



[New South Wales Government](#)

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## Sea level rise

In the twentieth century, the global average sea level rose by 17 cm and sea levels are projected to continue to rise. There is strong national and international evidence supporting a projected rise of up to 40 cm by 2050, and 90 cm by 2100, for the NSW coastline.

Coastal land has been subject to natural coastal hazards for thousands of years, including [coastal erosion](#) and coastal flooding. Projected sea level rises will increase these hazards, and NSW needs to plan now for these long-term impacts to minimise social and economic disruption.

To support sea level rise adaptation, the NSW Government has prepared a [Sea Level Rise Policy Statement](#) (09708sealevrisepolicy.pdf, 75KB). This sets out the Government's approach to sea level rise, the risks to property owners from coastal processes and assistance that Government provides to councils to reduce the risks of coastal hazards.

The Policy Statement includes sea level planning benchmarks which have been developed to support consistent consideration of sea level rise in land-use planning and coastal investment decision-making. The adopted benchmarks are for a rise relative to 1990 mean sea levels of 40 cm by 2050 and 90 cm by 2100. These benchmarks represent the Government's guidance on sea level rise projections for use in decision-making.

In February 2009, the NSW Government invited submissions on the draft Policy Statement. The [response to submissions](#) provides an overview of the issues raised during this consultation period and how the Government has or intends to respond to these issues.

A [technical note](#) (09709technotesealevelrise.pdf, 1288KB) has been prepared which explains how these benchmarks were derived from Intergovernmental Panel on Climate Change and CSIRO reports.

### Consultation on draft guidelines

The Department of Environment, Climate Change and Water has released draft guidelines on incorporating sea level rise into [flood risk](#) (09711draftfloodrisk.pdf, 188kb) and [coastal hazard assessment](#) for consultation (09710draftcoastrisk.pdf, 190KB).

Submissions on the draft guidelines are invited from any interested person or organisation. Please send your submissions by email to [coast.flood@environment.nsw.gov.au](mailto:coast.flood@environment.nsw.gov.au) or by post to:

Draft Coast and Flood Risk Assessment Guidelines - Consultation  
 Urban and Coastal Water Reform Branch  
 Department of Environment, Climate Change and Water NSW  
 PO Box A290

SYDNEY SOUTH NSW 1232

## Closing date for submissions

Submissions must be received by the Department of Environment, Climate Change and Water by 5pm, Friday 11 December 2009.

## Questions

If you have any questions on the coastal hazard or flood risk assessment guidelines, please email [coast.flood@environment.nsw.gov.au](mailto:coast.flood@environment.nsw.gov.au).

## Department of Planning Draft Guidelines

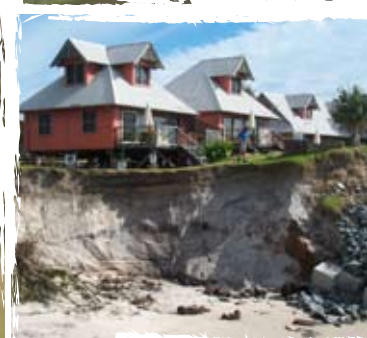
The Department of Planning has also released draft guidelines for consultation on incorporating sea level rise in land-use planning and development assessment available at

<http://www.planning.nsw.gov.au/PlansforAction/Coastalprotection/SeaLevelRisePolicy/tabid/177/Default.aspx>

## Download

- [Sea Level Rise Policy Statement](#) (09708sealevrisepolicy.pdf, 75KB)
- [Derivation of the NSW Government's sea level rise planning benchmarks: Technical Note](#) (09709technotesealevelrise.pdf, 1288KB)
- [Draft guidelines on incorporating sea level rise benchmarks into coastal hazard assessment](#) (09710draftcoastrisk.pdf 190KB)
- [Draft guidelines on incorporating sea level rise benchmarks into flood risk assessment](#) (09711draftfloodrisk.pdf, 182KB)

Page last updated: 04 November 2009



## NSW Sea Level Rise Policy Statement



New South Wales  
Government

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*Cover (clockwise from main photo):*

Bellinger River flooding at Myleston (Coffs Harbour Advocate);  
coastal erosion at Old Bar (P. Watson, DECCW);  
flooding from the Richmond River at Coraki, January 2008 (B. Eggins, Richmond Valley Council); coastal erosion at Belongil Beach, Byron Bay (P. Watson, DECCW).

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## Introduction

The NSW Government acknowledges that increased sea levels will have significant medium- to long-term social, economic and environmental impacts. As an integral part of the state's response to climate change, the Government is committed to supporting coastal communities in adapting to long-term rising sea levels in a manner that minimises the resulting social disruption, economic costs and environmental impacts. Sea level rise is a global problem that will impact locally on the NSW coastline and will require action by communities, the Government and local councils.

Coastal communities and environments are particularly vulnerable to climate change due to the potential for permanent coastal inundation and increasing coastal hazards associated with changing weather patterns and extreme weather events. This policy statement deals with sea level rise only, and represents an important component of the Government's response to climate change.

This policy statement outlines the Government's objectives and commitments in regards to sea level rise adaptation. It outlines the support that the Government will provide to coastal communities and local councils to prepare and adapt to rising sea levels.

## The impacts of rising sea levels

Over the period 1870–2001, global sea levels rose by 20 cm, with a current global average rate of increase approximately twice the historical average<sup>1</sup>. Sea levels are expected to continue rising throughout the twenty-first century and there is no scientific evidence to suggest that sea levels will stop rising beyond 2100 or that the current trends will be reversed.

Sea level rise is an incremental process and will have medium- to long-term impacts. The best national and international projections of sea level rise along the NSW coast are for a rise relative to 1990 mean sea levels of 40 cm by 2050 and 90 cm by 2100<sup>1</sup>. However, the Intergovernmental Panel on Climate Change (IPCC) in 2007 also acknowledged that higher rates of sea level rise are possible.

In simple terms, sea level rise will raise the average water level of oceans and estuaries. As the average water level rises, so too will high and low tide levels affecting the natural processes responsible for shaping the NSW coastline. Exactly how the coast and estuaries will respond is complex and often driven by local conditions but, in general, higher sea levels will lead to:

- increased or permanent tidal inundation of land by seawater
- recession of beach and dune systems and to a lesser extent cliffs and bluffs
- changes in the way that tides behave within estuaries
- saltwater extending further upstream in estuaries

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<sup>1</sup> Refer to the Department of Environment, Climate Change and Water 2009 *Technical note: Derivation of the NSW Government's sea level rise planning benchmarks* for further details



- higher saline water tables in coastal areas and
- increased coastal flood levels due to a reduced ability to effectively drain low-lying coastal areas.

These physical changes will have an impact on coastal ecosystems, access to and use of public and private lands, historical and cultural heritage values, arable land used for agriculture, freshwater access, public and private infrastructure, and low-lying areas of coastal land that are affected by flooding.

Sea level rise will also affect coastal hazards such as beach erosion during storms and coastal flooding. As the sea level rises, severe erosion of beaches during storms will affect areas further inland, while the depth of floodwaters and the areas affected by flooding will increase due to a reduced ability to effectively drain low-lying coastal areas. Climate change will also affect the frequency and intensity of storms, further exacerbating the effects of sea level rise. Such hazards will further impact coastal ecosystems, historical and cultural heritage values, agriculture and infrastructure, and residential and other urban land uses on land around beaches, estuaries, bays and harbours.

## **Related NSW Government initiatives**

The NSW Government currently has in place policies, programs and legislation that allow for ecologically sustainable growth in coastal areas, while reducing the risks to life and property from coastal hazards and flooding. These are also relevant to managing the projected increased risks from sea level rise.

The [NSW Coastal Policy 1997](#) sets the overall strategic direction for coastal management in NSW and is based on the principles of ecologically sustainable development. It aims to facilitate the development of the coastal zone in a way that protects and conserves its values. One of the policy's goals is to recognise and accommodate coastal processes and hazards, including a related objective to recognise and consider the potential effects of climate change in the planning and management of coastal development. The NSW Coastal Policy is given statutory effect through State Environmental Planning Policy 71 – Coastal Protection and through a Ministerial Direction to local councils under section 117 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The State Environmental Planning Policy 71 – Coastal Protection (SEPP 71) also requires that both land use planning and development assessment within the NSW Coastal Zone consider the likely impact of coastal processes and coastal hazards on development and any likely impacts of the development on coastal processes and coastal hazards.

In 2006, the State Government gazetted the new Standard Instrument – Principal Local Environmental Plan. Clause 5.5 of the Standard Instrument prevents the granting of development consent on land that is wholly or partly within the NSW Coastal Zone, unless consideration has been given to the effect of coastal processes and coastal hazards and potential impacts, including sea level rise on the proposed development, and arising from the proposed development.

Two additional NSW Government policies of relevance to sea level rise are the 1988 NSW Coastline Hazard Policy and the NSW Flood Prone Land Policy. This Sea Level Rise Policy Statement supersedes the 1988 NSW Coastline Hazard Policy. Most of the objectives from that policy were included in the NSW Coastal Policy 1997, which remains current. Other objectives from the NSW Coastline Hazard Policy are updated by this Sea Level Rise Policy Statement.

The NSW Flood Prone Land Policy remains in effect and has a primary objective to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods.

These policies are supported by the Government's Coastal, Estuary and Floodplain Management programs, which provide technical policy support and grants to local councils in order to identify and manage coastal hazards and flooding risks. The hazards associated with sea level rise have been incorporated into these programs from as early as 1990, and the benchmarks established under this policy statement will support the consistent consideration of sea level rise across these activities.

## **The NSW Government's objective and commitments for action on adapting to sea level rise**

The NSW Government has an objective to see coastal communities adapt to rising sea levels in a manner that minimises the resulting social disruption, economic costs and environmental impacts. To assist in meeting this objective, the Government will support local councils and the community in adapting to sea level rise by:

1. promoting an adaptive risk-based approach to managing the impacts of sea level rise
2. providing guidance to local councils to support their sea level rise adaptation planning
3. encouraging appropriate development on land projected to be at risk from sea level rise
4. continuing to provide emergency management support to coastal communities during times of floods and storms
5. continuing to provide up-to-date information to the public about sea level rise and its impacts.

Further details of these commitments are provided below.

### **1. Promoting adaptive risk-based management**

The NSW Government will promote an adaptive, risk-based approach to managing the impacts of sea level rise. The adaptive risk-based approach recognises that there are potentially significant risks from sea level rise and that the accuracy of sea level rise projections will improve over time.

Planning and investment decisions should therefore consider the sea level rise projections over timeframes that are consistent with the intended timeframes of the decision. For example, these decisions should consider likely sea levels over the expected life of an asset in order to decide on how the asset can be located or designed, thereby avoiding or minimising any associated impacts. This early consideration will minimise the initial costs of considering sea level rise and the future costs of adapting to sea level rise, such as through relocation of affected buildings or infrastructure.

The NSW Government has adopted sea level rise planning benchmarks to support this adaptive risk-based approach. These benchmarks will enable the consistent consideration of sea level rise within this adaptive risk-based management approach. The primary purpose of the benchmarks is to provide guidance supporting consistent considerations of sea level rise impacts, within applicable decision-making frameworks. This will include strategic planning and development assessment under the EP&A Act and infrastructure planning and renewal.

The use of the benchmarks will be required when undertaking coastal and flood hazard assessments in accordance with the Coastline Management and Floodplain Development Manuals. It is already a statutory requirement that the preparation of local environmental plans give effect to and be consistent with these manuals.

The NSW sea level rise planning benchmarks are an increase above 1990 mean sea levels of 40 cm by 2050 and 90 cm by 2100, with the two benchmarks allowing for consideration of sea level rise over different timeframes. The benchmarks were established by considering the most credible national and international projections of sea level rise<sup>2</sup> and take into consideration the uncertainty associated with sea level rise projections. The Government will continue to monitor sea level rise observations and projections and will periodically review these planning benchmarks, with the next review likely to coincide with the release of the fifth IPCC report, due in 2014.

The sea level rise planning benchmarks can be used for purposes such as:

- incorporating the projected impacts of sea level rise on predicted flood risks and coastal hazards
- designing and upgrading of public and private assets in low-lying coastal areas where appropriate, taking into account the design life of the asset and the projected sea level rise over this period
- assessing the influence of sea level rise on new development (see below for further details)
- considering the impact of sea level rise on coastal and estuarine habitats (such as salt marshes) and identifying valuable habitats at most risk from sea level rise
- assessing the impact of changed salinity levels in estuaries, including implications for access to fresh water.

## **2. Supporting local councils**

The NSW Government recognises that local councils are responsible for many of the land use planning and development assessment decisions made in coastal areas. Local councils prepare studies to identify areas at risk from coastal flooding and coastal hazards through the coastal, estuary and floodplain management programs, and the NSW Government will continue to provide assistance. Priority for funding assistance will be given to areas at greatest current and future risk from flooding and coastal hazards. These studies will provide information on the influence of sea level rise on coastal hazards and flood risk, which can be considered at the land use planning and development assessment stage.

The Government will also continue to provide guidance and assistance to local councils on reducing the risks to private and public property from coastal hazards. The risks from coastal hazards are significant and are projected to increase with sea level rise. Government financial assistance to local councils is unlikely to extend to protecting or purchasing all properties at risk from coastal hazards and sea level rise.

When allocating funding assistance to local councils for coastal protection works, the

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<sup>2</sup> Refer to the Department of Environment, Climate Change and Water *Technical Note: Derivation of the NSW Government sea level rise planning benchmarks*



Government will give priority to public safety and protecting valuable publicly-owned assets, and then to private land. The criteria that the Government will use to allocate any funds to local councils to protect or voluntarily purchase private property will include the:

- magnitude of current and future hazards
- cost-effectiveness of management actions
- contribution to the project's costs from the local council and benefiting landowners, taking into consideration genuine hardship for affected coastal residents
- effectiveness of the proposed arrangements for maintaining any proposed works
- ability of the project to accommodate sea level rise.

Where assistance is provided to reduce the impacts of coastal hazards, the Government does not assume any responsibility for these hazards. The Government will continue to provide funding assistance to local councils for coastal hazard studies and management planning.

These criteria will not affect the NSW Coastal Lands Protection Scheme, where the criteria for land purchase under the scheme does not include coastal hazard reduction.<sup>3</sup>

### **3. Supporting appropriate coastal development**

Provisions under the EP&A Act require consent authorities to consider coastal and flooding hazards in their planning and development approval decisions. The NSW Coastal Policy and coastal regional strategies also require consideration of sea level rise, as does the Standard Instrument for Local Environmental Plans where relevant.

The sea level rise planning benchmarks will support consistent consideration of the influence of sea level rise on any coastal hazards and flooding risks that may influence a development or redevelopment site. The benchmarks are not intended to be used to preclude development of land that is projected to be affected by sea level rise. The goal is to ensure that such development recognises and can appropriately accommodate the projected impacts of sea level rise on coastal hazards and flooding over time, through appropriate site planning, design and development control.

Department of Planning guidelines will describe how sea level rise should be considered in land use planning and development assessment. These guidelines will provide assistance to local councils, landowners, infrastructure providers and developers.

Coastal hazards and flooding are natural processes and the Government considers that the risks to properties from these processes appropriately rest with the property owners, whether they be public or private. This will continue where these risks are increased by sea level rise. Under both statute and common law, the Government does not have nor does it accept

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<sup>3</sup> The Coastal Lands Protection Scheme is used to bring significant coastal lands into public ownership. The criteria for acquisition under the Scheme are to promote public access to the coastal foreshore, to maintain the scenic quality of the NSW coast, and to protect ecological sites of regional, state and/or national significance.

specific future obligations to reduce the impacts of coastal hazards and flooding caused by sea level rise on private property.

Landowners affected by current and future coastal hazards may seek approval from their local council to construct works on their land to protect their property. These works may be approved under the EP&A Act where they do not cause adverse impacts on coastal processes beyond the property boundary or on public amenity or the environment. Private landowners will not normally be permitted to construct works on State-owned land to protect their property. All required approvals must be obtained before any works commence and unauthorised works may be removed at the landowner's cost.

#### **4. Community support during emergencies**

The Government currently provides emergency management support to coastal communities during and following floods and major storms. This support is normally coordinated by the State Emergency Service, operating under the *State Emergency and Rescue Management Act 1989*. The Government will continue to provide this support to coastal communities likely to be affected by sea level rise.

The Government's direct community support will be focused on emergency management. The Government currently does not provide compensation to the owners or potential developers of land affected by coastal hazards or flood risks, except for some compensation and other payments that may be made in relation to an emergency or disaster. This arrangement will continue and will include land where these hazards or risks are increased by sea level rise. Compensation will not be provided for any impact on property titles due to erosion or sea level rise.

#### **5. Information availability**

The Government has provided information to the community on sea level rise projections and the likely impacts of sea level rise on low-lying coastal areas. The Government will continue to provide up-to-date information on sea level rise and its impacts, and will continue to work with local councils to provide information on the impacts of sea level rise on local flooding and coastal hazards.

Continuing public access to current and credible information on sea level rise is important for various reasons, including:

- supporting community adaptation to sea level rise
- supporting the community and the private sector to make appropriate investment decisions in coastal areas
- assisting the insurance industry to price risks from sea level rise in their insurance policies.



# Derivation of the NSW Government's sea level rise planning benchmarks

## Technical Note

Department of  
**Environment, Climate Change and Water** NSW



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## Introduction

The NSW Government has prepared this Technical Note to support the *Sea Level Rise Policy Statement*. The Policy Statement includes sea level rise planning benchmarks for use in coastal hazard and flood risk assessments. These assessments are used in land-use planning and development assessment decisions in coastal areas and for sea level rise adaptation.

The Policy Statement's sea level rise planning benchmarks are an increase in sea levels above 1990 mean sea level of 40 cm by 2050 and 90 cm by 2100. This Technical Note outlines the derivation of these benchmarks, including how relevant scientific information was used.

The components of these sea level rise planning benchmarks are noted in Table 1, with details of these components provided in the following sections. These benchmarks were based on the sea level rise projections developed by Australian and international experts and considered most appropriate for planning purposes in NSW, while acknowledging the uncertainty associated with these projections. The benchmarks will be reviewed based on updated information, with the next review likely to coincide with the release of the fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) in 2014.

**Table 1** Components of the sea level rise planning benchmarks

Component	Year 2050	Year 2100
Sea level rise	30 cm	59 cm
Accelerated ice melt	(included in above value)	20 cm
Regional sea level rise variation	10 cm	14 cm
Rounding*	–	–3 cm
Total	40 cm	90 cm

\* Rounding was adopted as the projections have a degree of uncertainty, and adopting values to the nearest centimetre would imply unrealistic precision.

## Global greenhouse gas emissions projections and observations

### *Global greenhouse gas emissions projections*

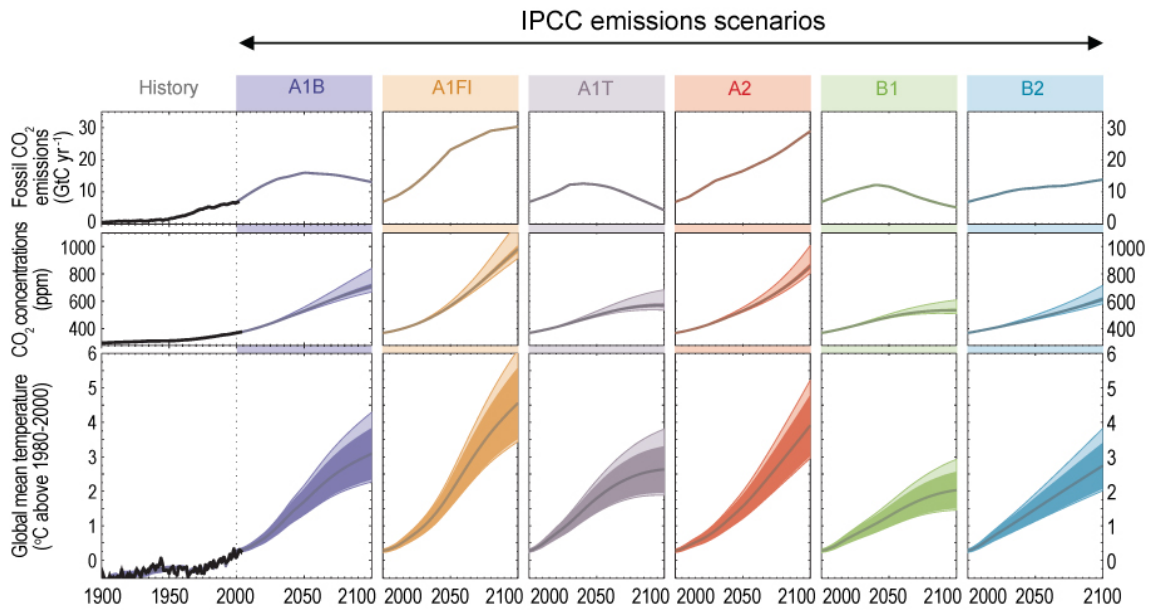
The IPCC 2007 Assessment Report provides projections for carbon dioxide emissions (CO<sub>2</sub> equivalent or CO<sub>2</sub>-e\*) associated with six different future development and mitigation scenarios (IPCC 2007). These emission scenarios influence projections for atmospheric CO<sub>2</sub> concentrations. While three of these scenarios are associated with reduced emissions over the twenty-first century, none of the scenarios are projected to result in decreased atmospheric CO<sub>2</sub> concentrations by the year 2100 (see Figure 1).

Due to the projected increase in CO<sub>2</sub> concentrations, global temperatures are also expected to increase under all of the IPCC's scenarios. This is also illustrated in Figure 1, which notes the range of temperature predictions for each emissions scenario (a range is provided due to uncertainties in the temperature projections from the computer models based on defined concentration data).

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\* CO<sub>2</sub>-e concentration includes the contribution from other greenhouse gases such as methane, nitrous oxide and perflourcarbons, in addition to carbon dioxide.

