

Guidelines for Coastal Catchment Management Authorities

Assessing development in relation to sea level rise.
June 2012



These Guidelines have been developed in consultation with representatives of the Catchment Management Authorities, Melbourne Water, the Department of Sustainability and Environment and the Department of Planning and Community Development.

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Purpose of the guidelines

These guidelines set out relevant criteria and considerations to be taken into account by coastal Catchment Management Authorities (CMAs) in assessing development proposals that may potentially be affected by sea level rise. They do not apply to Melbourne Water. Melbourne Water has developed similar guidelines, tailored to meet local circumstances.

The guidelines will be reviewed in 2017, or prior to, if there are advances in adaptation planning prior to this date.

The role of CMAs is to provide advice on flooding and development controls pursuant to Section 202 of the *Water Act 1989*. This does not include advising on coastal physical vulnerability such as erosion.

Application of guidelines

CMAs need to consider these guidelines when advising the responsible authority on development proposals under the *Planning and Environment Act 1987*, and the application of Clause 13.01 of the State Planning Policy Framework relating to predicted rises in sea level.

In addition, these guidelines should inform any pre-application advice provided to relevant applicants by the CMA and or the responsible authority.

It is important to note that these guidelines focus on coastal inundation and are not relevant to the CMA's role in providing advice on development proposals located on floodplains that are not affected by coastal inundation.

Specifically, these guidelines apply to land including:

- areas adjoining the coastline;
- estuaries, such as the Gippsland Lakes; and
- the tidal reaches of rivers, drains and other waterways.

Where a responsible authority forms the view that land may be subject to potential coastal inundation, it may seek a CMA's view pursuant to the referrals process outlined in Sections 52 and 55 of the *Planning and Environment Act 1987*.

Policy basis for guidelines

These guidelines apply the policies set out in Clause 13.01-1 of the State Planning Policy Framework relating to coastal inundation.

In addition to these guidelines, flood information specific to a particular locality set out in the planning scheme or known by a Floodplain Management Authority, must also be considered in assessing development in areas susceptible to coastal inundation or in riverine and estuarine areas that are impacted by sea level rise.

Any relevant information in addition to these guidelines must be construed consistently with and reflect the intent of the objective and strategies set out in Clause 13.01-1 of the State Planning Policy Framework.

Objectives of the guidelines

The primary objective of these guidelines is set out in Clause 13.01 of the State Planning Policy Framework in the planning scheme.

That is, to plan for and to manage the potential coastal impacts of climate change in advising on development and use of land.

In order to realise this objective, the following strategies apply:

Plan for sea level rise of not less than 0.8 metres by 2100, and allow for the combined effects of tides, storm surges, coastal processes and local conditions such as topography and geology when assessing risks and coastal impacts associated with climate change.

Although coastal inundation from sea level rise and storms may take years to be experienced, in some areas the impacts will be felt sooner. If development intensifies in coastal areas at risk of current or future inundation, property and infrastructure damage may increase, and increased numbers of people may be exposed to health and safety issues associated with flooding. However, tight restrictions on development at this point in time may impact on the viability and vitality of coastal communities, which may not be affected by sea level rise for some time. Effective adaptation planning is ultimately the medium to long term solution to managing the impacts of sea level rise.

Apply the precautionary principle to planning and management decision-making when considering the risks associated with climate change.

The precautionary principle states that where there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for delaying actions to prevent environmental degradation. In practice, this means decision makers should consider the best available science and information on potential impacts and risks and take action to prevent degradation of the environment where there are threats of serious or irreversible environmental damage.

Ensure that new development is located and designed to take account of the impacts of climate change on coastal hazards such as the combined effects of storm tides and river flooding.

Climate change will progressively impact on flood risk at the property level. This can come from increased sea and flood levels. The progressive change in flood risk will necessitate appropriate planning and building controls.

Buildings typically have a lifespan of 30 to 80 years, but it is not unusual for some form of re-development to occur before then, either through a new building or extensive renovations/additions to a building, requiring a new planning and/or building control where new conditions can be applied.

Ensure that land subject to coastal inundation is identified and appropriately managed to ensure that future development is not at risk.

These guidelines support the need for flood mapping at a suitable scale and quality, to enable referrals to be made to CMAs. The Victorian Government will provide the following information and guidance to assist decision makers as it is completed:

- Digital elevation models of the Victorian coast provide three-dimensional representations of the land (topographic) to indicate areas that may be more vulnerable to coastal inundation.
- Bathymetric (sea-floor) digital elevation models along the entire Victorian coast.
- Regional climate change projections developed by CSIRO for ten regions of Victoria that include projections on temperature and rainfall.
- The Victorian state-wide inundation dataset, which maps the projected extent of coastal inundation due to sea level rise and storm tide events (the rise of water associated with a storm event combined with a high tide) for four different time periods: 2010, 2040, 2070 and 2100.
- The Victorian Coastal Hazard Guide provides further information for land managers and decision makers on coastal hazards such as erosion and inundation. It describes the impact that climate change may have on these hazards, and provides guidance on the ways to manage the effects of these hazards.
- A coastal asset data library containing information about built and natural assets on Victoria's coast.

