured to the external edge of the structures).

Note:

(1) As defined by the Local Government (Manufactured Home Estates, Caravan Parks, Camping Grounds and Moveable Dwellings) Regulation 2005

(2) Where the Environmental Planning Instrument (EPI) land use definition is not used, the bracketed text refers to the EPI land use definition.

Schedule C – Flood Compatible Materials and Methods

BUILDING COMPONENT	FLOOD COMPATIBLE MATERIAL
Flooring and Sub-floor Structure	• Concrete slab-on-ground monolith construction. • Suspended reinforced concrete slab.
Floor Covering	• Clay tiles. • Concrete, precast or in situ. • Concrete tiles. • Epoxy, formed-in-place. • Mastic flooring, formed-in-place. • Rubber sheets or tiles with chemical-set adhesives. • Silicone floors formed-in-place. • Vinyl sheets or tiles with chemical-set adhesive. • Ceramic tiles, fixed with mortar or chemical-set adhesive. • Asphalt tiles, fixed with water resistant adhesive.
Wall Structure	• Solid brickwork, blockwork, reinforced, concrete or mass concrete.
Roofing Structure (for Situations Where the Relevant Flood Level is Above the Ceiling)	• Reinforced concrete construction. • Galvanised metal construction.
Doors	• Solid panel with water proof adhesives. • Flush door with marine ply filled with closed cell foam. • Painted metal construction. • Aluminium or galvanised steel frame.
Wall and Ceiling Linings	• Fibro-cement board. • Brick, face or glazed. • Clay tile glazed in waterproof mortar. • Concrete. • Concrete block. • Steel with waterproof applications. • Stone, natural solid or veneer, waterproof grout. • Glass blocks. • Glass. • Plastic sheeting or wall with waterproof adhesive.
Insulation **Windows**	• Foam (closed cell types). • Aluminium frame with stainless steel rollers or similar corrosion and water resistant material.
Nails, Bolts, Hinges and Fittings	• Brass, nylon or stainless steel. • Removable pin hinges. • Hot dipped galvanised steel wire nails or similar.

Schedule C – Flood Compatible Materials (cont.)

Electrical and Mechanical Equipment

For dwellings constructed on land to which this chapter applies, the electrical and mechanical materials, equipment and installation should conform to the following requirements.

- Main power supply

Subject to the approval of the relevant authority the incoming main commercial power service equipment, including all metering equipment, shall be located above the relevant flood level. Means shall be available to easily disconnect the dwelling from the main power supply.

- Wiring

All wiring, power outlets, switches, etc., should, to the maximum extent possible, be located above the relevant flood level. All electrical wiring installed below the relevant flood level should be suitable for continuous submergence in water and should contain no fibrous components. Earth core leakage systems (or safety switches) are to be installed. Only submersible-type splices should be used below the relevant flood level. All conduits located below the relevant designated flood level should be so installed that they will be self-draining if subjected to flooding.

- Equipment

All equipment installed below or partially below the relevant flood level should be capable of disconnection by a single plug and socket assembly.

- Reconnection

Should any electrical device and/or part of the wiring be flooded it should be thoroughly cleaned or replaced and checked by an approved electrical contractor before reconnection.

Heating and Air Conditioning Systems

Heating and air conditioning systems should, to the maximum extent possible, be installed in areas and spaces of the house above the relevant FPL. When this is not feasible every precaution should be taken to minimise the damage caused by submersion according to the following guidelines.

- Fuel

Heating systems using gas or oil as a fuel should have a manually operated valve located in the fuel supply line to enable fuel cut-off.

- Installation

The heating equipment and fuel storage tanks should be mounted on and securely anchored to a foundation pad of sufficient mass to overcome buoyancy and prevent movement that could damage the fuel supply line. All storage tanks should be vented to an elevation of 600 millimetres above the relevant FPL.

- Ducting

All ductwork located below the relevant FPL should be provided with openings for drainage and cleaning. Self draining may be achieved by constructing the ductwork on a suitable grade. Where ductwork must pass through a water-tight wall or floor below the relevant FPL, the ductwork should be protected by a closure assembly operated from above relevant FPL.

Flood Compatible Building Methods

In addition to conforming to the BCA and other relevant standards, Council may requires builders to utilise best practice building methods to minimise the susceptibility of structures to damage when inundated by floodwaters. Details of these methods are documented in the following document:

> *Reducing Vulnerability of Buildings to Flood Damage – Guidance on Building in Flood Prone Areas*. Hawkesbury-Nepean Floodplain Management Steering Committee (HNFMSC), June 2006. (Copies available from the NSW Office of Environment and Heritage);

and within other supplementary information available from Council.

