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1 Purpose

The purpose of these Guidelines is to provide additional information to assist in preparing a development application for development on flood prone land, in accordance with Chapter G9: Development on Flood Prone Land of Shoalhaven DCP 2014.

2 Application Information

In preparing a development application, you will need to make investigations in order to ensure your application meets Council's requirements for development on flood prone land. These considerations are stated in sections 2.1 to 2.4.

2.1 My proposal is small scale – do I still need consent?

Some small scale developments such as some fences or drainage works and the like may not require development consent, however, on flood prone land careful consideration is needed to ensure that such development does not have a significant impact in relation to flooding. Please check with Council or a local planning consultant whether you need consent or meet specific conditions to minimise flood impact.

2.2 What type of flood information is available?

The controls that apply to development on flood prone land will depend on the hydraulic and hazard categorisations for a site, which can only be determined if flood information is available. Due to the large number of water bodies within the Shoalhaven, the information that is available for different catchments varies significantly and could range from historical information to very detailed flood modelling data formulated as part of the floodplain risk management process.

It is necessary to determine the type of information available for your site, including whether or not a floodplain risk management plan has been adopted for your area. This can be done by checking the most up to date flood maps on Council's website at www.shoalhaven.nsw.gov.au

For areas where sufficient flood information is available, you will be able to obtain a site specific Flood Certificate from Council (please refer to Schedule 2 of this Guideline for information on how to do this).

There are a number of catchments within the Shoalhaven that have not been the subject of a detailed flood study and will not be studied in the near future. Any development application proposing works within such an area must therefore be accompanied by a flood assessment report undertaken by a suitably qualified hydraulic engineer recognised under the National Engineers Register (NER) (please refer to Schedule 3 of this Guideline).

2.3 What sections of Chapter G9 apply to my application?

Depending on the type of development proposed as well as the type of flood information that is available for a particular site, the development application will be assessed against different sections within the Chapter:

- **Flood prone land where a floodplain risk management plan has not been adopted**

For areas where Council has not adopted a floodplain risk management plan, generic development controls as contained in Sections 5.1 - 5.3 will apply. These controls apply to all flood prone land as identified in flood modelling data as well as in areas where the property is within 40m of a watercourse or within 10m of a major drainage system, overland flood path or drainage easement, or has a history of flooding. Please check www.shoalhaven.nsw.gov.au for up to date information on which areas currently do not have a floodplain risk management plan.

- **Land where a floodplain risk management plan has been adopted**

For areas where Council has adopted a floodplain risk management plan, site specific controls will apply in addition to generic controls as mentioned above. These specific controls are contained in Section 5.4. Please check www.shoalhaven.nsw.gov.au for up to date information on which areas currently have an adopted floodplain risk management plan.

2.4 How to address the requirements of Chapter G9

To determine the flood-based development controls that are relevant to a proposed development and to prepare your submission to Council, the following steps should be taken:

<i>Step 1:</i>	Read the background information contained in these Guidelines, particularly Schedule 5.
<i>Step 2:</i>	Determine what flood information is available for your site and whether or not Council has adopted a floodplain risk management plan for the area via www.shoalhaven.nsw.gov.au If flood information is available, obtain a Flood Certificate. If no flood information is available from Council, you may be required to engage a suitably qualified hydraulic engineer recognised under the National Engineers Register (NER) to undertake a flood assessment report. Refer to Schedule 3 of these Guidelines for more information on what is required for such an assessment.
<i>Step 3:</i>	Determine the land use category that best fits the proposed development, keeping in mind that your development may relate to more than one land use category. For example development may be a retail outlet plus an ancillary car park (refer to Schedule 1 of Chapter G9 for assistance). If a proposed type of development does not fit within any of the categories, the development will be assessed on a merit basis, however you will be required

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	to provide additional supporting information as determined by Council. Confirm the chosen land use category with Council.
<i>Step 4:</i>	<p>From your Flood Certificate or flood assessment report determine which part of the floodplain the site is located on. In this regard, the categories are:</p> <ul style="list-style-type: none"> i. Within the flood planning area (refer to Figure 3 in Schedule 5): <ul style="list-style-type: none"> a) High Hazard floodway b) High Hazard flood storage area c) High Hazard flood fringe d) Low Hazard floodway e) Low Hazard flood storage area f) Low Hazard flood fringe <p>Outside the flood planning area but within the flood prone area, that is below the PMF level (refer to Figure 2 in Schedule 5).</p>
<i>Step 5:</i>	Review the appropriate development performance criteria in Sections 5.1 - 5.3 and determine which criteria are relevant to your proposal.
<i>Step 6:</i>	If a floodplain risk management plan has been adopted for your area, review all additional development controls in Section 5.4 and determine which of these additional criteria are relevant to your proposal. If site specific controls contradict generic controls determined in Step 5, the site specific controls will prevail.
<i>Step 7:</i>	Compile your flood DCP compliance report for the proposed development, as outlined in Schedule 3 of these Guidelines.
<i>Step 8:</i>	Ensure that you have included all required documentation with your development application. Refer to checklist in Schedule 1 of these Guidelines.
<i>Step 9:</i>	Submit all information to Council for assessment.

3 Development application documents

3.1 Flood Compliance Report

To enable Council to assess a development proposal, a flood DCP compliance report is to be provided for every development proposal on flood prone land. A flood DCP compliance report checklist is provided in Schedule 1 of these Guidelines.

The flood DCP compliance report must include the following compulsory information:

Existing flood information on the site (prior to the proposed development)

The information can be provided as either:

1. A current Flood Certificate

Where available, an up to date Flood Certificate must be submitted with your development application (refer Schedule 2 of these Guidelines for information on how to obtain this document and whether you need a basic or detailed certificate).

OR

2. A flood assessment report

A flood assessment report is needed in the following two instances:

a) Where flood data is not available but the site:

- is within 40 meters of a creek;
- is within 10 meters of a major drainage system, local overland flood path or drainage easement; or
- has a history of flooding; or
- is considered to be flood prone by Council's Floodplain Engineer

OR

b) Where flood data is available but may require interpolation, extrapolation, or refinement to greater detail.

Where a flood assessment report is required, the report must be submitted with the development application as part of the flood DCP compliance report.

A flood assessment report must be prepared by a suitably qualified and experienced engineer recognised under the National Engineers Register (NER) in this field. The full name of the person who prepared the report, relevant qualifications and registration number are to be provided on the front page of the report.

Please refer to Schedule 3 in these Guidelines for a detailed description on what information is required within such a report.