CMAs are encouraged to make use of new information and scientific data on coastal hazards as it becomes available.

New large-scale development outside existing urban areas, such as greenfield subdivisions, has the potential to significantly increase the number of people and amount of infrastructure at risk. Aside from flooding considerations at the site there will be a need to consider how roads, drains, water, gas, power and other services can be provided to the site in a sustainable manner. Other considerations relate to preserving significant flowpaths or flood storage areas and their associated ecological values.

Development proposals outside established urban areas which require rezoning may also be subject to Ministerial Direction 13 under the *Planning and Environment Act 1987*. The Direction applies to any planning scheme amendment involving coastal land which would have the effect of allowing non-urban land to be used for an urban use and development.

Avoid development in identified coastal hazard areas susceptible to inundation.

It is usually too late to avoid development in existing urbanised areas because the streetscape and infrastructure have already been established, and in many situations, it is better to allow development inside existing urban areas rather than expand into rural areas. This is not the case for new development outside existing urban communities that would substantially increase numbers of people at risk of future flooding. For such areas a long term planning approach is warranted, to ensure that new development will be located, designed and protected from potential coastal hazards well into the future.

Considering and advising on development proposals

Responsible authorities are encouraged to give CMAs notice under the *Planning and Environment Act 1987* where advice is required from the CMA on the impacts of sea level rise on a proposed development and or use of land.

An applicant may also seek advice from the CMA as part of their pre-application discussions.

The CMA's role is to provide the responsible authority with expert advice on the potential flood risk arising from coastal inundation. It is not the CMA's role to provide advice or a response on other aspects of the planning scheme that are not relevant to its functions under Section 202 of the *Water Act 1989*.

In providing advice or a response, the CMA must consider all reliable information relevant to coastal inundation available at the time it considers the application.

Where there is a level of uncertainty about how climate change will affect sea level rise in relation to particular land, the precautionary principle should be applied. The precautionary principle is reflected in the benchmark flood levels set out in these guidelines.

Where direct enquiries are received as part of a pre-application process or from the public generally, the CMA should state that any advice provided is on an information only basis and should not be construed as giving approval or otherwise for development on the property. The CMA may also recommend that the person contact the relevant council for further information.

Establishing flood levels and associated risk

Flood behaviour, and therefore flood hazard, is influenced by a range of factors, including the catchment and floodplain topography, and for coastal flooding, the coastline and shape of the estuary. These vary significantly with location. The process is complex and accuracy of the flood hazard will improve with better data.

Factors that influence the flood risk include: frequency, duration, extent, depth and velocity of flooding of the site and access pathway; the flood warning time available; and the danger to occupants of the development, other floodplain residents, and emergency personnel if the site or access path is flooded.

It is envisaged that flood level estimates will improve over time, and will be influenced by the capture of historic data and the implementation of local and regional adaptation plans.

Considerations that influence flood level estimates along the coast and estuaries may include:

- mean sea level rise associated with global warming;
- storm surges, which are a rises above the normal water level along a shore resulting from strong onshore winds and / or reduced atmospheric pressure;
- tidal variations;
- flows from drains and rivers, including the effects of outfalls being drowned out by high water levels;
- flood storage in lakes and estuaries;
- the effect of openings such as sand bars across estuaries; and
- the impact of waves on the shoreline - wave set up and run-up.

CMAs need to consider these factors where relevant, and are advised to use the best available data and evidence to estimate one per cent Annual Exceedence Probability (AEP) flood levels and the flood hazard.

Assessing proposals

Assessment of development proposals will involve the following steps 1 to 4.

Step 1: Establish if there is a need to request additional information

As a minimum, the information provided by an applicant should include the following:

Plans that adequately describe the nature of the proposed development and its relationship to adjoining area, (including but not limited to scaled site plans, locality maps, architectural drawings detailing the proposals, and an existing conditions plan showing how the land is currently used and developed).

A feature survey of the property and its access routes to enable the depth of flooding to be estimated (unless the CMA already has sufficient information).

The CMA or the responsible authority may require additional relevant information from the applicant to enable the proposals to be satisfactorily assessed against the relevant considerations set out in Appendix A to these Guidelines. Under Section 54 of the *Planning and Environment Act 1987* the statutory referral response time in which a CMA has to consider a referral would be suspended until such information is provided.

Assessing the Proposed Development

A two-fold approach should be applied when assessing development proposals:

1. assess the compliance of the proposal with applicable benchmark flood levels applying to the proposals; and
2. evaluate the proposal with regard to other relevant considerations.

