Map 1
Effect of Climate Change on Sea Level Rise

Plan 2
Assessing Implications of Coastal Hazards for Planning

Comm 3
Communicating Sea Level Rise

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Sydney Coastal Councils & CSIRO

Mapping & Responding to Coastal Inundation

2 Incorporating Coastal Inundation & Sea Level Rise into Local and Regional Planning Responses

SYDNEY COASTAL COUNCILS GROUP

CSIRO

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1. INTRODUCTION

The Sydney Coastal Councils Group (SCCG) region is particularly vulnerable to climate change impacts including extreme weather events and sea level rise (Preston et al., 2008; Hebert & Taplin, 2006). While mitigation remains a critical component of the climate change challenge – there is growing awareness of the need to adapt to unavoidable impacts (Adger et al., 2005; Burton et al., 2007; Wilson, 2006). As key decision makers and service provider's local governments play a vital role in identifying, planning and implementing cost-effective and timely adaptation options. Yet, embedding adaptation measures into existing local and regional planning and decision-making processes is proving to be a complex and difficult task for planners and policy makers.

Figure 1: Map of Sydney Coastal Councils Group region

Local councils in the SCCG area recognise the need to adopt a pragmatic, mainstreamed and coordinated approach to managing risks of coastal inundation related to sea level rise (Smith et al, 2008a). Some councils in the region are yet to include specific actions to manage these risks within their existing land use planning and management instruments (Smith et al, 2008b). Specific, implementable and locally relevant actions within councils that are coordinated and consistent across the broader region will increase the effectiveness of the planning response.

In 2009 the Sydney Coastal Councils Group (SCCG) was awarded funding under the Natural Disaster Mitigation Program to undertake the "Mapping and Responding to Coastal Inundation Project". The project aims to provide Councils and the community with the science, management and planning provisions and community awareness raising materials necessary to effectively incorporate sea level rise and extreme storm surge events into the planning and management systems of Local Government. The project involves the following stages:

- Phase 1: Map the effect of climate change on sea level rise and extreme sea levels.
- Phase 2: Develop model planning provisions to integrate sea level rise and extreme sea level events into relevant planning strategies of the SCCG.
- Phase 3: Develop and distribute community risk disclosure information and corresponding community and stakeholder education program.

2. AIM OF THIS REPORT

This report focuses on Phase 2 of the project (Assessing Implication of Coastal Hazards for Planning). Firstly, the key findings from an Environmental Defender's Office review commission by the SCCG entitled "Audit of Sea Level, Coastal Erosion and Inundation Legislation and Policy, 2011) of relevant international and national legislation and policy are presented. The report then goes on to overview the planning and policy context in the State of NSW in which local government planners in the SCCG operate and the sea level rise related hazards in the Sydney region. In this section of the report, a suite of guiding principles are proposed to inform the development of planning instruments and other responses in light of the needs of climate adaptation broadly and sea level rise specifically. Thirdly, the results of structured discussions with local government planners on future planning responses are outlined before recommendations and priorities for further work are presented.

The overall aim of this phase of the project has been to assist local councils in planning and managing responses to sea level rise and coastal inundation by highlighting issues that need to be more effectively embedded within environmental planning instruments. Importantly this stage of the project involves the participation of local government planners in this process. As such the responses and recommendations presented in this report reflect local government knowledge and priorities in the region, combined with knowledge of best practice internationally.

Through the literature review that the Project Team undertook as part of this research, and in the conversations with stakeholders involved with this project, it is clear that many of the issues raised in this report have formed the basis of past reviews stretching back many years. Bruce Thom quotes the 1991 House of Representatives Inquiry "The Injured Coastline" (Thom, 2008)

> *Existing ad hoc, hodge podge pattern of development slowly nibbles away at a precious and beautiful resource, the natural coastline.*
>
> *Existing coastal management arrangements are fragmented and poorly coordinated.*
>
> *There has been a tendency in coastal management to focus on specific issues…such a perspective has been revealed as too narrow.*

In reviewing international examples of climate adaptation in coastal areas, Barbara Norman notes "where there is significant national commitment to climate change adaptation, this has largely been followed by local examples of implementation" (Norman, 2009a).

Finally, in introducing this topic, Doug Lord and Angus Gordon (Lord and Gordon, 2011) highlight that "Local Government is increasingly being handed responsibility for implementing climate change adaptation measures…[yet] they are not provided with the financial, legal or technical backing to underpin such actions, particularly as they affect private property".

This report brings together a range of ideas and examples for action in the very immediate term as well as larger, more complex opportunities that will require multi-party support and

considerable time to achieve. Coupled with the other outputs from the project, the research aims to provide the tools, insights and communication strategies to support local government in responding to the challenge of sea level rise and coastal inundation.

3. LEGISLATIVE AND POLICY BACKGROUND

This section of the report addresses the legislative and policy context for managing and responding to coastal inundation. Using examples from other jurisdictions in Australia as well as overseas, options and opportunities for a more integrated and responsive planning system will be explored. This section of the report draws upon the work of the Environmental Defender's Office (EDO) of NSW and their audit of sea level rise, coastal erosion and inundation legislation and policy (EDO, 2011).

3.1 INTERNATIONAL EXAMPLES

The challenges facing coastal communities around the world as a result of climate change are complex and highly inter-linked in nature. Traditional planning responses are not well suited to the scale and scope of these challenges. Internationally, there are several countries that have sought to reform policy and legislative frameworks to better address the issues associated with coastal inundation, sea level rise and erosion. Examples of best practice from some countries that use a risk based approach are presented below from the analysis undertaken by the EDO (EDO, 2011) and the full report is provided as an Appendix.

- New Zealand

  A key reference document identified by the EDO is the Coastal Hazards and Climate Change Guidance Manual for Local Government (MoE, 2008). The document is highlighted because of the focus on new approaches to address coastal erosion caused by storms and long term processes and coastal inundation caused by storms or gradual inundation from high tides due to sea-level rise. Importantly, significant emphasis is placed on communication with the community and changing perceptions about coastal inundation. The Manual refers to changing paradigms and getting the message across that coastal hazards are in fact normal processes. This is a significant shift from the traditional view that hazards need to be battled against and are unusual occurrences (EDO, 2011 pg 43).

  Another core principle that features in this guidance manual is a simple, yet effective, categorisation of adaptation measures – "no-regrets", "low-regrets" and "win-win". This approach reflects other adaptation strategies such as the UK Climate Impacts Program (www.ukcip.org.uk). The intent of this classification system is to help identify adaptation options how their implementation may be staged. For example, options that offer benefits even under the current climate conditions are considered no regret options – and should be prioritised for implementation. Given the complex inter-connected nature of coastal systems, there will also be options that deliver multiple benefits – not just from a climate adaptation perspective. The case for these "win-win" options should reflect the wider benefits and recognise that initiatives implemented within the complex coastal environment will have wider consequences which need to be understood, accounted for and highlighted in order that adaptation outcomes are better supported.

A weakness that was identified by EDO with the New Zealand policy environment was with respect to enforcement and compliance – the concepts and ideas appear in subordinate instruments as opposed to primary legislation (EDO, 2011 pg 44).

- United Kingdom

  From the EDO's analysis, it is clear that much of the recent progress in legislative reform has been as a result of the findings from a review of the damaging 2007 floods that occurred throughout Cumbria. With a range of national, regional, and local level agencies involved in the management of all types of flooding, a key step in the reform process has been the clarification and codification of responsibilities. EDO describes the legislation as highly prescriptive and it was stated at the time the legislation was being passed that "one of the purposes of the Bill [Flood and Water Management Act 2010] is to make it absolutely clear for the first time who has lead responsibility".

  Equally, there are some good policy examples from the UK as well which are of relevance to this project (EDO, 2011).

  - A sequential risk based approach in identifying land for development – this test requires proponents to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate for the type of development proposed

  - Policy objectives targeted at preventing new development from being put at risk from coastal change. The language used in the policy is quite direct – "avoiding inappropriate development in areas that are vulnerable to coastal change" and "directing development away from areas vulnerable to coastal change".

  - Requirements for a vulnerability statement for planning applications for proposed development within at risk areas.

3.2 EXAMPLES FROM OTHER AUSTRALIAN JURISDICTIONS

Within Australia, each State and Territory has its own set of legislation and policies directed towards management of coastal areas. The EDO, using a simple search criteria, found very little reference to issues of "sea level rise", "coastal erosion", coastal inundation", and "coast" in state/territory based legislation and regulation. For one quite specific set of issues, sea level rise benchmarks, there is a range of adopted values as well as policy gaps where only recommendations have been made (Lord and Gordon, 2011). Considering 2100, mandated sea level rises range from 1.1 m (Commonwealth) to 0.8 m (Victoria and NT).

The EDO report covers the following state policies:

Table 1: Policy documents reviewed in EDO (2011) report

Western Australia	State Coastal Planning Policy 2003 Coastal Planning and Management Manual 2003 Development Control Policies (such as the Country Coastal Planning Policy)
Tasmania	Tasmanian State Coastal Policy Revised Draft State Coastal Policy 2008
Northern Territory	Environmental Guidelines for Reclamation in Coastal Areas Northern Territory Coastal Management Policy Northern Territory Planning Scheme
South Australia	Coastline: Coastal erosion, flooding and sea level rise standards and protection policy The Coastal Planning Information Package Living Coastal Strategy for South Australia Our Seas and Coasts: A Marine and Estuarine Strategy for South Australia Adelaide's Living Beaches: A Strategy for 2005 – 2025 Marine Planning Framework for South Australia (2006) South Australia's Strategic Plan 2004
Victoria	The Victorian Coastal Strategy 2008 Coastal Action Plans and Coastal Management Plans State Planning Policy Framework
Queensland	State Coastal Management Plan Draft Queensland Coastal Plan Draft State Policy – Coastal Management Draft State Planning Policy – Coastal Protection (SPP) Draft State Policy Guideline – Coastal Management Draft State Planning Policy Guideline – Coastal Protection Draft Guideline – Coastal Hazards
New South Wales	Coastal Protection and Other Legislation Act 2010 Coastal Protection Act 1979 Coastal Protection Regulation 2011 NSW Sea Level Rise Policy Statement Coastal Planning Guideline

	Coastal Risk Management Guide and Flood Risk Management Guide Environmental Planning and Assessment Act 1979 State Environmental Planning Policy No. 71 State Environmental Planning Policy (Major Development) 2005 NSW Coastal Policy 1997 NSW Coastal Design Guidelines (2003)

Against this backdrop, there are a number of forward thinking and very relevant initiatives that are worth highlighting from the EDO assessment.