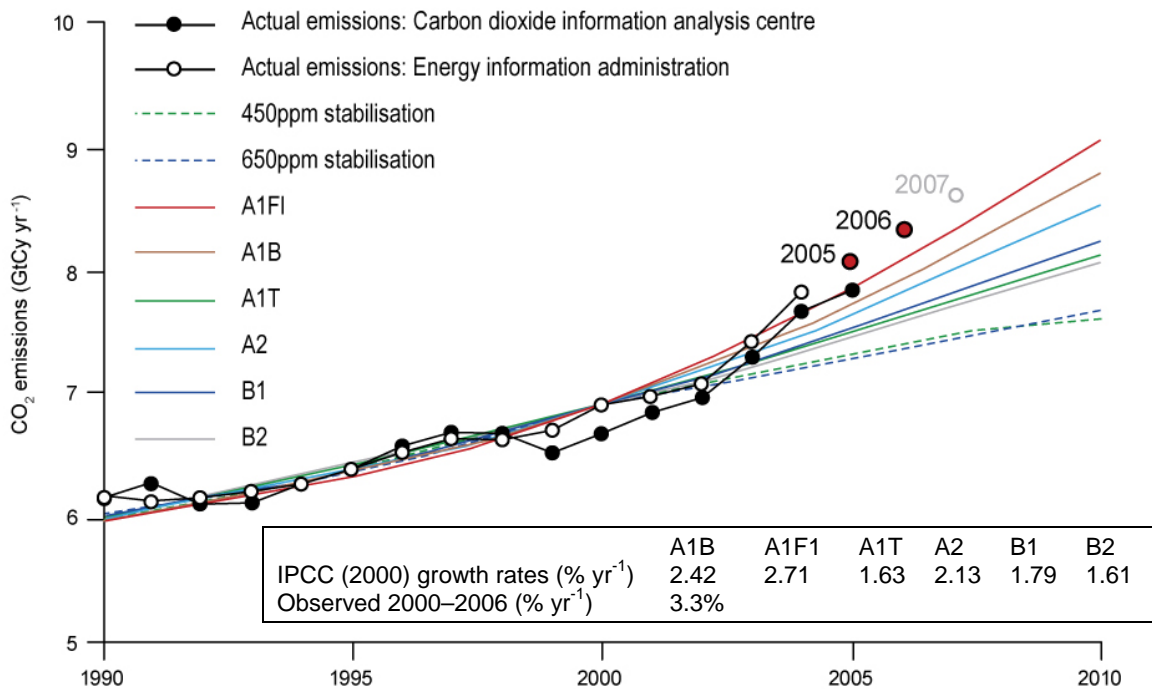




**Figure 1** Projected CO<sub>2</sub> emissions and associated projected CO<sub>2</sub> concentrations and global mean temperatures (Source: IPCC 2007)

*Comparison of projected versus observed greenhouse gas emissions*

The IPCC has projected greenhouse gas emissions since its first report in 1990. Figure 2 presents actual CO<sub>2</sub> emissions since 1990 against projected emissions (Steffen 2009). This comparison of the IPCC projected CO<sub>2</sub> emissions and actual observed CO<sub>2</sub> emissions indicates CO<sub>2</sub> emissions have been higher than the highest projected IPCC emissions scenario (scenario A1FI) since 2005. Preliminary estimates of 2008 emissions by the Netherlands Environmental Assessment Agency (2009) indicate emissions grew by 1.7% from 2007 levels, despite the global financial crisis.



**Figure 2** Projected and observed CO<sub>2</sub> emissions. The envelope of IPCC projections are shown for comparison (Source: Steffen 2009, Raupach et al. 2007; with additional data points from Canadell et al. 2007 and Global Carbon Project annual carbon budgets; © National Academy of Sciences, USA)

### *Influence of emission reductions on projected sea level rise*

Various initiatives in Australia and internationally are underway or proposed to reduce greenhouse gas emissions. While there is some uncertainty about future emissions, the following points are relevant to future sea level rise projections.

- In order to have a 50% chance of limiting global temperature change to a maximum of 2°C, global CO<sub>2</sub>-e concentrations must stabilise at or below 450ppm (European Commission 2008). This will require ambitious global cuts in CO<sub>2</sub>-e emissions to approximately 50% of 1990 levels by 2050 (IPCC 2007).
- While stabilisation of CO<sub>2</sub>-e concentrations in the short term may halt temperature increases, other processes such as sea level rise will take centuries to reach their maximum potential and stabilise (IPCC 2007).
- At CO<sub>2</sub>-e concentrations of 450ppm, thermal expansion alone is expected to contribute 0.4–1.4 m of total sea level rise above 1990 levels (IPCC 2007), with an additional contribution expected from melting ice sheets.

## **Global sea level rise projections and observations**

### *Sea level rise associated with global warming*

Increasing global temperature has a direct impact on sea level. As atmospheric temperature increases so too does ocean temperature through heat transfer. As oceans warm, they expand and take up more space; therefore, any increase in global temperature will result in sea level rise. Increased atmospheric temperatures can also increase the melting of land-based ice into water, which then flows into the ocean elevating sea levels.

Ice sheets on land can also break up and slide into the ocean. This process is referred to as the 'dynamic response of ice sheets' and can contribute to increasing sea levels in three important ways: surface meltwater increasing the speed at which glaciers flow, the break up and removal of sea ice that would otherwise slow the flow of large land-based glaciers, and the floating of grounded ice sheets.

Global warming may also lead to changes in land-based water storage and snowfall over Antarctica, with both processes having the potential to slightly offset the rise in sea level (IPCC 2007).

### *Projections of future sea level rise*

The IPCC reports base their projections of sea level rise on various future greenhouse gas emissions scenarios and provide a range of sea level rise projections for each emissions scenario. In the latest report, released in 2007, the IPCC projections ranged 0.18 to 0.59 m across all the emissions scenarios by 2090–2099 – these projections have been applied to 2100 (Table 2).

When making these projections the IPCC did not include projections for how much the dynamic response of ice sheets would contribute to future sea levels because they could not be made with confidence owing to limited understanding of the relevant processes in 2007. So the IPCC noted that if this contribution was to grow in line with global average temperature change, the upper ranges of sea level rise for the emissions scenarios shown in Table 2 would increase by 0.1 to 0.2 m.

**Table 2** IPCC projected global average sea level rise by 2050 and by 2100

Emissions scenario	Sea level rise by 2050 (m) *	Sea level rise by 2100 (m) †
B1 scenario	0.05–0.26	0.18–0.38
A1T scenario	0.07–0.29	0.20–0.45
B2 scenario	0.06–0.28	0.20–0.43
A1B scenario	0.06–0.28	0.21–0.48
A2 scenario	0.06–0.27	0.23–0.51
A1FI scenario	0.06–0.30	0.26–0.59

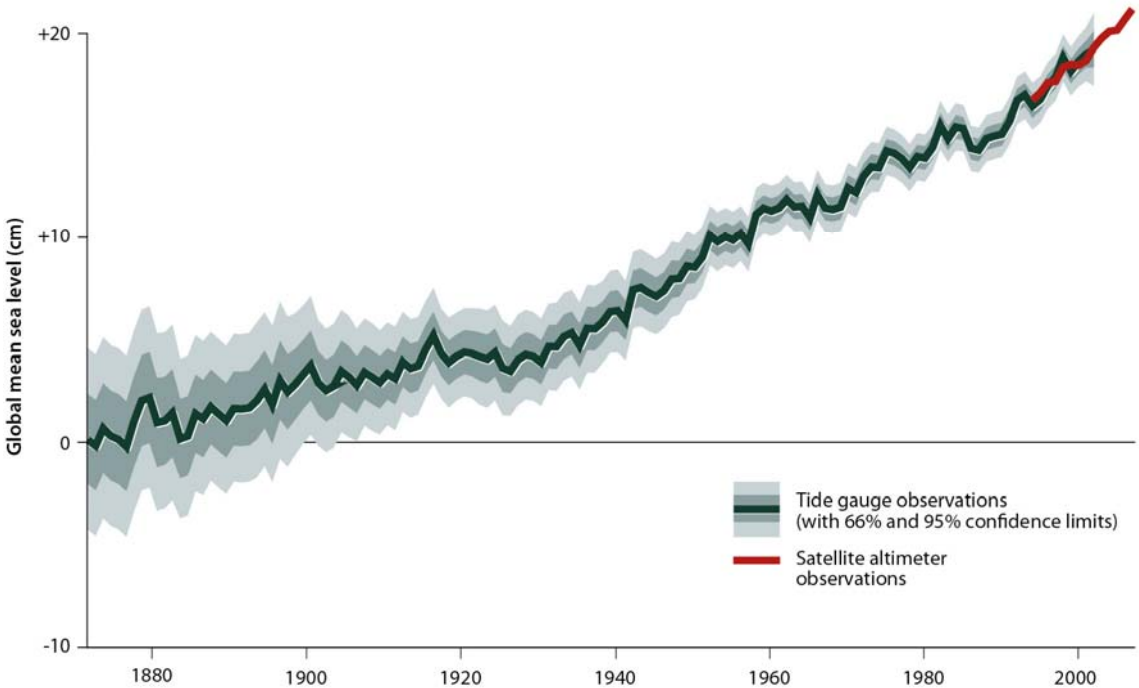
All values are the relative increase to 2090–2099 from average levels at 1980–1999. The projections for 2100 exclude contributions from future rapid dynamical changes in ice flow.

\* IPCC 2001  
 † IPCC 2007

The IPCC also noted that larger values were not excluded. Overall the understanding of the likely dynamic response of the ice sheets was considered too limited to assess their likelihood but important enough for the IPCC to not provide a best estimate or an upper bound for sea level rise.

*Observations of sea level rise*

An analysis of tide gauge records from around the world has found that during the twentieth century (1870–2001), global sea level rose by 19.5 cm at a rate of  $1.7 \pm 0.3$  mm per year, with the rate of sea level rise accelerating towards the end of the twentieth century (Church & White 2006). This information is summarised in Figure 3, which includes global average tide gauge data between 1870 and 2001 and global average satellite altimeter data from 1993 to 2006. A recent analysis of satellite data (1993–2007) shows the current global average annual sea level rise to be  $3.4 \pm 0.4$  mm per year (Beckley et al. 2007).



**Figure 3** Annual averages of the global mean sea level (cm)  
 (Source: UNEP/GRID-Arendal 2007a)

The relative contributions of thermal expansion and melting of land-based ice to observed sea level rise were identified by the IPCC in 2007 (Table 3). These contributions show that, in the decade 1993–2003, thermal expansion and land based ice melting had increased substantially when compared to the past 40–50 years. Since the release of the latest IPCC report, the contributions from land based ice have continued to grow (Cazenave et al. 2009; Rignot et al. 2008) and suggest the dynamic response of the major ice sheets will make an important contribution to sea level rise during the twenty-first century. These observations support the inclusion of the additional 0.1–0.2 m allowance discussed by the IPCC when considering projections for sea level rise by the year 2100.

**Table 3** Contributions to sea level rise over the past 50 years

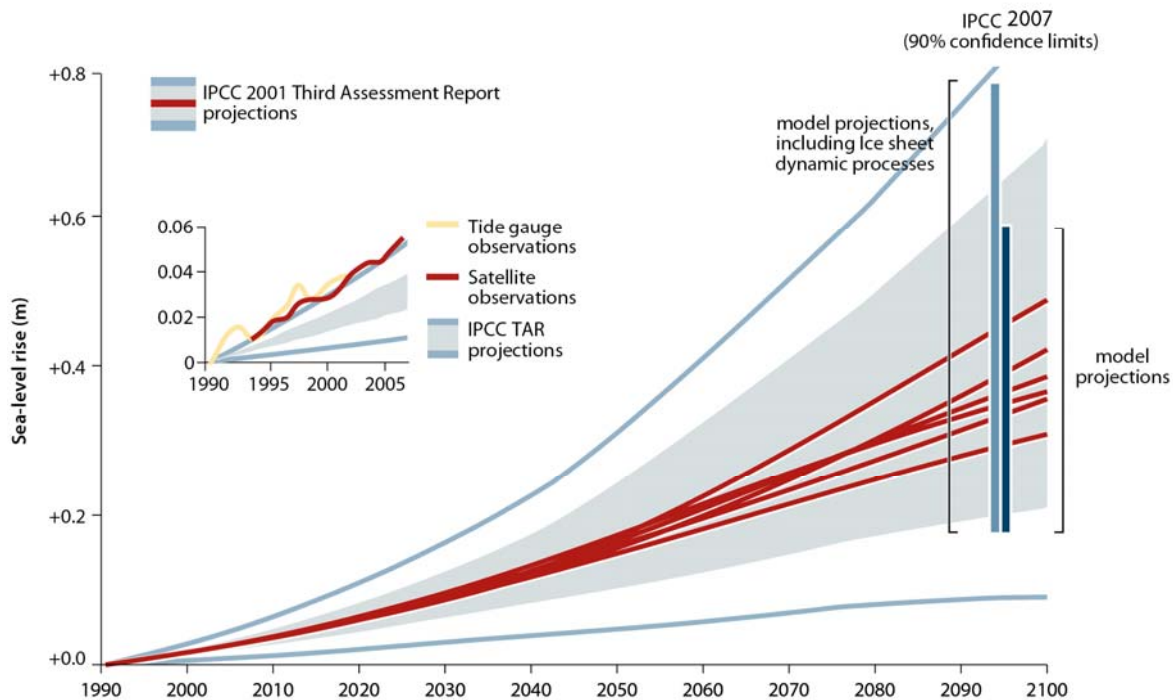
Source	Contribution to sea level rise (mm per year)		
	1961–2003 *	1993–2003 *	2003–2008 †
Thermal expansion	0.42 ± 0.12	1.6 ± 0.5	0.37± 0.1
Glaciers and ice caps	0.50 ± 0.18	0.77 ± 0.22	1.1± 0.24
Greenland ice sheet	0.05 ± 0.12	0.21 ± 0.07	0.38± 0.05
Antarctic ice sheets	0.14 ± 0.41	0.21 ± 0.35	0.56 ± 0.06

\* IPCC 2007

† Cazenave et al. 2009

#### *Comparison of projected versus observed sea level rise*

In 2007, the IPCC only provided projections for sea level rise for the decade 2090–2099 (IPCC 2007), which does not enable a direct comparison with observations since 1990. Recent research has been able to make the comparison by using the IPCC’s 2001 projections (Church et al. 2008; Rahmstorf et al. 2007). This research indicates observed global mean sea levels are rising at the top of the IPCC’s sea level rise projections for the highest emissions scenario (scenario A1FI) but only when including the additional 0.1–0.2 m for the dynamic response of ice sheets (Figure 4). It is acknowledged that this data represent observations for around 15% of the period to 2100, when comparison can validly be made with the IPCC’s 2007 projections.



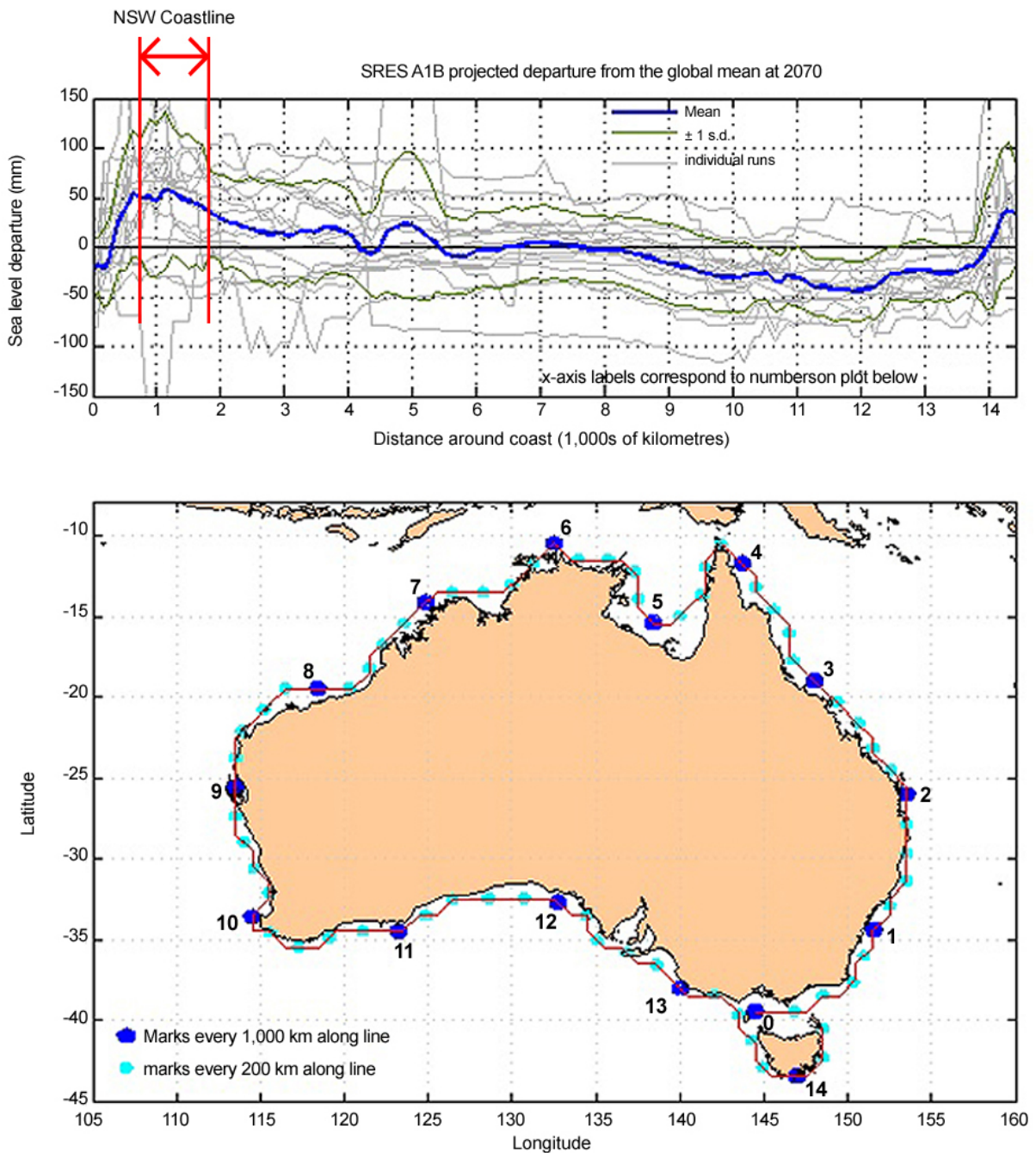
**Figure 4** Projected global sea level rise for the twenty-first century (Source: UNEP/GRID-Arendal 2007b)

#### *Regional variation in sea level rise*

Current and projected sea level rise is not uniform across the globe due to the influence of currents, water temperature, local land movements and other more complex factors (Peltier 2009).

CSIRO have modelled the regional sea level rise variation around Australia, with the highest projected increases occurring along the NSW coastline. This is illustrated in Figure 5, which presents 2070 sea level rise projections for a mid-range greenhouse gas emissions scenario. Higher regional variations are therefore projected for the NSW coastline in 2100. The Queensland and Victorian coastlines are projected to have either minor increases or decreases relative to the global average.

CSIRO undertook detailed modelling to derive sea level rise projections for the NSW coastline. The modelling results projected a NSW regional variation above global levels of up to 8 cm by 2030 and 12 cm by 2070 (McInnes et al. 2007). This regional variation is associated with a projected strong warming of the sea surface temperatures in the region and a strengthening of the East Australian Current. Linear interpolation and extrapolation of these upper limit projections were used to arrive at a value of 0.1 m for 2050 and 0.14 m for 2100. This in part explains the differences in the NSW benchmark figures from those adopted for Victoria (Victorian Coastal Council 2008) and proposed for Queensland (Queensland Department of Environment and Resource Management 2009).



**Figure 5** Regional variations in projected sea level rise along the Australian coastline  
 (Source: CSIRO 2009, reproduced with permission from [www.cmar.csiro.au/sealevel](http://www.cmar.csiro.au/sealevel))

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# Reforms to coastal erosion management in NSW

## Introduction

Coastal communities and local councils are facing difficult issues associated with coastal erosion along the NSW coastline. There are some 19 'hot spots' where erosion is severe and the coastline is actively receding (see Figure 1). The NSW Government has designed a new coastal erosion reform package that focuses on appropriate actions and provides a broader toolkit for both councils and communities when they are adapting to these challenging circumstances.

This issue is not new - there are records of coastal properties being affected by coastal erosion date back to the early 1900's.

However the projections for [sea level rise](#) and increased storm activity, and the desire of ever more people to live and build close to the coast, has the potential to increase this risk considerably.

NSW has an established framework for managing coastal erosion risks, through the NSW Coastal Policy and the Coastal Protection Act. This sees local councils, with financial and technical support from the State, undertaking coastal hazard studies and developing coastal management plans which then inform land-use planning, development controls and coastal activities.



Erosion at Collaroy

These plans and the related planning schemes should contain a range of suitable management strategies to inform the community about how coastal erosion will be dealt with in their communities and how individual landowners of properties at risk can and should respond. Progress on this coastal planning has been slow and needs to be accelerated. To date few coastal management plans have been completed for coastal areas with houses at immediate risk and a number of other plans in various stages of development need to be completed.

Recent storms in May 2009 once again highlighted the need for coastal hazards to be understood and to have planned emergency responses in place for all the 'hot spot' areas along the NSW coast as a matter of urgency. Without these plans in place, there remains uncertainty about how communities and landowners should respond in emergencies and into the longer term.

The NSW Government is now bringing forward a coastal erosion reform package to better equip the State and local councils with the tools needed to deal with the challenges of coastal erosion. The reforms include amendments to legislation, new guidelines, and additional support for councils to re-energise their planning processes.

## Key elements of the reforms:

### Sea level rise policy

A draft sea level rise policy was released in February this year and consultation is now complete. Feedback was supportive and a final policy is being prepared for release and workshopping at the NSW Coastal Conference in November. This will be supported by new guidelines that explain how the sea level rise benchmarks are to be applied in coastal and flood hazard assessments and in land-use planning. Comments will be sought from councils and other stakeholders on these draft guidelines.

### Emergency management

To better prepare for future storms, a package of emergency management preparations will be implemented:

- 

Councils with 'hotspots' will be required to prepare coastal erosion emergency management plans by 30 June 2010. These will set out how landowners, agencies and councils will respond in the event of storm driven erosion. The Government will provide funding to help councils prepare their plans.

- 

The Department of Environment, Climate Change and Water (DECCW) will issue a Code of Practice that sets out appropriate temporary measures that can be used to protect property under immediate threat from coastal erosion.

-

The Infrastructure State Environmental Planning Policy, Marine Parks and Crown Lands legislation will be amended to permit temporary landowner funded emergency works where they are consistent with the council's emergency management plan and the Code of Practice.

## Legislative amendments

To upgrade the longer term toolkit for dealing with expected increases in coastal erosion hazards, the Government will introduce amendments to the Coastal Protection Act, the Local Government Act and various regulations to:

- include adaptation to sea level rise as a management objective
- enable councils that implement coastal erosion protection works through their approved coastal management plans to require benefiting landowners to make pro rata contributions to their costs, through a coastal protection service charge. The charges would be outside the system of rate pegging, and cover the private benefit share of design, construction and operational costs
- provide new powers to enable a council or the Minister to issue an order to stop an unapproved action likely to result in significant beach erosion, backed by increased penalties for unlawful works or activities. These orders may be appealed in the Land and Environment Court
- various operational and procedural matters.

