Defining the Sea Level Rise Problem in South Australia

Issues Paper

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Coast Protection Board

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Executive Summary

This Issues Paper examines South Australia's coastal management systems including coast protection and land use planning and identifies system breakdowns and barriers to adaptation to sea level rise, as well as opportunities to improve the response to sea level rise risk.

Sea level rise threatens economic, social and environmental systems in ways that will affect all South Australians. The warming of the global climate system is unequivocal, with warming oceans and melting glaciers and ice sheets causing sea levels to rise at an increasing rate around the world, including along South Australia's coasts.

Direct impacts on the coastal environment and infrastructure will increase the costs of managing coastal areas and compromise their amenity and value. There will also be impacts beyond the coastal environment extending to ecosystem services, the operation of business and industry, provision of public services, and the health and wellbeing of communities.

This complexity forms the context in which governments must make decisions about sea level rise, by determining what constitutes acceptable and unacceptable levels of risk and by deciding on appropriate adaptation responses.

It is amongst competing interests and high public expectations of the coast that a mismatch can occur between the stated objectives of coastal management systems, and the extent to which those objectives are realised in the actions and decisions of governing bodies.

Constraints to managing coastal impacts in South Australia potentially arise from:

- Levels of understanding and support amongst communities and decision makers for addressing the impacts of sea level rise;
- Limitations to the access and utilisation of a range of technologies for understanding projected sea level rise impacts; and
- Trade-offs arising from consideration of social, economic and environmental issues, as well as intergenerational equity.

There are current examples of decisions being made that are placing communities and assets at risk of coastal hazards, risks which are being exacerbated by sea level rise. Organisations, and officers of those organisations, have raised concerns that poor decisions are being made.

Following a Sea Level Rise forum hosted by the Premier's Climate Change Council in April 2013 the Department for Water, Environment and Natural Resources, the Coast Protection Board and the Local Government Association of South Australia commissioned the development of this paper to explore in more detail:

1. A hypothesis for effective coastal management, by considering:
    - Protection of existing community assets;
    - Approval and protection of new developments;
    - Protection of environment assets;
    - Value for money; and
    - Minimal disruption of services.
2. An analysis of current legal, planning and other governance issues, along with technical considerations and social expectations that either enable or prevent effective coastal management from being achieved, addressing the following questions:
    - How does the land-use planning system interact with coastal management?
    - How does NRM governance and functions interact with the coast?
    - What is the role and function of the Coast Protection Board, and how does this affect development?
    - Which communities, assets and natural resources are at risk from sea level rise in the coming decades, and what are the nature and scale of those risks?
    - What strategies are currently employed to deal with new development?
    - What strategies currently exist to manage sea level rise impacts on existing development?
    - What are the legal issues associated with property ownership and how does that relate to the function of the planning authorities?
    - What information exists on the extent of coastal impacts, and what is the current response to risk?
    - What format is the information in, and how accessible is technical information about sea level rise, coastal impacts and potential responses?
    - What case studies exist that examine how the system has either worked or failed, to deliver ideal outcomes?
3. A definition of the extent of work required to achieve the ideal scenario, and provide recommendations on which pathway to take (i.e., how to bridge the gap between ideal and current circumstances).

The resulting analysis considers documents associated with coastal management systems and leading practice concepts of coastal management and climate change adaptation, and the findings of 13 semi-structured interviews with representatives of State and Local Government and the development industry.

Strengths to build on

It is generally recognised that South Australia's coastal management systems have good policy and system architecture in place to support adaptation to sea level rise.

Key strengths of the system include:

- The land use planning system, which facilitates consideration of sea-level rise in strategic planning, policy development and development assessment. Strong policy guidance for addressing sea level rise is present in the Planning Strategy and Development Plans state-wide.
- The Coast Protection Board possesses significant data, knowledge and expertise in relation to coastal risks, has strong policy positions on new coastal development and coast protection works and provides advice and, in some cases, direction over coastal development proposals;
- Regional climate change adaptation planning occurring under the State Adaptation Framework is involving Local Governments and communities in understanding a range of climate risks, including those associated with sea level rise; and
- Natural resources management, emergency management, and public asset management systems in place in South Australia also have functions and mechanisms that support management of coastal risks and adaptation to sea level rise.