- Factors to calculate setback to protect development from physical coastal processes. Based around scientific research, four factors were developed as the basis for calculating setback for a given development. These factors relate to coastal type; extreme storm events; erosion/accretion trends; and, sea level rise. [Western Australia].

- A case study from Clarence City Council [Tasmania] (Norman, 2009a) highlighted several adaptation responses that the council was considering through a pilot project. These included:

    - Planning controls for new development and engineering / technical specifications for materials, construction methods and design guidelines

    - Development freeze where protection measures against erosion are impractical or undesirable

    - Engineered works

    - Emergency management and planning

    - Community education

- From a review of practices in South Australia, EDO recognised the use of checklists by both applicants and development assessors helped to clarify the information that was required in assessing development applications. While this example is quite procedural in nature, it does highlight the value of streamlining and clear communication of expectations and requirements in the development assessment process which is not only relevant in this climate adaptation context.

- In Victoria, the 2008 Coastal Strategy requires planning for a sea-level rise of not less than 0.8 m by 2100. This Strategy explicitly notes that the 0.8 m benchmark is not fixed and will be reviewed as further scientific data becomes available. This flexibility was viewed favourably by EDO as it was seen to provide parameters for action in the short term while still acknowledging that new, updated scientific findings may at some point in the future require the benchmark to be changed.

In concluding the report, the EDO lists a number of recommendations for reform in NSW (EDO, 2011).

- Review the ad-hoc framework – the current system is comprised of a patchwork of ad-hoc policy and legislation. Instruments that are considered obsolete need to be repealed as a first step before developing an over-arching piece of legislation

- Detail to appear in primary legislation as opposed to subordinate instruments – this distinction limits the number of prescriptive legal obligations and instead pushes the concepts and strategies as recommendations and guidance only.

- Improved enforcement and compliance – as well as the issue raised above about the prevalence of sub-ordinate legislation, the EDO also notes a lack of resources and understanding throughout those authorities charged with enforcement duties

- Dealing with existing inappropriate development – EDO recommends that State Government provide more guidance on how to manage properties that have previously been given development consent and are now seen as likely to be subject to the impacts of erosion and sea level rise.

- Providing certainty to those managing the uncertain – ensure there are requirements for evidence based planning and decision making

- Lines in the sand – 'no go' areas for development – legislation should be provided that prohibits any new development in immediate coastal risk areas

- Development of a federal framework – this may provide a much needed coordination role and assist with guidance and coordination as well as the provision of baseline data

- The need for a paradigm shift in NSW – alter the perception that coastal erosion is a hazardous, abnormal process to a realisation that these processes are part of life on the coast

- Hierarchy of adaptation options – the report emphasises the importance of developing anticipatory adaptation responses as well as reactive adaptation responses.

- Communication – recommendation is for a communication plan to be developed by State Government based on international examples covered in the report

4. CONTEXT FOR SCCG REGION

This section outlines the current challenges facing the Sydney Coastal Council Group region in terms of coastal inundation risks as well as the policy and legislative framework.

4.1 INUNDATION HAZARDS IN THE SYDNEY COASTAL REGION

The coastal zone of Sydney extends from Broken Bay in the north to Port Hacking in the south, and contains approximately 86 km of ocean shoreline and over 340 km of estuarine frontage. There are 38 ocean beaches separated by high sandstone and shale cliffs, four drowned river valley estuaries (Sydney Harbour, Broken Bay (Hawkesbury), Port Hacking (Bate Bay) and Botany Bay and four coastal lagoons (Manly, Curl Curl, Dee Why and Narrabeen) which periodically enter the ocean across the northern beaches (SCCG, 2010). The Sydney Coastal Councils region covers some 1346 square kilometres. The region is comprised of 15 local government areas adjacent to these marine and estuarine environments, and coastal waterways (SCCG, 2011).

The Australian Department of Climate Change (DCC, 2009) 'first pass assessment' of climate change risks on Australian coasts states that the combination of rising sea levels and changes in extreme events gives rise to two basic risks on the coasts: inundation and coastal erosion. This project dealt in the main with inundation risk and its implications for planning practice. Inundation risk is best expressed as the likelihood of exceeding a given level of tide, surge and flood height over a particular time horizon (DCC, 2009). While the product of broader regional and global level changes, the expression of inundation risk will differ from one local area to the next dependant on the specific characteristics of the natural and built environments in those locations.

Coastal risks have traditionally been assessed with the assumption mean sea level will remain constant. In this way, risks to assets can be estimated if relevant data is available – of course this only considers current conditions risk. A changing sea level means that the baseline upon which current inundation risk is being calculated is moving. The challenge of planning with a moving baseline becomes more difficult when considering longer planning horizons and accelerating sea-level rise. These concerns are of significant importance for local governments in the diverse and densely populated Sydney coastal region.

Inundation analysis for coastal NSW suggests that between 40,800 and 62,400 existing residential buildings may be at risk of inundation from a sea level rise of 1.1 metres and storm tide associated with a 1-in-100 year inundation event. The cost of replacing those dwellings considered at risk is between $12.4 billion and $18.7 billion. These are likely to be underestimates however as they do not contain a wave set up component or account for the potential for future development in at risk locations (CSIRO cited in DCC, 2009). Equally these figures do not consider non-residential properties or other infrastructure such as roads, water and wastewater. Rockdale, Southerland Shire and Pittwater, three LGAs in the Sydney coastal region are amongst those with the highest number of existing dwellings in NSW at risk from such a coastal inundation event (DCC, 2009). Nationally, approximately 700,000 properties are within 3 kilometres of the coast and have an elevation of less than 6 m (Crompton et al, 2008).

By increasing mean sea level, climate change will increase the frequency of extreme sea level events. With a mid-range sea-level rise of 0.5 metres in the 21st century, events that now happen every 10 years would happen about every 10 days in 2100. An even larger increase in the frequency of extremes would occur around Sydney, with smaller increases around Adelaide and along parts of the Western Australian coast. Estimated increases in the frequency of high sea-level events caused by sea-level rises of 0.5 metres will increase the

frequency of events by between 1000 and 10, 000 times in the Sydney Coastal region (DCC, 2009).

The Sydney Coastal Councils Group have undertaken considerable work in recent years to develop a regional and local level understanding of vulnerability to climate change including coastal hazards and sea level rise hazards. This work also explored the limits to institutional capacity of councils at the time to respond to these hazards. Some of the major issues reported by councils included:

- the perception of climate change as an isolated rather than mainstreamed issue within council business;
- living with the legacy of and managing the effects of earlier inappropriate development;
- the multi-jurisdictional character of planning and development with different tiers of government and agencies influencing development decisions; and,
- Inconsistent policies and decisions between neighbouring councils (Smith et al 2008b).

This work also highlights the way that different councils have different exposures and sensitivities to climate hazards, as well as different adaptive capacities (Preston et al, 2008). Here adaptive capacity of council areas has been defined by the socio-economic characteristics of residents in the local government area and the financial and technical resources available to the council. Table 2 shows vulnerability scores relating to sea level rise for the SCCG councils as they relate to exposure, sensitivity and adaptive capacity scores.

Table 2: Council vulnerability to sea level rise and coastal management showing exposure, sensitivity and adaptive capacity components and net vulnerability (from Preston et al, 2008)[1]

Local Government Area	Exposure	Sensitivity	Adaptive capacity[2]	Net vulnerability[3]
Botany Bay	5	7	6	9
Hornsby	5	4	4	1
Leichhardt	4	7	1	8
Manly	5	6	1	7
Mosman	4	5	1	3
North Sydney	4	8	1	2
Pittwater	5	7	3	5
Randwick	4	5	4	6
Rockdale	5	8	8	9
Sutherland	5	3	5	4
Sydney	4	5	2	8
Warringah	5	4	2	2
Waverley	5	5	1	4
Willoughby	4	5	1	1
Woollahra	4	7	1	6

[1] See Preston et al 2008 p.37 for indicators used to calculate vulnerability components
[2] A higher score indicates a lower adaptive capacity
[3] Calculated see Preston et al 2008

High net vulnerability councils (scores of 7-9) include Sydney, Rockdale, Manly, Leichhardt and Botany Bay. Councils with moderate net vulnerability (scores 4-6) were Woollahra, Waverley, Sutherland, Randwick, Pittwater. Council areas with low vulnerability ratings include Hornsby, Mosman, North Sydney, Warringah and Willoughby. The table highlights the considerable diversity amongst councils in the region which has implications for the design of the planning response. On one hand this suggests a need to develop a spatially differentiated response on a council by council basis that addresses the particular vulnerabilities of each council and recognises these differences in cost-sharing arrangements or responsibilities. On the other hand it also points to the potential of climate change exacerbating these differences unless a regionally consistent and coordinated planning response to inundation is adopted.

This work in assessing the vulnerabilities and responses across the Sydney region has been extended in a separate, third phase of this current project that is focused on developing and distributing community risk disclosure information and corresponding community and stakeholder education program. Table 3 summarises council's approach to hazards, community engagement, climate change and sea level rise.