Schedule D - Prescriptive Measures

Planning Consideration	Low Flood Risk						Medium Flood Risk						High Flood Risk						Extreme Flood Risk					
	Critical Uses & Facilities	Sensitive Uses & Facilities	Residential	Commercial & Industrial	Recreation & Non-Urban	Concessional Development	Critical Uses & Facilities	Sensitive Uses & Facilities	Residential	Commercial & Industrial	Recreation & Non-Urban	Concessional Development	Critical Uses & Facilities	Sensitive Uses & Facilities	Residential	Commercial & Industrial	Recreation & Non-Urban	Concessional Development	Critical Uses & Facilities	Sensitive Uses & Facilities	Residential	Commercial & Industrial	Recreation & Non-Urban	Concessional Development
Floor Level		3	2,6			4			2,6, 7	5,7	1	4,7			2,6, 7	5,7	1	4,7					1	4,7
Building Components & Methods		2	1	1	1	1			1	1	1	1			1	1	1	1					1	1
Structural Soundness		3				2			2	2	2	2			2	2	1	1					1	1
Flood Affectation															1	1	2	2					2	2
Car Parking									1,3, 4,5	1,3, 4,5	2,3, 4,5	4,5, 6			1,3, 4,5	1,3, 4,5	2,3, 4,5	4,5, 6					2,3, 4,5	4,5, 6
Evacuation		3	2	1 or 2		2			2	1 or 2	3	2			2	1 or 2	3	2					3	2
Management & Design		1							1,2	1,2, 3,4	1,2, 3,4	2,3, 4			1,2	1,2, 3,4	1,2, 3,4	2,3, 4					1,2, 3,4	2,3, 4

= Unsuitable Land Use (refer to General Note b). = No controls.

General Notes:

a. The relevant environmental planning instruments (generally the Local Environmental Plan) identify development permissible with consent in various zones in the LGA. Notwithstanding, constraints specific to individual sites may preclude Council granting consent for certain forms of development on all or part of a site.

b. Filling of the site, where required by Council or proposed and acceptable to Council, may change the Flood Risk Precinct (FRP) considered to determine the controls applied in the circumstances of individual applications.

c. Terms in italics are defined in Schedule A of this Policy.

d. *Design floor* level or ground level means the minimum floor level or ground level that applies to the development. If the development is concessional development, this level is determined based on what land use category would apply if it was not categorised as Concessional Development.

e. *Habitable* and *non-habitable* floor levels are typically subject to different controls in this Schedule. Unless otherwise stated, consideration of 'floor levels' implies separate consideration of habitable and non-habitable floor levels.

Floor Level

1 All floor levels to be no lower than FPL2 unless justified by a site specific assessment.

2 *Habitable floor* levels to be no lower than FPL5.

3 *Habitable floor* levels to be no lower than FPL6. *Non-habitable floor* levels to be no lower than FPL5 unless justified by a site specific assessment.

4 Floor levels to be no lower than the *design floor level*. Where this is not *practical* due to compatibility with the height of adjacent buildings, or compatibility with the floor level of existing buildings, or the need for access for persons with disabilities, a lower floor level may be considered. In these circumstances, the floor level is to be as high as *practical*, and, when undertaking alterations or additions no lower than the existing floor level.

5 The level of *habitable and non-habitable floor* areas to be equal to or greater than FPL4. If this level is not *practical* for a development in a business zone, the floor level should be as high as possible. *Non-habitable floor* levels to be equal to or greater than FPL4 where possible, or otherwise no lower than FPL1 unless justified by a site specific assessment.Lower floor levels may be justified for lift wells, foyers and access ways subject to a site specific assessment.

6 *Non-habitable floor* levels to be equal to or greater than FPL5 where possible, or otherwise no lower than FPL1 unless justified by a site specific assessment.

7 A restriction is to be placed on the title of the land, pursuant to S.88B of the Conveyancing Act, where the lowest *habitable floor* area is elevated above finished ground level, confirming that the sub-floor under croft area is not to be enclosed, where Council considers this may potentially occur.

Building Components & Methods

1 All structures to have *flood compatible building components and methods* below FPL5.

2 All structures to have *flood compatible building components and methods* below FPL6.

Structural Soundness

1 Engineer's report to certify that the structure can withstand the forces of floodwater, debris and buoyancy up to and including FPL5, or FPL6 if required to satisfy evacuation criteria (i.e. use as a refuge area). In the case of alterations or additions to an existing development, the structure to be certified is that which is proposed to be newly constructed or otherwise required to be of a specified standard to satisfy other controls.

2 Applicant to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including FPL5, or FPL6 if required to satisfy evacuation criteria (i.e. use as a refuge area). An engineer's report may be required.

3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including FPL6. An engineer's report may be required.

Flood Affectation

1 Engineers report required to certify that the development will not increase *flood* affectation elsewhere, will not decrease conveyance and will not decrease the volume of flood storage. Compensatory flood mitigation works will likely be required.