This report identifies a number of key areas to advance best practice integrated coastal zone management. The following have been identified as critical initiatives to pursue:

1. Supporting good decisions

Barriers and breakdowns identified in existing systems relate to the application of those systems, and the decision making that occurs within them.

Such breakdowns can be attributed to a number of factors including:

- The capacity of decision makers to access and interpret risk information to inform what are often "on balance" decisions involving social, economic and environmental "trade-offs";
- Decision makers' understanding of their own roles and responsibilities and those of others in coastal risk management; and
- Local interests and values that form the context in which decisions are made.

The research has identified the requirement for additional clear guidance and support to be provided to coastal decision makers (particularly for Local Government responsibilities such as planning and asset management) to improve the performance of existing systems, and support consistent application of strategic and policy intent.

2. Increasing awareness and understanding

The level of understanding of sea level rise risks and impacts amongst stakeholders can influence decision making within coastal management systems as interests, values and expectations of use intersect with the realities of coastal risks.

The research has identified the necessity to raise awareness and understanding of sea level rise amongst coastal stakeholders, including the broader community and land developers.

3. The role of leadership

Due to the multitude of interests and values associated with the coast, strong leadership is required for adaptation to sea level rise to occur.

Local Governments and regions seek leadership and support to elevate the importance of the sea level rise issues in their communities, understand risks and impacts, and develop effective adaptation strategies.

Adaptation to sea level rise will continue to occur in a complex social, political and cultural context. This is likely to require strong leadership able to make unpopular decisions and controversial trade-offs over time, as well as coordination and integration in policy, information sharing and planning across jurisdictions to foster effective coastal management and adaptation.

The research has identified an opportunity for an expanded leadership role for the State Government to provide greater guidance and support to Local Government and regions. This will complement the ongoing role of the Commonwealth Government in research, data collection and distribution.

4. Acting now for the future

There is no formalised basis for identification and prioritisation of sea level rise risk that can inform policy and decision making across various land-use planning and coastal management systems at all locations for the whole of the South Australian coast.

In the absence of a coordinated and strategic approach to adaptation to sea level rise, the "default" management system will be reactive to the most immediate risk – particularly in a context of limited public understanding of sea level rise risks.

A strategic and coordinated approach to sea level rise requires the ability to identify and assess risk, and for decision makers and stakeholders to agree acceptable levels of risk in the context of the social, economic and environmental value of the coast. This understanding forms a basis for proactive decision making today that can reduce future exposure to risk.

The model sea level rise adaptation framework that has been developed for this Issues Paper has identified that there is a requirement for a more consistent criteria to be employed in determining sea level risk and response state-wide.

The model also identifies stakeholder involvement as fundamental to a consistent approach to ensure the broad range of functions and values of the coast is considered through multi-criteria assessment incorporating of the five capitals (natural, social, human, manufactured and financial).

5. Investing in adaptation

Adaptation to sea level rise requires investment of resources to build the capacity of coastal decision makers and stakeholders, to undertake risk assessments, and to implement adaptation strategies.

A lack of long term planning and investment can result in inequitable distribution of public resources, and funds being spent on activities that do not provide broad community benefit. This occurs at the expense of activities that do have broad public benefit, including future planning to mitigate the risk of sea level rise to future generations.

The research has identified that investment in a proactive approach to sea level rise would allow targeting of current efforts towards mitigating future impacts and costs as well as current risks, and would facilitate orderly, sustainable, and equitable adaptation.