Table 3: Review of approaches to hazards, community engagement, sea level rise and climate change

Vulnerability to CC hazards[4] for each council	Current hazard management[5]	Activity on climate change	Activity on Sea Level Rise (SLR)	Community engagement	Community feedback or survey	Council resources used
Botany Bay High: extreme heat, extreme rain, SLR, ecosystems Moderate: bushfire Low: -	• Urban hazards	• ICLEI member 2001-09 • Ongoing mitigation activities	• No mention	• No formal strategy? • Resident consultative committees for new developments • Local community involved through attending council or committee meetings or contacting councillors	• None found	• Beautiful Botany report to the community 2010 • SoE Supplementary report 2010
Hornsby High: bushfire Moderate: extreme heat, extreme rain, ecosystems Low: SLR	• Bushfire management plan	• Mitigation activities • SOE report suggests cc will be an issue for council in future • Climate	• Community expectations are for sea walls • Hornsby Overland Flow study • Flood prone land mapping • Climate Vulnerability	• Bushfires management plan has community engagement process	• Regular community surveys Survey in 2009 showed: • Public should contribute a significant amount in council decisions • High degree of interest in being involved in council processes • Local issues are most	• Hornsby Ku-ring-gai bushfire Management Plan • Community surveys 2009, 2010 • SoE supplementary report 2009-10 • Living on Estuary's edge brochure

[4] Preston et al (2008)

[5] Urban hazards include non natural hazards such as: asbestos, house fire, stormwater, trip hazards on footpaths.

		Change Action Strategic Plan (CCASP)	Assessment of estuarine vegetation		important for involvement Survey in 2010 showed that residents priority is for urban issues (trees, footpaths etc)	• Climate Change Action Strategic Plan (CCASP) 2009 (Data from survey & doc analysis)
Leichhardt High: Moderate: extreme heat, extreme rain, ecosystems, SLR Moderate: - Low: bushfire	• Urban hazards • Flood study done. Draft for exhibition Sep 2010	• Focus on mitigation and especially sustainability	• Flood studies (draft) • Maps available to community • FAQs discuss SLR as NSW gov requirement for flood studies	• Community engagement framework – commitment to open government: timely information, encourage participation, identify and remove barriers to participation; feedback provided to participants and community • Communication toolkit	• Community perceptions 2011 • Satisfied with council services (71%) • Think council is committed to sustainability (81%) • Think council does what it says it will do (53%) • Encourages community participation and open government (74%)	• Community perceptions Survey 2011 • draft Leichhardt Flood Study, Draft Estuarine Planning Levels Study (and associated Vols & FAQs)
Manly High: extreme rain, SLR, ecosystems Moderate: extreme heat Low: bushfire	• Urban hazards • Climate change • Landslips • Bushfires	• High commitment to CC – has a mitigation and adaptation plan	• Has coastal plans for specific areas • History of seawalls & beach nourishment	• Community engagement framework based on IAPP	• Community consultation on coastal plans – sea walls are important	• Community Engagement policy 2009 • Community consultation North Harbour Coastal Management plans 2010

Mosman High: extreme rain, ecosystems Moderate: extreme heat Low: SLR, bushfires	• Urban hazards	• Mitigation adaptation and resilience strategies	• SLR included in Mosplan community sustainability indicators • Sea walls but concern due to their age • Historical data does not identify flooding issues and is being reviewed • DCP shows a need to review new developments below 6.5m AHD	• Community engagement policy of inform consult involve (but not called IAP2) • Mosplan outlines community consultation • Annual 'Community environmental contract' reports	• Sustainability group member survey said engagement is an issue (meeting notes)	• Mosplan documents • Sustainability group meeting notes (10/6/10) • Community engagement policy 2009 (Data from survey & doc analysis))
North Sydney High: extreme rain, extreme heat ecosystems Moderate: Low: SLR, bushfire	• Bushfire management	• Low in community but council seems to consider important	• SLR included in revisions to 2020 strategic plan	• Community engagement policy (2009) • Looks regulatory in scope	• Community vision doc? Not sure what this is based on	• SoE report 1999-2000
Pittwater High: extreme rain Moderate: extreme heat,	• Beach safety, bushfires, flooding, plants and animals rock	• Sustainability and climate change • Strong focus on	• Pittwater flood maps release May 2011 • Draft policy for public buildings in	• Community engagement policy based on IAPP • Community consultation toolkit	• Community survey in 2010 • Community is satisfied – highly satisfied with most (29/33) council services • Relevant community	• Community survey report 2010 • Community consultation toolkit 2010

SLR, ecosystems, bushfire Low: -	fall, cliff failure, landslide	sustainability • ICLEI	erosion areas • Pittwater Foreshore Flood plain project • Narabeen Creek Investigation area		priorities: no 7 – community involvement in council decision making, no 14 managing and protection creeks & waterways, no 15 managing natural hazards; no 33 coastal environment centre.	• Climate change policy 2009 • Council media releases about sea level rise projects
Randwick High: extreme rain, ecosystems Moderate: extreme heat, SLR, Low: bushfire	• Urban hazards; asbestos, stormwater	• Most focus on sustainability • CC focuses on mitigation activities	• Have a current Maroubra Flood study – but this is related to stormwater not coastal inundation	• Community engagement policy (2009) • Randwick 2020 plan outcome #3 is for informed and engaged community • Value the skills, knowledge of the community	• Community survey 2008 shows beaches are a high priority • Least satisfaction with: long term planning; and how Council plans for and assesses development	• Community engagement policy 2009 • Maroubra Flood Study 2011 draft • Community survey 2008
Rockdale High: extreme heat, SLR extreme rain, ecosystems Moderate: - Low: bushfire	• Flooding (and disaster management response)	• Have a climate change adaptation plan? (Referred to but not found?)	• SoE report identifies potential effect of SLR on groundwater • Need identified to review freeboard allowance	• Based on IAPP • To standardise processes • Ensuring that decision making processes are based on outcomes acquired from community engagement process, relevant	• Community feedback seems to be gathered for specific proposals and projects	• Community engagement plan 2006 • SoE Report 0809 • Climate change adaptation plan • Wolli Flood management plan 2009

				legislative requirements and other Council policies.		
Sutherland High: - Moderate: SLR, Extreme rain, bushfire, ecosystems Low: extreme heat	• Bushfire • Detailed information available on identifying, mapping bushfire prone land – development restrictions on bushfire prone land	• SoE report (2007) outlines vulnerability and seems to adopt mostly a mitigation focus • Our Shire our future highlights cc as an issue	• Have completed a sea level rise risk assessment • Have flood studies • Have estuary management plans • Risk management plan for Botany Bay floodplain	• Community engagement strategy aims to empower its community to actively engage in civic life, to be involved in the decision making process and to take responsibility for providing solutions to their own concerns	• None located through desktop study	• Community engagement strategy 2009 • Sea level Rise Risk assessment (2010) • Flood management studies (2004 & ongoing) • Estuary management studies (2004-09) • State of the Shire (SoE) report 2007
Sydney High: SLR, Extreme rain, Ecosystems Moderate: extreme heat Low: bushfire	• urban	• Sustainable Sydney • Carbon neutral program	• Floodplain management underway	• Seems to be around specific projects rather than general? • Floodplain management study is asking for local knowledge	• Satisfaction seems high across all categories but data is several years old (2007) now	• Draft Floodplain management plans • Community satisfaction survey 2007
Warringah High: - Moderate:	• Bushfire – detailed plans, map and	• Mitigation focus	• Draft coastal erosion emergency action plan	• Community engagement policy, tool kit and matrix	• Community Survey 2010 Issues of concern • Transport/ Traffic	• Warringah coastal erosion plan (draft 2011)

extreme rain, ecosystems Low: Bushfire, extreme heat, SLR	documents • Coastal erosion		• Flood studies for 4 coastal lagoons • Updated flood studies for Manly and Narrabeen lagoons to account for SLR and increased rainfall • Draft hazard mapping for Collaroy, Narrabeen Beach, Fisherman's Beach • Coastal Erosions Emergency Action plan including community forums	• Use IAPP principles • Committee for flood studies which includes residents and stakeholders – engaged for each stage of flood project – comm products for each stage • Community forums for Coastal Erosion Emergency Action plan	management/ Congestion (44.8%) • Over development/ Poor planning (36.5%) • Population growth (15.1%) • Road & footpath maintenance (14.2%) • Environment (14.0%) • Satisfaction with council decreased from 2009 (69 – 59%) & dissatisfaction increased (x – x%)	• Community Engagement Policy 2011 • Engagement Toolkit 2011 • Engagement Matrix 2011 • Community Survey 2010 • Bushfire prone land& building on bushfire prone land (Data from survey & doc analysis)
Waverley High: extreme rain, ecosystems Moderate: extreme heat, SLR Low: bushfire	• Urban hazards	• Climate change program	• coastal hazards survey mooted in 2009 and $100K set aside • Interim policy for sea level rise	• Community engagement strategy being prepared (2010) – adopted?	• None located through desktop study	• Interim draft Sea Level Rise Policy 2010 • Draft Community Engagement Strategy presentation 29/6/2010 • Report to community, housing public works and

						environmental committee (Climate Change Adaptation: A09/1017)
Willoughby High: extreme rain, extreme heat, ecosystems Moderate: Low: SLR - bushfires	• Bushfire hazard management plan include maps on fire prone land	• Sustainability program • Climate mitigation activities	• Floodplain studies done for three areas • Simple mapping of sea level rise (metres) against land topography for potential impact, without extreme events, flooding or tidal data.	• Community engagement strategy under development • Talking Willoughby online forum	• None located through desktop study	• Community engagement strategy update (Data from survey & doc analysis)
Woollahra High: Extreme rain, ecosystems Moderate: SLR extreme heat, Low: bushfire	• Flood risk	• Sustainability program • CC flagged as impetus for change in Woollhara 2025 Strategic Plan and in LEP review • Council's risk department	• Foreshore inundation assessment thru flood studies • Double Bay Flood study – SLR benchmarks applied to flood study area • Rushcutters Bay Flood study – map lands affected by	• Woollhara 2025 is considered a community engagement plan • Woollahra 2025 contains goals and actions regarding sea level rise impacts on Woollahra. • Council's 149 planning certificates	• Woollhara 2025 Strategic Plan	• Woollhara 2025_strategic plan • Sustainable Woollhara brochure (2010) • Draft flood risk management DCP (Data from survey & doc analysis)

		and a consultant we ranked the threat to the Municipality from SLR to various Council responsibilities.	SLR of 40 & 90 cm • Repair of Darling Pt sea wall due to erosion • CZMP brief prepared	have been amended consistent with the requirements of the NSW Government's coastal reforms.		