Legislation will also be amended to permit appropriate landowner funded long term coastal protection works to slow erosion of their properties. Development consent under the Environmental Planning and Assessment Act would be required for these works from the relevant Joint Regional Planning Panel. These works would only be approved if they complied with stringent environmental and engineering requirements, including managing potential off-site impacts during construction and thereafter.

The requirements to manage off-site impacts are important to ensure coastal protection works avoid any significant impacts on the State's beaches. Landowners would be responsible for paying into the future for any beach nourishment needed to minimise any impacts on beaches from their works. The Government recognises beaches are highly valued by the community.

## Coastal zone management plans

To expedite the planning, the Minister will issue directions to those councils that have not yet completed overall coastal zone management plans (where the council area includes one or more of the State's identified 'hot spots'). These will require completion of these

plans within 12 months or as otherwise agreed.

## New coastal zone management planning guidelines

The 1990 Coastline Management Manual and the 1992 Estuary Management Manual will be replaced with new Coastal Zone Management Planning Guidelines for local councils. Draft guidelines will be released for consultation at the NSW Coastal Conference in November.

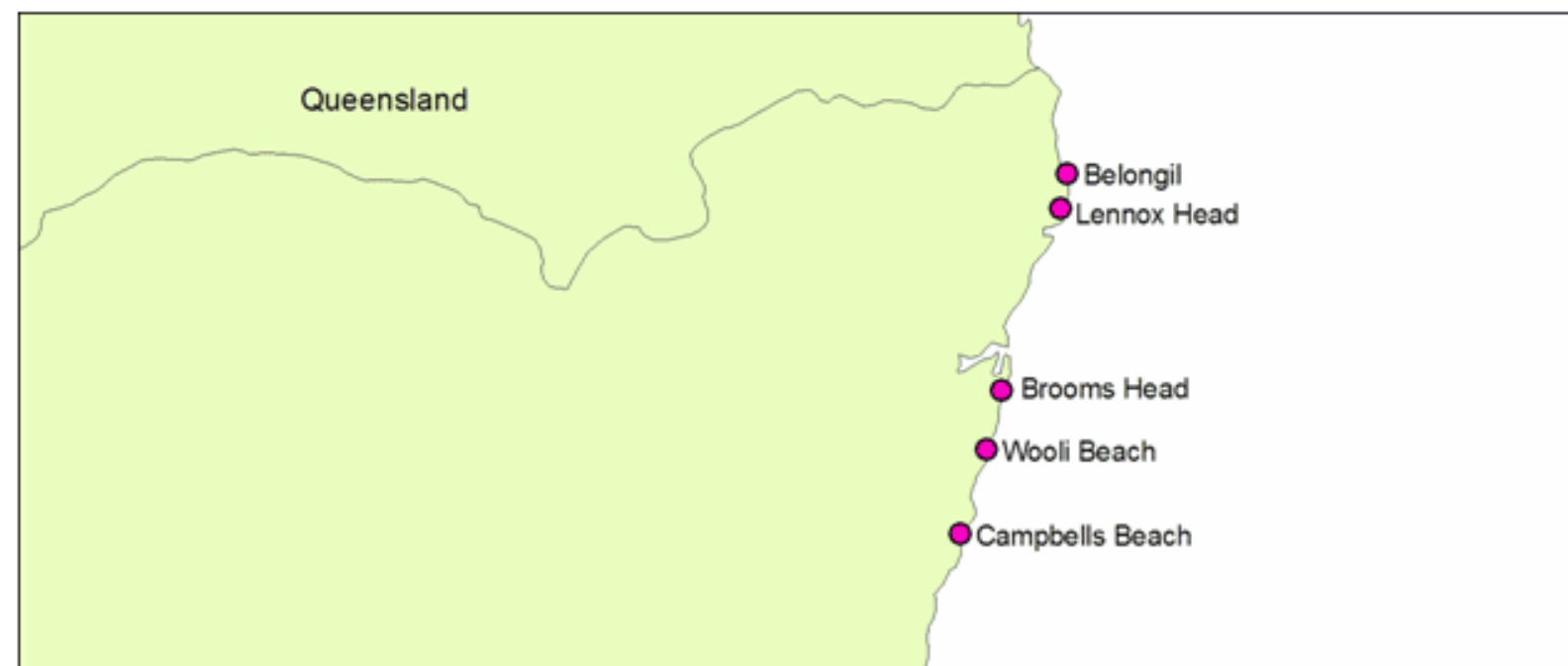
## Indemnity provisions

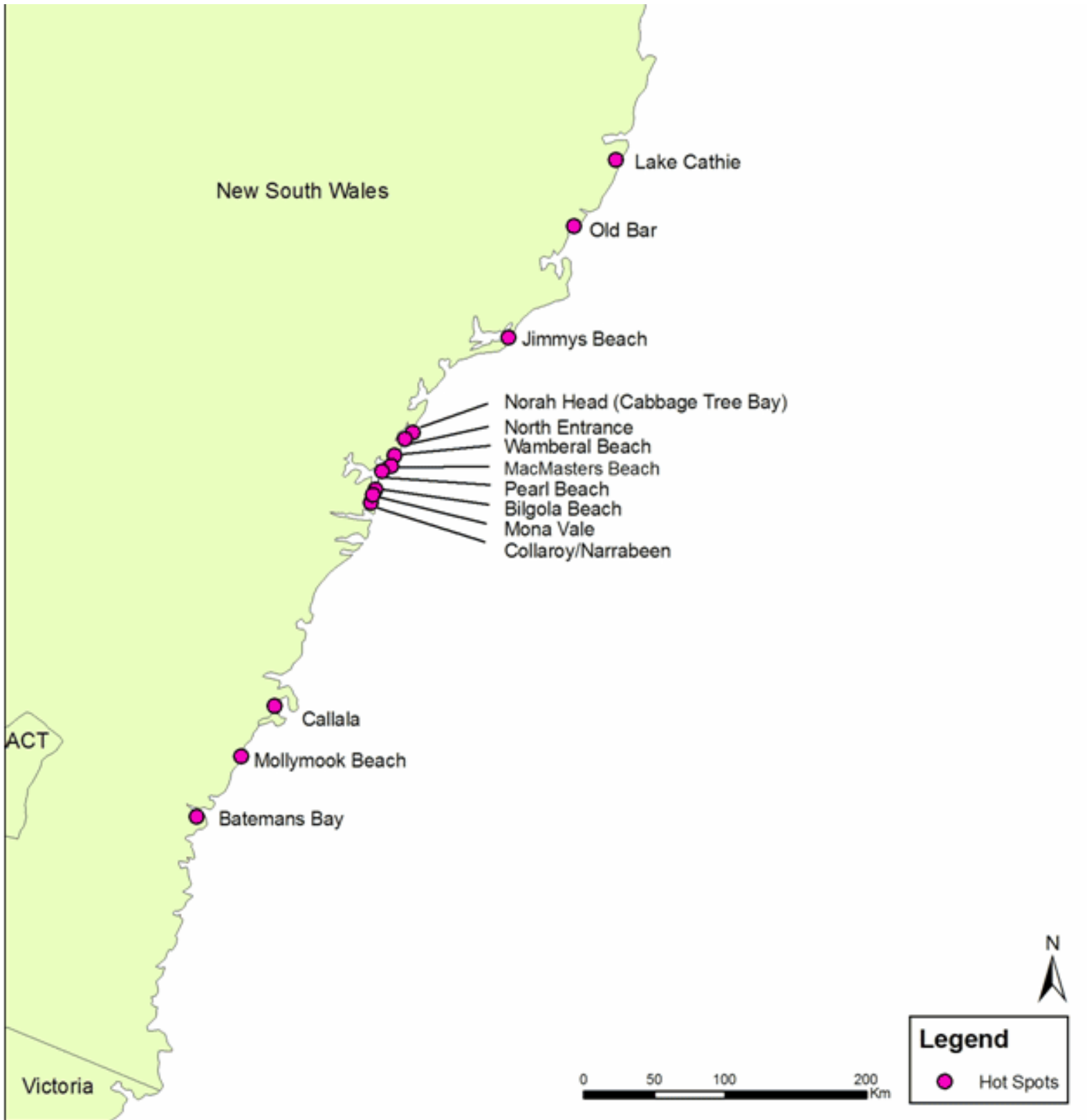
To support councils in dealing with challenging issues, the Government will introduce amendments to the Local Government Act to clarify indemnity provisions. These will specify more clearly the limits of liability for property damage due to coastal erosion caused by natural processes, exacerbation by climate change, failure to upgrade works in response to climate change, or failure to undertake compliance to remove illegal structures or to require a landholder to maintain approved private works.

## Implementation

While the immediate risks of coastal erosion have serious implications in some local communities, the large scale of the long term challenges caused by sea level rise is significant for the whole State. Potentially large numbers of buildings, infrastructure, iconic public recreation spaces and the natural environment face future risks. The issues are complex and there will be much to be learned in the years ahead. The Government and its agencies will work closely together with local councils and communities to implement the reform package. For further information and future updates please view this site or contact the Director Urban and Coastal Water Reform, NSW Department of Environment, Climate Change and Water via [info@environment.nsw.gov.au](mailto:info@environment.nsw.gov.au).

Figure 1: Coastal Erosion Hot Spots in NSW







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Draft Flood Risk Management Guide:

**Incorporating sea level rise benchmarks  
in flood risk assessments**

Department of  
**Environment, Climate Change and Water** NSW



## Submissions invited

Please send your submissions by email to [coast.flood@environment.nsw.gov.au](mailto:coast.flood@environment.nsw.gov.au) or posted to

Sea Level Rise Technical Guide Consultation  
Urban and Coastal Water Reform Branch  
Department of Environment, Climate Change and Water  
PO Box A290  
Sydney South, NSW 1232

### Closing date for submissions

Submissions must be received by the  
Department of Environment, Climate Change and Water  
by **5 pm, Friday 11 December 2009**.

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October 2009

# 1. Introduction

The NSW Government has adopted a Sea Level Rise Policy Statement (NSW Government 2009) to support adaptation to projected sea level rise impacts. The policy statement includes sea level rise planning benchmarks for use in assessing potential impacts of projected sea level rise in coastal areas, including flood risk and coastal hazard assessment.

These benchmarks are a projected rise in sea level (relative to 1990 mean sea level) of 0.4 m by 2050 and 0.9 m by 2100 (DECCW 2009). The projections were derived from sea level rise projections by the Intergovernmental Panel on Climate Change (IPCC) and the CSIRO. These benchmarks will be periodically reviewed.

This guide has been prepared to assist local councils, the development industry and consultants incorporate the sea level rise benchmarks in floodplain risk management planning and flood risk assessments for new development. The information in this guide updates the sea level rise information in *NSW Floodplain Development Manual* (NSW Government 2005) and can be used in the floodplain risk management planning process described in this manual. This guide also updates the sea level rise section of the *Floodplain Risk Management Guideline: Practical Consideration of Climate Change* (DECC 2007). The 2007 guideline provides additional advice on dealing with the impacts of climate change on existing development areas and discusses the consideration of potential changes to flood producing rainfall events caused by climate change.

## 2. The impacts of sea level rise on flooding

Sea levels can have a significant impact upon both the tidal range and flood levels in lower coastal waterways. Flood levels can be affected even where these may be generally separated from the ocean by outlet berms, such as intermittently closed and open lakes and lagoons (ICOLLs). The Appendix to this guide provides advice on the determination of ocean boundary conditions for hydraulic flood modelling in coastal waterways.

The degree of the impact of sea level rise will vary significantly with location and vulnerability and may lead to:

- an increase in the depth and areas affected by inundation due to normal tidal fluctuations and an increase in the frequency and duration of inundation in areas already affected by tides
- improved hydraulic efficiency of tidal entrance channels, increasing current tidal ranges in coastal waterways and associated geomorphic and environmental impacts
- an increase in the duration, frequency and magnitude of coastal flooding and the levels reached by flood waters during these events
- a reduction in the capacity of drainage systems discharging into tidal waters. This may lead to an increase in localised stormwater flooding and more water flowing overland to waterways rather than through drainage systems.



Flooding from the Hunter River at Morpeth, June 2007

### 3. Where is sea level rise likely to impact on flood levels?

This guide applies to areas where projected sea level rise is likely to have a discernable impact on predicted flood levels. This includes the NSW Coastal Zone and areas in the vicinity of lower coastal waterways, including rivers, creeks, estuaries and ICOLLs. In particular, this is likely to apply if the land is:

- likely to be inundated if water levels were 1.0 m above the upper limit of the current tidal range, generally defined by mean high water springs
- likely to be inundated if water levels were 1.0 m above the current flood planning level
- within 1.5 m of the maximum historic height of the entrance berm or the upper limit for management intervention identified in entrance management plans for any ocean entrance to the waterway which controls flooding (this commonly applies to ICOLLs)
- below 4 m AHD.

Major infrastructure crossings (road and rail bridges) often have a significant impact on flood levels and therefore may represent the upper limit of the likely area of influence of changes in sea level on flooding. This needs to be assessed on a case by case basis, as the impacts on flood levels (that is, backwater effects) will depend on the relative size of the crossing's waterway area.

### 4. Sea level rise planning areas

Flood behaviour may have been identified in a flood study prepared as part of the floodplain management planning process described in the *NSW Floodplain Development Manual* (NSW Government 2005) or carried out on behalf of a developer for new urban development areas. This may have involved the prediction of flood levels and mapping of flood extents, usually corresponding to the current 1-in-100 year average recurrence interval (ARI) flood. Additional mapping may have been prepared to define flood planning areas, which represent the extent of the flood planning level, being the extent of the design flood (e.g. 1-in-100 year ARI) plus an appropriate freeboard (e.g. 0.5 m) and the probable maximum flood (PMF).

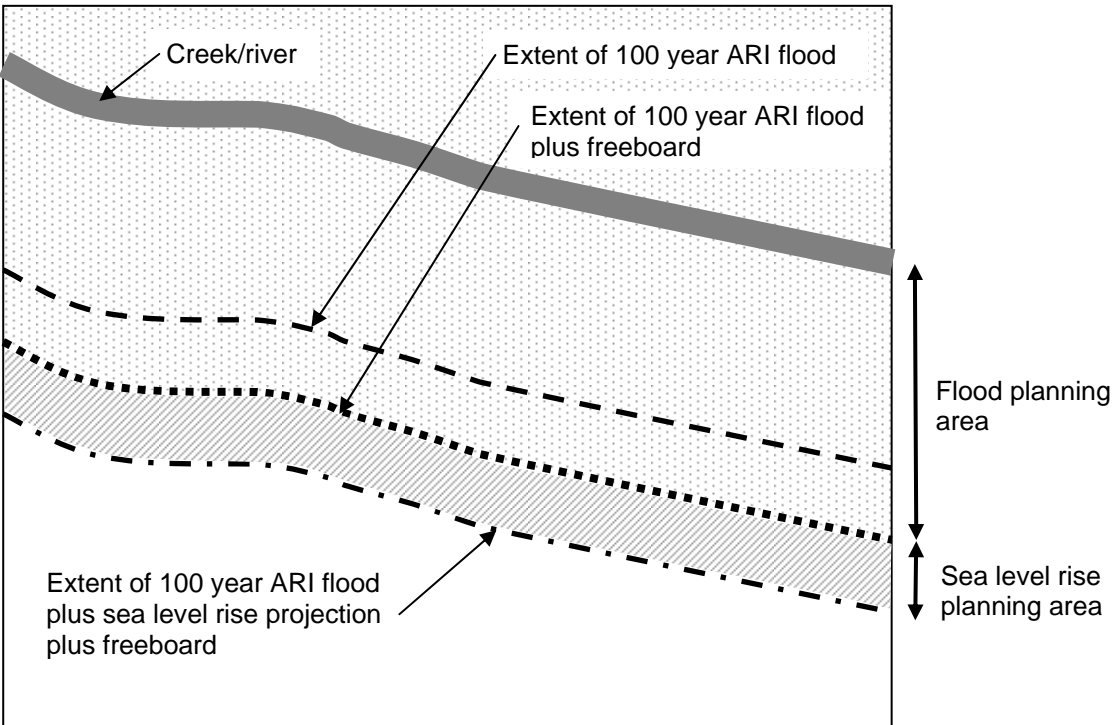


Flooding from the Hunter River at Maitland, June 2007

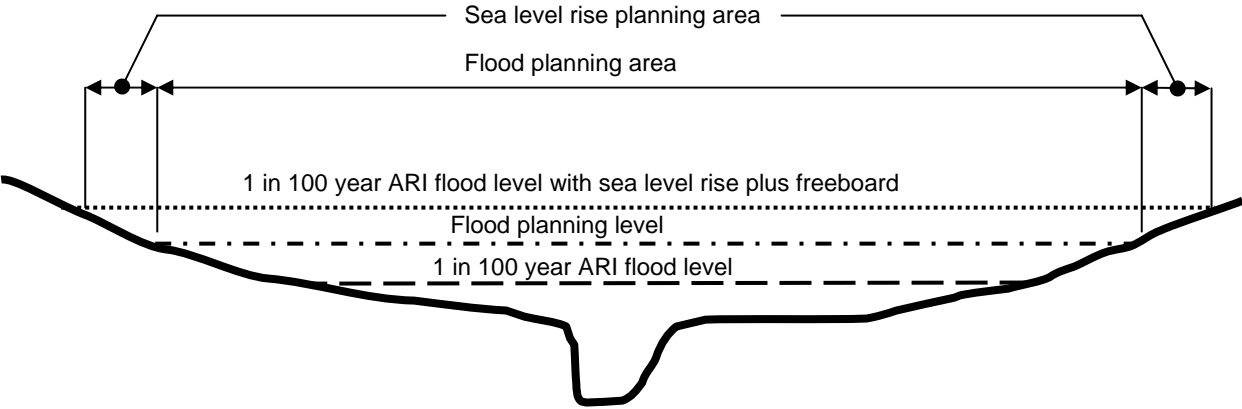
Projected sea level rise will increase flood levels and flood extents in coastal waterways, with this effect generally diminishing with distance upstream from the coast. A sea level rise planning area applies between the:

- flood planning area (derived from a flood assessment excluding consideration of sea level rise) and
- predicted extent of the design 1-in-100 year ARI flood level incorporating the sea level rise benchmarks plus an appropriate freeboard (e.g. 0.5 m).

This is illustrated in Figures 1 and 2. Flood studies should use the 2100 sea level rise benchmark and may use the 2050 benchmark if information on the projected extent of flooding by 2050 is likely to be relevant for future decision-making.



**Figure 1** Flood extents and planning areas



**Figure 2** Flood levels and planning areas (cross-section view)

The *Draft NSW Coastal Planning Guideline – Adapting to Sea Level Rise* (DoP 2009) provides detail about the consideration of this information in land use planning and development assessment.

The 0.5-m freeboard outlined in the *NSW Floodplain Development Manual* (NSW Government 2005) for general residential development provides a factor of safety to ensure that the risk exposure selected is accommodated. This freeboard includes a component related to climate change impacts on flood levels in both coastal and non-coastal areas and for a wide variation in sensitivity of estimated design flood levels to flood flow. The freeboard provides only a relatively small allowance to accommodate some of the projected increases



in rainfall intensity of flood-producing storm events associated with climate change, which has currently not been accurately quantified. The manual's small allowance for climate change in the 0.5-m freeboard figure should be considered to only address some of the uncertainty associated with estimating climate change impacts. Freeboard should not therefore be used to allow for sea level rise impacts, which should be quantified and applied separately as shown in Figure 1.

The estimation of a sea level rise planning area will usually involve an extension to an existing floodplain risk management study and plan for a coastal area. This involves modelling changes, particularly increasing the ocean boundary conditions, whether static or dynamic, and initial water levels for dynamic hydraulic models by the sea level rise benchmark.

Specific local council requirements may apply to these flood studies, including:

- key parameters to be used in the study (such as downstream boundary conditions and initial water levels) that may be influenced by sea level rise
- the use of appropriate flood models used in previous studies
- the availability of improved land surface elevation data (e.g. aerial laser survey)
- the availability of any new flood information, and
- allowances for the potential impact of climate change on rainfall.

Flood levels in low-lying coastal areas are influenced by ocean and estuarine water levels. Flood studies therefore need to make appropriate assumptions about these downstream boundary conditions. The influence of sea levels on flood behaviour varies significantly with the location, the catchment, and the floodplain and the type of ocean–waterway interface. Flood planning levels therefore need to account for both the flooding by catchment rainfall in addition to elevated ocean levels. Given the complexity of the issue of combined probabilities of these two independent flood events occurring simultaneously, the Appendix has been provided to assist in estimating flood levels.

*Australian Rainfall and Runoff* (Engineers Australia 1999) is currently being updated and is expected to provide advice in relation to the coincidence of catchment and ocean flooding derived from the same storm cell, as a combination of these factors often control flood levels in lower coastal waterways. The Appendix to this guide provides interim advice on the assessment of these conditions for a variety of classes of entrances and conditions (excluding sea level rise considerations).

Where a flood investigation has been prepared, the modelling can be updated to include sea level rise projections or a conservative assumption can be made about sea level rise impacts. Where the site is below 4 m AHD, an appropriate conservative assumption to estimate the 1-in-100 year ARI flood level is to add the sea level rise benchmarks to the 1-in-100 year ARI flood level relevant to the site. Site-specific modelling can be undertaken to refine this approach where warranted. The additional extent of flooding beyond the flood planning area (the sea level rise planning area) can then be determined based on the flood level (derived from the sea level rise benchmarks) and freeboard.



Flooding from the Richmond River at Coraki, January 2008

In addition to the 1-in-100 year ARI flood, the PMF should also be modelled including the effects of sea level rise for emergency response planning purposes, critical infrastructure, such as emergency care hospitals and vulnerable developments, such as aged care homes facilities.

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## Further reading

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## Glossary

average recurrence interval (ARI)	The long-term average number of years between the occurrence of a flood as big as (or larger than) the selected event.
Australian Height Datum (AHD)	A common national surface level datum approximately corresponding to mean sea level.
flood planning level	The combinations of flood levels and freeboards selected for floodplain risk management purposes.
flood planning area	The area of land below the flood planning level.
Freeboard	A factor of safety typically used in relation to the setting of flood planning levels.
NSW Coastal Zone	Land identified in a series of gazetted maps under the <i>Coastal Protection Act 1979</i> .
ocean boundary conditions	The ocean water level used as the downstream boundary level for hydraulic modelling for a flood study.
PMF	The probable maximum flood.
sea level rise planning area	The area of land excluding the flood planning area which is below the 1-in-100 year ARI flood level plus freeboard plus projected sea level rise influence.