Compliance Assessment

A detailed assessment on how the proposed development will achieve all relevant objectives, performance criteria and/or acceptable solutions of Chapter G9 is required. It is expected that you list all relevant performance criteria and explain how each individual criteria has been met.

Development Plans

Plans for the proposed development or works that indicate compliance with all relevant development controls must be submitted.

Survey Details In addition to the requirement to lodge general survey details with the development application, the survey plan prepared by a registered surveyor must also indicate the following:

- a) Existing ground levels at each corner of the proposed building envelope;
- b) The floor levels of all existing buildings or structures to be retained as well as proposed floor levels for all new buildings and structures; and
- c) The location of any existing buildings or structures.

All levels must be relative to Australian Height Datum (AHD). Levels relating to an arbitrary assumed datum are not acceptable.

Note: Some applications for minor/ancillary development may not require survey details if a structural engineering certificate is provided.

Fill or A development application that includes land filling must be supported by:

*Excavation
Details*

- a) A site plan drawn to scale showing:
 - i. The extent of the proposed filling or excavation and the existing contours and levels of the land;
 - ii. The proposed contours and levels of the land and the depth and quantity of the filling, and;
 - iii. Details of proposed filling material, the method of compaction and stabilisation of the filling material.
 - b) Calculations showing the fill volume and the percentage of the 20%, 5% and 1% AEP flood volume taken up by the proposed fill material on site (for climate change conditions);
 - c) Details of the purpose of the proposed filling;
 - d) Details of the quality of the proposed fill material; and
 - e) Details of when the filling will be carried out and any other reasonable information required by Council.
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3.2 Additional development application documents

The reporting requirements vary depending on the nature of the proposed development. Please confirm with Council which certification and reporting requirements apply to your specific development application before commissioning a consultant to undertake the work.

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<i>Additional Survey Information</i>	<p>For some development the above minimum survey requirements may not be sufficient to assess the proposed development. Council may ask for the following additional information to be provided by the applicant:</p> <ul style="list-style-type: none">a) Existing ground levels at 0.2 metre contour intervals across the entire property (contours are to extend across adjoining land to enable suitable consideration of the effect of the proposed development);b) The ceiling heights of existing buildings or structures that are retained as well as for proposed new buildings and structures;c) Existing and/or proposed drainage lines (including sizes and if piped or open channel) or easements and watercourses, or other means of conveying stormwater that are relevant to the flood characteristics of the site; and,d) The contour lines showing the 2050/2100 flood planning level and PMF level if only parts of the property are flood prone.
<i>Hydraulic Impact Assessment Report</i>	<p>Some development (refer to Schedule 2 of Chapter G9) will require a hydraulic impact assessment report. A hydraulic impact assessment report is a document prepared by a suitably qualified hydraulic engineer, detailing how a proposed development will change flood behaviour on and off the site as well as how the new development itself will be impacted by flooding.</p> <p style="text-align: center;">Note: The full name of the person who prepared the report, relevant qualifications and registration number are to be provided on the front page of the report.</p> <p>The report must demonstrate that the development will not increase flood hazard or flood damage to other properties or adversely affect flood behaviour for a 5% AEP up to the PMF scenario (using the relevant 2050 or 2100 climate change conditions).</p> <p>Refer to Schedule 3 of these Guidelines for a detailed description on what information is required within such a report.</p>
<i>Structural Engineering Certificate</i>	<p>Some developments may require structural engineering certification to ensure that the proposed structures can withstand flood forces including debris and buoyancy forces up to a specified flood scenario. Please refer to Section 3 to confirm the level of certification required. Schedule 3 of these Guidelines also provides suggested structural conditions for developments affected by flood waters. Consultation with the Building Code of Australia – ABCB Standard for Construction of Buildings in Flood Hazard Areas is also recommended.</p>
<i>Geotechnical Engineering Certificate</i>	<p>Flooding of developed areas has the potential to cause significantly reduced bearing capacities of building foundations and, for masonry structures, these may lead to capacity failures. As such, some proposed development may require certification of building foundations by a chartered geotechnical practitioner especially in light of changing flood behaviour due to climate change and sea level rise.</p>

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<i>Flood Evacuation Plan</i>	Some development may require an engineering report demonstrating that permanent, fail-safe, maintenance free measures are incorporated in the development to ensure that the timely orderly and safe evacuation of people is possible from the area and that it will not add significant cost and disruption to the community or the SES.
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<i>Community Consultation Details</i>	Some development may require a report on community consultation that was undertaken as part of the pre-development investigations. It should note all issues raised and how they were addressed.
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Please note that Council may undertake further community consultation in accordance with Council's *Community Consultation Policy for Development Applications (Including Subdivision) and the Formulation of Development Guidelines and Policies*.

Schedule A1 - Flood Compliance Report Checklist

Please check with Council's Development Planner which of the following items you need to provide with your development application.

Item	Prepared by	Required?	Supplied
Current Flood Certificate or Flood Assessment Report			
Compliance Assessment			
Development Plans			
Survey Details (Some applications for minor / ancillary development may not require full survey details if a structural engineering certificate is provided)			
Fill or Excavation Details			
Note: The <u>items above are mandatory information required for a development application.</u> The <u>items below may be required</u> depending on type and scale of the proposed development.			
Additional Survey Details			
Hydraulic Impact Assessment Report			
Structural Engineering Certificate			
Geotechnical Engineering Certificate			
Flood Evacuation Plan			
Community Consultation Details			
Other:			

Schedule A2 – Flood Information Enquiries and Flood Certificates

One component of your application is to determine whether the land proposed for development is flood prone. To do this you can:

- a) Look at Council's online mapping by:
 - i. Searching Council's website www.shoalhaven.nsw.gov.au - the zoning details of properties within Shoalhaven can be found in the LEP maps online. Where Council has flood information, this is shown on Council's online mapping. Alternatively you can look at the individual catchment maps in the flood risk section.
 - ii. Attending Council's Customer Service Counter in the Administration Building to view the mapping, or
 - iii. Contacting Council by either phone, email or in writing and request the flood information for a subject site.

OR

- b) Consult the Section 10.7 Planning Certificate (10.7 Certificate)

A 10.7 certificate for a parcel of land may state whether the land is subject to "flood related development controls".