4.2 STATUS OF NSW LEGISLATION AND POLICY

The Environmental Defenders Office have recently undertaken two studies of the legislative, policy and planning frameworks related to managing coastal inundation and broader climate change impacts for the Sydney Coastal Council Group (EDO 2008; 2011). The second report was undertaken in relatively quick succession give the rapid pace of change in the policy and legislative environment since 2008. These changes, most significantly, include the NSW Sea Level Rise Policy Statement which provide benchmarks (get specific detail); And secondly the NSW Coastal planning Guideline – Adapting to Sea Level Rise (2010) which seeks to inform councils on appropriate measures to consider SLR through the processes of risk identification, strategic and local land use planning and development assessment.

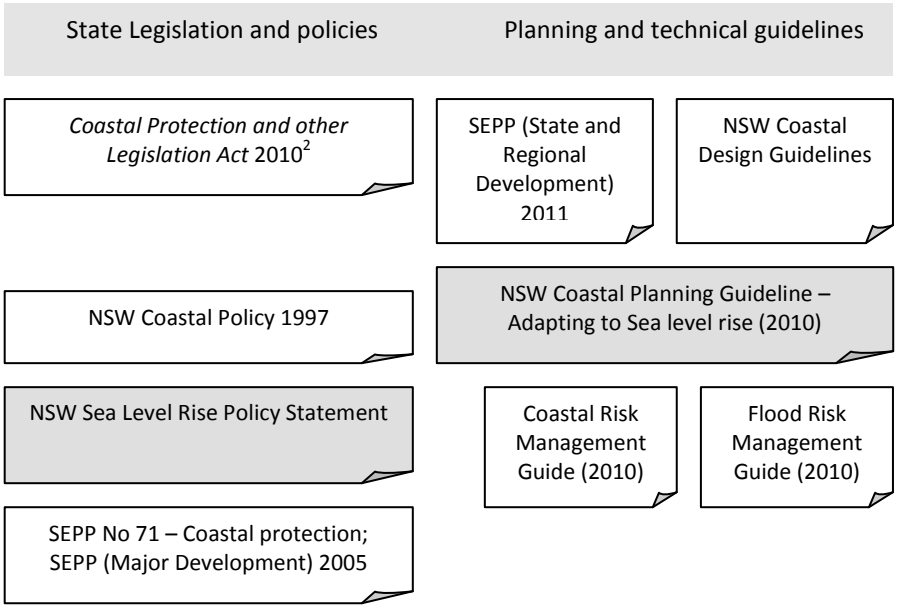


Figure 2: Policy and legislative framework in NSW for coastal inundation and related hazards (see EDO reports for detail of these instruments (EDO 2008; 2011); Other State legislation relevant to this issue includes the Coastal Protection Act 1979; Environmental Planning and Assessment Act 1979)

- The NSW Sea Level Rise Policy Statement (NSW Government, 2009)

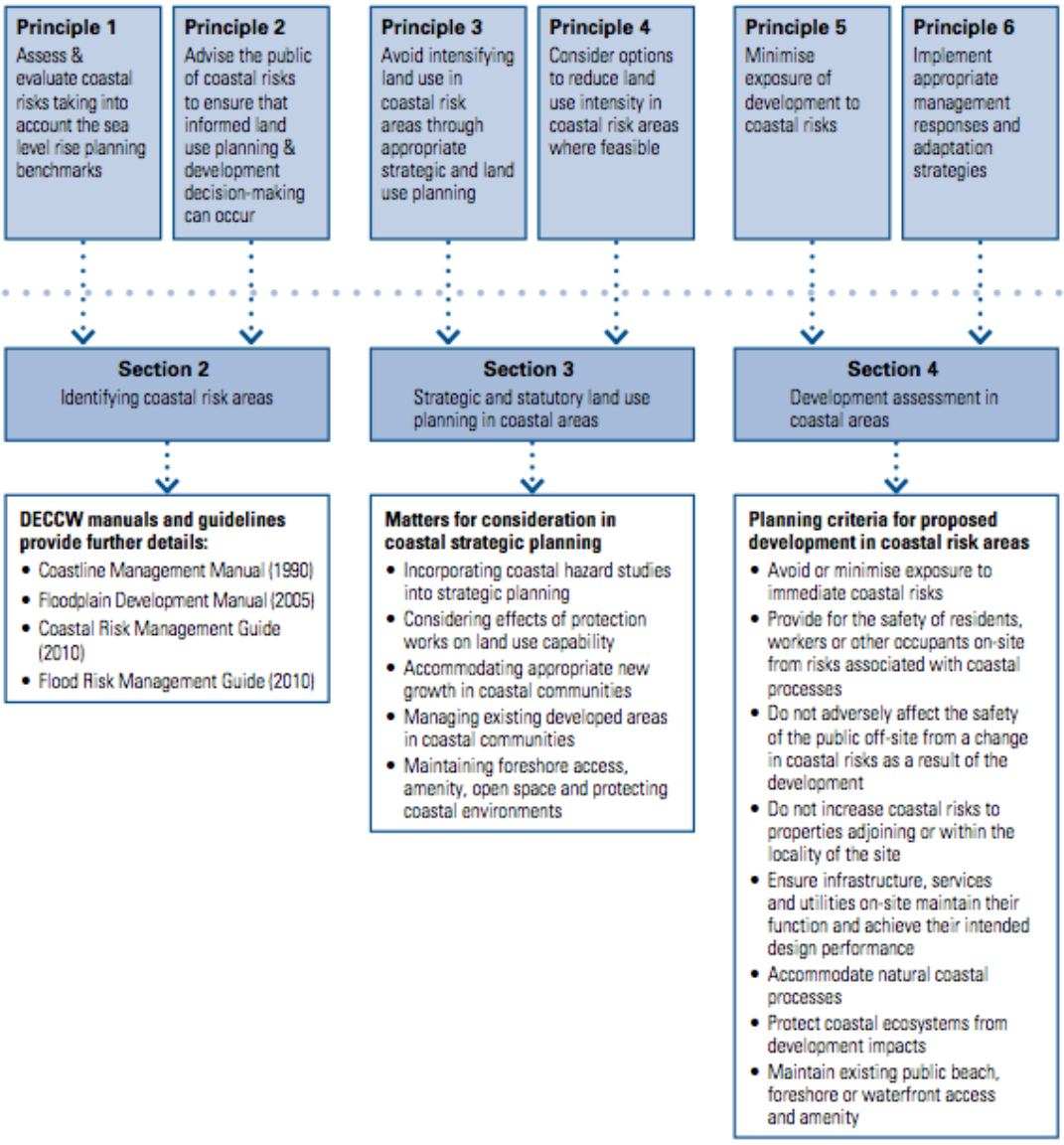
  Issued in 2009, this document aims to promote an adaptive risk based approach to managing the impacts of sea level rise; encourage appropriate development; provide guidance to local councils; and, provide emergency management and community support and up-to-date information.

  The main objective of this document was to specify two planning benchmarks – sea level rise of 0.4 m and 0.9 m for 2050 and 2100 respectively, relative to 1990 mean sea levels. In reviewing the policy statement, EDO concluded that it fails to prohibit certain development or propose rezoning in areas that are clearly vulnerable to inundation.

- NSW Coastal Planning Guideline: Adapting to Sea Level Rise (NSW Dept. Planning, 2010))

  This Guideline is structured around guidance for both decision makers in planning agencies as well as development proponents with a set of criteria that should be considered. This comment about 'should be considered' highlights a weakness from the perspective of EDO – namely that there is no requirement to adhere to the criteria.

  The document provides a summary of coastal planning principles relevant to sea level rise as well as planning criteria for proposed development in coastal risk areas.



PLANNING CRITERIA FOR PROPOSED DEVELOPMENT IN COASTAL RISK AREAS
1. Development avoids or minimises exposure to immediate coastal risks (within the immediate hazard area or floodway). 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 including those associated with projected sea level rise. 7. Coastal ecosystems are protected from development impacts. 8. Existing public beach, foreshore or waterfront access and amenity is maintained.

There have been some further documents released recently by the NSW Government that are summarised below.

- Planning Circular PS 10-032

  This Planning Circular addressed several issues related to the assessment of impact of an activity on the coastal environment. Two key areas are:

  1. When giving consideration to the likely impact of an activity on coastal processes and coastal hazards, the assessment also needs to include impacts under projected climate change conditions. This is in reference to clause 228 of EP&A Regulation (2000).

  2. Changes were made to the Infrastructure SEPP (NSW STATE ENVIRONMENTAL PLANNING POLICY (INFRASTRUCTURE) 2007 on issues related to coastal protection works. Consideration of relevant coastal zone management plans (or referral a new consent authority "NSW Coastal Panel" in the absence of such plans) is now a requirement (see http://www.environment.nsw.gov.au/coasts/coastalpanel.htm)

- Planning Circular PS 11-001

  This Planning Circular addressed a number of issues relevant to amendments to s149 planning certificates related to coastal matters. With the specification of sea level rise benchmarks for 2050 and 2100 outlined in the NSW Sea Level Rise Policy Statement, the Planning Department now recommends that identification of coastal risks (covering coastal erosion, tidal inundation and coastal flooding) should now include these benchmarks. The Circular also presents recommended notation for inclusion on the planning certificate in the following form:

  > *This land has been identified as being affected by projected sea level rise. In identifying coastal risks caused by projected sea level rise, council is to consider the NSW sea level rise planning benchmarks. Those benchmarks specify an increase above 1990*

mean sea levels of 40cm by 2050 and 90cm by 2100. In the event of a (40 cm / 90 cm) sea level rise, this land will be affected by (coastal erosion / tidal inundation and / or coastal flooding)

These two Planning Circulars are attached in the Appendix.

4.3 PRINCIPLES TO GUIDE A COORDINATED PLANNING RESPONSE

Much of the current delay in responding to climate change impacts, such as SLR and coastal storm surge events, can be attributed to the long term projections, the scientific uncertainty surrounding the spatial and temporal scale of potential impacts, and the large number of stakeholder interests and values that are mobilised in vulnerable locations (Leitch et al., 2010). While these challenges and complexities are well recognised there are some important principles that have emerged from the literature regarding planning and policy considerations for adaptation to climate change. The following section of this report provides an overview of the principles that will enhance the decision-making process to ensure that adaptation options are meaningful, efficient and respond to the needs and expectations of all stakeholders. These principles relate to 1) protecting environmental and community values, 2) translating climate science for management, 3) timing of action: anticipatory or reactive responses, 4) increase policy convergence and minimise mal-adaptation, and 5) allocating costs, benefits and responsibilities.