Step 2: Assess compliance of the proposal with benchmark flood levels

A proposal should be assessed against the applicable benchmark flood levels shown below. The one per cent AEP flood level is equivalent to the 1-in-100 year flood level, which should be based on the best information available. This is expected to be either flood levels derived from CSIRO work undertaken for Victoria¹, or from more detailed flood investigations if they have been carried out and, in the view of the CMA, provide better information.

Development	Minimum Benchmark Flood Level
Development accommodating emergency and community facilities (as per Clause 13-02 of the VPPs) Greenfield development (as defined in the glossary)	1% AEP flood level, taking into account a rise in mean sea level of at least 0.8 m, and the impacts of storm tides.
All other development in existing urban areas. New and replacement dwellings and other individual buildings outside existing urban areas	Current 1% AEP flood level

Notes

1. In some areas, where adaptation planning has already occurred or is occurring, and there is a strong case for locally approved solutions, CMAs and local councils may agree to continue to apply local criteria for assessing local development.
2. In some instances flood levels in estuaries from riverine flooding have been determined that incorporate the impacts of sea level rise, resulting in more appropriate estimates of flood levels for these areas.
3. Dwelling is defined in the glossary but is generally taken to be a place of residence, excluding motels and hotels.
4. For the purpose of these guidelines, urban areas are within or in the vicinity of a gazetted town and zoned business, industrial or residential (other than low density) in planning schemes.
5. Greenfield developments such as multi lot subdivisions may require rezoning, in which case Ministerial Direction No.13 will apply, in addition to these guidelines. This sets out the requirements for consideration of coastal climate change impacts as part of the planning scheme amendment process.

¹ This information is available in two reports by Kathleen L. McInnes, Ian Macadam and Julian O'Grady, CSIRO Marine and Atmospheric Research 2009: *The Effect of Climate Change on Extreme Sea Levels in Port Phillip Bay* and *The Effect of Climate Change on Extreme Sea Levels Along Victoria's Coast*.

Step 3: Evaluate the proposal against other relevant considerations

Once the Benchmark Flood Level has been identified, the next step is to assess whether the development is appropriate, having regard to the evaluation criteria set out in Appendix A of these Guidelines and any other relevant considerations. If a CMA considers, having regard to the evaluation criteria and or any other relevant consideration, that a proposal creates an unacceptable flood risk, then the CMA may wish to object to the proposal.

For example, a site in an established urban area that has an high or extreme hazard, according to the criteria in Appendix A, may not be suitable for a subdivision.

Step 4: Advice / response to responsible authority on application

If the CMA is a referral authority in relation to the application, then it must provide its response in accordance with Section 56 of the *Planning and Environment Act 1987*

Section 56 enables the CMA as referral authority to respond to a referred permit application by:

- not objecting to the grant of a permit;
- not objecting to the grant of a permit subject to conditions; or
- objecting to the grant of a permit.

In addition, referral authorities may also provide comments on the application.

The responsible authority must decide the application in accordance with the provisions of the *Planning and Environment Act 1987*.

Conditions on planning permits

In order to be valid, any condition proposed by the CMA for inclusion on a planning permit must relate to the proposed development, and must be for a flood management related planning purpose.

At the discretion of the CMA, valid floodplain management related planning purposes could include (but are not limited to):

- requiring measures to protect development against the potential adverse effects of rises in sea level;
- setting minimum floor levels for building and works to protect development from flooding;
- requiring protection measures such as higher floor levels and setbacks for building and works that may be subject to wave action;
- setting minimum requirements in relation to foundations, sub floors and cladding to protect against the potential adverse effects of rising sea level;
- requiring a proposal for a temporary development with a limited lifespan to be removed from the site at a particular point in time; and
- preventing further intensification of development through construction of more than 2 dwellings on a lot, or further subdivision.

Application of Freeboard

Freeboard is the height above the adopted design (one per cent AEP) flood level, and is typically used to provide a safety margin, to take into account uncertainties in the flood level estimate. This is illustrated in Figure 1.

Uncertainties include:

- inaccuracies in the way flood levels have been estimated;
- differences in water levels across the flooded area because of local factors such as turbulence around objects or an undulating water surface; and
- increases in water level as a result of local wave action or coastal effects.

CMA's generally apply a minimum of 0.3 m freeboard, but this can vary. Melbourne Water for example sets a freeboard of 0.6 m for development subject to riverine flooding. Freeboard requirements should be determined in consultation with the local council.