# Appendix - Ocean boundary conditions for hydraulic flood modelling

## A1 Introduction

Flooding in lower coastal waterways may occur due to a combination of ocean and catchment flooding driven by the same storm cell. The influence of flooding from these two sources on overall flood risk in these waterways varies with location, distance from the ocean, and the entrance conditions for discharge to or from the ocean.

The guidance in this Appendix provides interim advice on the consideration of the coincidence of flooding from these sources considering the variation of typical ocean boundary conditions and initial water level conditions in the waterway.

This information will be reviewed when Australian Rainfall and Runoff (Engineers Australia 1999) is updated to provide advice on the coincidence of catchment and ocean flooding or when improved interim advice is available.

## A2 Envelope approach

Consideration of catchment and coastal flooding provides an envelope of effects which can be determined by considering scenarios such as the following:

- 1-in-100 year ARI ocean level (with the addition of wave setup and/or wave runup where relevant) with 1-in-20 year flooding from the catchment;
- 1-in-20 year ARI ocean level (with the addition of wave setup and/or wave runup where relevant) with 1-in-100 year flooding from the catchment.
- Neap tide cycle with 1-in-100 year ARI flooding from the catchment.

These scenarios assume that initial water levels within the coastal waterway are based upon the peak tidal water level in the waterway or the height of any controlling entrance outlet. They provide an envelope of peak impacts that can be used to determine the 1-in-100 year ARI flood affects in the lower coastal waterway. A sensitivity analysis of key parameters such as relative timing of peak catchment flooding and peak ocean levels should be carried out to enable Councils to make informed decisions about appropriate flood planning levels.

Any rise in sea level is expected to have a direct impact upon ocean boundary conditions and initial conditions in the coastal waterway and therefore the sea level rise benchmarks need to be added directly to these downstream ocean boundary conditions for the assessment of the impacts of the benchmarks outlined in the *NSW Government Sea Level Rise Policy Statement* (NSW Government 2009).

## A3 Downstream ocean related boundary conditions

Downstream ocean boundary conditions can vary significantly with the class of entrance and the specifics of the location and can be costly to derive. Advice is provided on simplistic approaches that can be used to derive a conservative ocean boundary conditions in particular circumstances in lieu of more sophisticated site specific analysis. However, if the simplistic approach results in levels considered too conservative for the particular situation, a site specific coastal engineering assessment can be carried out.

A conservative assumption for an ocean boundary condition for a catchment that drains directly to the ocean (that is, does not drain into an ICOLL or coastal lake) is to adopt a 1-in-100 year ARI ocean level of 2.6 m AHD. This boundary level comprises components related to elevated ocean water level levels, tidal anomalies and wave setup. A more sophisticated approach would be to use the default dynamic open ocean boundary condition (Figure 3). Site-specific analysis would give a further degree of sophistication and potentially a lower, less conservative answer.

The sea level rise benchmarks would be added directly to the ocean related boundary conditions to obtain ocean boundary conditions under projected sea level rise conditions.

#### **A4 Classes of entrances and their modelling**

There are four general classes of entrances outlined below:

- Class 1 - Catchments that drain to a coastal lake (e.g. Lake Illawarra, Tuggerah Lakes);
- Class 2 - Catchments that drain direct to the ocean via trained or otherwise stable entrances;
- Class 3 - Catchments that drain direct to the ocean via shoaled entrances; or
- Class 4 - Catchments with normally closed or partially blocked entrances.

The method of deriving appropriate downstream starting water levels will vary for each class of entrance, as the downstream controls differ. Their determination and the required background data are discussed in Sections A4.1 with the analysis of entrance breakout discussed in Section A4.2.

##### *A4.1 Downstream ocean related boundary conditions*

Data for the following is needed for effective modelling of downstream ocean related boundary conditions.

1. The fixed or starting entrance geometry condition (for dynamic situations). This may be impacted upon by:
  - a any entrance management arrangements that control entrance conditions within set limits. For managed entrances, the case governing catchment flood levels will be the trigger for management intervention under the management policy, which should have regard to prevailing entrance conditions (that is, degree of choking/shoaling). The case governing upstream flow velocities in the post intervention geometry (that is, fully scoured opening) case also needs to be modelled.
  - b the dynamics of entrance conditions over time. This may be directly relevant for:
    - i a particular historical event. This may require alteration to the entrance configuration within realistic limits to match available calibration data; or
    - ii providing details on peak shoaled and scoured states over time. Peak shoaled condition will govern upstream catchment flood levels whereas peak scoured condition will govern coastal flow ingress.
  - c The geometry for current conditions would preferably be confirmed as part of the survey data collected for model development.
2. The limits of potential dynamics. These include limits to vertical and lateral scour, including any headlands, rock shelves or reefs known to exist in the locality is essential to appropriate modelling of the area rather than arbitrary limits.

3. The dynamics of entrance conditions during an event, particularly in relation to scour due to entrance management practices. Modelling of entrance breakout is discussed in detail in Section A4.2.

Modelling of ocean boundary conditions should involve a detailed understanding of the ocean boundary geometry, and in the case of entrance shoaling and scouring, their dynamics and physical limits, as discussed above. Modelling may generally be either: steady state; or unsteady state with either a built in dynamic scour model or with interface to a breach model to examine scouring.

The dynamics of the situation may be complex, involving flow, downstream ocean levels, and ocean boundary geometry. In addition, different conditions may dominate flooding at different times during an event and different starting conditions can govern peak flood levels (most restricted conditions) and flow velocities (most open conditions). This can make modelling complex, requiring a number of runs, and the development of upper boundary curves for flood level and flow velocities and limit the effective use of steady state modelling in these areas.

It is recommended that the elevated ocean levels presented in Figure 3 are used until significant advances in methods to predict elevated ocean levels produce more reliable estimates or further advice is provided through updates to *Australian Rainfall and Runoff*. The levels in Figure 3 include ocean anomaly and wave setup factors.

These estimates include wave setup and wave runup factors and are therefore conservative in some coastal waterways where these factors are negated by entrance conditions.

Site-specific or alternate analysis may provide advice more directly relevant to a particular entrance condition. Where this analysis is undertaken and relied upon to support the development it should be submitted to the consent authority for review.

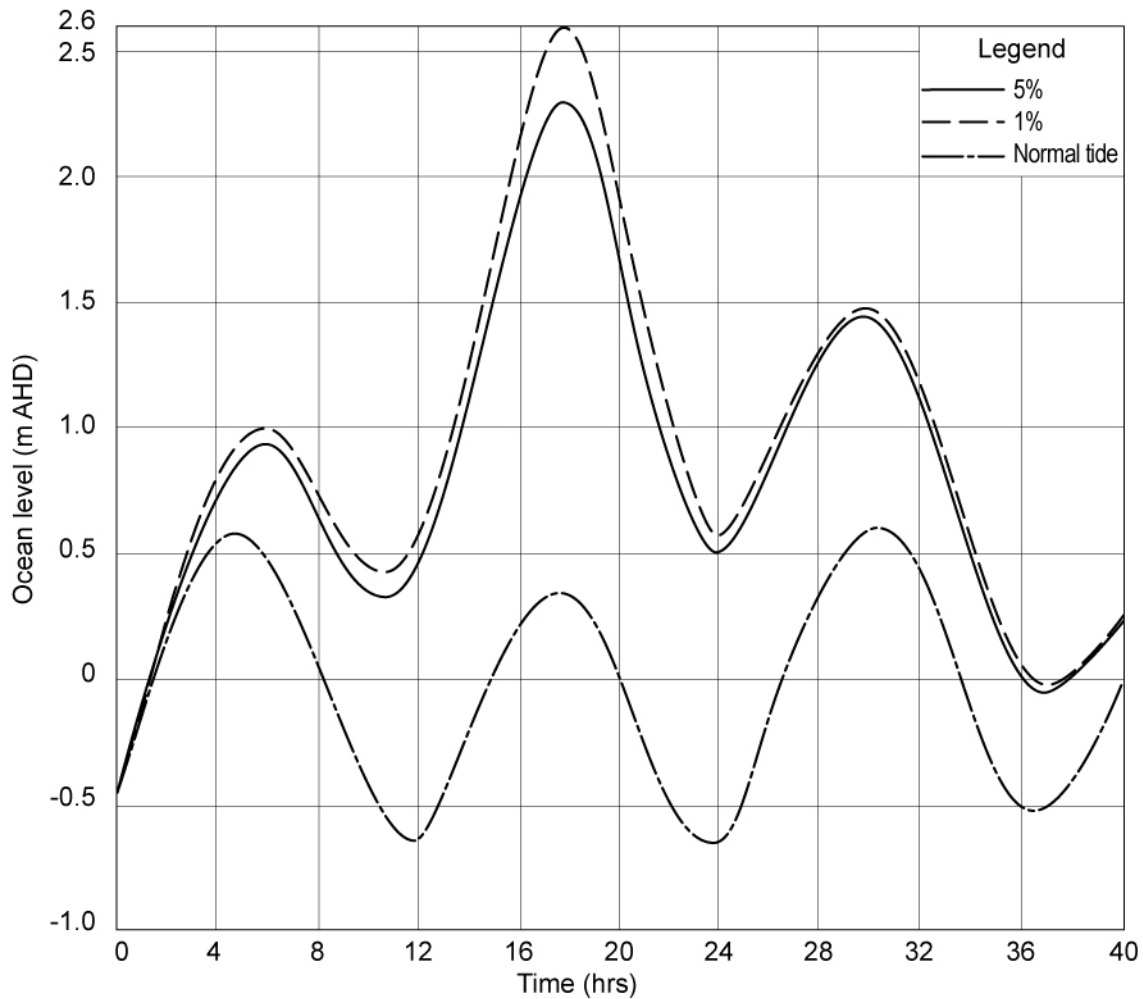
Consideration of the sea level rise benchmarks requires direct addition of the benchmark levels to both the fixed or varying ocean boundary conditions and the initial water level conditions in the waterway.

#### *A4.2 Entrance breakout analysis*

The appropriate approach to entrance breakout analysis depends upon the scale of the ramifications of the potential flooding on the community at the site in question. Where these ramifications are low a more simplistic conservative approach can be undertaken.

Sensitivity analyses should consider a range of ocean levels, and the upper limit for management intervention where management is undertaken or else a range of known historical configurations. Where the entrance is managed, management protocols should be available from the local council or other agency that may manage the entrance. Controlling historical entrance configurations can be assessed based upon the interpretation of historical aerial photos and other relevant information.

Use of the upper limit of management intervention or the range of known historic configurations is conservative as it assumes that the entrance configuration, including the beach bar, does not erode during the flood event. If the ramifications resulting from this sensitivity analysis are significant, then some form of analysis (e.g. Gordon 1990) or simplified modelling should be undertaken.



Note: 1% represents 1 in 100 year ARI and 5% represents 1 in 20 year ARI

**Figure 3** Default open ocean boundary condition  
 Note: 1% represents 1-in-100 year ARI and 5% represents 1-in-20 year ARI

The object of this analysis is to determine a conservative estimate of the erosion likely to occur during the rising limb of the flood event. This in turn allows an estimate of the height of the beach bar prior to the onset of the flood peak and in combination with the results of the sensitivity analysis yields the flood level profile. More detailed modelling of the breakout using an appropriate hydraulic model incorporating dynamic scour capabilities or by running interactively with a breach model may be worthwhile particularly if the ramifications are considerable and the approach outlined in the previous paragraph does not produce workable or satisfactory outcomes.

Sea level rise can be expected to alter entrance conditions directly relative to the change in the sea level rise benchmark. Table 1 provides a summary of typical ocean boundary conditions and modelling issues.

**Table 1 - Summary of typical ocean boundary conditions and modelling issues**

<b>Class of entrance</b>	<b>Starting water level</b>	<b>Influence of sea level rise benchmarks</b>	<b>Modelling</b>	<b>Analysis method</b>	<b>Entrance breakout</b>
<b>Class 1 Coastal lakes</b>	May be obtained from lake flood studies or else the lake should be modelled as part of this study. In the latter case refer to classes 2–4.	Should be assessed as changed ocean boundary and initial water level conditions as part of flood study for lake.	Use of steady and unsteady models may be suitable. Other consideration outside entrance conditions will determine the form of modelling	NA	Should be considered as part of lake flood study. If the lake is modelled as part of this study refer to classes 2–4.
<b>Class 2 Trained or deep stable entrances</b>	See Figure 3 * Note that the information in Figure 3 may be considered conservative for these entrances and could be refined by a site-specific analysis.	Should be assessed as changed ocean boundary conditions and initial water level in the waterway.	Use of steady and unsteady models may be suitable. Other considerations other than entrance conditions will determine the form of modelling	Develop an upper limit envelope curve for scenarios outlined in Section A.2.	Not applicable
<b>Class 3 Shoaled entrances</b>	See Figure 3 *	Should be considered as changed shoaled conditions and initial water level conditions for the waterway.	Use unsteady models.	Develop an upper limit envelope curve for scenarios outlined in Section A.2.	See Section A4.2
<b>Class 4 Closed entrances</b>	See Figure 3 *	Should be considered as changed entrance conditions and initial water level conditions for the waterway.	Use unsteady models.	Develop an upper limit envelope curve for scenarios outlined in Section A.2.	See Section A4.2

\* Site-specific or alternate analysis may be undertaken by a suitably qualified specialist



Draft Coastal Risk Management Guide:

**Incorporating sea level rise benchmarks  
in coastal risk assessments**

Department of  
**Environment, Climate Change and Water** NSW



## Submissions invited

Please send your submissions by email to [coast.flood@environment.nsw.gov.au](mailto:coast.flood@environment.nsw.gov.au) or posted to:

Sea Level Rise Technical Guide Consultation  
Urban and Coastal Water Reform Branch  
Department of Environment, Climate Change and Water NSW  
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Sydney South, NSW 1232

### Closing date for submissions

Submissions must be received by the  
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by **5 pm, Friday 11 December 2009**.

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DECCW 2009/710

October 2009

# 1. Introduction

The NSW Government has adopted a Sea Level Rise Policy Statement (NSW Government 2009) to support adaptation to projected sea level rise impacts. The Policy Statement includes sea level rise planning benchmarks for use in assessing the potential impacts of projected sea level rise in coastal areas, including flood risk and coastal hazard assessment.

These benchmarks are a projected rise in sea level (relative to 1990 mean sea level) of 0.4 m by 2050 and 0.9 m by 2100 (DECCW 2009). The projections were derived from sea level rise projections by the Intergovernmental Panel on Climate Change (IPCC) and the CSIRO. These benchmarks will be periodically reviewed.

This Guide has been prepared to assist local councils, the development industry and consultants incorporate the sea level rise benchmarks in coastal hazard assessments. This includes coastal hazard assessments carried out as part of a coastal hazard study during a coastal zone management planning process or for assessing coastal hazard constraints for proposed coastal developments. The information in this guide updates the sea level rise information in the *NSW Coastline Management Manual* (NSW Government 1990). This information may also be useful for planners and designers of coastal infrastructure.

## 2. Sea level rise impacts in coastal areas

Of all the impacts from climate change, the projected rise in mean sea level is one of the most significant concerns for integrated coastal zone management. In addition to higher projected storm surge and oceanic inundation levels, a rise in mean sea level will also result in complementary recession of unconsolidated (sandy) shorelines.

Depending on the rate and scale of sea level rise, the environmental, social and economic consequences within low lying inter-tidal areas, in particular, are expected to be significant. In addition to open coast recession and higher inundation levels, salt water intrusion and landward advance of tidal limits within estuaries will, amongst other things, have significant implications for freshwater and saltwater ecosystems and development margins, particularly building structures and foundation systems within close proximity to the shoreline. Existing coastal gravity drainage, stormwater infrastructure and sewerage systems may become compromised over time as mean sea level rises. Sea level rise will also influence the entrance opening regimes for intermittently closed and open lakes and lagoons (ICOLLs). The level of protection provided by existing seawalls and other hard engineering structures will decrease over time due to the increasing threat from larger storm surges and inundation at higher projected water levels.

The adaptation to sea level rise will require careful planning and management into the future in order to minimise social, environmental and economic impacts.



Coastal erosion at Belongil Beach, Byron Bay

### 3. Coastal hazard assessment

The *Coastline Management Manual* (NSW Government 1990) identifies a range of coastal hazards, two of which will be directly exacerbated by sea level rise – shoreline recession and coastal inundation.

Coastal hazard studies or assessments commonly identify hazard limits or hazard lines, which define the estimated extent of land projected to be impacted upon by coastal processes and hazards over a defined coastal planning period. These studies can be used to define coastal hazard planning areas which are used in land use planning and development assessment. The immediate hazard line represents the estimated landward extent of beach erosion from a design storm event plus any zone of reduced foundation capacity (Nielsen et al. 1992). Additional hazard limits are derived landward of the immediate hazard line to represent the expected beach recession landward over defined planning periods (commonly 50 or 100 years). This is illustrated in Figure 1.

The extent of the calculated recession plus any allowance for reduced foundation capacity can be used as a coastal hazard planning area. The predicted recession to 2100 should normally be the maximum extent of the coastal hazard planning area (the 2100 hazard line shown in Figure 1).

Sea level rise will increase the predicted recession over the adopted planning period, as described in section 4.3, resulting in a landward movement of the hazard lines, as illustrated in Figure 1. Coastal hazard studies should provide coastal hazard lines over the adopted planning period assuming both no sea level rise and incorporating sea level rise projections.



Coastal development at The Entrance

A 'sea level rise planning area' is to be defined in coastal hazard studies, for use in land use planning and development assessment. Future studies will therefore need to include 2100 hazard lines based on defining both a 'coastal hazard planning area' assuming no sea level rise and defining a 2100 hazard line incorporating sea level rise induced recession using the benchmarks. Both sets of lines will now be required to be determined for planning purposes. This will ensure consistent consideration of sea level rise in coastal hazard assessment for planning purposes.

Past coastal hazard studies have commonly determined 2100 hazard lines incorporating projected sea level rise. Where these studies have used the 2100 sea level rise benchmark, these hazard lines define the landward extent of the ‘sea level rise planning area’. Where other sea level rise projections have been used, the hazard lines should be recalculated through a revised hazard definition study.

Coastal inundation assessment should incorporate the increased still water levels resulting from sea level rise projections (see section 4.2).

The *Draft NSW Coastal Planning Guideline – Adapting to Sea Level Rise* (DoP 2009) provides detail about the consideration of this information in land use planning and development assessment.

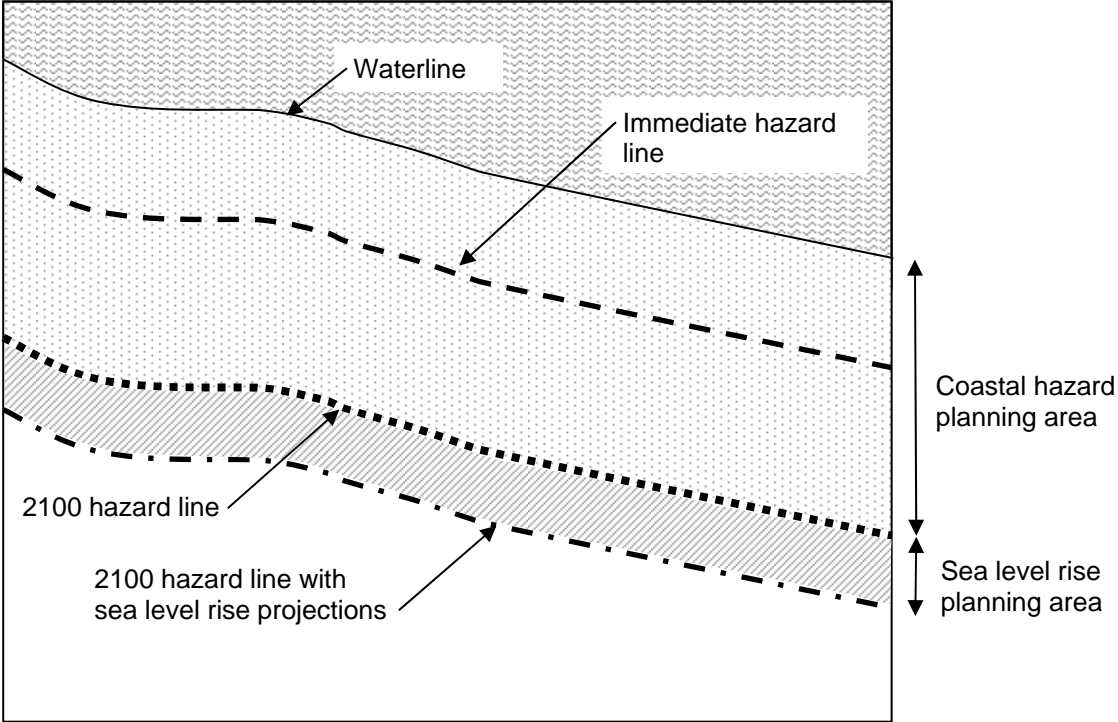


Figure 1 Hazard lines and planning areas

## 4. Application of sea level rise planning benchmarks

### 4.1 General

Increasing mean sea level over time will have two primary impacts within and adjacent to tidal waterways:

- increasing still water levels over time, and
- subsequent recession of unconsolidated shorelines.

In circumstances where physical coastal processes and/or the influence of tidal waters are required to be considered, it is recommended that the additional impact of projected sea level rise up to the planning benchmarks be considered. This will enable sea level rise to be appropriately considered in planning decisions, hazard mitigation strategies and infrastructure design.





Seawalls and coastal erosion at Belongil Beach, Byron Bay

Linear interpolation between the 1990 base sea level and the 2050 and 2100 sea level rise benchmarks can be used to estimate projected sea level rise for coastal planning horizons or asset life other than those corresponding to the benchmark years. For consideration of sea level rise beyond 2100, an additional 0.1 m per decade allowance can be used above the 2100 benchmark level. This approach assumes a linear rise beyond 2100 at rates equivalent to that projected for the last decade of the twenty-first century (2090–2100) and is consistent with the approach adopted in New Zealand (Ministry for the Environment 2008).

For practical implementation, the sea level rise benchmarks, which are generally referenced to 1990 mean sea levels, can be broadly related to the Australian Height Datum (AHD). Analysis of hourly water levels at Fort Denison (Sydney Harbour) over the period from January 1989 to December 1990 indicates a mean sea level over this period at approximately 0.060 m AHD.