Protecting environmental and community values

The coastal zone provides a broad range of social, cultural, economic and ecological values and benefits. The impact of climate change on coastal processes and coastal values will be significant and it will not be possible to protect everything in the future. In particular, sea level rise is expected to impact on coastal access, coastal ecosystems (e.g. beaches, dunes, wetlands) and community values (e.g. recreational values, scenic amenity, and open space). People are attracted to the coast because of the high amenity values, services and infrastructure. Decision-making must ensure that these coastal values are managed and protected for future generations. In doing so, planning must not only consider the environmental impacts of proposed developments on the environment, but also, consideration should be given the impacts of the environment on development (Vasey-Ellis, 2009). It is important to note however, coastal sensitivity to climate change varies significantly along the Australia coastline, thus, context matters. Sound policies for adaptation should be adapted to local circumstances, each of which is unique, and to the profound complexities and uncertainties that exist (Lynch & Brunner, 2007). Local communities are well placed to 'understand their own context, to decide on sound policies and to take responsibility for those decisions' (Lynch & Brunner, 2007).

Translating climate science for management

Planners and policy-makers rely on the delivery of understandable information about climate change risks that can support adaptation (Mastrandrea et al., 2010). Scientists have been successful in delivering broader national and global climate change trends and projections; however, there is still a lack of precision regarding the local and regional consequences of the climate science. The long time frames and scientific uncertainties all 'conspire to test the abilities of existing decision-making processes' (Tompkins & Adger, 2005). While mitigation has largely focused at the national and international scales (Urwin &

Jordan, 2008), there is consensus that adaptation must occur at the local and regional scales (Bray et al., 1997). To enable successful on-ground adaptation at the local scale there needs to be clear science and guidelines, consistent messages that are well articulated and communicated at an early stage. Providing a clear and consistent message is a critical component of building trust and confidence between stakeholders. Greater consultation between scientists and policy makers is needed to ensure that inconsistencies are minimised (Bray et al., 1997). Poorly communicated science will ultimately result in failed adaptation. The process for developing adaptation at the local scale is perhaps best addressed through a bottom-up and top-down vulnerability assessment which seeks to build on the knowledge of existing locally specific vulnerability and downscaled global climate projections (Mastrandrea et al., 2010).

Timing of action: anticipatory or reactive responses

Decisions about when, what, and how to develop, implement and fund adaptation are difficult and complex (Burton et al., 2002). There are many different types of adaptation measures. The most common distinctions between adaptation actions relate to their timing. Climate adaptation can reactive or anticipatory. Anticipatory adaptation occurs before the event or impacts are experienced and are preferable where the costs of prevention are lower than reactive responses or remediation. Thus, there are opportunities to avoid catastrophic impacts, and financial benefits, of early action (Adger et al., 2009; Bray et al., 1997). Nevertheless, some options will be most effective if implemented when problems arise (Bray et al., 1997). In most cases, it will be the options that are the most politically and socially acceptable that will be implemented. However, consideration of early adaptation responses will also be based on low-cost and easily implementable options that have multiple benefits. These multiple benefits may be in the form of mitigation of greenhouse gas emissions

Increase policy convergence and minimise mal-adaptation

There is increasing recognition that climate change needs to be factored into all areas of public policy and decision making (Urwin & Jordan, 2008). Yet, the integration of climate adaptation policy across sectors and scales remains a key challenge (Adger et al. 2005; Urwin and Jordan 2008). Where possible, consideration should also be given to developing synergies between climate mitigation and adaptation where there are mutual benefits from implementing a single climate policy option (Klein et al., 2005). The ability to respond to climate change impacts will require an integrated and coordinated policy response by government and non-government sectors (Norman, 2009b).

Despite recent planning attempts to facilitate better policy integration across scales, the overarching planning framework for coastal planning and development in Australia is heavily dominated by sectoral policy and decision-making processes. This creates profound complexities for integrating and coordinating climate policy response.

Allocating costs, benefits and responsibilities

Any decision to respond to climate change impacts at the local scale must be backed by sufficient funding and resources at higher scales (Vasey-Ellis, 2009). The responsibility to address the challenges that climate change present are not confined to the efforts of local government planners and elected officials; it requires all tiers of governments to respond

collectively – although each will have varying roles and responsibilities – of which these are often poorly articulated and not well understood. While adaptation must occur at the local and regional scales, there are significant resources constraints that severely hamper local government's ability to respond to the challenge. This was also reflected in research undertaken by Preston et al (2008c).

In addition, enhancing local government capacity through improved vertical integration that is supported by state and national government by enhancing the resources to local governments will improve the capability and efficiency of adaptation responses (Leitch et al., 2010; Vasey-Ellis, 2009).

4.4 MODEL PLANNING PROVISIONS

This section of the report addresses model planning provisions and opportunities for inclusion with LEPs. Within NSW, there have been some steps towards the development of model planning provisions and there has been feedback on the importance of establishing such provisions. However these ideas have not been codified and remain as suggestions rather than formal policy.

A key step in the development of a draft LEP Coastal Risk Planning Model Clause was taken through the consultation process with the Draft Sea Level Rise Planning Guideline released in 2009. In this document, a model clause was put forward. The clause was structured as follows.

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 impacts 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 2008)

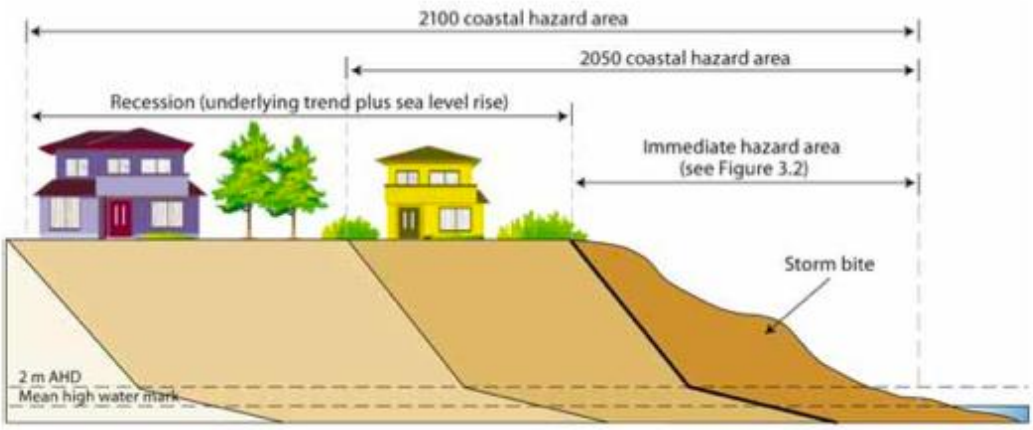


Figure 3: Idealised schematic of a dune profile depicting the high hazard area, 2050 coastal hazard area and 2100 coastal hazard area (from NSW Coastal Risk Management Guide)

In the final version of the Sea Level Rise Planning Guideline, the approach to develop a model planning provision for LEPs was not included as it was still going through Parliamentary Council finalisation.. Many of the submissions to the consultation process for this Planning Guideline document welcomed the suggestion of a model planning clause or provision. For example, the EDO's submission (EDO, 2009) cited the lack of prescriptive measures as an impediment to addressing climate change risks in NSW. A well structured, mandatory clause built around robust principles and clear legal requirements was seen as an important step forward.

Another key issue associated with this original drafted planning provision – and variations that may be considered - is the definition of the hazard line and implications for land seaward of this line. In the Coastal Risk Management Guide (DECCW, 2010), the Coastal Hazard Line is defined under a 2100 scenario using projected sea level rise and a design storm approach. Wave setup and wave runup are not considered in this determination. It should be noted that wave setup is a component of the inundation modelling that the first phase of this research project undertook. A separate, Immediate Hazard Line is defined as land at risk from beach erosion from a single extreme event. A more prescriptive planning clause would provide for referral options for proposals in these two zones.

So it is clear that the ideas put forward through recent consultation processes, and highlighted again through discussions as part of this research project, could make a significant difference in the way development in the coastal zone is assessed. The key

recommendations, from this research project and perspectives presented through public consultation processes can be summarised as follows using the draft clause as a starting point:

- Assess how wave setup would change the location of the 2100 Coastal Hazard Line
- Ensure the clause is mandatory and requires an evidence based approach to assessing impact where hazard lines have been established
- Ensure that different impacts from development in coastal risk areas are considered in an integrated way. This means that the cumulative impact of social, environmental and economic components be considered

5. LOOKING TO THE FUTURE

A key component of the research program undertaken for this project involved a workshop with representatives from local council as well as other relevant technical experts. The goal of the workshop was to brainstorm ideas for improving the management of coastal areas – and not simply ideas within reach of an individual council.

5.1 BACKGROUND TO WORKSHOP

The primary data gathering and engagement processes in this stage of the project involved structured discussions with representatives of member councils in the region and key informants. The approach used here was a research-based workshop conducted by the CSIRO research team in conjunction with the SCCG and Member Councils. This workshop was informed by a survey administered to Member Councils prior to the workshop. The material presented below is a product of that process.

The pre-workshop survey, administered in February 2011, gathered information from SCCG councils relating to risk mapping, current and prospective planning measures to address sea level rise and extreme storm surge events, key challenges and communication of risk. In total, eleven surveys were mailed out and seven were received back to the project team for review. For more detailed information regarding the survey questions and structure refer to Appendix A. It is important to note that the level of detail provided by the participants varied considerably. The purpose of the survey was not to evaluate or assess local government performance in the context of planning and management of SLR, but to gain a better understanding of the suite of work being undertaken. The pre-workshop survey also assisted in the design and structure of the workshop. The purpose of the workshop was to consult with staff from Member Councils on their issues and needs in relation to implementing and communicating the land use planning and development assessment responses to sea level rise and the associated coastal inundation.