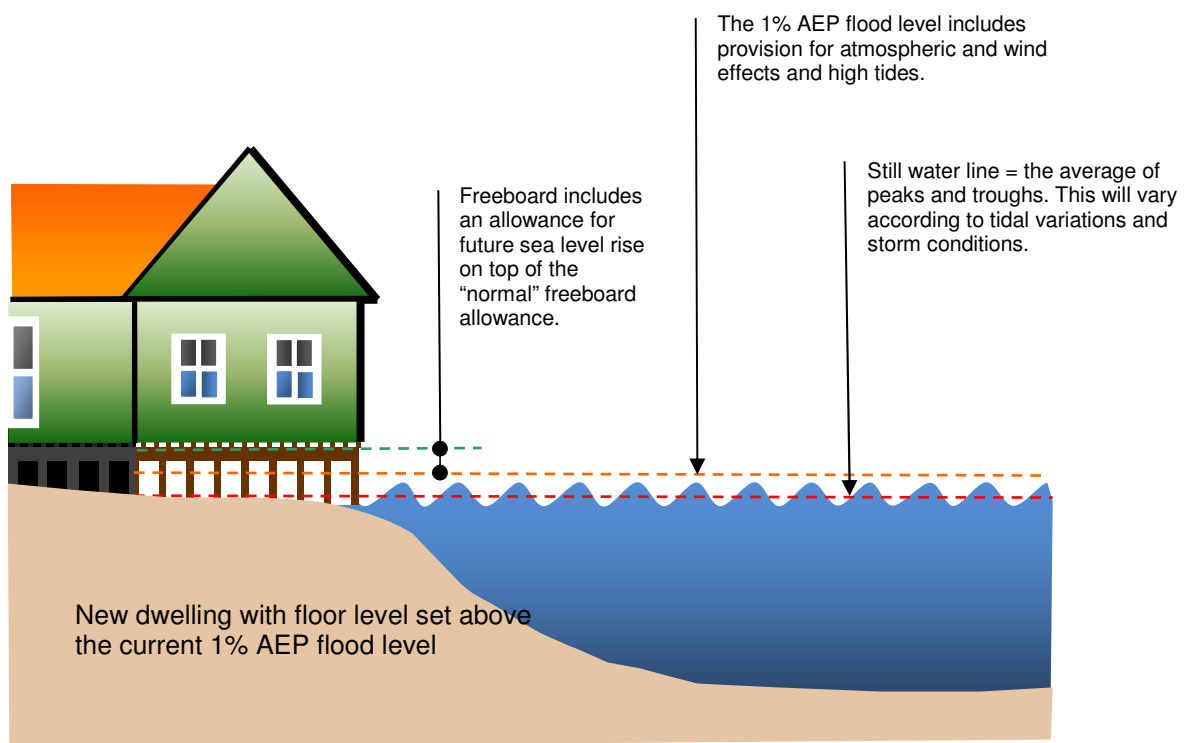


Figure 1 – applying freeboard

Sea level rise introduces additional uncertainties, such as the impacts of waves that reach the shore, the rate at which sea level will rise and the complex behaviour of tide and storm affects.

Where development proposals are assessed against current one per cent AEP flood levels, CMA's should therefore include an additional freeboard allowance of at least 0.2 m on top of the normal freeboard they apply, to offset these additional uncertainties about the rate of future sea level rise.

However, the CMA has discretion to apply a different freeboard if, in its opinion:

- the likelihood and consequences flooding are small relative to the existing risk (e.g. car port, small building extension, bungalow).
- there is a reasonable expectation that the flood risk can be mitigated through flood insurance arrangements or as part of business planning, where it can be demonstrated that the potential costs of flood damage is an acceptable business risk. This could apply to buildings associated with some forms of industrial, retail or warehouse land use; and/or
- the CMA adopts flood levels that take sea level rise into account.



APPENDIX A

Evaluating proposals

In addition to identifying the benchmark flood level applicable to a proposal, the CMA must also evaluate the proposed development and or use, as relevant, against the following evaluation criteria, in addition to any matters that the CMA considers relevant:

- Whether the land is also subject to tidal influenced riverine or stormwater flooding and the associated hazards.
- Development in active flow paths and or flood storage areas will be inappropriate if it increases the hazard, impedes flood flows, causes local rises in flood levels and velocities, or has adverse environmental effects.
- Development should be avoided in wetlands and areas which in the opinion of the CMA pose an unacceptable flood hazard. These areas should be preserved for recreational or other low-intensity passive uses that promote environmental values.
- Flood levels in adjacent areas must not be significantly increased as a result of a loss of flood storage or an obstruction to flood flows resulting from the proposed development. Any adverse impacts must be prevented or mitigated.

What can be done to mitigate the risk

Development should not occur if the proposed mitigation measures to combat coastal inundation solely rely on flood defence mechanisms, such as levees and sea-walls.

Building entrances and other key outdoor access areas should not be affected by unsafe levels of flooding.

Access to the development must not be through an area which in the opinion of the CMA poses an unacceptable hazard.

Development subject to wave action may be acceptable provided there are appropriate protection measures in place such as, adherence to adequate design standards, higher floor levels or provision for setback. In addition, infrastructure and services designed to adequately accommodate the wave action must be in place.

Any development affected by flooding must be designed to withstand flood impacts with minimal damage. This includes foundations, sub floors, services (e.g. plumbing and electrical) and cladding.