2 The impact of development on flooding elsewhere to be considered. No decrease in either flood conveyance or flood storage will be permitted. An engineer's report may be required. Compensatory flood mitigation works will likely be required.

Car Parking

1. The minimum surface level of open car parking spaces or carports shall be as high as *practical*, and not below: (i) FPL2. 1; or (ii) the level of the crest of the road at the location where the site has access; (whichever is the lower). In the case of garages, the minimum surface level shall be as high as *practical*, but no lower than FPL31.

2. The minimum surface level of open car parking spaces, carports or garages, shall be as high as *practical*.

3. Garages capable of accommodating more than 3 motor vehicles on land zoned for urban purposes, or enclosed car parking, must be protected from inundation by flood waters up to FPL3.

4.*Basement carparking will only be permitted in the Ballina Town Centre precinct in accordance with Combined DCP Chapter 2 Ballins town Centre. Enclosed car parking* and car parking areas accommodating more than 3 vehicles with a floor level below FPL1 or more than 0.8m below FPL3, shall have adequate warning systems, signage and exits. (*Enclosed car parking* is defined in the glossary and typically refers to car parks in basements.)

4.

5. Restraints or vehicle barriers to be provided to prevent floating vehicles leaving a site during a 100 year *flood* event as defined by FPL3.

6. Parking space levels to be no lower than the *design floor level or ground level*. Where this is not *practical*, a lower level may be considered. In these circumstances, the level is to be as high as *practical*, and, when undertaking alterations or additions, no lower than the existing level.

Evacuation

1 *Reliable access* for pedestrians or vehicles required during a *flood* event defined by FPL3.

2 *Reliable access* for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest *habitable floor* level to a *refuge area* above FPL6, or a minimum of 20% of the gross floor area of the dwelling to be above FPL6. In the case of alterations or additions to an existing development, this may require retro-fitting the existing structure if required to support a *refuge area* above FPL6.

3 The evacuation requirements of the development are to be considered. An engineer's report will be required if circumstances are possible where the evacuation of persons might not be achieved within the *effective warning time*.

Management and Design

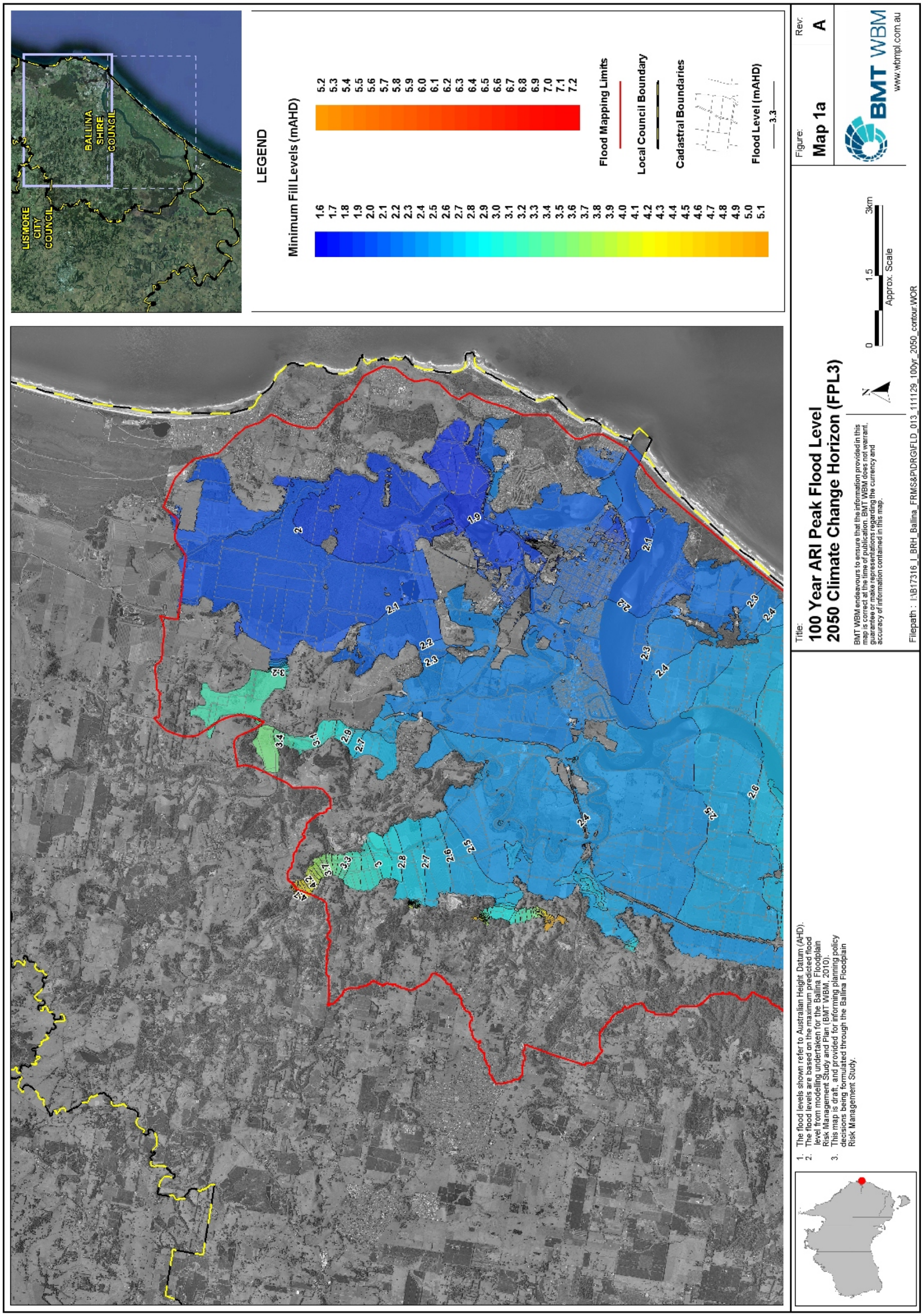
1 If the application involves subdivision, the applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accordance with this Policy.