Summary of recommendations

The research led to development of ten principles of an ideal seal level rise management system for South Australia (refer Section 5 of the Issues Paper), as well as eleven recommendations (refer Section 6 of the Issues Paper). The recommendations and their relationship to the principles are as follows:

#	Recommendation	Responsibility to progress	Ideal principles supported
1	Further develop and implement the model sea level rise management framework described in Section 5.2 of the Issues Paper (page 108). Actions to implement the framework are set out in Table 5.1 (page 111).	State LGA	All
2	Continue to lobby for/contribute to an improved national approach to sea level rise management, and Commonwealth funding and support for State led management	State LGA	1, 8

#	Recommendation	Responsibility to progress	Ideal principles supported
3	Expand responsibilities and resources of an existing body or create a new body to, in addition to current coastal management responsibilities, have explicit responsibility for leadership on sea level rise management including: • Coordinating sea level rise adaptation across sectors and jurisdictions; • Identifying state-wide objectives for sea level rise management and their relationship with various coastal management systems; • Communicating roles and responsibilities in sea level rise management; • Engaging with stakeholders to better define roles and responsibilities; and • Providing guidance, support, and accountability for discharge of responsibilities in relation to sea level rise objectives.	State	1, 2, 3, 4, 5
4	Implement broad scale communications, engagement and awareness raising programs around sea level rise risks, impacts, and adaptation responses	State Councils	2
5	Disclose known coastal risks on Contracts for Sale of Land or Business forms under Schedule 1 of the *Land and Business (Sale and Conveyancing) Regulations 2010* c	State	2
6	Consider statutory limitations on local and State government liability for climate change related actions	State LGA	3
7	Facilitate access to up to date, effectively communicated sea level rise information and decision making tools	State LGA	2, 4

#	Recommendation	Responsibility to progress	Ideal principles supported
8	Plan and implement a state-wide program of capacity building to: • Direct decision makers to available data for use in decisions where sea level rise is a relevant consideration; • Provide guidance and build skills in its use; and • Locate their decisions in the context of sea level rise risks, coastal issues, and their responsibilities in the management system.	State LGA	4
9	Undertake research to better understand the reasons for development applications being approved not in accord with Coast Protection Board advice (refer discussion in Section 4.3.2), and identify potential strategies to respond.	LGA	7
10	Review specific provisions of the Development Regulations identified in the Coast Protection Board's submission to Think Design Deliver to ensure referral mechanisms function appropriately in all circumstances	State	7
11	Consider levies and differential rates for coastal land to reflect costs and benefits of coastal adaptation	State LGA Councils	8

1.0 Introduction

1.1. Background

The recent report by the Intergovernmental Panel on Climate Change (IPCC) reconfirmed that warming of the global climate system is unequivocal. One effect of this condition is the sea level rising as the result of warming oceans and melting glaciers and ice sheets.[1] Global average sea levels have risen over the last century, and more quickly in recent years.[2]

South Australia is vulnerable to sea level rise. Data collected at Port Stanvac shows that sea levels have risen at an average rate of 5.1mm per year since 1992, compared to 1.5mm per year over the previous century (calculated from tidal records).[3]

If the climate were to stabilise through global climate change mitigation efforts, sea levels will continue to rise for many centuries, posing a risk to coastal areas both in itself, and in combination with other climate change caused risks such as more frequent storm surges.[4]

The impacts of sea level rise threaten social, economic and environmental systems both directly and indirectly, in ways that affect all South Australians. For example:

- Direct impacts on coastal assets including buildings, transport infrastructure, and essential services, and costs to repair or replace assets generating flow on impacts to the broader community;
- Disruption to ecosystem services provided by mangroves, that in turn may have adverse impacts on commercial fisheries; and
- Reduced recreational opportunities in coastal areas that may impact the health and well-being of local communities.

In this context, sea level rise is a coastal management issue that must be addressed in South Australia.

The number of systems, complexity of issues, and diversity of stakeholders involved in coastal management means that the sea level rise problem can appear intractable. Despite the clear impetus for adaptation strategies to be implemented along South Australia's coast, and considerable efforts in strategy and policy development, action to date has been neither swift nor consistent.

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[1] Intergovernmental Panel on Climate Change (IPCC) 2013, *Climate Change 2013: The Physical Science Basis.*

[2] Over the last century global average sea level rose by 1.7 [1.5 to 1.9] mm per year, between 1993 and 2010 this rate has increased to 3.2 [2.8 to 3.6] mm per year, IPCC 2013.

[3] Government of South Australia 2012, *Prospering in a Changing Climate, A Climate Change Adaptation Framework for South Australia*, p. 35.

[4] IPCC 2013.