Where possible, development should be sited to minimise flood risk. This does not necessarily mean the highest point of ground on the site, as safe access is also an important consideration.

The nature of the development and its effect on others

Minor developments will usually be appropriate provided they comply with the Benchmark Flood Level and do not obstruct flood flows.

When evaluating evacuation routes, the distance to flood-free relief services, the depth and velocity of the floodwater likely to be encountered, and the vulnerability of the people being evacuated are important considerations.

Development that accommodates vulnerable sectors of the community and or will provide emergency services or refuge during a flood should preferably be located at levels above the height of the probable maximum flood. As a minimum, assessment should be conservatively assessed, as indicated in Step 2.

Risk management

Risk management is essential to responsible floodplain management (SCARM 2000)². Risk assessment is strategically based on the likelihood and consequences of flooding.

In relation to likelihood it is customary for development proposals to be assessed against the one per cent AEP (equivalent to the 1-in-100 year flood), which has a probability of one per cent to be equalled or exceeded in any one year. A consequence of sea level rise is that coastal properties currently inundated rarely or not at all will be inundated more frequently in the coming decades. Strategic adaptation planning will focus on quantifying these risks, but is outside the scope of these guidelines.

Evaluation of development proposals (as determined in Step 2) will be in accordance with four categories of hazard. It is assumed that flow velocities will be less than 0.4 m/s for areas where coastal flooding is influenced by sea levels.

If flow velocities are low, buildings can be designed to be safe in a flood. Therefore the potential requirements people to self evacuate during a flood is the main consideration.

If higher flood velocities are likely, further reference should be made to other sources of information such as Hazard graphs in SCARM³, or material from Engineers Australia.⁴

The four hazard categories are tied to the safety of people:

- Low - depth of floodwaters is less than 0.3 m
- Medium - depth of floodwaters is between 0.3 and 0.6 m
- High - depth of floodwaters is between 0.6 and 1.2 m
- Extreme - depth of floodwaters is more than 1.2 m.

Generally with regard to evacuations:

- A low hazard means that there are no significant evacuation problems.
- A medium hazard means that most adults and some children are likely to be able to wade to safety (at least for relatively short distances). Small children may experience difficulties when depths exceed 0.5 m and most cars will float.
- A high hazard means that children and the elderly will have trouble wading to safety and evacuation by most vehicles will be impossible.
- An extreme hazard means that evacuation other than by boat or helicopter is not an option.

Table 1 provides a guide for some of the more common development proposals encountered and how they should be assessed.

Referring to the viability prompt in this table:

- If the answer is “yes”, the development is likely to be viable, subject to appropriate conditions of permit.
- If the answer is “no” the flood risk is likely to be too great for the intended purpose and the planning permit application should be opposed.

² Agriculture and Resource Management Council of Australia and New Zealand Standing Committee on Agricultural and Resource Management, (SCARM - 2000). *Floodplain Management in Australia: Best Practice Principles and Guidelines*, CSIRO Publishing, Melbourne.

³ Agriculture and Resource Management Council of Australia and Resource Management Council of Australia and New Zealand Standing Committee on Agricultural and Resource Management, (SCARM - 2000). *Floodplain Management in Australia: Best Practice Principles and Guidelines*, CSIRO Publishing, Melbourne.

⁴ Engineers Australia, Australian Rainfall and Runoff Revision Projects, Project 10 Appropriate Safety Criteria for People and Vehicles.

Table 1: Development viability in coastal areas

Flood Hazard category:	Extreme	High	Medium	Low	Comments
Subdivision in urban area	No	No	Yes	Yes	
House extension	Yes	Yes	Yes	Yes	If hazard is high or extreme, may need to restrict the size of the extension if floor levels are to be set to the existing floor level, and the foot print size of the building.
Replacement dwelling other than dual occupancies	Yes ¹	Yes	Yes	Yes	Main concern is development intensification and safety implications. There may be a need to restrict the foot print size of the building and to keep rooms with a high flood damage potential flood free.
New single dwelling on vacant residential lot (including dual occupancy)	No ²	No ²	Yes	Yes	The main concern will be the long term flood risk to future occupants and how this can be mitigated.
New commercial development (e.g. warehouse, factory) New hotel, motel	No ²	No ²	Yes	Yes	Preference is for no increase in the number affected by the flood risk. Main concern is development intensification and safety of future occupants.
Commercial expansion (e.g. warehouse, factory) Replacement hotel, motel	No ²	No ²	Yes	Yes	
Residential apartment complex	No	No ²	Yes	Yes	Main concerns are the safety of occupants and the level of intensification.
Basement (non habitable floors below ground level)	No	No	Yes	Yes	Main concerns are flood proofing and exposure to wave setup.
Temporary dwelling	Yes ³	Yes ³	Yes ³	Yes ³	Would need to be satisfied that the temporary status of the building will not change over time.
Car parking	Yes	Yes	Yes	Yes	Should be located away from active flow areas and have a means of evacuating safely or not at all.
Emergency Management Facilities (new and extensions)	No	No	No	No	These should be preferably located outside the Probable Maximum Flood extent if possible.
New education, hospital, retirement village or child care facility	No	No	No	No ⁴	Preference is for these to be located well outside the 1% AEP extent.
Extension/expansion to education, hospital, retirement village or child care facility	No	No	No ⁵	No ⁵	Main concerns are the safety of occupants.
New caravan park	No	Yes	Yes	Yes	Main concerns are the safety of residents, and whether moving caravans (which may contain annexes) to high ground is feasible.
Expansion of caravan park	No ⁶	Yes	Yes	Yes	
Minor sheds, outbuildings	Yes	Yes	Yes	Yes	May need to look at flow obstructions if there are drainage issues.