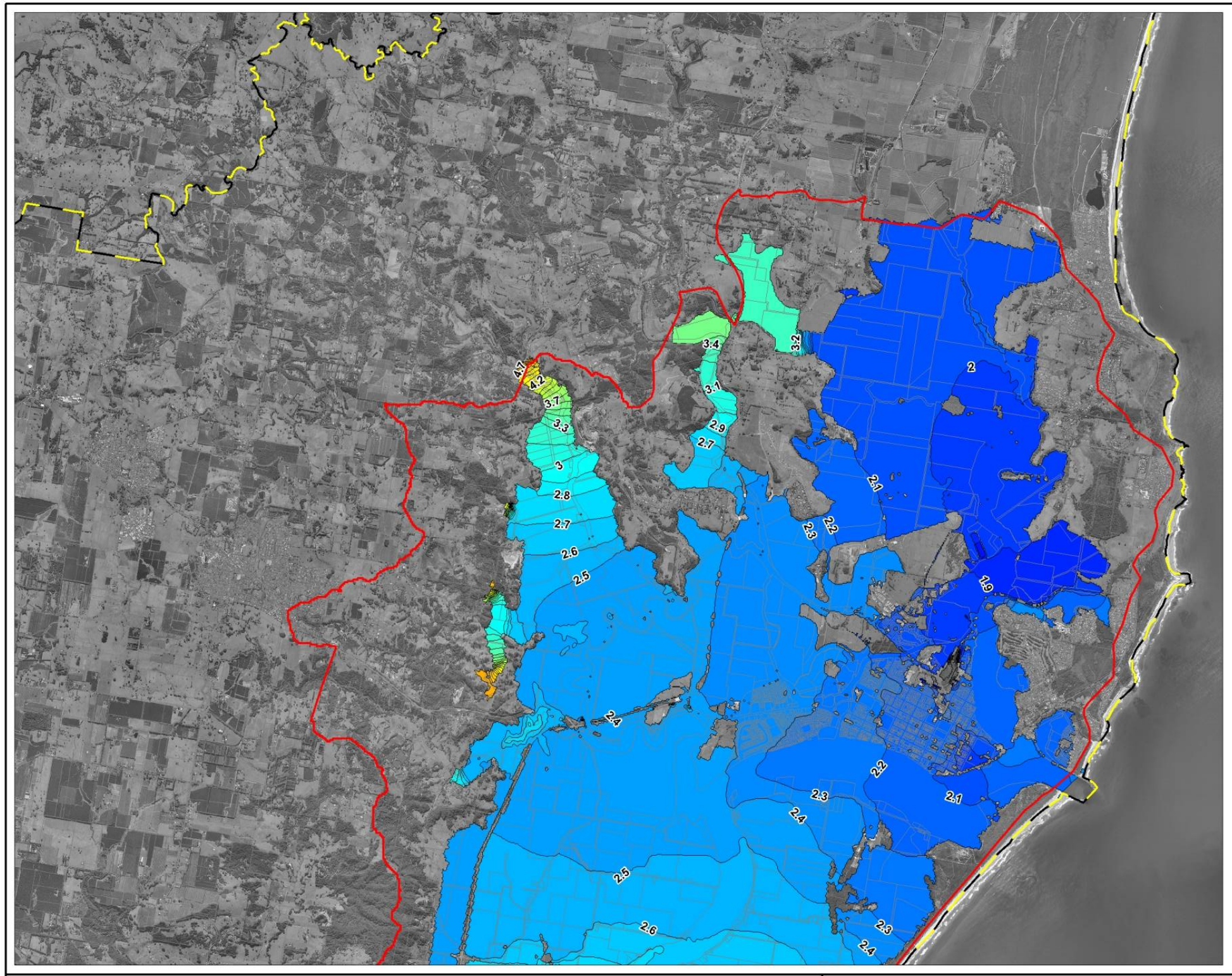
2 *Site Emergency Response Flood plan* required where floor levels are below the *design floor level* (except for single dwelling-houses).