There is concern that decisions being made within the current coastal management framework – including 'default' decisions to not act in response to known risks - are putting communities and assets at risk in both the near and more distant future.

The Local Government Association of South Australia (the LGA), Climate Change Unit - Water & Climate Change Branch of Department for Environment, Water and Natural Resources (DEWNR), and the Coast Protection Board (the Board) have commissioned this Issues Paper to define the sea level rise problem in South Australia, and consider options to better manage the risks from sea level rise, and better support implementation of appropriate coastal adaptation efforts.

1.2. Aim of the Issues Paper

The aim of this Issues Paper is to identify opportunities for improvement of current arrangements for management of South Australia's coastal zone, and more specifically a model management framework, to facilitate effective adaptation to the impacts of sea level rise.

It is anticipated that the Issues Paper will form a basis for discussion amongst coastal zone stakeholders, with a view to advancing effective adaptation responses along the coast.

Within the Issues Paper, unless otherwise specified, a broad definition of 'coastal zone' is adopted, consistent with the concept of Integrated Coastal Zone Management (ICZM – see Section 3.1 of this paper).

Towards its aim, the Issues Paper:

- Briefly summarises the effects and likely impacts of sea level rise on South Australia (Section 2.0);
- Considers selected leading practice concepts of coastal management and climate change adaptation (Section 3.0);
- Describes current coastal zone management arrangements in place across various regulatory bodies, as well as non-regulatory conditions that currently impact on coastal management (Section 4.0);
- Identifies principles and a model that reflect an ideal coastal management system that would facilitate adaptation efforts in the coastal zone, and assesses the performance of the existing management framework against the ideal (Section 5.0); and
- Sets out recommendations for changes to the current management arrangements to better embody the principles of an ideal system (Section 6.0).

1.3. Scope of investigations

The Issues Paper considers current and ideal coastal management arrangements that relate both to areas of existing coastal development, and establishment of new development in coastal areas. Broadly, the risks associated with each of these are as shown in Table 1.1.

Table 1.1: Risks to existing and new coastal development

Existing coastal development	Risk to life
	Risk to existing development and assets and natural systems from sea level rise
	Risks from ad hoc and unauthorised attempts to adapt to sea level rise
New coastal development	Risks to life
	Risks to new development and assets from sea level rise
	Risk of new development exacerbating pre-existing coastal risks to life, existing development and natural systems

1.4. Method of investigations

Development of the Issues Paper has involved:

- Review of relevant legislation and government policy;
- Review of selected published and unpublished reports; and
- Thirteen (13) semi-structured interviews with representatives of state and local government and the development industry.

Interviewees were selected by the client group comprising representatives of the LGA, the Climate Change Unit of DEWNR, and the Coast Protection Board.

The purpose of the interviews was to obtain stakeholder insight in relation to constraints and limitations of existing coastal management systems and frameworks in managing sea level rise. Insights provided by interviewees are woven through the section of the Issues Paper that examines the current management system's performance in relation to the principles of an ideal management system (Section 5.0).

2.0 Risks from sea level rise in South Australia

2.1. Sea level rise in South Australia

2.1.1. Historic sea level rise

Our understanding of the extent of sea level rise that has occurred along South Australia's coast is based on:

- Data from tide gauges operating since 1992 at Thevenard and Port Stanvac; and
- A range of locally specific coastal studies either arising from planning processes, or in response to the emergence of coastal risks.[5]

The tide gauges have not been operating long enough to provide statistically significant results, but the gauge data can provide an indication of short term trends.

The Port Stanvac gauge recorded an average annual increase in sea level of 4.7 mm/year between 1992 and 2010 (at which time it was decommissioned due to removal of the jetty it was mounted on), and Thevenard an average annual increase of 5.0mm/year between 1992 and 2012.[6] These observations are slightly higher than average global sea level rise observations for a similar period of between 2.8 and 3.6 mm per year between 1993 and 2010.[7]

The Thevenard gauge (as well as the Port Stanvac gauge when it operated) is part of the Australian Baseline Sea Level Monitoring Project that uses in situ gauges to identify long period sea level changes nationally, and calibrate satellite altimeters as part of global sea level monitoring.[8]

2.1.2. Future sea level rise

Mapping methods

Understanding of the extent of sea level rise that will potentially be experienced in South Australia in the future involves extrapolating global sea level rise projections reported by the IPCC based on the past relationship between South Australian and global mean observations, and considering additional data where available.