## 4.2 Design still water levels

Table 1 provides an estimate of design ocean still water levels for the NSW coastline for varying average recurrence interval (ARI) events for 2050 and 2100 that incorporate provision for sea level rise. It is recommended that these levels be used in the design of maritime structures, determining oceanic inundation/wave runup levels and for oceanic and hydrodynamic modelling processes where full oceanic tidal conditions are expected.

Where tidal conditions less than the oceanic range prevail (e.g. inside constrained estuarine environments), Table 1 does not apply and locally-derived design still water levels would have to be determined on a site-specific basis taking into consideration the sea level rise benchmarks for oceanic conditions.

### 4.3 Recession of unconsolidated shorelines

It is widely acknowledged that unconsolidated (or erodible) shorelines will recede in response to an incremental rise in mean sea level over time. Bruun (1962, 1988) proposed a simple two-dimensional model to estimate the amount of associated shoreline retreat which can be approximated as the product of the active profile slope and the amount of sea level rise. There are limitations associated with the Bruun Rule for use throughout the coastal zone for determining foreshore recession due to sea level rise (Ranasinghe et al. 2007). Nevertheless, until more sophisticated methodologies are available, the Bruun Rule approach is recommended for estimating the likely width of shoreline recession attributable to sea level rise.



Coastal erosion at Collaroy/Narrabeen beach

For NSW open coast situations, the active profile slope has generally ranged in the order of 1:50 to 1:100. The use of active profile slopes in the Bruun Rule outside this range should be appropriately qualified and explained. There are several theoretical approaches available for determining the likely seaward limit of the active profile for use in establishing the offshore profile slope for the Bruun Rule. The approach proposed by Hallermeier (1981) is recommended in the absence of readily available information on active profile slopes at a location under consideration. Once the active profile slope has been established, the shoreline recession due to sea level rise can be estimated by multiplying this slope by the 2050 and 2100 sea level rise benchmark.

For estuarine foreshores, it is recommended that the recession due to sea level rise can be estimated for planning purposes using the same general approach with relevant average foreshore slopes inferred or estimated from survey information.



**Table 1** Design ocean still water levels for 2050 and 2100 incorporating projected sea level rise

ARI (years)	2009 design still water levels 1 (m AHD)	2050 design still water levels 2 (m AHD)	2100 design still water levels 2 (m AHD)
0.02	0.965	1.305	1.805
0.05	1.045	1.385	1.885
0.1	1.095	1.435	1.935
1	1.235	1.575	2.075
10	1.345	1.685	2.185
50	1.415	1.755	2.255
100	1.435	1.775	2.275

Notes:

1. 2009 design still water levels derived from extreme value analysis of Fort Denison tide gauge data from June 1914 to December 2008 (after Watson & Lord, 2008). There are negligible tidal friction losses between the ocean and Fort Denison within Sydney Harbour, therefore Fort Denison data provides an indicative representation of oceanic still water levels. The design still water levels inherently incorporate allowance for all components of elevated ocean water levels experienced over this timeframe (including tides, meteorological influences and other water level anomalies), but, exclude wave setup and wave runup influences.
2. The design still water levels for 2050 and 2100 incorporating the planning benchmark allowances for sea level rise with a reduction of 60mm to accommodate the estimated amount of global average sea level rise that has occurred between 1990 and present. This is estimated at approximately 3mm/year from satellite altimetry (CSIRO 2009).
3. The design still water levels advised in Table 1 are only relevant where full ocean tide conditions prevail.



Coastal erosion at Old Bar

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## Further reading

Standards Australia (2004) *AS/NZS 4360:2004 Risk Management*.

Engineers Australia, 2004. *Guidelines for Responding to the Effects of Climate Change*, Engineers Australia, Canberra.

## Glossary

active profile slope	The slope of the portion of a beach (including the underwater section) which has active sediment movement.
Australian Height Datum (AHD)	A common national surface level datum approximately corresponding to mean sea level.
coastal inundation	Coastal inundation can refer to two types of phenomenon. Properties immediately fronting the coast can be affected by wave runup. Others in low lying areas adjacent to the coast can be inundated as a result of elevated ocean water levels and overtopping of dunes by wave runup.
sea level rise planning area	The area of land between the 2100 hazard line calculated assuming no sea level rise and the 2100 hazard line calculated using the 2100 sea level rise benchmark.
shoreline recession	A net long term landward movement of the shoreline caused by a net loss in the sediment budget.
storm surge	The increase in coastal water level caused by the effects of storms. Storm surge consists of two components: the increase in water level caused by the reduction in barometric pressure (barometric setup) and the increase in water level caused by the action of wind blowing over the sea surface (wind setup).
still water levels	Average water surface elevation at any instant, excluding local variation due to waves and wave set-up, but including the effects of tides and storm surges.
wave runup	The vertical distance above mean water level reached by the uprush of water from waves across a beach or up a structure.
wave setup	The increase in water level within the surf zone above mean still water level caused by the breaking action of waves.
zone of reduced foundation capacity	Zone located adjacent to and landward of an erosion escarpment in unconsolidated dunal systems where beach erosion events can undermine unprotected structures.

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## Draft Sea Level Rise Guideline

# NSW Government's Sea Level Rise Policy Statement

The NSW Government has finalised the Policy Statement on Sea Level Rise following extensive consultation.

Download a copy of the [Policy Statement](#) .


The Policy Statement specifies sea level planning benchmarks for the NSW coastline. These benchmarks are an increase above 1990 mean sea levels of 40 centimetres by 2050 and 90 centimetres by 2100.



## Draft NSW Coastal Planning Guideline: Adapting to Sea Level Rise

The Department of Planning has released the *Draft NSW coastal planning guideline: adapting to sea level rise* for public consultation.

[The draft Guideline](#)  is on exhibition until 11 December 2009. A

Departmental [fact sheet](#)  has been published to summarise the guideline.

The draft Guideline adopts the NSW sea level rise planning benchmarks in the NSW Sea Level Rise Policy Statement.

The draft Guideline outlines a proposed approach to assist councils, State agencies, planners and development proponents when addressing sea level rise in land-use planning and development assessment.

It applies to all coastal areas of NSW, including the NSW Coastal Zone, as well as Sydney Harbour and Botany Bay. The term 'coastal areas' is used broadly to include the coastline, beaches, coastal lakes, estuaries, as well as the tidal reaches of coastal rivers. It also includes other low-lying land surrounding these areas that may be subject to coastal processes in the

future as a consequence of sea level rise.

The draft Guideline proposes to adopt the following six coastal planning principles for sea level rise adaptation:

1. Assess and evaluate coastal risks taking into account the NSW sea level rise planning benchmarks
2. Advise the public of coastal risks to ensure that informed land use planning and development decision-making can occur
3. Avoid intensifying land use in coastal risk areas through appropriate strategic and land-use planning
4. Consider options to reduce land use intensity in coastal risk areas where feasible
5. Minimise the exposure to coastal risks from proposed development in coastal areas
6. Implement appropriate management responses and adaptation strategies, with consideration for the environmental, social and economic impacts of each option.

## **How to make a submission**

Throughout the draft Guideline, specific consultation questions are put forward to obtain feedback on certain aspects of the document. Submissions may be:

- emailed to [innovation@planning.nsw.gov.au](mailto:innovation@planning.nsw.gov.au)
- faxed to 02 9228 6311
- mailed to the Director, Policy, Planning Systems and Reform, NSW Department of Planning, GPO Box 39, Sydney, NSW 2001.

For further information on the draft Guideline please contact the Department's Information Centre on tel 1300 305 695.

# Guidelines by the Department of Environment, Climate Change and Water

The Department of Planning's draft Guideline should be read in conjunction with two draft guides prepared by the Department of Environment, Climate Change and Water to assist councils in preparing coastal hazard and flood studies to incorporate the sea level rise planning benchmarks. These guides are:

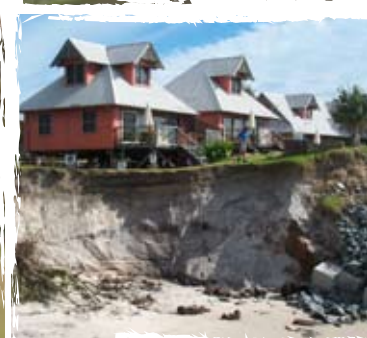
- Draft Coastal Risk Management Guide: Incorporating the sea level rise benchmarks in coastal hazard assessments
- Draft Flood Risk Management Guide: Incorporating the sea level rise benchmarks in flood risk assessments.

For further information on these guides, please visit the [Department of Environment, Climate Change and Water website](#).

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# NSW Sea Level Rise Policy Statement



New South Wales  
Government

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*Cover (clockwise from main photo):*

Bellinger River flooding at Myleston (B. Rees, Coffs Harbour Advocate);  
coastal erosion at Old Bar (P. Watson, DECCW);  
flooding from the Richmond River at Casino, January 2008 (P. Campbell, NSW State  
Emergency Service); coastal erosion at Belongil Beach, Byron Bay (P. Watson, DECCW).

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## Introduction

The NSW Government acknowledges that increased sea levels will have significant medium- to long-term social, economic and environmental impacts. As an integral part of the state's response to climate change, the Government is committed to supporting coastal communities in adapting to long-term rising sea levels in a manner that minimises the resulting social disruption, economic costs and environmental impacts. Sea level rise is a global problem that will impact locally on the NSW coastline and will require action by communities, the Government and local councils.

Coastal communities and environments are particularly vulnerable to climate change due to the potential for permanent coastal inundation and increasing coastal hazards associated with changing weather patterns and extreme weather events. This policy statement deals with sea level rise only, and represents an important component of the Government's response to climate change.

This policy statement outlines the Government's objectives and commitments in regards to sea level rise adaptation. It outlines the support that the Government will provide to coastal communities and local councils to prepare and adapt to rising sea levels.

## The impacts of rising sea levels

Over the period 1870–2001, global sea levels rose by 20 cm, with a current global average rate of increase approximately twice the historical average<sup>1</sup>. Sea levels are expected to continue rising throughout the twenty-first century and there is no scientific evidence to suggest that sea levels will stop rising beyond 2100 or that the current trends will be reversed.

Sea level rise is an incremental process and will have medium- to long-term impacts. The best national and international projections of sea level rise along the NSW coast are for a rise relative to 1990 mean sea levels of 40 cm by 2050 and 90 cm by 2100<sup>1</sup>. However, the Intergovernmental Panel on Climate Change (IPCC) in 2007 also acknowledged that higher rates of sea level rise are possible.

In simple terms, sea level rise will raise the average water level of oceans and estuaries. As the average water level rises, so too will high and low tide levels affecting the natural processes responsible for shaping the NSW coastline. Exactly how the coast and estuaries will respond is complex and often driven by local conditions but, in general, higher sea levels will lead to:

- increased or permanent tidal inundation of land by seawater
- recession of beach and dune systems and to a lesser extent cliffs and bluffs
- changes in the way that tides behave within estuaries
- saltwater extending further upstream in estuaries

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<sup>1</sup> Refer to the Department of Environment, Climate Change and Water 2009 *Technical note: Derivation of the NSW Government's sea level rise planning benchmarks* for further details

- higher saline water tables in coastal areas and
- increased coastal flood levels due to a reduced ability to effectively drain low-lying coastal areas.

These physical changes will have an impact on coastal ecosystems, access to and use of public and private lands, historical and cultural heritage values, arable land used for agriculture, freshwater access, public and private infrastructure, and low-lying areas of coastal land that are affected by flooding.

Sea level rise will also affect coastal hazards such as beach erosion during storms and coastal flooding. As the sea level rises, severe erosion of beaches during storms will affect areas further inland, while the depth of floodwaters and the areas affected by flooding will increase due to a reduced ability to effectively drain low-lying coastal areas. Climate change will also affect the frequency and intensity of storms, further exacerbating the effects of sea level rise. Such hazards will further impact coastal ecosystems, historical and cultural heritage values, agriculture and infrastructure, and residential and other urban land uses on land around beaches, estuaries, bays and harbours.

## **Related NSW Government initiatives**

The NSW Government currently has in place policies, programs and legislation that allow for ecologically sustainable growth in coastal areas, while reducing the risks to life and property from coastal hazards and flooding. These are also relevant to managing the projected increased risks from sea level rise.

The [NSW Coastal Policy 1997](#) sets the overall strategic direction for coastal management in NSW and is based on the principles of ecologically sustainable development. It aims to facilitate the development of the coastal zone in a way that protects and conserves its values. One of the policy's goals is to recognise and accommodate coastal processes and hazards, including a related objective to recognise and consider the potential effects of climate change in the planning and management of coastal development. The NSW Coastal Policy is given statutory effect through State Environmental Planning Policy 71 – Coastal Protection and through a Ministerial Direction to local councils under section 117 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The State Environmental Planning Policy 71 – Coastal Protection (SEPP 71) also requires that both land use planning and development assessment within the NSW Coastal Zone consider the likely impact of coastal processes and coastal hazards on development and any likely impacts of the development on coastal processes and coastal hazards.

In 2006, the State Government gazetted the new Standard Instrument – Principal Local Environmental Plan. Clause 5.5 of the Standard Instrument prevents the granting of development consent on land that is wholly or partly within the NSW Coastal Zone, unless consideration has been given to the effect of coastal processes and coastal hazards and potential impacts, including sea level rise on the proposed development, and arising from the proposed development.

Two additional NSW Government policies of relevance to sea level rise are the 1988 NSW Coastline Hazard Policy and the NSW Flood Prone Land Policy. This Sea Level Rise Policy Statement supersedes the 1988 NSW Coastline Hazard Policy. Most of the objectives from that policy were included in the NSW Coastal Policy 1997, which remains current. Other objectives from the NSW Coastline Hazard Policy are updated by this Sea Level Rise Policy Statement.

The NSW Flood Prone Land Policy remains in effect and has a primary objective to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods.

These policies are supported by the Government's Coastal, Estuary and Floodplain Management programs, which provide technical policy support and grants to local councils in order to identify and manage coastal hazards and flooding risks. The hazards associated with sea level rise have been incorporated into these programs from as early as 1990, and the benchmarks established under this policy statement will support the consistent consideration of sea level rise across these activities.

## **The NSW Government's objective and commitments for action on adapting to sea level rise**

The NSW Government has an objective to see coastal communities adapt to rising sea levels in a manner that minimises the resulting social disruption, economic costs and environmental impacts. To assist in meeting this objective, the Government will support local councils and the community in adapting to sea level rise by:

1. promoting an adaptive risk-based approach to managing the impacts of sea level rise
2. providing guidance to local councils to support their sea level rise adaptation planning
3. encouraging appropriate development on land projected to be at risk from sea level rise
4. continuing to provide emergency management support to coastal communities during times of floods and storms
5. continuing to provide up-to-date information to the public about sea level rise and its impacts.

Further details of these commitments are provided below.

### **1. Promoting adaptive risk-based management**

The NSW Government will promote an adaptive, risk-based approach to managing the impacts of sea level rise. The adaptive risk-based approach recognises that there are potentially significant risks from sea level rise and that the accuracy of sea level rise projections will improve over time.

Planning and investment decisions should therefore consider the sea level rise projections over timeframes that are consistent with the intended timeframes of the decision. For example, these decisions should consider likely sea levels over the expected life of an asset in order to decide on how the asset can be located or designed, thereby avoiding or minimising any associated impacts. This early consideration will minimise the initial costs of considering sea level rise and the future costs of adapting to sea level rise, such as through relocation of affected buildings or infrastructure.

The NSW Government has adopted sea level rise planning benchmarks to support this adaptive risk-based approach. These benchmarks will enable the consistent consideration of sea level rise within this adaptive risk-based management approach. The primary purpose of the benchmarks is to provide guidance supporting consistent considerations of sea level rise impacts, within applicable decision-making frameworks. This will include strategic planning and development assessment under the EP&A Act and infrastructure planning and renewal.



The use of the benchmarks will be required when undertaking coastal and flood hazard assessments in accordance with the Coastline Management and Floodplain Development Manuals. It is already a statutory requirement that the preparation of local environmental plans give effect to and be consistent with these manuals.

The NSW sea level rise planning benchmarks are an increase above 1990 mean sea levels of 40 cm by 2050 and 90 cm by 2100, with the two benchmarks allowing for consideration of sea level rise over different timeframes. The benchmarks were established by considering the most credible national and international projections of sea level rise<sup>2</sup> and take into consideration the uncertainty associated with sea level rise projections. The Government will continue to monitor sea level rise observations and projections and will periodically review these planning benchmarks, with the next review likely to coincide with the release of the fifth IPCC report, due in 2014.

The sea level rise planning benchmarks can be used for purposes such as:

- incorporating the projected impacts of sea level rise on predicted flood risks and coastal hazards
- designing and upgrading of public and private assets in low-lying coastal areas where appropriate, taking into account the design life of the asset and the projected sea level rise over this period
- assessing the influence of sea level rise on new development (see below for further details)
- considering the impact of sea level rise on coastal and estuarine habitats (such as salt marshes) and identifying valuable habitats at most risk from sea level rise
- assessing the impact of changed salinity levels in estuaries, including implications for access to fresh water.

## **2. Supporting local councils**

The NSW Government recognises that local councils are responsible for many of the land use planning and development assessment decisions made in coastal areas. Local councils prepare studies to identify areas at risk from coastal flooding and coastal hazards through the coastal, estuary and floodplain management programs, and the NSW Government will continue to provide assistance. Priority for funding assistance will be given to areas at greatest current and future risk from flooding and coastal hazards. These studies will provide information on the influence of sea level rise on coastal hazards and flood risk, which can be considered at the land use planning and development assessment stage.

The Government will also continue to provide guidance and assistance to local councils on reducing the risks to private and public property from coastal hazards. The risks from coastal hazards are significant and are projected to increase with sea level rise. Government financial assistance to local councils is unlikely to extend to protecting or purchasing all properties at risk from coastal hazards and sea level rise.

When allocating funding assistance to local councils for coastal protection works, the

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<sup>2</sup> Refer to the Department of Environment, Climate Change and Water *Technical Note: Derivation of the NSW Government sea level rise planning benchmarks*

Government will give priority to public safety and protecting valuable publicly-owned assets, and then to private land. The criteria that the Government will use to allocate any funds to local councils to protect or voluntarily purchase private property will include the:

- magnitude of current and future hazards
- cost-effectiveness of management actions
- contribution to the project's costs from the local council and benefiting landowners, taking into consideration genuine hardship for affected coastal residents
- effectiveness of the proposed arrangements for maintaining any proposed works
- ability of the project to accommodate sea level rise.

Where assistance is provided to reduce the impacts of coastal hazards, the Government does not assume any responsibility for these hazards. The Government will continue to provide funding assistance to local councils for coastal hazard studies and management planning.

These criteria will not affect the NSW Coastal Lands Protection Scheme, where the criteria for land purchase under the scheme does not include coastal hazard reduction.<sup>3</sup>

### **3. Supporting appropriate coastal development**

Provisions under the EP&A Act require consent authorities to consider coastal and flooding hazards in their planning and development approval decisions. The NSW Coastal Policy and coastal regional strategies also require consideration of sea level rise, as does the Standard Instrument for Local Environmental Plans where relevant.

The sea level rise planning benchmarks will support consistent consideration of the influence of sea level rise on any coastal hazards and flooding risks that may influence a development or redevelopment site. The benchmarks are not intended to be used to preclude development of land that is projected to be affected by sea level rise. The goal is to ensure that such development recognises and can appropriately accommodate the projected impacts of sea level rise on coastal hazards and flooding over time, through appropriate site planning, design and development control.

Department of Planning guidelines will describe how sea level rise should be considered in land use planning and development assessment. These guidelines will provide assistance to local councils, landowners, infrastructure providers and developers.

Coastal hazards and flooding are natural processes and the Government considers that the risks to properties from these processes appropriately rest with the property owners, whether they be public or private. This will continue where these risks are increased by sea level rise. Under both statute and common law, the Government does not have nor does it accept

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<sup>3</sup> The Coastal Lands Protection Scheme is used to bring significant coastal lands into public ownership. The criteria for acquisition under the Scheme are to promote public access to the coastal foreshore, to maintain the scenic quality of the NSW coast, and to protect ecological sites of regional, state and/or national significance.



specific future obligations to reduce the impacts of coastal hazards and flooding caused by sea level rise on private property.

Landowners affected by current and future coastal hazards may seek approval from their local council to construct works on their land to protect their property. These works may be approved under the EP&A Act where they do not cause adverse impacts on coastal processes beyond the property boundary or on public amenity or the environment. Private landowners will not normally be permitted to construct works on State-owned land to protect their property. All required approvals must be obtained before any works commence and unauthorised works may be removed at the landowner's cost.

#### **4. Community support during emergencies**

The Government currently provides emergency management support to coastal communities during and following floods and major storms. This support is normally coordinated by the State Emergency Service, operating under the *State Emergency and Rescue Management Act 1989*. The Government will continue to provide this support to coastal communities likely to be affected by sea level rise.

The Government's direct community support will be focused on emergency management. The Government currently does not provide compensation to the owners or potential developers of land affected by coastal hazards or flood risks, except for some compensation and other payments that may be made in relation to an emergency or disaster. This arrangement will continue and will include land where these hazards or risks are increased by sea level rise. Compensation will not be provided for any impact on property titles due to erosion or sea level rise.

#### **5. Information availability**

The Government has provided information to the community on sea level rise projections and the likely impacts of sea level rise on low-lying coastal areas. The Government will continue to provide up-to-date information on sea level rise and its impacts, and will continue to work with local councils to provide information on the impacts of sea level rise on local flooding and coastal hazards.

Continuing public access to current and credible information on sea level rise is important for various reasons, including:

- supporting community adaptation to sea level rise
- supporting the community and the private sector to make appropriate investment decisions in coastal areas
- assisting the insurance industry to price risks from sea level rise in their insurance policies.





Planning

# DRAFT NSW COASTAL PLANNING GUIDELINE: ADAPTING TO SEA LEVEL RISE

CONSULTATION DRAFT – NOT GOVERNMENT POLICY

OCTOBER 2009



## **DRAFT FOR PUBLIC COMMENT**

This document titled the Draft NSW Coastal Planning Guideline: Adapting to Sea level Rise is a consultation paper outlining a proposed approach for addressing sea level rise in land use planning and development assessment in coastal NSW.

Throughout the document, specific consultation questions are put forward to obtain feedback on certain policy aspects of the consultation paper.

This document is on public exhibition until 11 December 2009.