Notes for Table 1: Development viability in coastal areas

1	A replacement dwelling in an area of extreme flood risk may not be appropriate under some conditions, for example if the dwelling it is to replace is derelict because of the existing flood hazard and the entire property will be permanently inundated in the future.
2	<p>Building in an area of extreme or high hazard could be appropriate in some instances. Assessing proposals for new dwellings on vacant lots, or for commercial, large-scale residential or accommodation development, would require careful appraisal of the flood hazard, as well as current practices followed when assessing development in other flood prone areas. Decision making could be assisted by requesting that a coastal hazard vulnerability assessment be carried out.</p> <p>Some considerations that may be relevant include:</p> <ul style="list-style-type: none"> • what alternatives there may be for accommodating future development; • relevant CMA or Melbourne Water policies on urban development and past development decisions; • State government policies, e.g. Melbourne 2030 and Melbourne @ 5 million; • the frequency of flooding; • what steps can be taken to reduce the flood risk; and • in the case of large scale development, whether it can be demonstrated that any resultant flood damage can be allowed for as an acceptable commercial risk without compromising safety.
3	The need for the temporary dwelling would have to be established and a suitable time-frame for its removal given.
4	Development could be considered appropriate for a low hazard area if it can be established that there are no suitable alternative sites on higher ground.
5	Development could be considered appropriate for low or medium hazard area if there is an evacuation route above the 1% AEP event.
6	An expansion of a caravan park may be acceptable if an effective emergency management plan is developed and maintained.

Additional Guidance Material

Types of development

Greenfield Development

This applies to the intensification of land use from rural to urban purposes, generally by subdivision into residential and commercial lots and subsequent construction of buildings. Rezoning is usually required, in which case Ministerial Direction 13 would apply. In some cases rezoning may have already occurred or may not be required.

Aside from flooding considerations at the site there will be a need to consider how roads, drains, water, gas, power and other services can be provided to the site in a sustainable manner. Other considerations relate to preserving significant flowpaths or flood storage areas and their associated ecological values.

The State Planning Policy Framework (Clauses 11.05-5, 12.02-1 and 13.01-1) has some strong requirements for coastal developments that are particularly relevant to Greenfield development. Areas likely to be affected by flooding should be avoided because of the increase in the frequency and consequences of flooding over time, not just to future occupants, but also to those responsible for maintaining infrastructure and emergency services personnel. Therefore, irrespective of whether land proposed for Greenfield development has been zoned to a commercial or residential use, if the intention is to transform land used for a rural purpose to an urban purpose, the proposal should be assessed against the current one per cent AEP flood level plus 0.8 m.

Greenfield sites may provide an opportunity for minor reshaping of the land to provide flood free lots and safe access. Areas of medium and higher hazard, and any wetlands or significant flowpaths, should be preserved for a recreational or other use that is consistent with its values.

Land development that is flood free may not be appropriate if access to the land is cut off by floodwaters. In these instances, considerations will be guided by the potential impact on community health caused by the isolation, potential safety issues if people choose to evacuate, and the loss of water, sewerage, gas and other services, which may continue for some time after floods have abated.

Proposals that rely on flood defence mechanisms, such as levees and sea-walls, are not considered appropriate because of their long term maintenance implications and because sea level rise will continue beyond 2100.

Development within an existing urban area

The flood hazard, as it applies to the current use of the land and also after the proposed development has occurred, will influence whether development should proceed. Some of the considerations relating to the coastal flood hazard are:

- **Site safety.** While floors can be built above the nominal flood protection level, consideration should be also be given to ensuring that building entrances and their surrounds, and other key outdoor access areas are not affected by unsafe levels of flooding.
- **Access safety.** Site constraints will limit hazard treatment options such as providing flood free sites or access. This may mean that future occupants may be marooned unless they evacuate. Guidance on what needs to be considered has been provided in the main body of the guidelines. Access safety will be a major constraint if the access route is through an area of extreme hazard.
- **Flood damage potential.** Even if floor levels are raised, damage will still occur to property and possibly parts of the building below the floor level. Consideration will need to be given to ensuring that new structures have a low damage potential and that the amount of damage associated with the proposed development does not increase significantly compared to the current use.
- **The capacity to increase flood impact to adjoining areas.** It is imperative to ensure that flood levels in adjacent areas do not significantly increase as a result of a loss of flood storage or an obstruction to flood flows. Any potentially adverse impacts on adjacent, upstream or downstream areas must be identified and prevented or mitigated. Consideration will need to be given to the cumulative impact of similar proposals. This is not generally a problem for areas impacted by flooding from the sea unless it is compounded by riverine or stormwater flooding. For example, the construction of sea walls can result in localised drainage problems.
- **The flood warning time available and evacuation requirements.** There are no formal arrangements for providing coastal flood inundation warnings. This may affect the capacity of people to become aware that coastal flooding is imminent, particularly if coastal flooding occurs infrequently. If flash flooding also occurs there may be no effective flood warning time. Proposals that create an additional imposition to emergency services personnel should not be supported.
- **Vulnerability of people affected.** Some sectors of the community are more vulnerable than other sectors, e.g. the sick, elderly or disabled. Proposals for new buildings that house vulnerable sectors of the community (such as hospitals, retirement and aged care homes, and special accommodation centres) should preferably be located in areas above the relevant one per cent AEP level.
- **The potential for those exposed to a flood risk to increase.** A comparison should be made between the number of people occupying or visiting the site now compared to the number at risk if the site is occupied.

Minor Developments

Minor developments include minor buildings such as outhouses, garages and sheds; and works to improve amenity, e.g. swimming pools, tennis courts, landscaping, fill pads and fences.

Generally no objections should be raised to these proposals, provided they are:

- consistent with the intended land use (e.g. associated with a permitted dwelling or building);
- designed so as not to obstruct flood flows;
- located in a suitable area (e.g. in reasonable proximity to the house and away from any unstable cliff face);
- in the case of fill pads, designed to have stable slopes, be well compacted and to take into account any settlement of the ground; and
- in the case of buildings, have floor level requirements appropriate for the proposed use.

Flood warning and evacuation requirements

Even if floor levels are set with a freeboard margin above the one per cent AEP flood level, buildings can still be affected by higher flood levels from more severe events or from unquantified storm related effects (such as wave run-up). Proposed development needs to take into account the potential need to relocate.

The safety of future occupants and emergency services personnel is an important consideration. Ideally, occupants should be able to safely travel from their premises to high ground with relief services, preferably by road. This may not be achievable for established urban areas.

As flooding will generally be intermittent, a low level of flood awareness should be assumed. Also, because there are currently no formal flood warnings for coastal flooding, it should be assumed that evacuation may need to take place in an uncontrolled manner in the dark and in poor weather.

Even if emergency services personnel were available to assist, evacuation may be difficult because of the number of people requiring assistance in similar circumstances and the danger of crossing floodwaters which are highly turbid and likely to contain debris. Coastal wave action can also create a significant risk where it crosses evacuation routes. Development intensification in areas of high or extreme flood risk will invariably add to the workload of emergency services personnel.

When evaluating evacuation routes, the distance to flood-free relief services, the depth and velocity of the floodwater encountered and the vulnerability of the people being evacuated are important considerations.

Certain types of development have a higher potential for damage in flood events than others, and may present a danger to personal safety that requires addressing. These types of development include:

- caravan parks need to have processes in place to evacuate people and property safely and secure vans and mobile homes that aren't removed;
- hospitals, aged care facilities and retirement villages have specific issues relating to evacuation of vulnerable residents; and
- cul-de-sac residential developments on rising land, where the access road runs downhill from the properties, have issues associated with safe access, given that access will be cut off before properties are impacted.

Flood emergency response plans

Flood emergency response plans can be used to mitigate a remaining flood risk in areas where the development is considered acceptable for the level of flood hazard, but for which some level of risk remains. For example, where a residential development is approved with a floor level raised above the appropriate one per cent flood level, a flood emergency response plan could be used to ensure future occupants have a strategy for safe evacuation in place.

While a flood emergency response plan can reduce the flood consequences, its effectiveness depends on the flood awareness, ability and capacity of the person implementing the plan, Flood emergency plans are not fail safe.

It is not appropriate to require a flood emergency response plan to offset an inappropriate flood risk. Referring to Table 1 for example, it would not be appropriate to approve a subdivision in a high or extreme hazard area provided the future occupants have a flood emergency response plan.

APPENDIX B – Acronyms and Glossary

Acronyms

AEP	Annual Exceedance probability
AHD	Australian Height Datum
CMA	Catchment Management Authority

Glossary

Active flow paths: Those parts of a waterway and its floodplain that are important for flow conveyance. They are often associated with fast moving floodwaters, and the depth of flooding is often significant.