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[5] For example Geoscience Australia and the Commonwealth Department of Climate Change and Energy Efficiency 2010, OzCoast Sea Level Rise Maps, http://www.ozcoasts.gov.au/climate/sd_visual.jsp, and the Yorke Peninsula Sea Flood Risk Mapping project conducted by the then Department of Environment and Heritage and then Planning SA.

[6] Bureau of Meteorology 2012, *The Australian Baseline Sea Level Monitoring Project - Monthly Data Report, June 2012.*

[7] IPCC 2013.

[8] National Tidal Centre, Australian Bureau of Meteorology 2011, *The Australian Baseline Sea Level Rise Monitoring Project Annual Sea Level Data Summary Report for July 2010 – June 2011.*

The most common approach to sea level rise mapping is known as the 'bathtub' or 'bucket-fill' method in which assumptions are made about likely sea level rise in a given location, and the increased sea level is overlaid on terrain and elevation mapping to show land likely to be inundated. The quality of this mapping varies considerably depending upon the resolution of available elevation/terrain mapping, and landform complexity. Most approaches utilise some form of Digital Elevation Model (DEM) that provides a 3D representation of the earth's surface that may or may not include built structures.

While many models including those used over larger geographic areas do not account for the role of structures in water movement, it is generally accepted that structures have a significant bearing on whether water will flow over land. More sophisticated sea level rise mapping incorporates additional factors to more accurately simulate the way in which a volume of additional water associated with sea level rise, rainfall events and storm surge would move through a given area.

The global projections on which our understanding of potential future sea level rise is developed involve a range of assumptions, and are subject to revision based on updated data collected through regular monitoring. Projections are prepared for several scenarios involving different rates at which greenhouse gases are emitted in the future.[9]

Adaptation planning in South Australia involves selecting a future climate scenario on which to base adaptation efforts.[10] Currently global emissions are in excess of the highest emissions scenario considered by the IPCC.[11] In the IPCC's highest emissions scenario, global average sea level rise will likely be in the range of 0.45m to 0.81 during the period 2081-2100, relative to 1986-2005.[12]

Available mapping

Projected sea level rise has been mapped for some locations on South Australia's coastline but mapping has not been undertaken for the entire length of the coastline, on either a coordinated or ad hoc basis.

OzCoasts mapping was prepared by Geoscience Australia and the Commonwealth Department of Climate Change and Energy Efficiency[13] to illustrate the potential effects of sea-level rise on heavily populated coastal localities across Australia. This mapping included the metropolitan area of Adelaide from Outer Harbour south to Marino, and is relevant to understanding the impacts of projected sea level rise at a strategic level. The OzCoasts mapping did not allow for consideration of local factors such as structures and coast protection infrastructure.

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[9] IPCC 2013.

[10] Local Government Association of Australia (LGA SA) 2012, *Guidelines for Developing a Climate Change Adaptation Plan and Undertaking and Integrated Climate Change Vulnerability Assessment*, p. 29.

[11] Peters, GP, Robbie, AM, Boden, T, Canadell, PC, Le Quéré, C, Marland, G, Raupach, MRR & Wilson, C 2013, *The challenge to keep global warming below 2°C*, Nature Climate Change, Vol. 3 pp. 4-6.

[12] IPCC 2013.

[13] Geoscience Australia and the Commonwealth Department of Climate Change and Energy Efficiency 2010, OzCoast Sea Level Rise Maps.

The Yorke Peninsula Sea Flood Risk Mapping project mapped inundation extent for storm events at current and future sea levels for the Moonta Bay, Port Broughton, Marion Bay, Coobowie, Sultana Point, Corny Point, Parham and Thompson Beach using a similar approach to the OzCoasts modelling.