Please note that land may still be flood prone even though the 10.7 Certificate contains no reference to flooding. Historical information is not contained in certificates and further research should be undertaken if the property is in the vicinity of a watercourse or if the contours suggest a local flowpath may cross the land. While existing flood information may not exist there is the possibility that a property:

- is within 40 metres of a creek; or
- is within 10 metres of a major drainage system, local overland flood path or drainage easement; or
- has a history of flooding; or
- is considered to be flood prone by Council's Floodplain Engineer

and therefore further investigations by a suitably qualified engineer would be warranted. A 10.7 certificate for a parcel of land may state whether the land is affected by the above circumstances. Council's online mapping also identifies all know/recorded creeks, drainage systems, overland flow paths and drainage easements.

A 10.7 Certificate can be obtained by contacting Council.

If the property is flood affected you will need to obtain a Flood Certificate from Council. An application fee applies in accordance with Council's Fees and Charges. Figure 1 details the procedure for making a Flood Certificate request.

The Flood Certificate is required to be submitted with your development application. Please note that there are two types of certificates available, a basic and a detailed Flood Certificate. You will need to specify which type you are applying for.

A **Basic Flood Certificate** will contain the following information (if available):

- a. The 1% AEP flood level and the flood planning level (including the relevant sea level rise component when available) for the individual property;
- b. The hydraulic and hazard categorisation as per the NSW Floodplain Development Manual for the individual property; and
- c. The source of the provided data.

A **Detailed Flood Certificate** will include additional information such as PMF, 5% AEP, 20% AEP flood levels (including the relevant sea level rise component when available) and flood velocity. This information is generally required by structural engineers in order to provide hydraulic impact assessment reports for a development.

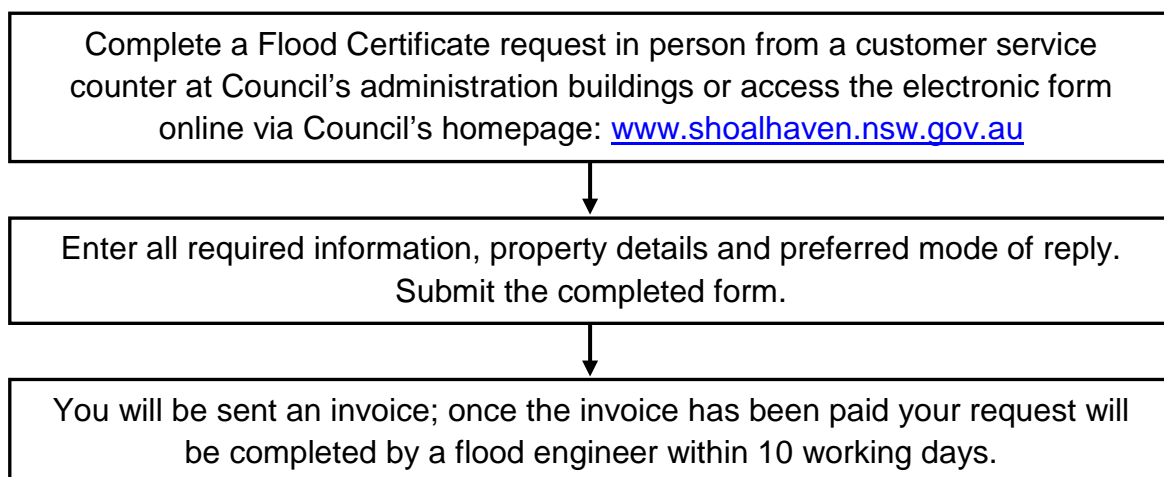


Figure 1: Procedure for obtaining a Flood Certificate from Council

Note: In order to prevent misunderstandings and in accordance with Council's policy, *Public Access to Council Information*, no verbal advice will be provided. Instead, you will be referred to Council's relevant LEP, any relevant flood study or floodplain risk management plan, or you may be requested to obtain a Flood Certificate.

Schedule A3 – Technical Reporting Requirements

A - Flood Assessment Report

A Flood Assessment Report must be prepared by a suitably qualified and experienced engineer recognised under the National Engineers Register (NER) in this field. The full name of the person who prepared the report, relevant qualifications and registration number are to be provided on the front page of the report.

The assessment report provides information on existing flood risk for a catchment and is to be commensurate with the NSW Floodplain Development Manual and must include the following information:

- (a) A description of the creek or drainage system that is relevant to the flood characteristics of the site, whether located on, adjacent to or remote from the development site;
- (b) A plan showing cross-sections through site - as a guide, the following cross-section information should be provided:
 - A minimum of 5 cross-sections, at a maximum distance of 20m apart, should be taken through the site, perpendicular to the likely flow path (i.e. the direction of the cross-section may not necessarily be in a single straight line);
 - One cross-section should be at the upstream end and one cross-section at the downstream end of the proposed development site;
 - Cross-sections should extend at least as high as the highest flood level available at the site and if possible be wide enough to cover the full width of the floodplain at that location; and
 - The cross-sections should be plotted at a suitable exaggerated scale (i.e. the vertical scale is not necessarily the same as the horizontal scale);
- (c) Flood levels for the PMF, 1%, 5%, 10% and 20% AEP events for the climate change pre development scenario (all assumptions, calculations and modelling output tables must be provided);
- (d) Flood velocities and vectors for the 1% AEP event for the climate change pre development scenario (all assumptions, calculations and modelling output tables must be provided);
- (e) Provisional Hazard categories based on depth and velocity as well as obvious other hazards such as evacuation difficulties as per the requirements of the 2005 NSW Floodplain Development Manual;
- (f) Provisional Hydraulic categories based on depth and velocity as per the requirements of the 2005 NSW Floodplain Development Manual; and

(g) Plans showing the results of (c) to (f) as well as the location of the proposed development.

Please note for:

- dot point a) The modelling shall include climate change considerations as per Council's adopted sea level rise projections for both sea level rise and predicted changes in rainfall.
- dot point b) The modelling shall include a 50% and 100% blockage analysis of all existing drainage structures that may affect the development site.
- dot point c) Localised flow effects shall be investigated and reported on where relevant.
- dot point d) The roughness coefficients used shall allow for fully vegetated stream conditions in order to account for potential revegetation of degraded areas without impact on flood levels.
- dot point e) In areas where local sub-catchment flooding, such as flows from drains, overland flow paths or similar, interact with overall catchment flooding from waterways and lakes; or, with ocean inundation a joint probability analysis of flood behaviour shall be undertaken.

B - Hydraulic Impact Assessment Report

For some development a Hydraulic Impact Assessment is required as part of the Flood Assessment Report, demonstrating that the development will not increase flood hazard or flood damage to other properties or adversely affect flood behaviour for a 5% AEP up to the PMF scenario.