You are invited to make comments on this document.

Submissions may be emailed to [innovation@planning.nsw.gov.au](mailto:innovation@planning.nsw.gov.au), faxed to 02 9228 6311, or mailed to:  
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# 1 INTRODUCTION

## 1.1 SCOPE AND AIMS OF THE GUIDELINE

The Draft NSW Coastal Planning Guideline: Adapting to Sea Level Rise (this Guideline) has been prepared to provide guidance on how sea level rise and its associated impacts are to be considered in land use planning and development assessment in coastal NSW.

The most recent climate change projections indicate increased temperature and evaporation rates for coastal NSW, increased storm intensity, seasonal changes to rainfall and runoff and subsequent impacts on bushfire regimes, biodiversity, soils, erosion and flooding. The primary impacts in coastal areas are likely to result from sea level rise which may lead to increased coastal erosion, tidal inundation and flooding.

This Guideline applies to all coastal areas of NSW, including the NSW Coastal Zone, as well as Sydney Harbour and Botany Bay. The term 'coastal areas' is used broadly in this Guideline to include the coastline, beaches, coastal lakes, estuaries, as well as the tidal reaches of coastal rivers. It also includes other low lying land surrounding these areas that may be subject to coastal processes in the future as a consequence of sea level rise.

In the Guideline 'coastal risks' are taken to include risks from coastal erosion, tidal inundation and coastal flooding exacerbated by sea level rise. Of note, coastal flooding in lowland areas will be of particular concern in the future as a consequence of sea level rise, including increased frequency of flooding and consequent emergency evacuations and property damage.

The aim of the Guideline is to promote ecologically sustainable development (ESD), and in particular to encourage a precautionary approach to land use planning and development assessment in light of potential sea level rise impacts in coastal areas. To achieve this, the Guideline adopts a risk-based approach to planning and development assessment in coastal areas.

## 1.2 POLICY CONTEXT OF THE GUIDELINE

Land use planning and development assessment processes require a balance between social, economic and environmental considerations. As a consequence of climate change, councils and the NSW Government face additional challenges in decision-making, particularly in coastal areas of NSW.

The NSW Government has made a concerted effort to incorporate climate change into relevant planning policies, manuals, plans, strategies and directions including the following documents:

- **NSW Sea Level Rise Policy Statement** (NSW Government 2009) specifies sea level rise planning benchmarks of an increase above 1990 mean sea levels of 40cm by 2050 and 90cm by 2100.
- **NSW Coastal Policy** (NSW Government 1997) requires that climate change be considered in planning and development assessment matters.
- **Coastal Regional Strategies** (Department of Planning) are strategic plans at a regional scale that:
  - seek to ensure future urban development is not located in areas of high risk from natural hazards including sea level rise, coastal recession, rising water tables and flooding;
  - state that in order to manage the risks associated with climate change, councils will undertake investigations of lands with the potential to be affected by sea level rise and inundation to ensure that risks to public and private assets are minimised;
  - specify that local environmental plans (LEP) will make provision for adequate setbacks in areas at risk from coastal erosion and/or ocean-based inundation in accordance with coastline management plans.



- **Sydney Metropolitan Strategy (2005)** and **draft Sub-Regional Strategies** contain a variety of actions factoring climate change into metropolitan planning frameworks.
- **Coastline Management Manual (1990)** and **Floodplain Development Manual (2005)** require consideration of climate change in the preparation of coastal hazard and flood studies and management plans.
- **Coastal Design Guidelines for NSW (2003)** encourage development to be sited outside areas affected by coastal processes, coastal erosion and sea level rise.
- **State Environmental Planning Policy 71: Coastal Protection** requires that councils consider the impact of coastal processes and coastal hazards when preparing LEPs and assessing development in the NSW Coastal Zone.
- **Section 117 Direction 2.2 – Coastal Protection** requires that planning proposals must include provisions that give effect to and are consistent with the NSW Coastal Policy, the Coastal Design Guidelines for NSW and the Coastline Management Manual.
- **Section 117 Direction 4.3 – Flood Prone Land** requires that planning proposals must include provisions that give effect to and are consistent with the Flood Prone Land Policy and the principles of the Floodplain Development Manual.
- **Standard Instrument: Principal Local Environmental Plan** contains clause 5.5: development within the coastal zone which requires that all development within the NSW Coastal Zone consider the effect of coastal processes and coastal hazards and potential impacts, including sea level rise on the proposed development, and arising from the proposed development.

This Guideline builds on these initiatives to encourage more detailed consideration of potential sea level rise impacts in coastal areas, including incorporation of the NSW sea level rise planning benchmarks.

Implementation of this Guideline will ensure more effective application of these existing policies in light of greater understanding and scientific certainty with respect to sea level rise.

Councils, State agencies, planners and development proponents are to have regard to this Guideline when addressing sea level rise matters in land use planning and development assessment in coastal areas.

## 1.3 GUIDELINE PRINCIPLES

This Guideline adopts six coastal planning principles for sea level rise adaptation. The principles should be applied in decision-making processes for land use planning and development assessment in coastal areas.

### Coastal planning principles: Adapting to climate change

**Principle 1** – Assess and evaluate coastal risks taking into account the NSW sea level rise planning benchmarks.

**Principle 2** – Advise the public of coastal risks to ensure that informed land use planning and development decision-making can occur.

**Principle 3** – Avoid intensifying land use in coastal risk areas through appropriate strategic and land use planning.

**Principle 4** – Consider options to reduce land use intensity in coastal risk areas where feasible.

**Principle 5** – Minimise the exposure to coastal risks from proposed development in coastal areas.

**Principle 6** – Implement appropriate management responses and adaptation strategies, with consideration for the environmental, social and economic impacts of each option.

**Note:** In this Guideline, ‘coastal risks’ refer to coastal erosion, tidal inundation and coastal flooding. ‘Coastal risk areas’ include coastal areas currently at risk, as well as areas that may be at risk in the future due to sea level rise (see Figures 1 and 2) in addition to investigation areas.





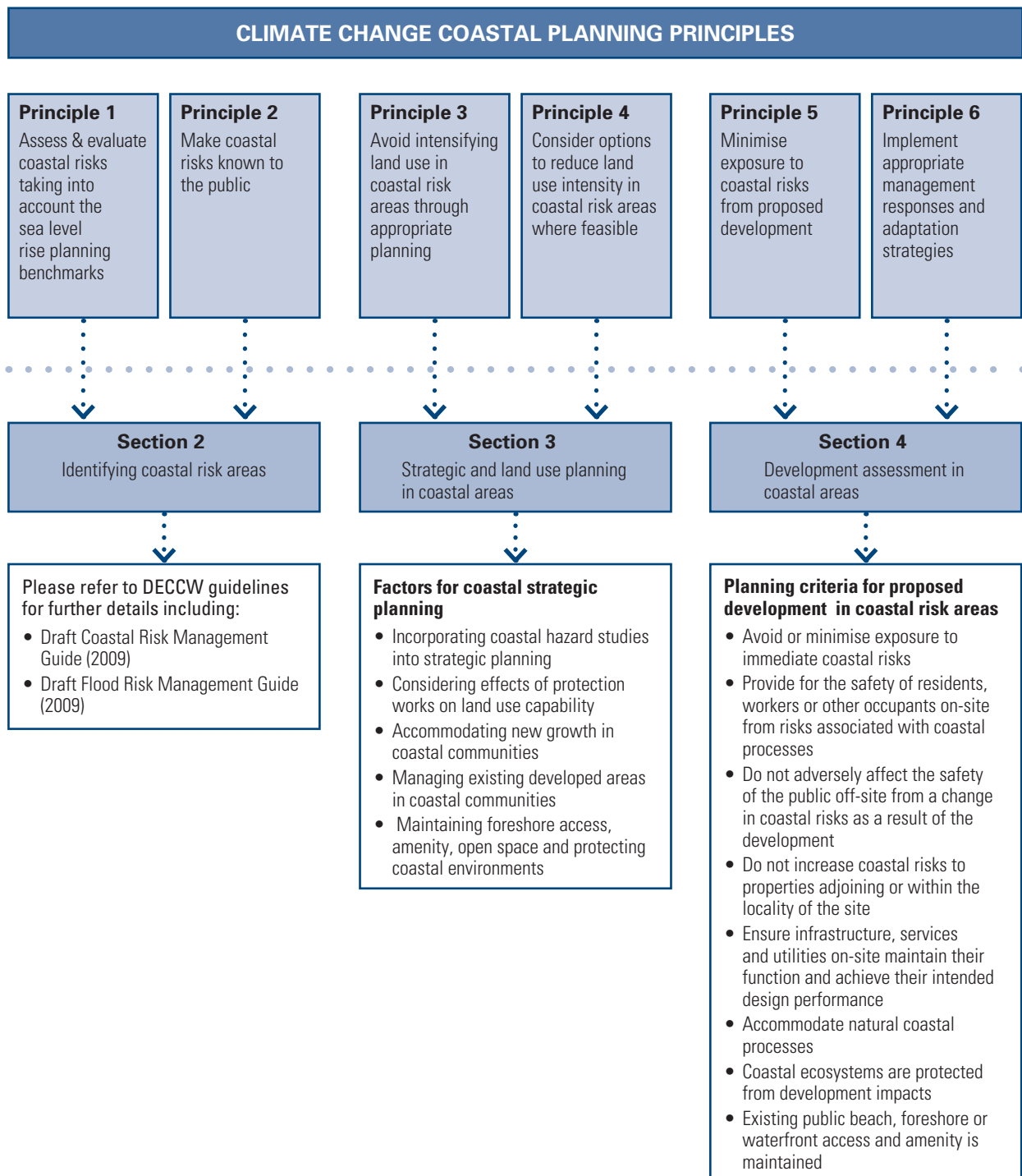
## 1.4 STRUCTURE OF THE GUIDELINE

The Guideline is structured around the implementation of the six coastal planning principles for the consideration of sea level rise. The following diagram illustrates the relationship between these principles and the structure of this Guideline.

**SECTION 2 – IDENTIFYING COASTAL RISK AREAS** outlines how sea level rise should be incorporated into coastal risk assessment.

**SECTION 3 – STRATEGIC AND LAND USE PLANNING** provides information on how sea level rise impacts can be factored into strategic and land use planning.

**SECTION 4 – DEVELOPMENT ASSESSMENT** outlines the process for considering sea level rise in the preparation and assessment of development applications in coastal areas.



# 2 IDENTIFYING COASTAL RISK AREAS

PRINCIPLE 1 – Assess and evaluate coastal risks taking into account the NSW sea level rise planning benchmarks

PRINCIPLE 2 – Advise the public of coastal risks to ensure that informed land use planning and development decision-making can occur

## 2.1 SEA LEVEL RISE PLANNING BENCHMARKS

This Guideline adopts the NSW sea level rise planning benchmarks in the NSW Sea Level Rise Policy Statement (NSW Government, 2009).

The NSW sea level rise planning benchmarks are an increase above 1990 mean sea levels of **40cm by 2050 and 90cm by 2100**. This was established by considering the most credible national and international projections of sea level rise and takes into consideration the uncertainty associated with sea level rise projections.

The adoption of the sea level rise planning benchmarks will ensure consistent consideration of the influence of sea level rise in coastal areas. The sea level rise benchmarks will be updated in light of any changes to internationally and nationally accepted science, such as the release of the next Intergovernmental Panel on Climate Change assessment report into climate change expected in 2014.

The sea level rise planning benchmarks are not intended to be used to prevent development on land projected to be affected by sea level rise. Planning proposals and development applications will continue to be assessed on their merits using a risk-based approach to determine whether the impacts of sea level rise and other coastal processes can be managed.

Coastal planning **Principle 1** emphasises the need to undertake coastal risk assessments incorporating the sea level rise planning benchmarks so that both current and future hazards can be determined.

## 2.2 IDENTIFIED COASTAL RISK AREAS

There are two primary documents currently used in NSW that guide the identification of coastal risk areas:

- *Coastline Management Manual* (1990) outlines the methodology for assessing and managing coastal hazards including beach erosion, shoreline recession, coastal entrance instability, vegetation degradation and sand drift, coastal inundation, slope and cliff instability and stormwater erosion; and
- *Floodplain Development Manual* (2005) outlines the methodology for assessing and managing flood hazards.

The sea level rise planning benchmarks are to be used in coastal hazard and flood studies. Existing coastal hazard and flood studies that have not incorporated the sea level rise planning benchmarks will need to be updated over time.

Two draft guides have been prepared to assist councils in preparing coastal hazard and flood studies to incorporate the sea level rise planning benchmarks:

- *Draft Coastal Risk Management Guide: Incorporating the sea level rise benchmarks in coastal hazard assessments* (DECCW 2009a); and
- *Draft Flood Risk Management Guide: Incorporating the sea level rise benchmarks in flood risk assessments* (DECCW 2009b).

Most coastal councils have prepared coastal hazard studies that define coastal hazard zones in areas most at risk from coastal erosion and recession. The *draft Coastal Risk Management Guide* provides guidance on how this coastal hazard information can be expanded to identify additional areas projected to be at risk in the future from coastal hazards due to sea level rise.

Flood studies have also been prepared for most coastal rivers and creeks likely to be affected by sea level rise. The *draft Flood Risk Management Guide* provides guidance on how existing flooding information can be expanded to identify additional areas projected to be at risk in the future from flooding due to sea level rise.

As these new studies incorporating the sea level rise planning benchmarks are completed, new 'at risk' areas of coastline, foreshore and floodplain (that previously were of lower risk) will be identified. These *identified coastal risk areas* will need to be taken into consideration when undertaking strategic land use planning and development assessment.

### 2.3 INVESTIGATION AREAS

Preparing new and updating existing coastal hazard and flood studies will take some time. Prior to the completion of new or revised studies, councils may adopt investigation areas (potential coastal risk areas) for the purpose of land use planning and development assessment.

An investigation area can be used by a council as an interim guide to indicate land likely to be subject to coastal risks now or in the future as a consequence of sea level rise. The sea level rise planning benchmarks should be incorporated into council's calculation of the investigation areas.

Examples of possible measures that can be used in the identification of investigation areas include:

- projected coastal erosion and recession distances along sandy coastlines – 90cm sea level rise may result in coastal recession of 45 to 90 metres landward;
- projected tidal inundation in the lower reaches of an estuary – additional 40cm by 2050 and 90cm by 2100; or
- projected extension of flood prone land in tidal river reaches – additional freeboard of 30cm added to the mapped flood planning area.
- coastal areas below a set elevation in metres (AHD).

References in this Guideline to coastal risk areas include a reference to identified coastal risk areas and investigation areas.

#### Consultation Question

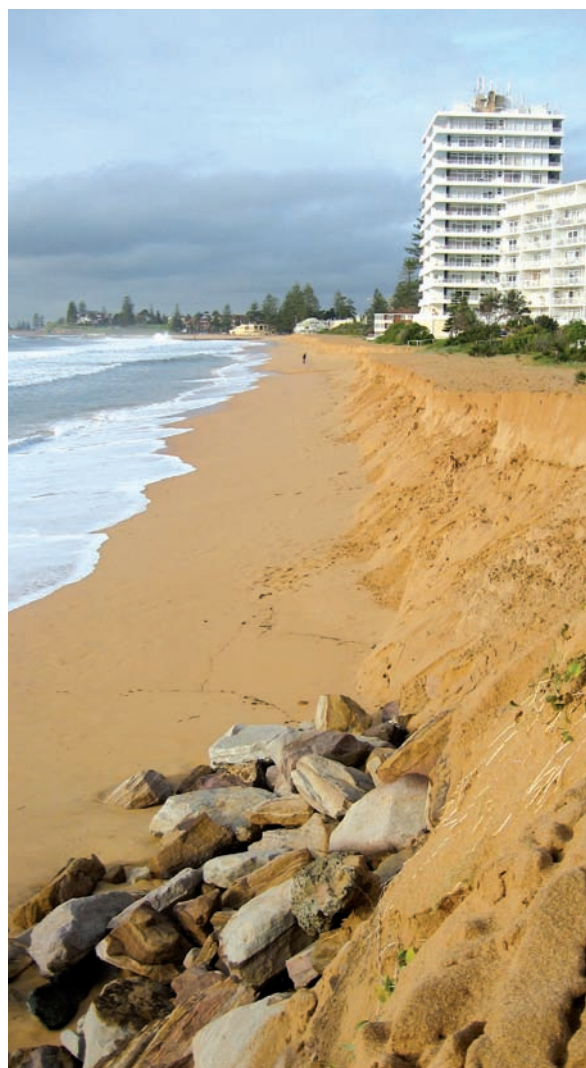
1. In the absence of completed coastal hazard and flood studies which take the NSW sea level rise planning benchmarks into consideration, should councils be able to use investigation areas for planning or development assessment purposes?
2. Should the NSW Government propose a set measure incorporating the sea level rise planning benchmarks for identifying investigation areas across the State?

### 2.4 CHANGES IN COASTAL RISKS OVER TIME

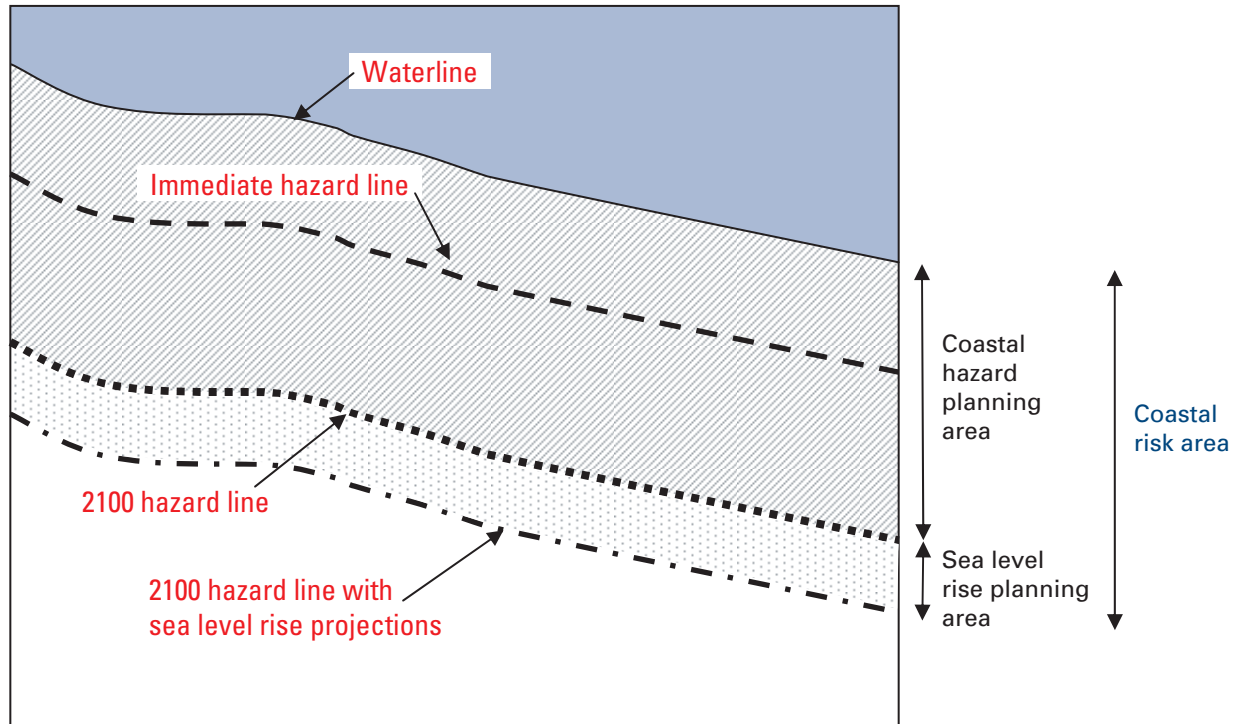
Coastal erosion hazards are often depicted on maps as immediate, 50 year and 100 year lines, showing areas of potential impact. With consideration of the sea level rise planning benchmarks, revised coastal risk studies for open sandy coastlines, estuaries and coastal lakes should identify *immediate hazard lines*, as well as *future hazard lines* based on sea level rise for the years 2050 and 2100 (see **Figure 1**).

Flood studies, which generally depict the 1 in 100 year average recurrence interval (ARI) and the probable maximum flood (PMF) lines on maps, should also include modelling of the impact of sea level rise for the years 2050 and 2100 (**Figure 2**).

While climate change projections extend to the year 2100 this does not mean that sea level rise is projected to cease after this time or that other climate change parameters will be static. It is also important to note that climate change impacts are not occurring in a linear pattern, with continued future acceleration possible (IPCC, 2007).

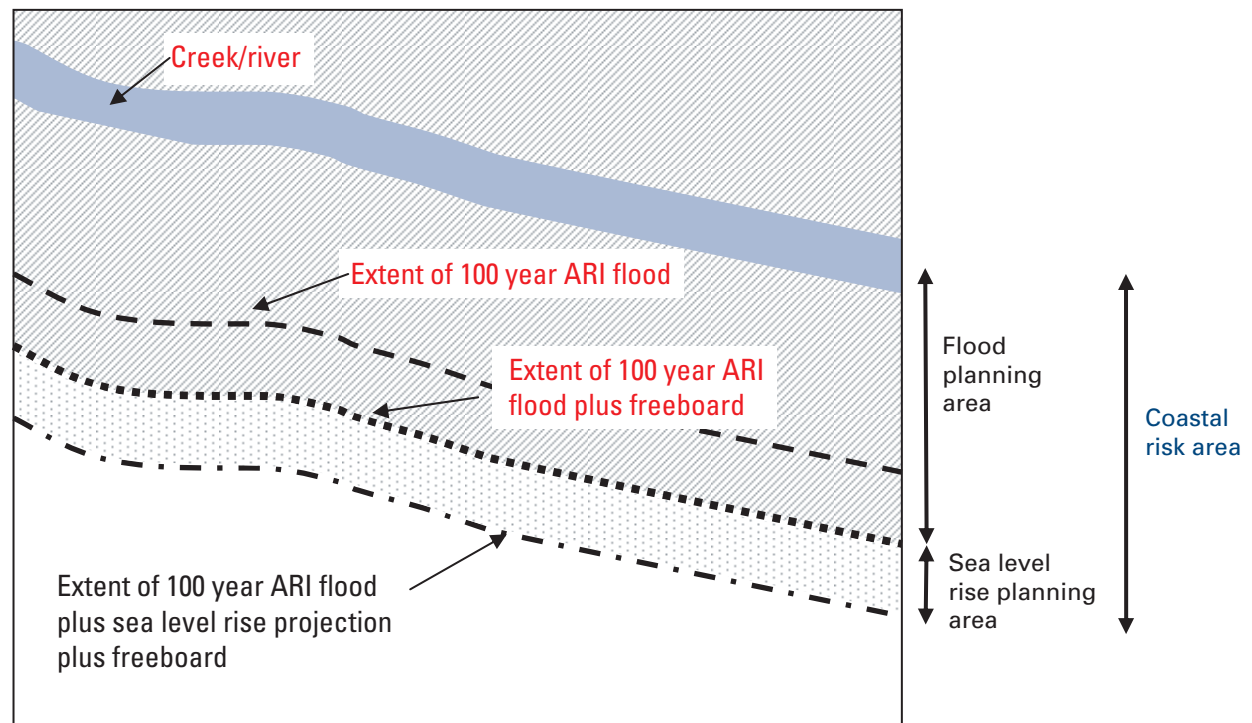


**Figure 1 – Coastal risk areas relating to coastal hazards**



**Nb:** Coastal hazard planning areas and sea level rise planning areas are identified in coastal hazard studies undertaken in accordance with the *Coastline Management Manual* and the *draft Coastal Risk Management Guide* (DECCW, 2009a). **Coastal risk area** is the term used in this Guideline to identify the land covered by both the coastal hazard planning area and sea level rise planning area.