3 Applicant to demonstrate that area is available to store goods above FPL5.

4 No external storage of materials below the *design floor level* which may cause pollution or be potentially hazardous during any *flood*.

Schedule E: FPLs Based on 2050 Climate Change Conditions
Map 1a: Ballina LGA (North)





LEGEND

Minimum Fill Levels (mAHD)

1.6	5.2
1.7	5.3
1.8	5.4
1.9	5.5
2.0	5.6
2.1	5.7
2.2	5.8
2.3	5.9
2.4	6.0
2.5	6.1
2.6	6.2
2.7	6.3
2.8	6.4
2.9	6.5
3.0	6.6
3.1	6.7
3.2	6.8
3.3	6.9
3.4	7.0
3.5	7.1
3.6	7.2
3.7	
3.8	
3.9	
4.0	
4.1	
4.2	
4.3	
4.4	
4.5	
4.6	
4.7	
4.8	
4.9	
5.0	
5.1	

Mapping Limits

Local Council Boundary

Cadastral Boundaries

Flood Level (mAHD)

3.3

1. The flood levels shown refer to Australian Height Datum (AHD).
2. The flood levels are based on the maximum predicted flood level from modelling undertaken for the Ballina Floodplain Risk Management Study and Plan (BMT WBM, 2010).
3. This map is draft, and provided for informing planning policy decisions being formulated through the Ballina Floodplain Risk Management Study.

Title:

100 Year ARI Peak Flood Level 2050 Climate Change Horizon (FPL3)

Figure: **Map 1a**

Rev: **A**

N

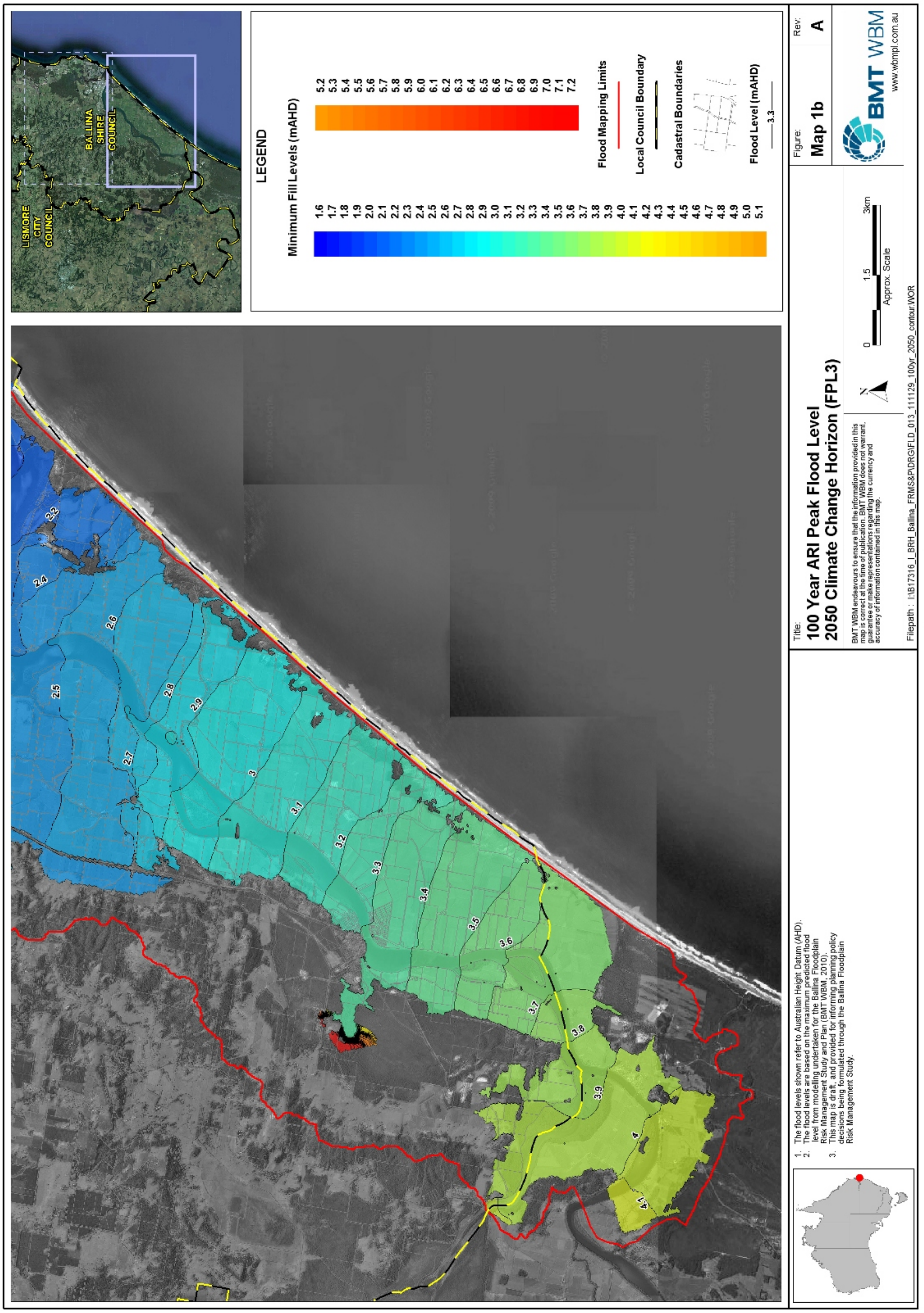
0 1.5 3km

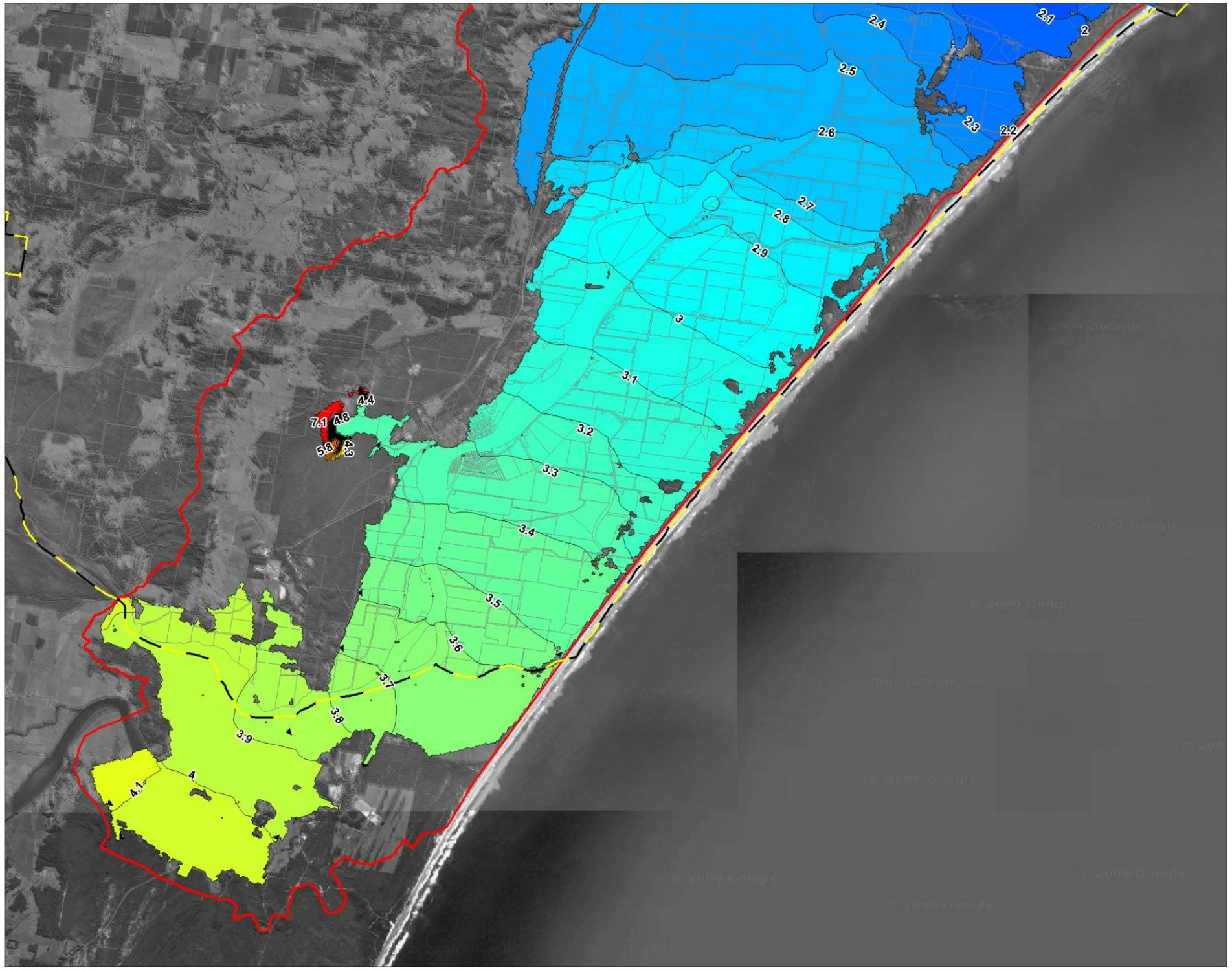
Approx. Scale

BMT WBM
www.wbmpl.com.au

Filepath : I:\B17316_I_BRH_Ballina_FRMS&P\DRG\FLD_013_110715_100yr_2050_contour.WOR