A Hydraulic Impact Assessment Report must be prepared by a suitably qualified and experienced engineer recognised under the National Engineers Register (NER) in this field. The full name of the person who prepared the report, relevant qualifications and registration number are to be provided on the front page of the report.

This Schedule describes two methods for assessing hydraulic impacts of proposed developments. The two methods are:

- **Assessment Method 1** — Cross-section Analysis (No Computer Modelling);
- **Assessment Method 2** — Use of Existing Flood Study Data or Preparation of Site-Specific Model (Computer Modelling).

Method 1 will be sufficient for small scale development proposals. For larger developments, developments in sensitive areas, or where special circumstances exist, Council may require assessment method 2 to be used.

Both Assessment Methods need to be carried out by an experienced engineer and are to be commensurate with the NSW Floodplain Development Manual. In some circumstances, Council may determine the method(s) to be used.

Assessment Method 1 - Cross-section Analysis (No Computer Modelling)

In order to satisfy the requirement that the development will not increase flood hazard or potential flood damage to other properties or adversely affect flood behaviour for the full range of flood scenarios, the applicant must demonstrate that:

- (i) The proposed development will not involve fill volumes that occupy more than 1% of the available 20%, 5% and 1% AEP flood volume on the development site or involve cutting or filling in floodways.

Please note: it is too simplistic to assume that earthworks will have a negligible impact on the hydraulics of a waterway if the net cut and fill volumes for the PMF balance out. Hydraulic processes are complex and a simple "total fill < total cut" equation will not guarantee that the flood storage capacity of a waterway corridor are maintained. It is therefore necessary to check net cut and fill volumes within the site over a range of flood events.

- (ii) The proposed development will not adversely change flow direction and velocity or create any new preferential flow paths for the PMF, 1%, 5%, 10% and 20% AEP events; and
- (iii) The proposed development will not change the flood conveyance at any of the cross sections up to and including the PMF.

The flood conveyance should be calculated at each cross-section for pre-development and post-development conditions. Flood conveyance should be calculated at a range of water levels, at each cross-section, including the 1% AEP and PMF. All assumptions, particularly those relating to hydraulic roughness, must be documented, especially where the development results in a change in hydraulic roughness.

In special circumstances, small size developments inside a floodway may not reduce conveyance (e.g. minor alterations or additions carried out in the 'lee' of an existing structure). In such cases, Council may require assessment using Assessment Method 1 and 2 of this Schedule to demonstrate that conveyance is not being reduced.

This method does not require computer modelling. It checks for changes in flood storage volume, flood behaviour and conveyance at critical cross sections only through the proposed development.

This approach, whilst simpler than computer modelling, assumes a thorough knowledge of flood behaviour to ensure that the cross-section locations are representative of the principal impacts of the development.

In addition to the survey details and pre development flood information, the following shall be submitted, accompanied by appropriate supporting written information:

- (a) Post development flood level plots for the PMF, 1%, 5%, 10% and 20% AEP events at all cross sections (all assumptions, calculations and modelling output tables must be provided);
- (b) Post development in-stream and overbank flow velocity vector plots for the 1% AEP event at all cross sections (all assumptions, calculations and modelling output tables must be provided);
- (c) Calculation results for all calculations undertaken in order to demonstrate the above requirements; and
- (d) Pre and post development ground surface levels — this information should be shown on each cross-section, with areas of cut and fill clearly shown.

Assessment Method 2 - Use of Existing Flood Study or Preparation of Site-Specific Flood Study (Computer Modelling)

This method requires computer modelling. An existing flood study model may be used if available and suitable (e.g. it contains sufficient local detail).

For large scale developments or developments in critical locations, a flood study using a fully dynamic one or two dimensional hydraulic computer model may be required. Such a flood study would be prepared in a manner consistent with the NSW Floodplain Development Manual, and the current *Australian Rainfall and Runoff — A Guide to Flood Estimation* (Institution of Engineers, Australia) and relevant Council codes.

In addition to the survey details and pre development flood information, the following shall be submitted in plan form, accompanied by appropriate supporting written information:

- (a) Post development water surface contours — these should be provided in metres to Australian Height Datum (AHD);
- (b) Post development flood profiles — these should be provided at a suitable vertical and horizontal scale such that any changes in flood levels are easily identified;
- (c) Post development velocity vectors — these show direction and relative size of flood velocities and should be provided in metres per second (m/s);
- (d) Difference plots for flood levels and velocities for the 20% and 1% AEP flood events;

- (e) Post development contours of flood velocities multiplied by depth of flooding over ground level indicating provisional hydraulic categories as per the requirements of the 2005 NSW Floodplain Development Manual — these should be provided to one decimal place; and
- (f) Post development provisional hazard categories based on depth and velocity as well as obvious other hazards such as evacuation difficulties as per the requirements of the 2005 NSW Floodplain Development Manual.

An interpretation of the results clearly indicating the effects of the proposed development on general and local flood behaviours and potential impacts on neighbouring properties is to be provided. This interpretation should clearly inform the last section of the Flood DCP Compliance Report which seeks to provide a detailed assessment of how the proposed development will achieve the objectives and performance criteria of this DCP.

Please note:

- *A range of flood sizes should be chosen for the above analyses so that the full impacts of the development can be assessed. Typically, the flood sizes to be considered would be: a 20% AEP, 5% AEP, 1% AEP and a probable maximum flood.*
- *For the post-development scenario, all proposed works and structures, including any revegetation and enhancements should be included in the analysis.*
- *All assumptions relating to hydraulic roughness should be clearly documented.*
- *Flood levels and velocities need to be computed not only at the site but also at an appropriate distance upstream and downstream to allow the principal impacts of the development to be determined.*

C - Structural Conditions for Developments Affected by Flood

A structural engineer must certify that the building will be able to withstand hydrostatic and hydrodynamic forces of flood waters including debris and buoyancy forces based on relevant depth, velocity and debris loadings for the specific site.

Some guidance is provided in Appendix A of the Hawkesbury and Nepean floodplain Management Steering committees. *Reducing Vulnerability of Buildings to Flood Damage.*

Schedule A4 – Flood Proofing Guidelines

There are many different ways in which to reduce flood damages and flood proofing is generally recommended for any building on land that is considered by Council as being flood prone. Flood proofing refers to the design and construction of buildings with appropriate water resistant materials such that flood damage to the building is minimised, should it be inundated. Certain types of materials are better able to withstand inundation than others, for example, plasterboard and chipboard, both materials commonly used for the internal wall linings and cupboard fittings of a house, can be badly damaged on inundation and may have to be replaced. In contrast, double brick construction can withstand inundation and may only require a hose and scrub down when the flood subsides.