**Figure 2 – Coastal risk areas relating to coastal flooding**



**Nb:** Flood planning areas and sea level rise planning areas are identified in flood studies undertaken in accordance with the *Floodplain Development Manual* and the *draft Flood Risk Management Guide* (DECCW, 2009b). **Coastal risk area** is the term used in this Guideline to identify the land covered by both the flood planning area and sea level rise planning area.



## 2.5 MAKING INFORMATION AVAILABLE TO THE PUBLIC

Coastal planning **Principle 2** emphasises the importance of providing the public with timely advice on coastal risks so that informed land use planning and development decision-making to occurs.

The current process for the development of coastal and floodplain management plans includes community consultation and involvement. The process also involves Ministerial approval of coastal zone management plans and gazettal by the local council. Councils' coastal hazard and flood studies should be made readily available to the public when completed.

Advice provided or action undertaken by councils relating to coastal risks does not incur liability if it is done in good faith, which includes acting substantially in accordance with the principles in the *Coastline Management Manual* or *Floodplain Development Manual* (section 733 of the *Local Government Act 1993*).

Planning certificates under section 149 of the *Environmental Planning & Assessment Act 1979* must include reference to coastal risks where Council (or a public authority) has adopted a policy that restricts the development of the specific parcel of land. This may include 'identified coastal risk areas' or 'investigation areas' if Council has applied development controls to such land.

### Consultation Question

3. Should council rate notices or other mechanisms be used to advise or remind landowners if their properties are located in coastal risk areas?



# 3 STRATEGIC & LAND USE PLANNING IN COASTAL AREAS

PRINCIPLE 3 – Avoid intensifying land use in coastal risk areas

PRINCIPLE 4 – Consider options to reduce land use intensity in coastal risk areas where feasible

## 3.1 STRATEGIC PLANNING

*Strategic planning* includes land use planning activities at the regional, sub-regional and local level, including the preparation of Regional Strategies, local environmental plans, as well as local studies and strategies that inform the preparation of local environmental plans.

In order to implement coastal planning **Principle 3** and **Principle 4** above, the following factors should be considered as part of the strategic planning process:

- Incorporating coastal and related flood risk studies into strategic planning
- Considering the effects of protection works on land use capability
- Accommodating new growth in coastal communities
- Managing existing developed areas in coastal communities
- Maintaining foreshore access, amenity and open space and protecting coastal environments.

### ***Incorporating coastal risk studies into strategic planning***

Councils are to assess and map risks in accordance with the NSW Government's Floodplain Development Manual (2005), Coastline Management Manual (1990) and updated DECCW guidance.

As new coastal risk studies incorporating the sea level rise benchmarks are completed, *identified coastal risk areas* may include new areas of coastline, foreshore and floodplain that previously were considered to be of lower risk. Once identified, these extended areas of risk will need to be taken into consideration when undertaking strategic planning.

In the interim, councils may adopt *investigation areas* as coastal risk areas for use in strategic planning.

### ***Considering the effects of protection works on land use capability***

The planned location of any coastal, foreshore or river protection works is an important strategic planning consideration, as it may influence the viability and appropriateness of different land uses.

Structural protection works can include seawalls, revetments, gabion walls, artificial reefs and groynes as well as temporary protection works (eg. sand bagging). Structural protection works can protect immediate areas from erosion but may divert or deflect erosive forces elsewhere if designed incorrectly or sited inappropriately. To minimise such effects, the installation of structural protection works should be consistent with an approved management plan (eg. the relevant coastline or floodplain management plan) or emergency action plan.

While structural protection works are generally undertaken by or on behalf of public authorities, they may also be proposed on private foreshore land on a site by site basis. Private structural protection works, as with public works, should be based on sound engineering and environmental principles and be consistent with the relevant approved management plan.

Where feasible, 'soft engineering' options are preferred to hard engineering works if protection of both assets and coastal habitats can still be achieved. For instance, options such as beach nourishment or re-establishing barrier dune systems may have the advantage of allowing ecological communities to persist, while still protecting landward development from coastal processes.

### ***Accommodating new growth in coastal communities***

Strategic planning plays an important role in accommodating future urban growth in a sustainable manner. It can assist in addressing the challenges faced by coastal communities that are affected by both development pressure and the impacts of climate change.

The *Coastal Design Guidelines for NSW* (NSW Coastal Council, 2003) provide advice on the design of coastal urban settlements. These Guidelines include advice on retaining foreshores and headlands in public ownership and protecting buildings and properties from storm events and sea level rise.

Coastal planning **Principle 3** discourages the intensification of development in coastal risk areas. For example, changing land use from rural to urban, or increasing the density of housing from low to medium or high density is strongly discouraged in high risk areas due to the potential future risk to life, property and the environment.

New urban centres should be sited away from coastal risk areas, with consideration for other strategic planning issues that affect where new centres are located, such as adequate transport networks, proximity to populations and urban services, and the commercial viability of locations.

### ***Managing existing developed areas in coastal communities***

Coastal planning **Principle 4** encourages the reduction of land use intensity in coastal risk areas where feasible. Reducing land use intensity may however be difficult to achieve in areas that have already undergone significant urban development (e.g. established residential zones).

Changing land use zoning from medium density housing to low density or prohibiting new urban development in general would affect the future development potential of a given area. This is particularly the case if the coastal risks are only minor and the future development potential of the land is not otherwise restricted by other environmental, social or economic constraints.

Conversely, sea level rise may significantly affect the development potential of some areas in the future. Appropriate planning now is needed to minimise the social and economic impacts of inappropriate development in the long term.

In addition to coastal risks, when councils consider reducing land use intensity, the following factors must be considered:

- land tenure (public or private owned land);
- current land uses and existing use rights;
- existing environmental constraints on development (e.g. bushfire hazards, flood risks, slope stability constraints, vegetation and threatened species, acid sulfate soils etc);
- other planning constraints on development (e.g. distance to community services, access to transport, sewage, water and utilities); and
- the risk of requiring land acquisition.

### ***Maintaining foreshore access, amenity, open space and protecting coastal environments***

Strategic planning should address and accommodate the effects of sea level rise on public foreshore access and coastal assets such as reserves, recreation areas or natural areas.



This also includes addressing the implications on the long term protection of coastal and estuarine ecology and the importance of accommodating landward migration of wetlands, mangroves and salt marsh communities.

Coastal public reserves in particular provide important public open space and the loss of these assets may place additional pressure on other open space areas.

## **3.2 STATUTORY PLANNING**

The coastal risk strategic planning considerations listed in section 3.1 should directly inform the preparation of planning proposals and local environmental plans (LEPs).

The following section outlines how an LEP can be used to implement coastal planning **Principle 3** and **Principle 4** to avoid intensifying land use or reduce land use intensity in coastal risk areas.

### ***Land use zones and zoning objectives***

Land use zones in the Standard Instrument provide an important mechanism for regulating land use in identified coastal risk areas.

The appropriateness of using a particular land use zone will depend on the level of coastal risk, as well as other environmental and planning considerations (e.g. existing and permitted land uses on site).

Additional objectives may be applied to a zone, but only if they are consistent with the mandated objectives for development in the zone. The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.

Where zones are identified as being subject to coastal risks it may be appropriate to include an additional objective for that zone requiring the accommodation of the projected impacts of sea level rise.



### Examples of Zoning Options in Coastal Risk Areas

For rural or undeveloped land in coastal risk areas, particularly seaward of the immediate hazard line, the E3 Environmental Management Zone may be appropriate in certain instances to manage land subject to environmental hazards or processes that may require careful management.

Other rural or undeveloped land in coastal risk areas may be zoned E2 Environmental Conservation Zone which provides the highest level of protection, management and restoration for such lands, while allowing uses compatible with those values. It must be noted that the range of permitted uses should not be drawn too restrictively as they may, depending on circumstances, invoke the *Land Acquisition (Just Terms Compensation) Act 1991* and the need for the Minister to designate a relevant acquiring authority.

For risk areas on coastal floodplains that have not yet been zoned for urban uses, retaining low intensity rural zones with large lot sizes may be more appropriate than intensifying land use by allowing residential, industrial or business uses – particularly if the land is projected to be flood prone in the future.

Where coastal risk areas are identified in a National Park or Nature Reserve, the E1 National Parks and Nature Reserves Zone will apply.

For other public land subject to coastal risks, councils may consider applying other zones with low intensity land uses permitted. For instance, in areas currently subject to coastal erosion such as beach and foreshore areas, it may be appropriate to zone the land RE1 Public Recreation Zone. In other circumstances, E2 Environmental Conservation Zone or E3 Environmental Management Zone may be more appropriate.



### Principal development standards

The principal development standards provided in the Standard Instrument are the main tools for controlling the bulk, scale and intensity of permissible land uses and include minimum lot size, building height and floor space ratio.

Councils can vary the principal development standards across zones so that they reflect the underlying land capability.

Development standards such as minimum lot size can be used to regulate land-use intensity without rezoning. This may be of assistance when addressing **Principle 3** and **Principle 4** to avoid intensifying land use or to reduce land use intensity in coastal risk areas.

### Additional LEP provisions

The Standard Instrument contains clause 5.5 – *development within the coastal zone* which requires that, when assessing development within the NSW Coastal Zone, the consent authority considers the effect of coastal processes and coastal hazards and potential impacts, including sea level rise on the proposed development, and arising from the proposed development.

Additional LEP clauses can be added to apply local provisions to specific locations identified on a map (as an overlay). These types of clauses may contain controls for development, provided the local provisions are consistent with the intent and objectives of the underlying land use zone and compulsory provisions of the Standard Instrument.

Inclusion of Clause 6.5 – *foreshore building lines* in LEPs may also be appropriate in some instances. The model clause prohibits certain development in foreshore areas, primarily in inner harbour/protected water locations.

Coastal risk areas may be identified in an LEP by a foreshore building line or a flood planning area, with development controls specified in the LEP, and performance criteria specified in a related development control plan.

### Consultation Questions

4. If land is subject to immediate coastal risks, should further development in these areas be prohibited?
5. How should consideration be given to potential coastal risk areas when zoning land in LEPs? i.e. areas that may be at risk in the future due to sea level rise and other climate change parameters.

### 3.3 DEVELOPMENT CONTROL PLANS

The controls within a development control plan (DCP) are part of a consent authority's statutory considerations when assessing a development application. It should be noted that the development controls in a DCP cannot be inconsistent with an LEP, nor can a DCP be used to place prohibitions on development.

DCPs can relate to issues over a whole LGA, or can relate to a mapped area, such as a coastal risk area.

Where an LEP outlines principal development standards (such as height of buildings, minimum subdivision lot size and floor space ratio) a DCP can make more detailed provision with respect to development. These provisions can take the form of text, maps, diagrams and the like, and usually contain further development standards, performance criteria, matters for consideration or procedural matters associated with controlling development.

For example, coastal risk areas could be mapped in a DCP. Performance criteria for development assessment could be applied to that coastal risk area. More detailed development controls can then be applied to the whole or sections of the coastal risk area (such as the immediate hazard line, 2100 hazard line and the 2100 hazard line with sea level rise projections). These development controls could cover construction methods or materials, size of the development, the need for development to be relocatable or temporary and the location of utilities or services within the site. See also **Figure 4** and **Figure 5**.



### Consultation Questions

6. Should a model clause be developed for councils to use in LEPs to identify coastal risk areas using maps and to apply specific development controls to that identified land?
7. Should a similar provision be incorporated directly into SEPP 71 – *Coastal Protection* to apply to development in the NSW Coastal Zone?
8. Should consideration be given to expanding the application of any coastal risk clause in SEPP 71 to also apply more broadly to the Sydney coastal region?

The following is an example of a possible model LEP clause that could address coastal risks:

#### **Draft LEP Coastal Risk Planning Model Clause**

##### **Coastal risk area**

1. The objectives of this clause are:
  - a) to maintain existing coastal processes and to avoid significant adverse impacts from those coastal processes; and
  - b) to enable safe evacuation of coastal risk areas in an emergency; and
  - c) to avoid significant adverse effects on the environment, and
  - d) to ensure uses are compatible with coastal risks.
2. This clause applies to land shown as “coastal risk area” on the Coastal Risk Planning Map.
3. Consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the development:
  - a) will not adversely affect coastal processes resulting in detrimental increases in coastal risk exposure of other development or properties; and
  - b) will not significantly alter coastal processes to the detriment of the environment; and
  - c) will make provision for safe evacuation of the land;
  - d) if located seaward of the immediate hazard line, will avoid or minimise exposure to coastal processes; and
  - e) make provision for relocation or modification if required.

4. In this clause:

**coastal risks** include coastal erosion, tidal inundation and coastal flooding.

**immediate hazard line** is the line identified on the Coastal Risk Planning Map which represents the estimated extent of beach erosion from a design storm event (as outlined in the draft *Coastal Risk Management Guide 2009*).

# 4 DEVELOPMENT ASSESSMENT IN COASTAL AREAS

PRINCIPLE 5 – Minimise the exposure to coastal risks from proposed development in coastal areas

PRINCIPLE 6 – Implement appropriate management responses and adaptation strategies, with consideration for the environmental, social and economic impacts of each option

## 4.1 DEVELOPMENT IN COASTAL AREAS

This section of the Guideline is intended to assist applicants in preparing coastal development applications and consent authorities assessing these development applications under the *Environmental Planning and Assessment Act 1979*.

The strategic planning mechanisms outlined in section 3 will assist councils in long-term planning by avoiding intensifying land use in areas subject to coastal hazards. The development assessment process provides a further opportunity to ensure that future coastal development does not increase exposure to coastal hazard risks.

The following planning criteria should be considered by applicants when selecting coastal development sites and designing development proposals, as these criteria will be considered by consent authorities when assessing coastal development proposals.

## 4.2 SITE SELECTION IN COASTAL AREAS

Strategic planning mechanisms (i.e. Regional Strategies and local studies) in general provide broad guidance on suitable locations for large-scale coastal developments to meet future housing and employment needs.

Where possible, new urban developments and coastal subdivisions should be located outside coastal risk areas (for the 2100 year sea level rise projection) to avoid increasing the communities exposure to coastal hazards. In particular, developments such as hospitals, schools, child-care or aged-care facilities should not be located in coastal risk areas where risks are high or where evacuation may be difficult.

Developments that are of a hazardous or potentially hazardous nature (e.g. manufacture or storage of hazardous or dangerous materials, or waste disposal) should also be sited outside coastal risk areas.

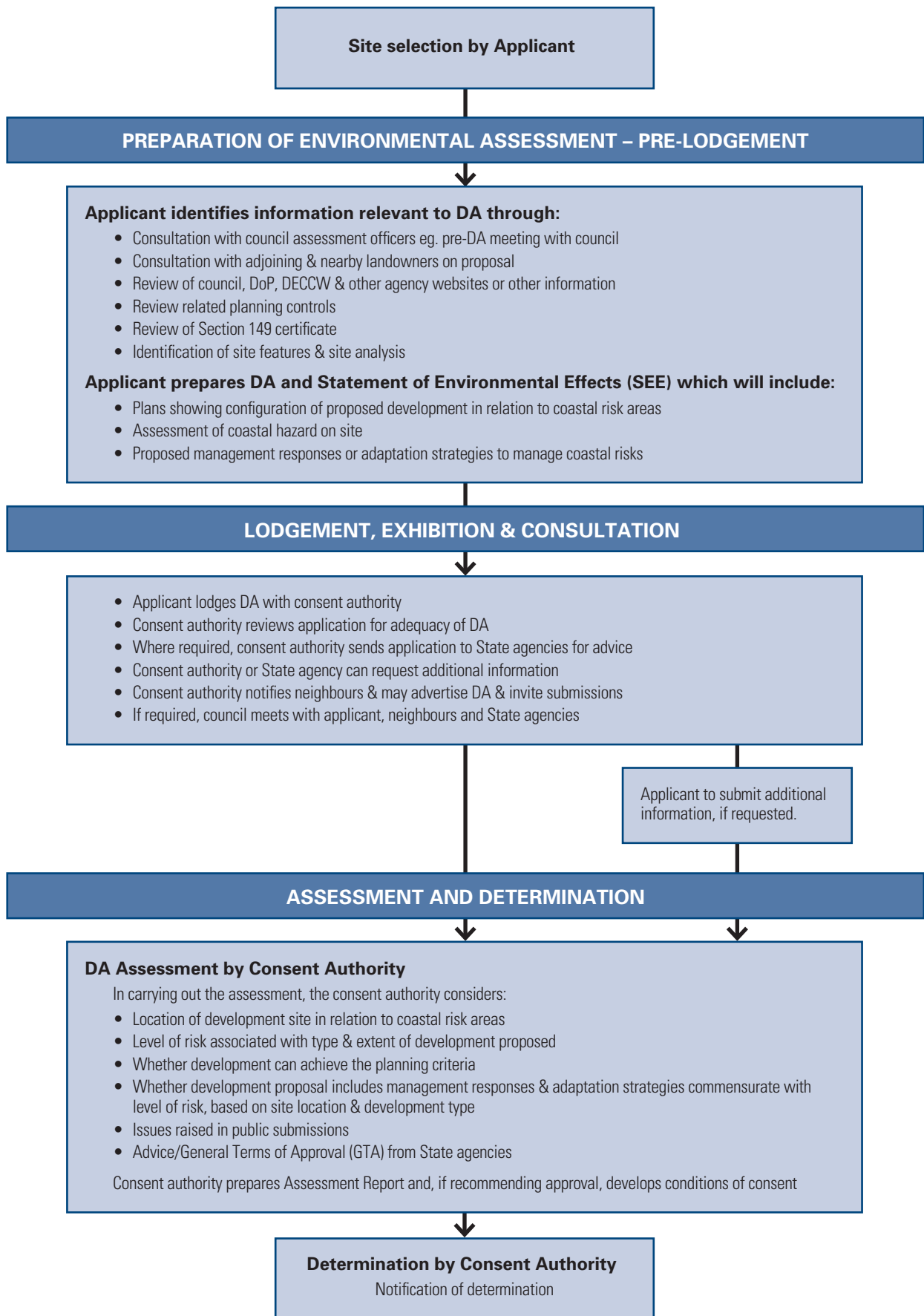
For development sites that are located within coastal risk areas, pre-DA consultation with the consent authorities and relevant State agencies will be an important component of the development assessment process.

As indicated by coastal planning **Principle 5** proposed developments should seek to minimise exposure to coastal risks.

### PLANNING CRITERIA FOR PROPOSED DEVELOPMENT IN COASTAL RISK AREAS

1. Development avoids or minimises exposure to immediate coastal risks (seaward of the immediate hazard line)
2. Development provides for the safety of residents, workers or other occupants on-site from risks associated with coastal processes
3. Development does not adversely affect the safety of the public off-site from a change in coastal risks as a result of the development
4. Development does not increase coastal risks to properties adjoining or within the locality of the site
5. Infrastructure, services and utilities on-site maintain their function and achieve their intended design performance
6. Development accommodates natural coastal processes
7. Coastal ecosystems are protected from development impacts
8. Existing public beach, foreshore or waterfront access and amenity is maintained

**Figure 3 – Assessment process for development applications in coastal areas**





### 4.3 APPLICANT PREPARES DEVELOPMENT APPLICATION (DA)

**Figure 3** outlines the process for development assessment in coastal areas.

#### **Pre-DA consultation**

Proponents who intend to submit applications for development proposals in coastal risk areas should seek early advice from the local council and DECCW on the nature and extent of the coastal risks that may affect the development site. Proponents should also review relevant technical documents and reports.

Councils may have DCPs, management plans or other council policies or strategies which apply to the land or the type of development being proposed which may assist proponents in siting and designing developments in coastal risk areas.

Discussions with councils could also assist in identifying how the proposed development could contribute to any initiatives proposed by the council to manage or avoid coastal hazard risks.

It is also important to consult with adjoining and nearby landowners to discuss both the proposed development and any actions proposed to manage or mitigate offsite coastal risks associated with the proposed development.

#### **Site design and layout**

For proposed developments located in coastal risk areas, the planning criteria will need to be addressed through site design and layout.

The council may also be able to provide advice on appropriate site design and layout for developments in coastal areas.

#### **Management responses and adaptation strategies**

Implementation of appropriate management responses and adaptation strategies will be an important component of any new developments coastal areas (**Principle 6**).

Applications for coastal development should outline management responses or adaptation strategies that will be adopted to address the planning criteria such as:

- configuring the development site layout to minimise exposure to coastal risks e.g. ensuring that buildings and infrastructure are placed in low risk areas on site and provide open space and landscaping between buildings and areas of higher hazard risk (see **Figure 4**);
- installing and maintaining protection works on-site;

- constructing buildings or structures that are easily decommissioned, dis-assembled or relocated either on-site or off-site as required;
- providing for safe exit routes above storm flood height levels;
- designing buildings with all habitable floors above storm flood height levels;
- using appropriate foundations (eg. driving piles down to a stable foundation, not slab on ground);
- designing adaptable buildings to extend the asset life such as:
  - utilising shorter design life elements, design for disassembly and separation, construct with materials suitable for reclamation and recycling in higher risk areas; and
  - investing in greater building permanence in construction and components where there are fewer risks.

The appropriateness of these management responses and adaptation strategies will differ on a case-by-case basis.