The workshop was held of the 4 March, 2011 in Sydney. It included presentations from NSW Department of Planning on the NSW Coastal Planning Guideline: Adapting to Sea Level Rise (August 2010), proposed amendments to related regulations and model planning provisions for coastal risk and flood management, a review of legislative frameworks by the Environmental Defenders Office NSW and presentations from Gosford and Pittwater Councils' on their responses to managing coastal hazards and inundation to date. The other main part of the workshop involved a series of facilitated, structured discussions amongst

small groups of participants on possible planning responses and their characteristics. Drawing on the earlier back-grounding presentations by the State and Councils, participants identified and discussed potential measures, describing:

- Key steps required to develop or implement these measures
- Timing and scale considerations
- Roles and responsibilities of different actors
- Key performance indicators
- Challenges and possible solutions relating to their implementation.

Note: While the findings from the pre-workshop survey are included in the workshop discussion and findings section 2.2 in more detail, section 2.1 provides a broad overview of the survey findings. This is not intended to create duplication but to strengthen the workshop findings by embedding them in to broader Member Council concerns / activity.

5.2 OVERVIEW OF PRE-WORKSHOP SURVEY OUTCOMES

The survey indicated that most Council's are in the process of conducting risk assessments / flood mapping. However, the long timeframes to finalise the assessments has meant that many Councils are still awaiting the outcomes to progress planning and management responses. Some Council's have updated their existing flood studies to include the 2050 / 2100 SLR provisions based on simple mapping (i.e. bathtub modelling). The simple bathtub modelling has generally been conducted in house by Council employees. On the other hand, Council's seeking a more comprehensive mapping and modelling approach to risk identification have engaged expert consultants. While some Council's had developed adaptation plans based on earlier vulnerability assessments – many are in review to incorporate changes based on the finalisation of comprehensive mapping and modelling.

The reported level of current and perceived future risk of coastal inundation ranged from low to high. It is perhaps no surprise that the perceived level of risk was sensitive to location and dependent on topography. The level of internal and external communication of risk to employees and the broader community also varied between Council's. The survey indicated that many have not engaged their local communities at this point. The ones that have engaged their local communities have adopted different strategies. Some have issued notification on 149 planning certificates regarding potential future risk and others have consulted more broadly through their community consultation process as part of their strategic plans. Other council's have involved community members through the establishment of committees for specific flood studies – comprising residents and stakeholders. In terms of internal dialogue on inundation / SLR issues some Council's have not engaged while others are broadly consulting departments. Other Council's have prepared reports for internal use only. Some Council's have revised provisions / clauses within DCP and LEP for flooding and coastal erosion.

In terms of current planning measures for SLR and inundation issues, most Council's are awaiting the finalisation of risk mapping / modelling to progress planning and management decisions. It was suggested that some of the mapping would not be complete for another 1-

2 years. All respondents acknowledged the existing standard LEP clause 5.5 for areas within the NSW coastal zone as being an existing statutory planning measure. Many indicated that they were considering future planning measure for SLR but no details were provided at this stage until mapping is completed.

In terms of key challenges, respondents raised concern over the ability to assess risk to development prior to the completion of risk mapping / identification. In this context, respondents indicated the need to implement interim planning measures in the absence of gazetted hazard lines and flood mapping studies. There were additional concerns around the feasibility of management decisions in SLR investigations areas. In particular, the ability to assess the potential conflict between interim planning measures and existing planning instruments / measures. There were also liability concerns. Respondents were also concerned about how best to communicate risk to local communities. A consistent methodology / approach to risk mapping and identification were seen to be critical to the success of adaptation decisions. There was further confusion around the types of development the guidelines apply to – e.g. extensions, pools, garages etc. In other words, what development triggers the need to consider future SLR?

5.3 WORKSHOP DISCUSSION AND FINDINGS

In this section we describe existing and potential future planning responses / measures developed from the pre-workshop survey and the workshop with the SCCG stakeholders, council planners and the technical advisory panel to the SCCG, and CSIRO researchers.

The material outlined below are intended to inform more detailed discussion on identifying implementable good practice options at local and regional levels of planning and assessment (see section 3 for next steps). Following the logic of the NSW Coastal Planning Guideline – Adapting to Sea level Rise (2010) the options presented below are organised in a framework of 1) Risk identification & Assessment 2) Strategic Land Use planning, and, 3) Development Assessment. Box 1 below presents a summary of the main measures identified in the project which are then described in turn, with suggested specific provisions, issues requiring resolution to assist their implementation and examples of local and international best practice.

Box 1: Summary of measures identified at SCCG workshop and survey

<u>Risk Assessment</u>
R1. Flood modelling and mapping
R2. Investigation areas

<u>Strategic Land Use Planning</u>
S1. Zoning and triggers for re-zoning
S2. Land tenure-based responses
S3. Strategic land purchase

<u>Development Assessment</u>
D1. Development assessment, criteria and conditions in coastal risk areas

Risk Assessment Measures

R1. Modelling and mapping of coastal flooding, tidal inundation and coastal erosion

Current state of practice

Councils in the region are at different stages of progress on conducting new or revising existing studies of coastal flooding, tidal inundation and coastal erosion. Similarly there is difference in perception of risk across the council areas from coastal inundation; and, a range of strategies currently employed for progressing flood modelling and mapping.

Several councils are undertaking new studies or revising existing ones. Examples of this work in the region include:

- the preparation of Foreshore Building Line Maps as part of the preparation of the draft Comprehensive LEP and overland flow studies for 1:100 ARI storm event (Hornsby);
- updating existing flood studies for a range of storm events in coastal lagoons, incorporating the 0.4m (2050) and 0.9 (2100) SLR benchmarks (Warringah);
- 'simple' or 'static' mapping of expected SLR levels (i.e. does not consider extreme events, storm surge) to identify hazard lines and potential impacts (e.g. Willoughby, Woollahra).

A common approach, as a first-pass assessment involved councils conducting simple 'bathtub' modelling. Here a stepwise process of establishing the annual still water level (using existing available information on tidal conditions), incorporate the 0.4m and 0.9m benchmarks, the 1% AEP and freeboard (0.5m), overlain on a digital elevation model (DEM) of the council area. From this exercise a general indication of the likely spatial extent of SLR and inundation can be gained. This approach was seen as suitable for a preliminary identification of hazards and assessment of risks to life and property. Participants at the workshop indicted this approach could be incorporated into existing flood studies or used as part of new flood studies. It was seen to be suitable also for establishing likely inundation in estuarine areas.

Timelines suggested for conducting new or revising existing work ranged from 6 months to more than 24 months. While some of this is conducted by council officers, in other cases councils engage consultants. The use of different consultants by councils contributes to inconsistency in methodology and product on a region-wide basis.

Issues to resolve

Issues effecting the implementation of inundation modelling and mapping included:

- Flood study timeframes are often long which makes planning decisions difficult until modelling is complete. Councils concerned about liability during this time.
- Current methods provide a broad indication of threat not property by property level information required for development assessment.
- There is inconsistency across councils as different consultants / councils use different parameters. The use of different parameters has a significant effect on the extent of SLR rise risk assessed.

- Several councils are concerned about the costs and technical capability required to complete and interpret more detailed studies. Communication of the results of more detailed studies within council and to the community more broadly is a difficult task due to the contentious nature of climate change science.
- Lack of clarity on application of section 117 of the environmental planning and assessment Act 1979 (Directions 2.2 and 4.3) on requirement for revision of LEP resulting from new information from flood studies.
- Rigorous technical assessment needs to be supported by strong council-level flood policy statement to reduce the likelihood of decisions being challenged in court on the basis of a 'weak policy'.
- The planning guidelines are 'silent' on the use or status of interim measures in the absence of gazetted hazard lines. It was discussed however that s.733 'good faith' clause of the Local Government Act provides some possible buffer here.

Recommendations

a. Articulate a standardised methodology and set of parameters for mapping and assessment of coastal inundation risk for the range of environments in the region

- this is informed by regional modelling work in phase 1 CSIRO
- draws on experience of more advanced work conducted by councils in the region already
- State Government accredits methodology and ensures consistency with risk management policies and manuals

b. SCCG with Councillors of Member Councils develop a regional policy statement that agrees on adoption and application of the methodology within a defined period;

c. In conjunction with Member Councils, SCCG identifies consultant or other service provider to conduct assessments across councils in a consistent manner – particularly starting with councils with currently limited assessment work, and providing additional information to councils with more advanced assessments.

R2. Sea level rise investigation areas

Description and current state of practice:
The NSW State Government states in its Guideline that sea level rise investigation areas can be established to identify potential coastal risk areas that require more detailed assessment of proposals at the development assessment stage. They may also be areas where knowledge of existing or potential risk to inundation suggests the level of development should not be intensified. Essentially these investigation areas can be applied as an interim planning measure whilst new or revised modelling is being undertaken by councils. According to State guidance they cannot be used as hazard lines in LEP or DCP or to prohibit all development.

Councils at the workshop describe their approach to the establishment of sea level rise investigation areas (as outlined in the NSW Coastal Planning Guideline: Adapting to Sea Level Rise 2010) as an interim measure until detailed coastal erosion and coastal flood studies are completed. This measure is seen as highly useful for the purposes of informing strategic land use planning (i.e. not increasing land use intensity and/or density) and asset

management in areas at risk of projected tidal inundation (based on SLR benchmarks). Some councils argued that the mapping of sea level rise investigation areas on a regional level by the NSW Government would also be (more) useful. The use of investigation as a beneficial 'communication tool' was also recognised, and, as a step to promote more detailed assessment and raise awareness within the community and council.

Other current activity included the preparation and issuing of planning certificates s149 (5) to properties identified within the investigation area. Requirements stipulated in planning certificates included that owners must carry out detailed studies in the area as a condition of development assessment as an interim measure until Council completes its own coastal hazard studies in 2-3 years.

This measure also provides opportunities for planners to incorporate their own expert knowledge of vulnerable locations and processes, in conjunction with the precautionary principle, to provide interim controls to guide planning in the coastal zone prior to undertaking further more detailed investigations.