Adequate flood proofing of buildings in flood liable areas is an effective and equitable means of reducing flood damage to the structure or building. The following table provides information on flood proofing measures and flood compatible materials (being those materials used in building that are resistant to damage when inundated). The table is not an exhaustive list, however provides an indication of what is considered as suitable in flood prone areas.

Further reference can be made to *the Building Code of Australia – ABCB Standard for Construction of Buildings in Flood Hazard Areas*.

A) Construction Methods and Materials

Construction methods and materials listed in the following table are graded into four classes according to their resistance to floodwaters:

Suitable - the materials or products which are relatively unaffected by submersion and unmitigated flood exposure and are the best available for the particular application.

Mild effects - where the most suitable materials or products are unavailable or economic considerations prohibit their use, these materials or products are considered the next best choice to minimise the damage caused by flooding.

Marked effects - as for "2nd preference" but considered to be more liable to damage under flood conditions.

Severe effects - the materials or products listed here are seriously affected by floodwaters and in general have to be replaced if submerged. They are not recommended for use in flood prone areas.

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COMPONENT	SUITABILITY OF MATERIAL OR CONSTRUCTION METHOD			
	Suitable	Mild Effects	Marked Effects	Severe Effects
Floor & Sub-Floor Structure	<ul style="list-style-type: none"> concrete slab-on-ground monolith construction where the ground level allows the flood planning level requirements to be met <i>note: clay filling is not permitted beneath slab-on-ground construction, which could be inundated</i> suspension reinforced concrete slab 	<ul style="list-style-type: none"> timber floor (T&G boarding, marine plywood) full epoxy sealed joints 	<ul style="list-style-type: none"> timber floor (T&G boarding, marine plywood) with ends only epoxy sealed on joints and provision of side clearance for board swelling 	<ul style="list-style-type: none"> timber close to ground surrounding base timber flooring with ceilings or soffit linings timber flooring with seal on top only
Floor Coverings	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> cement / bituminous formed-in-place cement / latex formed-in-place rubber tiles, with chemical set adhesive terrazzo vinyl tile with chemical-set adhesive vinyl-asbestos tiles asphaltic adhesives loose rugs 	<ul style="list-style-type: none"> asphalt tiles with asphaltic adhesives loose fit nylon or acrylic carpet with closed cell rubber underlay 	<ul style="list-style-type: none"> carpeting, glue-down type or fixed with smooth edge on jute felts chipboard (particle board) cork linoleum PVA emulsion cements vinyl sheets or tiles coated on cork or wood backings fibre matting (sea- grass matting)

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COMPONENT	SUITABILITY OF MATERIAL OR CONSTRUCTION METHOD			
	Suitable	Mild Effects	Marked Effects	Severe Effects
	<ul style="list-style-type: none"> vinyl sheets or tiles with chemical set adhesives ceramic tiles, fixed with mortar or chemical set adhesive asphalt tiles, fixed with water resistant adhesive 	<ul style="list-style-type: none"> ceramic tiles with acid and alkali-resistant grout 		
Wall Structure (up to FPL)	<ul style="list-style-type: none"> solid brickwork, block-work, reinforced, concrete or mass concrete 	<ul style="list-style-type: none"> two skins of brickwork or block-work with inspection openings 	<ul style="list-style-type: none"> brick or block-work veneer construction with inspection openings 	<ul style="list-style-type: none"> inaccessible cavities large window openings
Roof Structure (for situations where FPL is above the ceiling of an existing building)	<ul style="list-style-type: none"> reinforced concrete construction galvanised metal construction 	<ul style="list-style-type: none"> timber trusses with galvanised fittings 	<ul style="list-style-type: none"> traditional timber roof construction 	<ul style="list-style-type: none"> inaccessible flat roof construction ungalvanised steelwork eg. lintels, arch bars, tie rods, beams, etc. unsecured roof tiles
Doors (below FPL)	<ul style="list-style-type: none"> solid panel with water proof adhesives flush door with marine ply filled with closed cell foam painted metal construction 	<ul style="list-style-type: none"> flush panel or single panel with marine plywood and water proof adhesive T&G lines door, framed ledged and braced painted steel timber frame fully epoxy sealed before assembly 	<ul style="list-style-type: none"> fly-wire doors standard timber frame 	<ul style="list-style-type: none"> hollow core ply with PVA adhesives and honeycomb paper core

Supporting Document 1 - Chapter G9 - Guidelines for Development on Flood Prone Land

COMPONENT	SUITABILITY OF MATERIAL OR CONSTRUCTION METHOD			
	Suitable	Mild Effects	Marked Effects	Severe Effects
	<ul style="list-style-type: none"> aluminium or galvanised steel frame 			
Wall & Ceiling Linings (up to the FPL)	<ul style="list-style-type: none"> cement board brick, face or glazed clay tile glazed in waterproof mortar concrete concrete block steel and waterproof applications stone, natural solid or veneer, waterproof ground glass blocks glass plastic sheeting or wall with waterproof adhesive 	<ul style="list-style-type: none"> brick, common plastic wall tiles metals, non ferrous rubber mouldings and trim wood, solid or exterior grade plywood fully sealed 	<ul style="list-style-type: none"> chipboard exterior grade hardboard exterior grade wood, solid (boards or timber) with allowance for swelling wood, plywood exterior grade fibrous plaster board 	<ul style="list-style-type: none"> chipboard fibreboard panels mineral fibreboard paperboard plaster-board, gypsum plaster wall coverings (paper, burlap cloth types) wood, standard plywood strawboard
Insulation (up to FPL)	<ul style="list-style-type: none"> foam or closed cell types 	<ul style="list-style-type: none"> reflective insulation 	<ul style="list-style-type: none"> bat or blanket types 	<ul style="list-style-type: none"> open cell fibre types
Windows (below FPL)	<ul style="list-style-type: none"> aluminium frame with stainless steel or brass rollers or similar 	<ul style="list-style-type: none"> epoxy sealed timber waterproof glues with stainless steel or brass fittings 		<ul style="list-style-type: none"> timber with PVA glues mild steel fittings

Supporting Document 1 - Chapter G9 - Guidelines for Development on Flood Prone Land