A small number of locations have been the subject of more detailed stormwater inundation modelling and mapping projects that include sea level rise and catchment inflows, including:

- The Stormwater Management Plan for the Cities of Holdfast Bay and Marion which considered an existing conditions scenario as well as a long term scenario incorporating 0.5m sea level rise;
- The Port Adelaide Seawater and Stormwater Flood Risk Assessment that combined flood risks from both sea water and stormwater and considered the effect of sea level rise;
- The Patawalonga Lake Level Frequency Study that considered the interaction between seawater and stormwater inflows and outflows;
- Flood modelling undertaken for Silver Sands catchment in the City of Onkaparinga that determined the effect of sea level rise and storm surge on the extent and depth of coastal flooding.

Key message

It is unequivocal that sea level rise is occurring, and will continue to occur, even if the climate were to stabilise through global mitigation efforts.[14] This is a sufficient basis for coastal adaptation action to occur in South Australia.

However, it is a weakness for adaptation planning that understanding of future sea level rise relies on a single tide gauge on a 5,067 kilometre coastline[15], and ad hoc local information (i.e. not consistently collected at locations along the coast) as a basis on which to extrapolate the relationship of the South Australian coast to global average data.

[14] IPCC 2013.

[15] Geoscience Australia website, http://www.ga.gov.au/education/geoscience-basics/dimensions/coastline-lengths.html, accessed 20 January 2014.

2.2. Risks from sea level rise

Sea level rise and its associated effects threaten economic, social and environmental systems, some of which are already vulnerable as a result of the influence of global and national financial markets, social disadvantage, and development pressure and population growth.[16] The inter-related nature of economic, social and environmental systems means the direct impacts of sea level rise will have secondary impacts that will affect all South Australians.

Coastal systems are naturally dynamic, being influenced by tides, waves, storms, catchment inflows and shoreline landform (i.e. rock or sand). Notwithstanding sea level rise, development of coastal land disrupts natural processes of sand erosion and deposition, and the natural migration of coastal vegetation that stabilises the coast. Coastal areas can therefore be subject to flooding and erosion risks that will be exacerbated with rising sea levels.

The impacts of sea level rise will be seen first during storm surge events,[17] accelerating coastal erosion above natural rates. As the sea level rises, low lying areas will be more frequently and possibly permanently inundated. The combined impact of sea level rise with storm surge and catchment inflows will exacerbate coastal inundation, erosion, land subsidence, loss or damage to coastal wetlands and saltmarshes, and saltwater intrusion to groundwater systems. These cumulative impacts can be further exacerbated by various influences including factors that are both climate-related and non-climate related (as shown on Table 2.1).

The risks sea level rise poses to built assets, the environment, and the community are described in Sections 2.2.1 to 2.2.3 below, and summarised in Figure 2.1 which shows the council areas with the highest proportions of built assets at risk and vulnerable communities and environments.

[16] Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education 2013, *Climate Adaptation Outlook: A Proposed National Adaptation Assessment Framework*, Commonwealth of Australia.

[17] Storm surge is a non-tidal rise of sea level which can occur during storms with low atmospheric pressure and strong onshore wind (wind blowing toward the shore).

Table 2.1: Sea level rise effect interactions with other influences[18]

EFFECTS OF SEA LEVEL RISE		POSSIBLE INTERACTING FACTORS[19]	
		CLIMATE	**NON-CLIMATE**
Inundation/ flooding	a. Storm surge (flooding from the sea)	Wave/storm climate, erosion, sediment supply	Sediment supply, flood management, erosion, land reclamation
	b. Backwater effect (flooding from rivers)	Runoff	Catchment management and land use
Wetland loss (and change)		Sediment supply, runoff, rainfall, drought	Sediment supply, migration space, land reclamation (i.e., direct destruction), land use planning
Coastal Erosion		Sediment supply, wave/ storm climate	Sediment supply
Saltwater Intrusion	a. Surface waters	Runoff	Catchment management (over-extraction), land use
	b. Groundwater	Rainfall	Land use, aquifer use (over-pumping)
Impeded drainage/ higher water tables		Rainfall, runoff	Land use, aquifer use, catchment management
Land subsidence		Rainfall	Aquifer use, sediment compaction

Figure 2.1: The sea level rise problem along South Australia's coast – A summary of key economic, environmental and social issues [figure overleaf]

[18] Adapted from Nicholls RJ 2011, *Planning for the impacts of sea level rise*, Oceanography 24(2), pp. 144–157, p. 148.