Schedule E: FPLs Based on 2050 Climate Change Conditions
Map 1b: Ballina LGA (South)





LEGEND

Minimum Fill Levels (mAHD)

1.6, 1.7, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 5.0, 5.1

5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 6.0, 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 7.0, 7.1, 7.2

Study Limits

Local Council Boundary

Cadastral Boundaries

Flood Level (mAHD)

3.3

1. The flood levels shown refer to Australian Height Datum (AHD).
2. The flood levels are based on the maximum predicted flood level from modelling undertaken for the Ballina Floodplain Risk Management Study and Plan (BMT WBM, 2010).
3. This map is draft, and provided for informing planning policy decisions being formulated through the Ballina Floodplain Risk Management Study.

Title:
100 Year ARI Peak Flood Level
2050 Climate Change Horizon (FPL3)

Figure: **Map 1b**

Rev: **A**

N

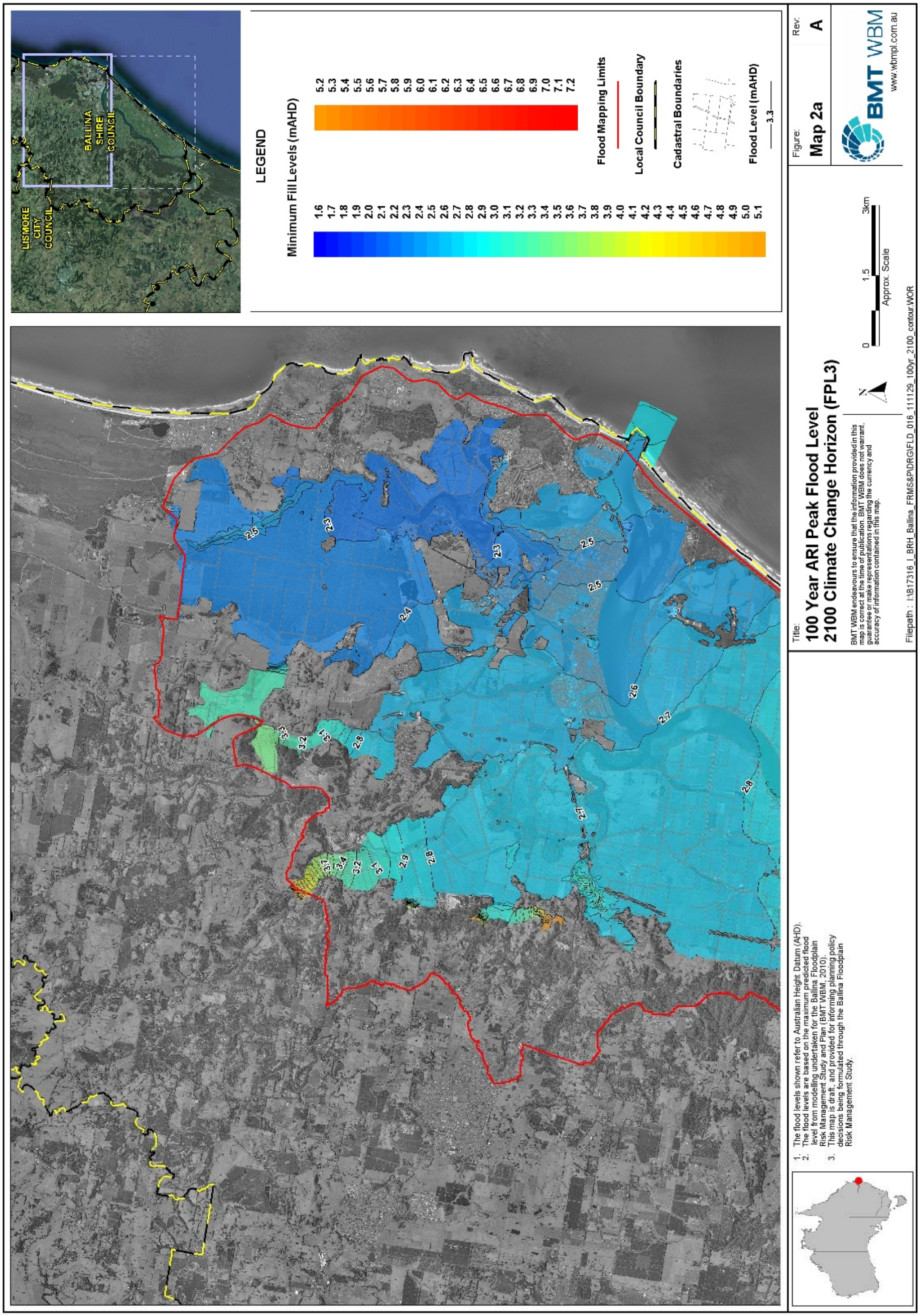
0 1.5 3km

Approx. Scale

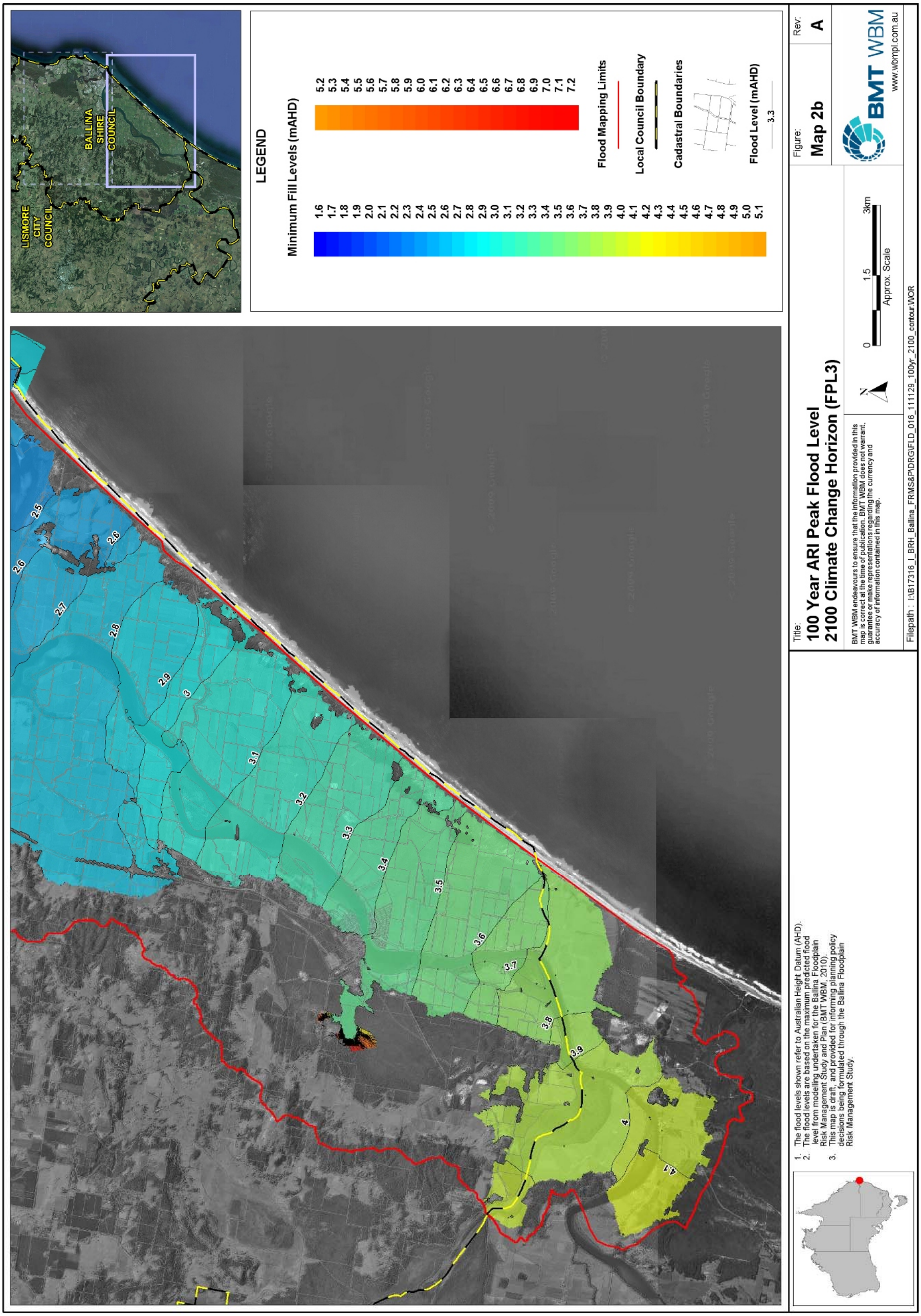
BMT WBM
www.wbmpl.com.au

Filepath : I:\B17316_I_BRH_Ballina_FRMS&P\DRG\FLD_013_110715_100yr_2050_contour.WOR

Schedule F: FPLs Based on 2100 Climate Change Conditions
Map 2a: Ballina LGA (North)



Schedule F: FPLs Based on 2100 Climate Change Conditions
Map 2b: South Ballina LGA



Schedule G – Diagram of typical requirements for filling urban lots