COMPONENT	SUITABILITY OF MATERIAL OR CONSTRUCTION METHOD			
	Suitable	Mild Effects	Marked Effects	Severe Effects
	corrosion and water resistant material	<ul style="list-style-type: none"> galvanised or painted steel 		
Nails, Bolts, Hinges & Fittings (below FPL)	<ul style="list-style-type: none"> brass, nylon or stainless steel removable pin hinges 	<ul style="list-style-type: none"> hot dipped galvanised steel wire nails aluminium 		<ul style="list-style-type: none"> mild steel

More information on reducing vulnerability of buildings from flood damage please refer to Reducing Vulnerability of Buildings to Flood Information prepared by the Hawkesbury-Nepean Floodplain Management Steering Committee

B) Electrical and Mechanical Equipment

For dwellings constructed on flood liable land, the electrical and mechanical materials, equipment and installation must conform to the following requirements:

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

Wiring - all wiring, power outlets, switches, etc., must, to the maximum extent possible, be located above the flood planning level. All electrical wiring installed below the flood planning level must be suitable for continuous submergence in water and must contain no fibrous components. Only submersible-type splices are to be used below the flood planning level. All conduits located below the flood planning level are to be so installed that they will be self-draining if subjected to flooding.

Equipment - All equipment installed below or partially below the flood planning level must 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 must be thoroughly cleaned or replaced and checked by an approved electrical contractor before reconnection.

C) Heating and Air Conditioning Systems

Heating and air conditioning systems must, to the maximum extent possible, be installed in areas and space of the house above the flood planning level. When this is not feasible every precaution must be taken to minimise the damage caused by submersion according to the following guidelines:

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

Installation - The heating equipment and fuel storage tanks must 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 must be vented to an elevation of 0.5m above the flood planning level.

Ducting - All ductwork located below the flood planning level must 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 flood planning level, the ductwork must be protected by a closure assembly operated from above flood planning level.

Schedule A5 – The Policy Context - Flood Prone Land

Chapter G9 and these Guidelines are based on best practice principles as set out in the NSW Flood Prone Land Policy and the NSW Floodplain Development Manual. The following provides a summary of the contents of these documents and shows how Chapter G9 sits within the overall policy framework.

Flood Prone Land Policy (1984)

The primary objective of the NSW Flood Prone Land Policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone land, and to reduce private and public losses resulting from floods.

At the same time, the policy recognises the benefits flowing from the limited use, occupation and development of flood prone land.

The policy promotes the use of a merit approach which balances social, economic, environmental, and flood risk parameters to determine whether a particular development or use of the floodplain is appropriate and sustainable.

In this way the policy avoids the unnecessary sterilisation of flood prone land. Equally it ensures that flood prone land is not the subject of uncontrolled development inconsistent with its exposure to flooding.

The policy requires that:

- Both mainstream and overland flooding be addressed in the preparation and implementation, by councils, of strategically generated floodplain risk management plans;
- The impact of flooding and flood liability on existing developed areas identified in floodplain risk management plans be reduced by flood mitigation works and measures, including on-going emergency management measures, the raising of houses where appropriate and by development controls; and
- The potential for flood losses in all areas proposed for development or redevelopment be contained by the application of ecologically sensitive planning and development controls.

NSW Floodplain Development Manual (2005)

The NSW Floodplain Development Manual 2005 (the Manual) is concerned with the management of the consequences of flooding as they relate to the human occupation of the floodplain for urban development and agricultural production. The Manual addresses flood risk. The Manual requires that management decisions taken in respect of the human occupation of the floodplain need to satisfy the social and economic needs of the community, as well as being compatible with the maintenance or enhancement of the natural ecosystems that the floodplain sustains.

The Manual supports the NSW Flood Prone Land Policy in providing for the development of sustainable strategies for managing human occupation and use of the floodplain considering risk management principles. These are based upon a hierarchy of avoidance, minimisation (using planning controls) and mitigation works.

The Manual states that the most effective means of achieving sound flood risk management outcomes is to formulate and implement management plans through the floodplain risk management process as shown in Figure 2 below. Due to the level of detail required; technical studies and other complexities, the process generally takes several years to be completed.

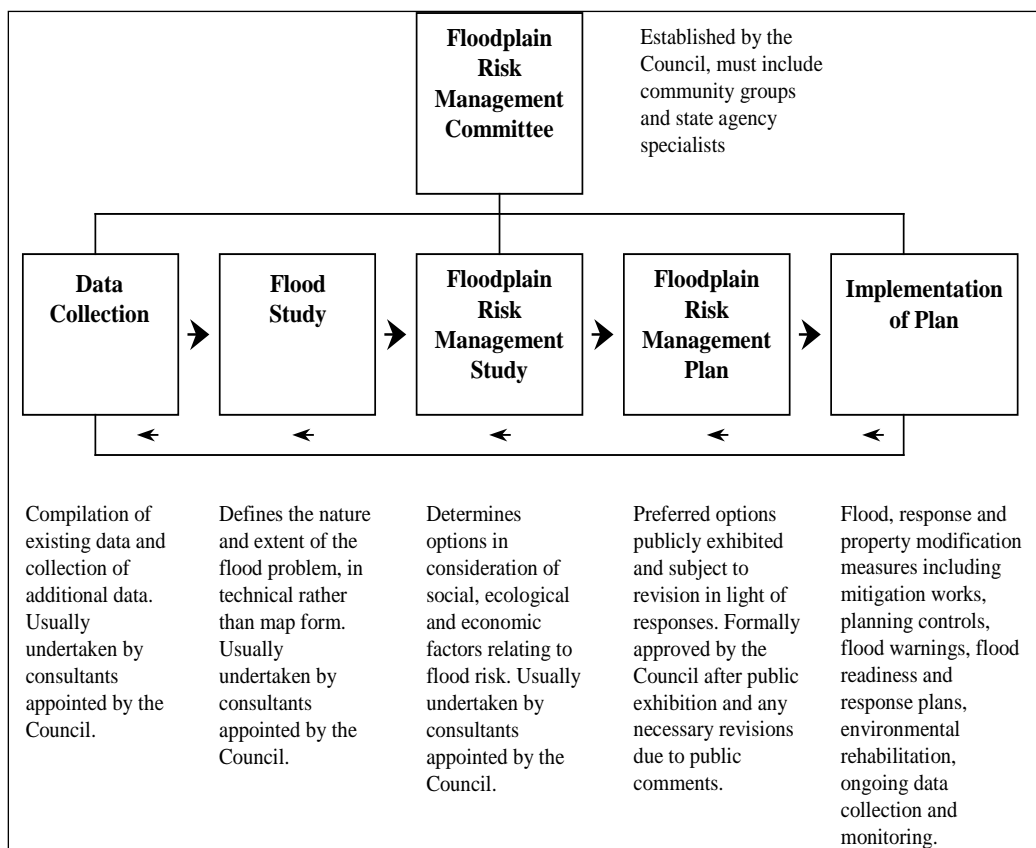


Figure 2: Floodplain Risk Management Process- Source: 2005 NSW Floodplain Development Manual

A management plan generally involves a mix of options as it is unusual for a single management option to manage the full range of flood risk. Determining the optimum mix of measures can require complex studies, exercise of professional judgement and extensive community consultation. Typical options considered are:

- a) Property modification measures such as development controls in new areas or voluntary purchase and house raising in developed areas;
- b) Response modification measures such as evacuation and associated operational logistics; and
- c) Flood modification measures such as levees or bypass channels.