#### **DA information requirements**

Applicants submitting DAs for development in coastal risk areas should outline how the proposal satisfies the planning criteria in section 4.1. In order to do so, the following information is to be submitted with the DA, as part of the Statement of Environment Effects (SEE), as appropriate to the scale and location of the proposal:

- Information outlining the type of proposed development including:
  - nature, bulk, scale and location of proposed development; and
  - proposed use and occupation of buildings, and those on adjoining land.



- Plans illustrating the position and configuration of the proposed development in relation to coastal risks including:
  - position of the existing and proposed buildings;
  - existing ground levels to AHD around the perimeter of the building and contours of site;
  - existing or proposed floor levels in AHD and foundation type; and
  - topographic levels to an accuracy of 0.1m, and structures to an accuracy of 0.01m, showing relative levels to AHD.
- A report addressing the following issues relating to sea level rise as they relate to the development site, where relevant:
  - permanent increase in sea level and increased tidal range;
  - soft coast erosion – beach and foredune loss and/or migration, shoreline recession, beach realignment;
  - coastal flooding;
  - coastal entrance behaviour;
  - intermittently open and closed lakes and lagoons (ICOLL) reconfiguration;
  - cliff and slope instability;
  - wetland migration; and
  - groundwater elevation and/or salinisation.
- Information that demonstrates whether the development proposal:
  - is consistent with the relevant approved coastline or floodplain management plan;
  - is consistent with any relevant DCP that relates to coastal or flood issues;
  - meets the coastal protection requirements of the LEP; and
  - incorporates appropriate management responses and adaptation strategies.

### Consultation Questions

9. If a relevant coastal hazard or flood study has not been completed or council has not identified an investigation area, should applicants be required to undertake their own coastal risk assessment as part of the DA requirements?
10. Should this requirement only be restricted to large-scale or medium to high risk coastal developments?

## 4.4 CONSULTATION

The consultation process informs the community of a development application and enables input from the community as well as other agencies that may have an interest in the development assessment process.

The consultation process for a development application within a coastal risk area is the same as for other developments. The consultation process and procedures is often outlined in a council's DCP.

## 4.5 CONSENT AUTHORITY ASSESSES DEVELOPMENT APPLICATION

When assessing a development application in a coastal area the consent authority should assess the level of risk of the proposal. Risk is a function of proximity and exposure to coastal hazard risks and the likely severity of the impacts of the event on the particular type of development.

Risk = Probability of an event occurring x  
Likely severity of the impacts

If the proposed development is not located within a coastal risk area, additional assessment under these Guidelines is not required.





### **Assess risk related to location of proposed development**

The *probability of an event occurring* will be dependent on the location and nature of the development site. The consent authority should determine whether any part of the development site is located in an identified coastal risk area or coastal risk investigation area (see also **Figure 4** and **Figure 5**).

The proponent must provide the consent authority with the appropriate information to determine whether the development is sited within a coastal risk area. In some cases, this information will be available in council plans or studies, in other cases, the applicant will need to undertake their own studies.

#### **Examples of development controls in coastal risk areas**

Depending on the proposed location of the development in relation to coastal risk areas, further detailed assessment may be required. In some instances the site may be deemed to be unsuitable for further development. See **Figure 4** and **Figure 5** for details.

As indicated in Figure 4, proposed developments located seaward of the 2100 hazard line incorporating sea level rise projections will need to address the planning criteria in this Guideline. Councils may also apply additional development controls on mapped land in a DCP (eg. the land seaward of the current 2100 hazard line). For example, buildings should be designed to be easily relocated in the event of coastal erosion (eg. not slab-on-ground, modular in construction). It is not suitable to develop land seaward of the immediate hazard line (ie. in close proximity to the erosion escarpment).

In relation to flooding (Figure 5) all development that falls within or below the sea level rise planning area will require merit assessment addressing the planning criteria in this Guideline. Furthermore, council's existing flood planning requirements continue to apply in the flood planning area. Development located outside the coastal risk area may still require consideration of flood emergency response such as adequate evacuation routes, especially in cases where the site is wholly surrounded by low-lying areas susceptible to flooding.

### **Assess risk related to type of proposed development**

The *impact of an event* (the effects of coastal hazard events on a development site) will be a function of the type of development.

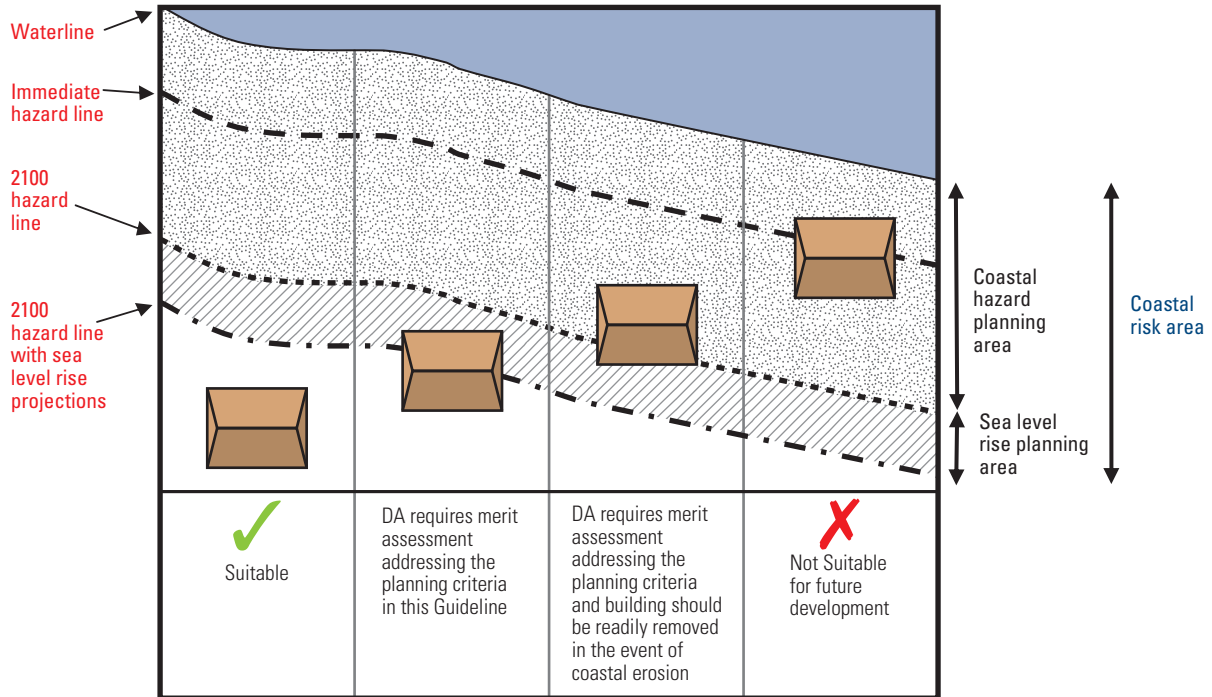
As a guide, the following types of development proposals in coastal risk areas would require further detailed assessment of risks to life, property or the environment:

- construction of new residential, commercial, retail or industrial buildings or structures or substantially increasing the floor space ratio of existing buildings or structures;
- subdivision, with consideration for proposed building envelopes, access and service easements;
- institutional developments, especially where evacuating people may be particularly difficult e.g. hospitals, schools, child care or aged care facilities;
- material change of use that substantially increases the number of people living or working on site;
- manufacture or storage of hazardous or dangerous materials or waste disposal; or
- sewerage treatment works, substations & other key infrastructure.

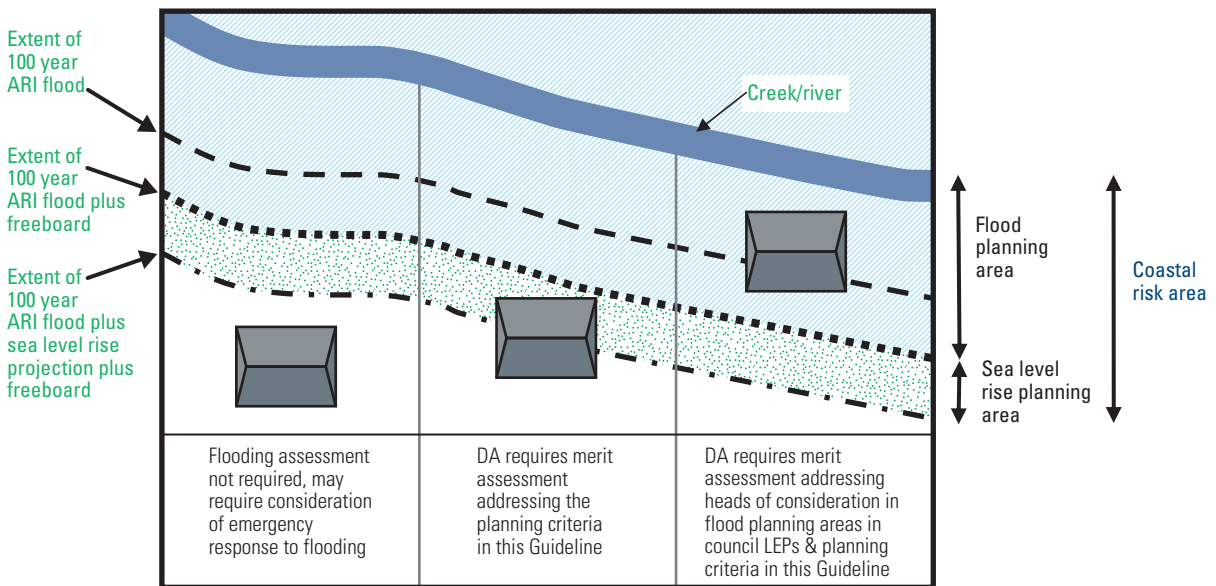
If these types of development are proposed in a coastal risk area, the consent authority should determine whether the type of development proposed (its nature, bulk, scale) and its use is likely to have implications for:

- exposure to immediate coastal risks (seaward of the immediate hazard line);
- safety of residents, workers or other occupants on-site;
- safety of public off-site from a change in coastal hazards as a result of the development;
- safety of properties adjoining or within the locality of the development site;
- performance of infrastructure, services and utilities on-site;
- natural coastal processes as a result of the design of the development;
- coastal ecosystems on or adjoining the site; or
- existing public beach, foreshore or waterfront access and amenity.

**Figure 4 – Coastal erosion consideration in DA assessment**



**Figure 5 – Coastal flooding consideration in DA assessment**



If the consent authority considers the proposed development to be minor development, applications need not be assessed against the above criteria.

The following types of development could generally be considered minor, however the consent authority should consider each application on a case-by-case basis:

- internal fitouts, minor alterations, additions or extensions to existing buildings or structures that are landward of the seaward alignment of the existing buildings or structures;
- waterway recreation structures including jetties, slipways, wharves, boat sheds and pontoons;
- exempt development; or
- temporary or minor relocatable structures.

#### ***Assess proposed development against criteria***

Based on the risk assessment process identified above, applications for development (other than minor development) in coastal risk areas will need to demonstrate how the proposed development will be designed and managed to achieve safety, planning and environmental performance outcomes.

This assessment approach promotes appropriate development in coastal risk areas through the merit assessment of proposals based on social, economic and environmental factors, rather than strict compliance with a set of prescriptive development controls.

The planning criteria will need to be considered by a consent authority before determining development applications in coastal risk areas.

## **4.6 DETERMINATION OF DEVELOPMENT APPLICATION**

When determining development applications in coastal areas, consent authorities are to have regard to the coastal planning **Principle 5** and **Principle 6** contained in this Guideline.

In addition, consent authorities should take into consideration:

- location of the development site in relation to coastal risk areas (see **Figures 4** and **5**);
- level of risk associated with the type and extent of development proposed;
- whether the development can achieve the planning criteria; and
- whether the development incorporates appropriate management responses and adaptation strategies commensurate with the level of risk associated with the site location and the type of development being proposed.

In addition to this Guideline, consent authorities should also have regard to other relevant policies and development controls that apply to the development and the subject site.

### ***Consultation Question***

- 11.** Should new development be prevented in coastal risk areas that are already subject to coastal risks (as identified by an immediate hazard line)?

# FURTHER INFORMATION & REFERENCES

**Coastal Council of NSW** (2003) *Coastal Design Guidelines for NSW*  
<http://www.planning.nsw.gov.au/PlansforAction/Coastalprotection/CoastalDesignGuidelines/tabid/174/Default.aspx>

**Department of Environment, Climate Change and Water** (2009a) *Draft Coastal Risk Management Guide: Incorporating the sea level rise benchmarks in coastal hazard assessment.*

**Department of Environment, Climate Change and Water** (2009b) *Draft Flood Risk Management Guide: Incorporating the sea level rise impacts in flood risk assessments.*

**Department of Planning's** *Coastal Regional Strategies*  
<http://www.planning.nsw.gov.au/PlansforAction/Regionalplanning/tabid/161/Default.aspx>

**IPCC** (2007) *Climate Change 2007: The Physical Science Basis – Summary for Policymakers, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 17 April 2007.* [http://www.ipcc.ch/publications\\_and\\_data/publications\\_ipcc\\_fourth\\_assessment\\_report\\_wg1\\_report\\_the\\_physical\\_science\\_basis.htm](http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg1_report_the_physical_science_basis.htm)

**NSW Government** (1990) *Coastline Management Manual*  
<http://www.environment.gov.au/coasts/publications/nswmanual/index.html>

**NSW Government** (1997) *NSW Coastal Policy*  
<http://www.planning.nsw.gov.au/plansforaction/pdf/CPPARTA.PDF>  
<http://www.planning.nsw.gov.au/plansforaction/pdf/CPPARTB.PDF>

**NSW Government** (2005) *Floodplain Development Manual*  
<http://www.dnr.nsw.gov.au/floodplains/manual.shtml>

**NSW Government** (2009) *NSW Sea Level Rise Policy Statement*  
<http://www.environment.nsw.gov.au/climatechange/sealevel.htm>

*Section 117 Direction 2.2 – Coastal Protection*  
[http://www.planning.nsw.gov.au/planningsystem/pdf/s117s\\_issued\\_01jul09.pdf](http://www.planning.nsw.gov.au/planningsystem/pdf/s117s_issued_01jul09.pdf)

*Section 117 Direction 4.3 – Flood Prone Land*  
[http://www.planning.nsw.gov.au/planningsystem/pdf/s117s\\_issued\\_01jul09.pdf](http://www.planning.nsw.gov.au/planningsystem/pdf/s117s_issued_01jul09.pdf)

*Standard Instrument – Principal Local Environmental Plan*  
<http://www.planning.nsw.gov.au/LocalEnvironmentalPlans/StandardInstrument/tabid/247/Default.aspx>

*State Environmental Planning Policy 71 – Coastal Protection*  
<http://www.legislation.nsw.gov.au/maintop/view/inforce/epi+816+2002+cd+0+N>

# GLOSSARY

**annual exceedance probability (AEP)** – the chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage.

**Australian Height Datum (AHD)** – a common national surface level datum approximately corresponding to mean sea level.

**average recurrence interval (ARI)** – the long term average number of years between the occurrence of a flood as big as (or larger than) the selected event.

**coastal area** – used broadly in this Guideline to refer to the coastline, beaches, coastal lakes, estuaries, as well as the tidal reaches of coastal rivers. It also refers to other low lying areas that may be susceptible to future coastal processes exacerbated by climate change impacts.

**coastal hazard planning area** – the extent of calculated coastal recession plus any allowance for reduced foundation capacity, as identified by undertaking a study in accordance with the *NSW Coastline Management Manual*. The 2100 hazard line should normally be the maximum extent of the coastal hazard planning area.

**coastal risk area** – the term used in this Guideline to identify the land covered by both the coastal hazard planning area and its associated sea level rise planning area (see Figure 1), as well as the flood planning area and its associated sea level rise planning area (see Figure 2). This includes ‘identified coastal risk areas’ and ‘investigation areas’.

**coastal risks** – in the context of this Guideline means coastal erosion, tidal inundation and coastal flooding.

**DA** – Development Application

**DCP** – Development Control Plan

**DECCW** – NSW Department of Environment, Climate Change and Water

**DoP** – NSW Department of Planning

**flood planning area** – the area of land below the flood planning level.

**flood planning level (FPL)** – are the combinations of flood levels and freeboards selected for floodplain risk management purposes.

**identified coastal risk area** – as new coastal hazard and flood studies incorporating the NSW sea level rise benchmarks are completed, *identified coastal risk areas* may include new areas of coastline, foreshore and floodplain that previously were of lower risk.

**immediate hazard line** – mapped line representing the estimated extent of beach erosion from a design storm event.

**investigation areas** – potential coastal risk areas adopted by council prior to preparing new and updating existing coastal hazard and flood studies. The sea level rise planning benchmarks should be incorporated into the calculation of investigation areas.

**LEP** – Local Environmental Plan

**NSW Coastal Zone** – land identified in a series of gazetted maps under the *Coastal Protection Act 1979*.

**NSW sea level rise planning benchmarks** – are specified in the *NSW Draft Sea Level Rise Policy Statement* as an increase above 1990 mean sea levels of 40 cm by 2050 and 90cm by 2100.

**planning criteria** – eight assessment criteria to be considered by consent authorities when assessing development applications in coastal risk areas (see section 4.1).

**risk** – is assessed on the basis of the probability of an event occurring multiplied by the impact of the event.

**sea level rise planning area (coastal hazards)** – area of land between the 2100 hazard line calculated assuming no sea level rise and the 2100 hazard line calculated using the 2100 sea level rise benchmark.

**sea level rise planning area (flooding)** – area of land excluding the flood planning area which is below the 100 year ARI flood level plus freeboard plus projected sea level rise influence.

**SEE** – Statement of Environmental Effects









# Draft NSW Coastal Planning Guideline: Adapting to Sea Level Rise

## BACKGROUND

The Draft Coastal Planning Guideline: Adapting to Sea Level Rise (the draft guideline) accompanies the NSW Government's Sea Level Rise Policy Statement and aims to provide practical advice to coastal councils on how sea level rise should be considered in future land use planning and development assessment in coastal NSW.

The policy statement, which underwent community consultation in early 2009 prior to its finalisation in November 2009, establishes sea level rise planning benchmarks of 40cm by 2050 and 90cm by 2100 (above 1990 mean sea levels).

The draft guideline encourages a risk-based approach to strategic land use planning and development assessment, taking into consideration these new benchmarks.

When finalised, it will be a landmark document which for the first time provides clear advice to councils for land use planning and development assessment in areas subject to coastal hazards.

## COASTAL PLANNING PRINCIPLES

The draft guideline is based around the implementation of six coastal planning principles guiding sustainable development with consideration for sea level rise, and these include to:

1. Assess and evaluate coastal risks taking into account the NSW sea level rise planning benchmarks;
2. Advise the public of coastal risks and to ensure that informed land use planning and development decision-making can occur;
3. Avoid intensifying land use in coastal risk areas through appropriate strategic and land use planning;
4. Consider options to reduce land use intensity in coastal risk areas where feasible;
5. Minimise the exposure to coastal risks from proposed development in coastal areas; and
6. Implement appropriate management responses and adaptation strategies, with consideration for

the environmental, social and economic impacts of each option.

## COMMUNITY CONSULTATION

The draft guideline has been released for community consultation until 11 December 2009.

Any interested parties are encouraged to lodge a submission. The guideline also includes consultation questions, seeking specific input on certain matters.

For more information on the guideline or to make a submission, please either call (02) 9228 6333 or visiting [www.planning.nsw.gov.au](http://www.planning.nsw.gov.au)

## IDENTIFYING COASTAL RISK AREAS: PRINCIPLES 1 AND 2

The draft guideline adopts the sea level rise benchmarks, ensuring consistent consideration of the influence of sea level rise on coastal areas.

In identifying and evaluating coastal risks, councils should use the Coastline Management Manual and the Floodplain Development Manual, in addition to the advice contained within the draft Coastal and Flood Risk Management Guides, all prepared by the Department of Environment, Climate Change and Water (DECCW).

Revised coastal hazard studies should identify immediate and future hazard lines, factoring in the new benchmarks.

Where new coastal hazard and flood studies have not yet been completed, the draft guideline says councils may use investigation areas as an interim measure to indicate land likely to be subject to coastal risks due to future sea level rise.

The draft guideline says coastal risk areas (including identified coastal risk areas and investigation areas) can be mapped in a development control plan (DCP), and additional development standards or criteria may be added to the DCP which impose further controls

on the type of development permitted in these areas, for instance:

- Type of construction materials;
- Size of the development; or
- Need for the development to be relocatable or temporary.

## STRATEGIC AND LAND USE PLANNING: PRINCIPLES 3 AND 4

The draft guideline says land use planning at the local, sub-regional and regional level should aim to avoid intensifying land use and, where possible, reduce land use intensity in coastal risk areas.

It advises councils to use their discretion in their strategic and land use planning to carefully weigh up the environmental, social and economic costs of altering land use intensity in coastal risk areas.

For instance, the draft guidelines says that changing land use from rural to urban or increasing the density of housing from low to medium or high density is strongly discouraged in high risk areas, and similarly new urban centres should be sited away from coastal risk areas.

The draft guideline encourages a reduction in land use intensity where feasible, however this should be carefully considered in light of the current land uses and use rights, existing environmental and planning constraints on development, land tenure and risk of requiring land acquisition.

For example, it may be appropriate to use the E3 Environmental Management zone for rural or undeveloped land seaward of the immediate hazard line that may require careful management due to ongoing risks from coastal hazards.

The draft guideline is designed to encourage a forward looking approach to coastal land use planning to prevent creating or exacerbating risks to property or life due to sea level rise.

## DEVELOPMENT ASSESSMENT: PRINCIPLES 5 AND 6

The draft guideline provides clear direction to consent authorities for development assessment in coastal areas, outlining how proposals should be considered based on their location in the coastal risk area, in particular that:

- Proposed development within the immediate hazard line should be avoided;
- Proposed development seaward of the current 2100 hazard line should be assessed

- against strict planning criteria and be portable in the event of coastal erosion; and
- Proposed development seaward of the 2100 hazard line with sea level rise projections should be assessed against the strict planning criteria.

According to the draft guideline, any proposal located outside the coastal risk area – in other words behind the 2100 hazard line with sea level rise projections – is considered suitable for development with regard to coastal hazards, subject to merit based assessment of other relevant issues.

The draft guideline says the eight planning criteria should be considered by proponents when preparing a proposal, and by consent authorities when assessing a development application in a coastal risk area. These criteria state that the proposal should not impact on natural coastal processes, not increase coastal risks around the site and should protect coastal ecosystems from development impacts.

## FURTHER INFORMATION

Department of Planning website:  
[www.planning.nsw.gov.au](http://www.planning.nsw.gov.au)

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