Adaptation planning. This may take many different forms depending on the context and should involve all relevant decision makers and stakeholders. Common approaches use scientific projections and information about present and future climate change impacts to assess potential risks and vulnerabilities, and to consider if there is any capacity to adapt to these impacts. Actions to reduce any residual negative impacts can be developed and assessed with preferred actions agreed to by all relevant parties with time frames for implementation and review.

Annual Exceedance Probability (AEP). The likelihood of occurrence of a flood of a given size or larger in any one year. For example if a flood level of 1.8 m AHD at a particular part of the coastline has an AEP of one per cent it means there is a one per cent chance of this level being equalled or exceeded in any one year.

Coastal erosion. The wearing away of land or the removal of beach or dune sediments by wave action, tidal currents, wave currents, or drainage. It is a natural process that is likely to change as a result of climate change. Potential impacts include loss of beaches, migration of sand dunes, damage to coastal structures and infrastructure, loss of habitat and biodiversity, loss of private and public land, adverse impact on lifestyle or amenity values and declining tourism values.

Coastal flooding. Flooding along the coastline. This is mainly associated with flooding from the sea associated with storm surge. It may also include additional flooding caused by heavy rainfall. Surface runoff following heavy rainfalls causes a temporary increase in normal water levels in a river, creek, watercourse, lake or drain. When the capacity of these water systems is exceeded, adjoining land which is normally dry land is temporarily inundated. In coastal areas, river or creek estuaries may become swollen, and water levels will rise until the inflows match the outflows into the sea.

Coastal Hazard Vulnerability Assessment. An investigation into the long term viability of a development proposal. This will generally require hydrodynamic modelling to evaluate the effects of coastal flooding, including the impacts of wave action, and coastal erosion. Solutions to mitigate the risk may include coastal engineering, design or setback responses necessary to demonstrate assessed risks can be effectively managed and in a sustainable manner.

Development is defined in the *Planning and Environment Act 1987* to include:

- (a) the construction or exterior alteration or exterior decoration of a building; and
- (b) the demolition or removal of a building or works; and
- (c) the construction or carrying out of works; and
- (d) the subdivision or consolidation of land, including buildings or airspace; and
- (e) the placing or relocation of a building or works on land; and
- (f) the construction or putting up for display of signs or hoardings;

Dwelling is defined in the *Planning and Environment Act 1987* to mean a building that is used, or is intended, adapted or designed for use, as a separate residence, (including kitchen, bathroom and sanitary facilities) for an occupier who has a right to the exclusive use of it but does not include:

- a building that is attached to a shop, office, warehouse or factory and is used, or is intended, adapted or designed for use, as a residence for an occupier or caretaker of the shop, office, warehouse or factory; or
- any part of a motel, residential club or residential hotel or residential part of licensed premises under the *Liquor Control Reform Act 1998*.

Floodplain Management Authority. An authority having the floodplain management functions described in s202 of the *Water Act 1989*. Melbourne Water and Catchment Management Authorities have these functions.

Flood Risk. An assessment of the likelihood and consequences of flooding. The likelihood of flooding can be usually linked to the annual exceedance probability (AEP) of the event. The consequences of flooding relate to qualitative or quantitative measures of the impacts of a flood in terms of loss, injury, disadvantage or gain.

Flood storage areas are those parts of the floodplain or overland flow path utilised for the temporary storage of floodwaters during the passage of a flood. Flood depths may be significant but flow velocities are generally low.

Areas with a large amount of flood storage will generally be associated with a significant reduction in the peak flow rate downstream. This could be affected if incremental development cumulatively reduces the amount of flood storage, causing peak flow rates and flood levels to rise.

Freeboard. The height above the design (one per cent AEP) flood level, typically used to provide a safety margin, to take into account uncertainties in the flood level estimate. These may include: uncertainties in the way flood levels have been estimated, differences in water levels across the flooded area because of local factors such as turbulence around objects or an undulating water surface; and increases in water level as a result of local wave action or coastal effects.

Greenfield development. The conversion of rural land to urban use, generally by subdivision into residential and commercial lots and subsequent construction of infrastructure and development.

Nominal flood protection level. The level for setting floor levels, and also fill levels and levee heights where appropriate. It is the design flood level (generally the one per cent AEP level) plus freeboard.

Precautionary Principle is defined in the Intergovernmental Agreement on the Environment to mean that where there are threats of serious or irreversible environmental damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In practice, this means decision makers should consider the best available science and information on potential impacts and risks.

Sea level rise. The increase in sea level as a result of the interaction of three mechanisms: mean sea level rise; astronomic tides; and storm surge. While the mean sea level can be regarded as a benchmark against which the impacts of tide and storm surge can be measured, climate change projections indicate that the mean sea level will rise.

Storm surge. A rise above the normal water level along a shore resulting from strong onshore winds and / or reduced atmospheric pressure. In Victoria storm surges generally accompany intense low-pressure systems.

Storm tide. The combination of storm surge and normal (astronomical) tide.