As per the Flood Prone Land Policy, the Manual provides for the application of a “merit approach” for decisions on the future use of the floodplain. This is an approach which weighs social, economic, ecological and cultural impacts of land use options for different flood prone areas together with flood damage, hazard and behaviour implications, and environmental protection and wellbeing of the State’s rivers and floodplains.

This "merit approach" operates at two levels:

- i. the strategic level; and
- ii. the site specific level.

At the strategic level, the "merit approach" allows for consideration of social, economic, ecological, cultural and flooding issues to determine strategies for the management of continuing and future flood risk. For example, floodplain risk management plans and Council environmental planning instruments such as the Shoalhaven LEP 2014.

At a site specific level, the "merit approach" involves consideration of the best way of assessing development allowable under the floodplain risk management plans, the local floodplain risk management policy and environmental planning Instruments. These considerations include site specific issues such as minimum floor levels, building location within the site, access to the site, structural stability, and flood proofing etc., as appropriate.

Flood Planning Concepts

Flood Planning Area

The criteria within Chapter G9 for determining development applications for development on flood prone land are structured in recognition that different controls are applicable to different land uses and levels of potential flood inundation and hazard. The following hydraulic and hazard classifications apply:

- a) Within the flood planning area (refer to Figure 2)
 - Flood Fringe (can be high or low hazard)
 - Flood Storage (can be high or low hazard)
 - Floodway (generally high hazard)

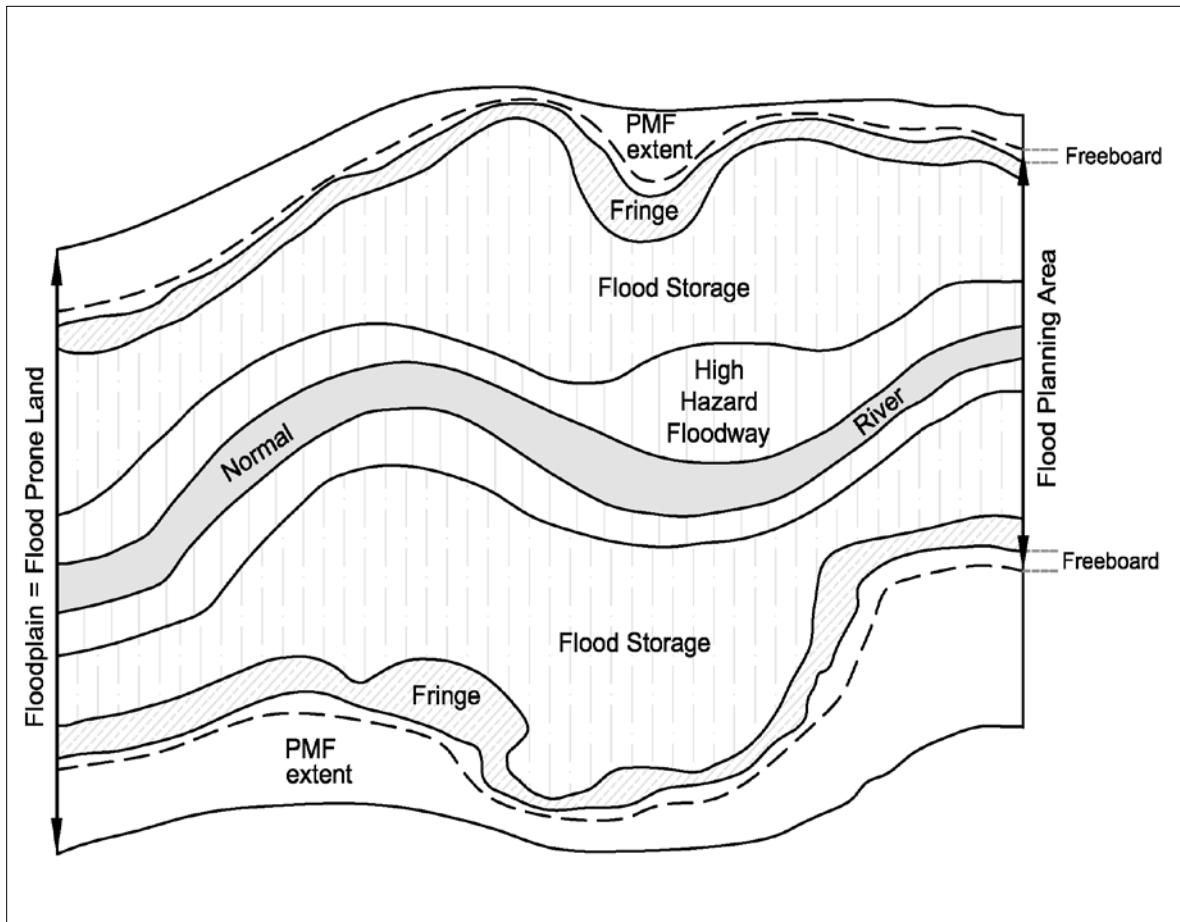


Figure 2: Floodplain Aerial View

- b) Outside the flood planning area but within the floodplain, that is below the PMF level (refer to Figure 3).