Issues to resolve:

While there is broad support for SLR investigation areas amongst planners, questions remained on the day-to-day conduct of planning and development in the area once identified, or as one participant put it 'the feasibility of management decisions' in these areas. Difficulties for planners discussed here included:

- How much scientific evidence is required to establish areas impacted by sea level rise to the extent that there is defensible justification for nominating the area? For example, should wave setup and other processes be considered?
- As new knowledge from studies comes to light, is there a defined stage where council would be required to start talking with community? How should such information be provided to the public (see communication section)?
- What criteria should be used to assess development proposals within the area prior to completion of detailed studies assessments;
- How it interacts with other planning instruments and controls; impacts with other planning clauses, management options etc.

In the workshop, some councils favoured more formal recognition of investigation areas as a zone it its own right or the provision of a clause in the Standard Instrument to trigger the need for further investigation. In regard to the intent to avoid 'up-zoning' in these areas once identified one council has requested the (State Government, Dept of Planning) to provide a hierarchy of zone intensities. More broadly several councils identified a clear need to stipulate a set of interim planning and development policies at council level that pertain to the investigation area specifically. These might include clarifying what types of development are permitted and what development assessment practices are required for proposals within the area.

Recommendations:

a. Local councils are responsible for identification of investigation areas based on available assessments, expert knowledge or other sources of local knowledge – the status of Investigation Areas should be verified, removed or updated to Coastal Risk Areas following more comprehensive assessment;

b. Investigation areas identified locally by Councils could be registered with the State government on a central SLR Investigation Area register, map or listing which is publicly available;

c. State Government in consultation with councils clarify a hierarchy of zone intensities to assist in decision-making about avoiding up-zoning in Investigation areas (in progress)

d. Council stipulate criteria to assess development applications in investigation areas – these may be modified from those suggested for development assessment in coastal risk areas;

Strategic Land Use planning measures

S1. Zoning and triggers for re-zoning

Zoning is the primary mechanism used to regulate land use. One option to reduce the level of exposure is through down zoning. This means a change in land use from residential to open space based planning activities, or alternatively from high density residential to low density residential. Down zoning can also provide an opportunity to maintain public foreshore access and open space. This strategy however may reduce the utility of land in the short to medium term. Much of today's planning problems can be attributed to past planning decisions putting existing development at potential future risk. Local government have a duty of care to ensure that communities are protected whilst promoting economic development and prosperity. Local planners will need to weigh up the costs and benefits of zoning (adaptation) decisions. In addition, local government need to exercise the 'precautionary principle' and consult local communities to communicate future risk. There may be opportunities to construct some dwellings / development in down zoned areas. This option needs to be further explored and articulated with local and state government stakeholders.

The participants at the workshop identified the option to rezone areas to E4 – Environmental Living – which had the potential to allow certain development. It was noted that decisions were justifiable and it didn't require a detailed study to inform those decisions. The workshop participants had a preference to use E4 zone over E2. It was also flagged that local government were reluctant to down zone because of extinguishing existing use rights and triggering the potential need to compensate landowners for lost development opportunity. Participants at the workshop raised concern over the high costs of compensating landowners in the coastal zone. In addition, given the potential community backlash, local governments are more readily inclined to up zone rather than down zone.

Nevertheless, down zoning was seen by many as a plausible option that requires greater whole of government consideration to reduce exposure – including significant support from State Government. However, there was concern and confusion surrounding the point at which local government decide to re zone an area in the LEP. This point was backed by the need to establish clear triggers within local planning to enable an efficient and justifiable need to rezone. A further issue related to community consultation.

Issues to resolve:

The use of zoning is an important planning tool for planners to manage land use in their local jurisdiction. In the past, zoning has provided an important means of separating incompatible land uses. The option to rezone an area to reduce exposure of climate related risks has clear benefits. However, there are some important operational, legal and technical considerations that need to be resolved before rezoning can become a viable land use option for local governments dealing with SLR. The first of these considerations relate to the need to clearly define the term 'down zone'. Participants at the workshop raised concern over how the term is used and deployed to the broader community. In addition, there were also concerns raised in relation to when a down zone technique might be applied and how it would be implemented. Clarification from the state government was seen to be the best solution to manage the uncertainty of rezoning techniques and potential implementation issues. There is still uncertainty about which zone (i.e. E2 or E4) to adopt when down zoning. Whilst believed to be technically possible it was acknowledged that the decision to downzone was also recognised as politically sensitive and even unpalatable for many and requires a whole of government approach. This was most evident in discussions about rezoning to E2 – environmental conservation. Rezoning council owned land to E2 was seen as more practical and acceptable but rezoning private property was seen to be problematic. Again, this highlights the issue of existing use rights, or perhaps a more accurate reflection of the Australian planning system, is managing perceived development rights.

Workshop participants also noted that zoning is a rigid tool and the current planning system is inflexible and doesn't readily adapt to changing circumstances. It was suggested that perhaps a realistic option which was not readily expressed was the option to outright exclude development in potentially vulnerable areas. The adoption of investigation areas were perhaps seen as a more realistic option for planners given the large uncertainties surrounding the magnitude of extreme weather events, including projected SLR in the first instance and then identify appropriate resources to undertaken more comprehensive studies and modelling to increase knowledge.

The ability to promote greater flexibility within the planning system to recognise the dynamic and unpredictable nature climate change presents needs further consideration. There are some clear problems associated with the conflicting planning and electoral cycles in local and state politics. This needs to be recognised and addressed through substantial reform. The workshop participants highlighted the need to plan beyond the current planning cycles to recognise the future challenges and realities that climate change present.

Recommendations:

a. Look to other examples of land buy back – such as Coastal Lands Protection Scheme which was set up to buy back land in order to increase public access to the coast (Thom, 2007).

b. Councils and relevant state agencies prepare scoping studies exploring policy options and practices associated with modifying or managing land use intensity through the system of zoning. This may involve a hierarchy of measures ranging from short-term strategic land use purchase in high risk locations, through to future down-zoning via planning instruments. Using more comprehensive assessments as they become available of at risk areas, councils could commission cost-benefit analyses of these different measures over the timeframes including those of the SLR planning benchmarks.

c. Councils in concert with the NSW State Government consider resourcing for feasibility study into the use of market-based instruments – in particular tradable development rights (TDRs) scheme in coastal risk areas. Such a scheme may assist in managing potential conflict over existing use rights whilst maintaining private access and provision of easements etc. TDRs can be considered as an alternative to longer term strategic land use purchase. Explore the potential for TDR pilot study.

d. Councils should explore the use of covenants within existing zoning arrangements to secure public access to foreshore areas, reducing the need to down-zone a whole area.

e. Socially and environmentally justifiable triggers for consideration of down-zoning would include i) frequency of inundation incidents etc ii) community pressure or acceptance ascertained through regular monitoring of community attitudes towards and perception of risk regarding coastal hazards; ii) or evidenced by measured changes in extreme weather events or assessment of biophysical risk; and/or iii) real estate market signals indicating reduced values in properties in at-risk locations

S2. Land tenure-based responses

There is a common misconception in Australia that individual landholders have development rights and outright own the land they occupy. However, these rights are expressed through a registered interest in the land only. For this very reason, government have the ability to compulsorily acquire land that is occupied by an individual(s). Nevertheless, compulsorily acquisition is not something government routinely exercise unless broader public benefit is obtained (there are examples related to motorway development for example where the NSW Roads and Traffic Authority purchased land to enable new roadways to be built). Leasehold land provides an opportunity for greater planning flexibility in managing potentially vulnerable land both now and in the future. Leasehold land also has a long institutional track-record with high level of acceptance and familiarity amongst the community in many parts of Australia.

Greater consideration to changes in land tenure is necessary along with more meaningful consultation with local stakeholders. Changes from freehold to leasehold land with the provisions of temporary housing and removable structure provides enhanced flexibility and adaptation to potential SLR and extreme weather events. Placing a time bound lease on land enables local government to make more informed decisions over time as new scientific information becomes available. While there are some challenges relating to existing use rights it was believed that changes to tenure based planning and implementation of such measure were possible in the review of the planning system in 5 years. State Government to provide stronger leadership and direction on requirements for tenure based planning changes including preparation of scoping and investigative reports and discussion papers.

Issues to resolve:

As with zoning reform, perhaps the greatest challenge relating to changes in tenure within the coastal zone relate to managing existing use rights. This is most problematic in the context of changing tenure in private ownership. Local Government participants at the workshop noted that it would be much easier to change tenure in potentially vulnerable localities that are currently under public ownership. Again, as with many other challenges

relating to climate change, communicating the benefits of planning and management decisions and maintaining existing use rights is important. However, much of Sydney's current coastal landscape is in private ownership and changes to tenure to cater for highly uncertain future climate change impacts are unlikely to be accepted by stakeholders. Whilst considered technically possible, local government participants believed that action to make real change in tenure based planning and management was politically restricted by the short term electoral cycles.

Leases provide an opportunity to place restrictive uses over land for certain timeframes. Placing a shortened time frame on leases (e.g. 20 years) will enable a more informed planning decision on climate change related impacts over time while allowing a legitimate use of the land until such time that suggests a retreat or complete abandonment of the landscape to higher ground. Alternatively, conditions may be imposed on dwelling applications that specifically state that dwellings will not be allowed to be rebuilt post extreme weather events or when particular thresholds are reached such as SLR. The identification of risk along with title rights on planning certificates offer an opportunity to more clearly define and articulate these issues / concerns. Local government should consult the state and their legal team for advice on wording.

In summary, there are opportunities to implement changes to land tenure to ensure that communities are protected. Leasehold land provides opportunities for local government and communities to continue the legitimate use of potentially vulnerable locations whilst enabling a retreat and accommodate type strategy. However, changing the land tenure from freehold land in private ownership to leasehold land held by the Commonwealth presents a number of challenges. One of the more significant of these is the need to maintain or manage existing use rights (diminishing existing use rights is likely to result in community backlash and poor acceptance although this may be essential in the longer term despite the difficulty of such an approach). This further highlights the current and well acknowledged tension between current short term local electoral cycles and the needs of strategic planning to cater for longer term climate change impacts.