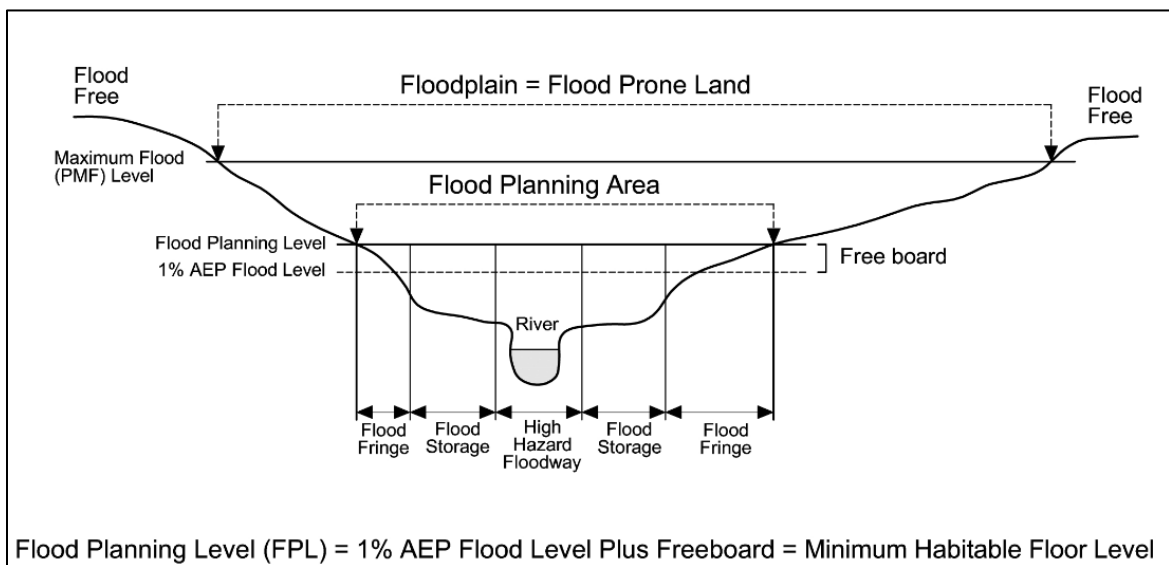


Figure 3: Cross Section through floodplain – hydraulic categories within flood planning area

Flood planning levels and Freeboard

Flood planning levels are the combination of adopted design flood level plus freeboard. They determine the area of land (flood planning area) on which specific flood related development controls will be imposed. They are set during the floodplain risk management process and are based on a detailed understanding of flood behaviour across the full range of floods, their probability of occurrence and the social, economic and ecological consequences associated with those floods.

Freeboard is a factor of safety applied as an additional height to identified flood levels. The purpose of a freeboard is to cater for uncertainties in the estimation of flood levels across the floodplain due to wave action, localised hydraulic behaviour such as eddies and embankment or levee settlement and some of the uncertainties associated with estimating climate change impacts. The freeboard and flood planning levels can be seen in Figure 3.

Climate Change

Climate change is expected to have impacts on sea levels and rainfall intensities, both of which may influence flood behaviour at specific locations. Potential impacts are therefore considered during the floodplain risk management process and are taken into account when design flood levels for each individual catchment are determined.

Current NSW Government legislation requires climate change to be considered.

Figure 4 shows how the 1% AEP flood levels will incrementally factor in sea level rise planning benchmarks:

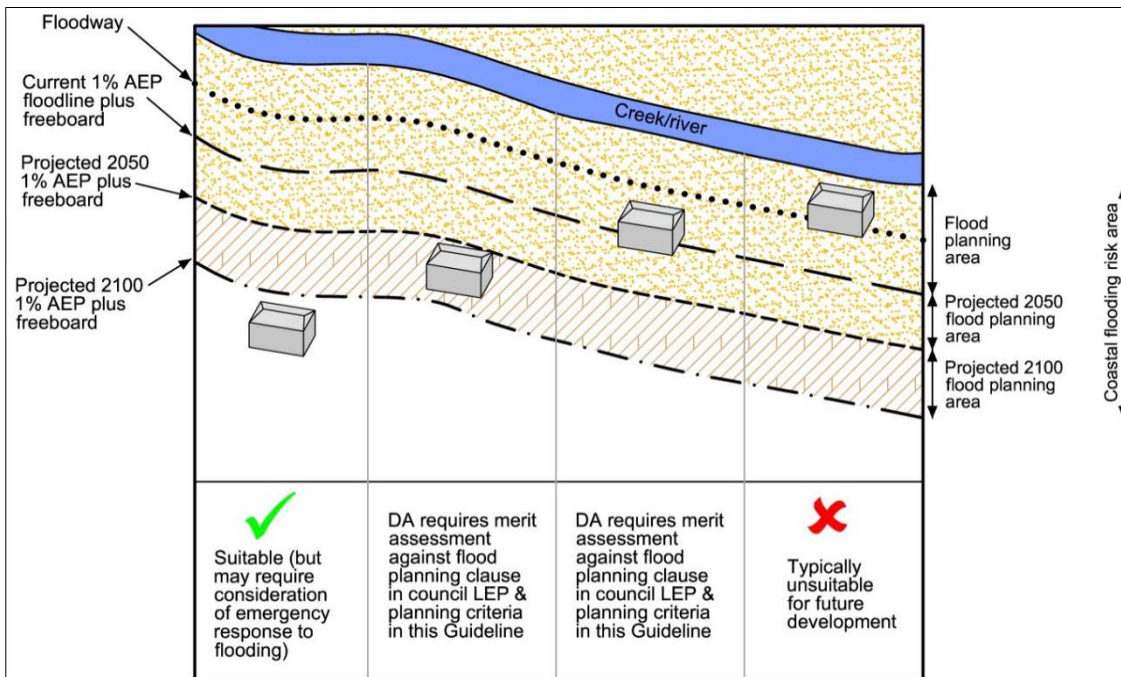


Figure 4: Coastal Flooding Consideration in Development Assessment Process

Source: NSW Coastal Planning Guideline: Adapting to Sea Level Rise 2010

Currently no relevant planning benchmarks have been adopted by Government in relation to rainfall intensity changes. However, NSW State Government guidelines recommend doing a sensitivity analysis using nominal increases in rainfall intensities. If a flood assessment report is required, the sensitivity analysis is to be done at this time.

In order to meet the above requirements, the following is to be considered.

- for new building applications, the impact of sea level rise for a 50 year period is to be assessed and included when determining the flood planning level; and
- for new subdivision applications, the impact of sea level rise in the next 100 years is to be assessed and considered in the design and calculation of the flood planning level.

Note: If a Flood Certificate provides flood levels for existing conditions as well as conditions in the year 2050 and 2100, climate change has already been included when calculating the flood planning level.

Throughout Chapter G9 and these Guidelines, various AEP flood events are referred to as well as the flood planning level. It is up to the applicant to use the appropriate climate change conditions for these AEP flood events and the flood planning level. For example, if the document says “1% AEP flood event” this means the 2050 1% AEP flood event if the application is for a new development or it means the 2100 1% AEP flood event if the application is for a new subdivision.