Recommendations:

a. Given its responsibility for the system of land tenure, the NSW State Government prepare a public discussion paper for Local Governments and other interested parties that canvasses possible tenure-related responses, including time or trigger-based conditions. This is a task that may require cooperation through the COAG framework to maintain a degree of national consistency across jurisdictions;

b. Responses to the discussion paper could be considered by the state and codified prior to next major review cycle for local government planning instruments;

c. Local Governments then have a role in discretionary application of these revised tenure arrangements in coastal risk areas; and,

d. Parallel to a review of tenure arrangements by the state for use in managing coastal risks to communities and development, some additional consideration of temporary and/or decentralised provision of infrastructure and services under the proposed arrangements would also be beneficial – again a state based review or include COAG partners;

S3. Strategic land purchase

Description:

Many local governments throughout Australia have an environmental levy or similar fund which is used to purchase environmentally sensitive land and open space for broader public benefit. Local governments are responsible for the management of local reserves and parklands. Local Government funding can be used opportunistically to purchase land abutting nature reserves for broader public benefit. However, the funds available to purchase properties in potentially vulnerable locations are inadequate to cover the cost of property values in coastal localities (as the value of much coastal land doesn't currently reflect it immediate and future risk). Notwithstanding, the public purchase of properties in vulnerable location is an important component of the Local Government toolkit in terms of preservation of public foreshore access and open space provision. Consideration of strategic land purchase will inevitably be based on two key strategies. Firstly, the purchase of properties will be opportunistic depending on the need and local funding availability. Secondly, the purchase of properties will most likely follow a series of extreme weather events when community awareness is high and property values decrease – making purchase more cost-effective for local government.

Local participants at the workshop identified the need to include an assessment of unacceptable risk, identify the resources available for property purchase and prioritise an area(s) for resource investment. Local government may need to consider additional avenues to bolster the available funding. This may include the need to increase current levies or the introduction of a new levy based on the justification of managing or maintaining public foreshore access and open space. Additional support from state and national government will also be required to ensure that property purchase is a viable and realistic option for local government.

Recommendations:

The triggers for Local Government strategic land purchase will likely be the result of multiple extreme weather events within short recurrence intervals. The strategic land purchase will be opportunistic for local government who will need to rely on significantly reduced property values to make it viable.

a. Joint state-local government discussion on determination of cost-sharing arrangements, principles and timelines across a range potential sources including i) increasing or establishing new rate-funded levies; ii) state or federal contributions for strategic land use purchase to maintain foreshore access and open space in the coastal area; and,

b. Local Governments to undertake key tasks of i) identifying unacceptable levels/areas of risk ii) identify current resources available for property purchase; and iii) prioritise areas for resource investment based on detailed coastal risk assessments (based on a setoff agreed Whole of Government principles and values)

<u>Development Assessment</u>

D1. Development assessment, criteria and conditions in coastal risk areas

Description and current practice:
Discussions at the workshop ranged across a wide set of issues related to development assessment practice. This is an area of practice that participants considered some of the most ambiguous and problematic.

- Some participants stressed the need for development assessment (and DCPs) to be clearly nested within, and supported by, higher level **strategic planning objectives** through Local Environmental Plans.

- Another challenge for development assessment is the time-lag associated with the **completion of risk studies** or detailed modelling, and the need to balance strategic goals and individual assessments in the interim. Indeed there was some concern over how development applications might be assessed in the absence of identified coastal risk areas in LEPs or DCPs. It became clear through the discussion that councils who had conducted detailed flood risk studies or identified coastal hazards were in a stronger position to argue for and set conditions to mitigate risk of development applications.

- The intent of the **planning criteria** outlined in the NSW Planning Guideline (2010) is to minimise the exposure of proposed developments to coastal risks through the development assessment process. These criteria were viewed as a helpful starting point for councils but were described as 'vague and broad'. Further some planners commented that the non-mandatory status of the criteria meant that their use might not be defensible or justifiable from a legal or technical position. This is consistent with the view expressed in the December 2010 report by the Environmental Defenders Organisation.

- While there was recognition of the likely value of **development approval conditions** including time or trigger-limited consent in risk areas, there was considerable uncertainty over how these might be practically implemented and justified. For instance these conditions might reflect temporal use rights of land (e.g. development consent for residential with 50 year limit, with review of consent linked to realised SLR levels within that timeframe). One council (Manly) is exploring the use of time restrictions/reviewable conditions on approvals. These conditions would reflect the expected lifecycle of a building and the timeframe in which coastal hazards are likely to encroach on the property. This information would be derived from, in this instance, the detailed site specific coastal hazard studies provided by the owner/applicant or in councils hazard mapping once prepared. The benefit of such an approach was described as enabling an appropriate re-assessment of risks or inclusion of further adaptation measures for sea level rise or retreat, if necessary.

- In relation to the setting of **design standards** to assist in mitigation and adaptation to improved understanding of likely coastal risks councils recognised the need to adopt standards that reflected the site specific topographic conditions and patterns of inundation. However their were arguments made for developing a consistent regional position between councils or agreed policy on how floor height standards are to be set, and consistency on the required floor height above expected inundation levels. This policy would need to account for existing and proposed heights on the same site, and be comparable between neighbouring sites or like sites between council areas. As councils are implementing their own approaches, or

revising planning instruments in different timeframes this exacerbates problems of decision consistency at the whole of region level.

- Another issue raised is the difficulty many councils face with **compliance and enforcement** with views put that in many instances compliance is beyond the scope and ability of local government. The increasing information requirements and technical complexity of much of that information presents two problems in the assessment process. The first is that where councils set too vigorous requirements for information or conditions by owners / applicants this tends to result in non-compliance i.e. 'the more difficult the council policy, the more people are likely to flaunt it'. The second problem is in setting multiple and complex conditions, it becomes increasingly difficult for councils to effectively monitor compliance or enforce the conditions. It a broader sense effectiveness of development policy might be assessed through longer term assessment of risk (reduction) at key sites.

Recommendations:

a. Formalise planning criteria for proposed development in coastal risk areas to ensure that decisions are legally defensible and justifiable. This is consistent with the views of the EDO as expressed in their recommendation for providing certainty to those managing the uncertain (EDO, 2011, pg 57)
b. Encourage the development and deployment of time bound approval conditions to allow the temporary use of potentially vulnerable land while it is safe to so. This would reflect the life cycle of buildings and materials in conjunction with predicted SLR / inundation events.

5.4 SUMMARY OF RECOMMENDATIONS AND PRIORITY IDENTIFICATION

Table 3 provides a summary of the recommendations. The information gathered through the survey and the workshop discussion highlighted several potential planning strategies and options that require further detailed assessment by stakeholders in the region. The 'measures' as presented above identify broad directions for risk assessment and strategic land use planning, and importantly critical issues and steps that are required in order to progress these approaches to more specific provisions. To progress the recommendations listed in this report it will be important to identify 1) which of the above measures present the most effective and feasible options to progress; and 2) identify the specific roles and responsibilities, actions, timeframes and performance measures required for successful implementation of these options.

Table 3: Summary of recommendations

Measure	Recommendations
R1	a. Articulate a standardised methodology for mapping and assessment of coastal inundation risk
	b. Develop regional policy statement that agrees on adoption and application of the methodology within a defined period as well as an evidence based approach to planning and decision making
	c. Identify consultants or other service providers to conduct assessments across councils in a consistent manner
R2	a. Local councils are responsible for identification of investigation areas

	based on available assessments
	b. Investigation areas identified locally could be registered with the State Government on a central register
	c. State Government in consultation with councils clarify a hierarchy of zone intensities
	d. Council consider the 'mandatory' issuing of s149 planning certificates detailing coastal erosion, flooding and tidal inundation 149 [2] s and or 149[5]s
S1	a. Councils prepare scoping studies exploring policy options and practices associated with modifying or managing land use
	b. Councils in concert with State Government consider resourcing for feasibility study into the use of market based instruments
	c. Councils to explore the use of covenants / easements to maintain public access to foreshore areas
	d. Socially and environmentally justifiable triggers for consideration of down-zoning
S2	a. Prepare a public discussion paper that canvasses possible tenure-related responses, including time or trigger-based conditions
	b. Reponses to the discussion paper could be considered by the State and codified prior next major review cycle for LEPs
	c. Local governments then have a role in discretionary application of these revised tenure arrangements in coastal risk areas
	d. consideration of temporary and / or decentralised provision of infrastructure and services
S3	a. Joint state-local government discussion on determination of cost sharing arrangements, principles and timelines
	b. Local government to identify unacceptable levels/areas of risk, current resources available for property purchase and prioritise areas for resource investment
D1	a. Formalise planning criteria to ensure decisions are legally defensible and justifiable
	b. Encourage the development and deployment of time bound approval conditions to allow temporary use of land

6. CONCLUSIONS

This phase of the research project has brought together work from CSIRO and EDO to provide a broad overview of the policy and legislative landscape as well as reviewing opportunities for councils to respond to climate change challenges associated with coastal inundation.

The research has shown that many of the best examples of policy and legislation addressing challenges faced by coastal inundation are focused and integrated. Multiple layers of policy instruments and ad hoc, independent documents restrict real progress in responding to the adaptation challenge. A more integrative approach better reflects the complex nature of the coastal environment with many different land uses, a dynamic shoreline and the range of stakeholders. This view has been well expressed in many submissions and research papers.

The review of NSW policies as well as the workshop sessions conducted through this project revealed a number of areas for reform that were seen as very promising by the councils and other members of the technical group. Clearly the input required from various levels of government to realise these suggested reforms would be very significant and not something that a single council or even the SCCG could progress in isolation. Indeed, throughout this project there was a tension between seeking adaptation solutions that could be readily implemented by individual councils versus options that were much more complex, and beyond the control of councils - but ultimately would have a much greater impact if successfully implemented. Many of the people contributing to the discussion contrasted the potential impact that options within their control to implement could have versus those that required a greater level of coordination and collaboration.

In the context of the wider project though, it is evident that the councils that from the SCCG can effect change. The development of a consistent methodology applied to the creation of inundation maps; and, the sharing of communication strategies for raising inundation challenges with the community – these are two clear examples from the broader research project. Despite the many challenges that this phase of the research identified, there remain important areas where the Sydney Coastal Councils Group should continue to take the lead in building capacity for adaptation.

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