[19] Some interacting factors (e.g., sediment supply) appear twice because they can be influenced both by climate and nonclimate factors, Nicholls 2011, p.148.

The Sea Level Rise Problem along South Australia's Coast

A summary of key economic, environmental and social issues

Sandy beaches are at greatest risk of erosion as a result of sea level rise and increased storm intensity.
Up to **47%** of South Australia's beaches are classified as sandy.

Salt marsh and **samphire flats** are important carbon sinks. Like mangroves, they can naturally migrate as sea levels change however barriers such as roads, seawalls and levees restrict this natural adaptation and ability to retreat.

Mangroves provide habitat and breeding areas for local and migratory birds, crustaceans and commercially important fish species. Whilst mangroves can naturally migrate as sea levels change, barriers such as roads, seawalls and levees restrict this natural adaptation and ability to retreat.

Port Augusta City Council
Up to **134** commercial buildings
Up to **24km** of rail at risk by 2100

Foreshore areas are key **gathering points** for communities across South Australia. Numerous **community events** and **activities** are held at beaches and foreshores every year.
Beaches and foreshores are a key **recreational** asset in all coastal communities. As temperatures increase and the incidence of heatwaves, there will be increased demand for access to the coast.

More than 1 million **visitors** to South Australia visit our beaches and coastal areas every year. Investment in infrastructure including hotels, restaurants, cafes and other **visitor destinations** is significant and contributes to the local and regional economy. Sea level rise will impact how we use the coast and the activities that are located there.

Port Pirie Regional Council
Up to **171** commercial buildings
Up to **2000** residential buildings at risk by 2100

District Council of Yorke Peninsula
Up to **2000** residential buildings will be exposed by 2100 (20% of total)

Key **industries** and state significant economic generators are located in coastal locations including Port Adelaide and Le Fevre Peninsula.

City of Port Adelaide Enfield
Up to **506** commercial buildings
Up to **692** light industrial buildings
Up to **45km** of rail at risk by 2100

Shack settlements along Eyre and Yorke Peninsulas and in the South East will be more vulnerable with rising sea levels. Protection works will be required, land rezoned to restrict development or retreat plans put in place.

Increased investment in **sand pumping** at metropolitan beaches will be required

Coorong District Council
Up to **730km** of roads at risk by 2100

The Adelaide coastline is highly valued for **recreation** and **amenity**. Sea level rise will impact how and when we can use the beach and activities located in proximity to the coast.

City of Charles Sturt
Up to **141** commercial buildings
Up to **14,100** residential buildings at risk by 2100

Increased risk **to public safety** during storm events due to coastal inundation

Kingston District Council
Up to **330km** of roads
Up to **70%** of all residential buildings at risk by 2100

Total Estimated Replacement Cost of Assets exposed to 1.1m SLR in South Australia

Commercial Buildings	Up to $27 billion
Light Industrial Buildings	Up to $1.2 billion
Residential Buildings	Up to $7.4 billion
Roads	$9.5 billion
Rail	$900 million

TOTAL REPLACEMENT COST

$46 billion

Data Source: Commonwealth of Australia (2011) Climate Change Risks to Australia's Coasts: a first pass national assessment

Increased incidence of **damage to infrastructure** such as jetties, foreshore areas, beaches, stairs, public toilets buildings and stormwater systems due to inundation during storm events.

District Council of Robe
Up to **50%** of all residential buildings at risk by 2100

City of Holdfast Bay
Up to **121** light industrial buildings
Up to **1000** residential buildings at risk by 2100

Increased risk **to public safety** due to cliff erosion and destabilisation.

Community expectations to access and live close to the coast will be challenged

District Council of Grant
Up to **35%** of all residential buildings at risk by 2100

Disclaimer: The information shown on this map is indicative only and is intended to conceptually summarise key issues. It should not be relied upon for decision making.

Sea level rise of 1.1m by 2100 consistent with projections of the International Panel of Climate Change has been assumed.

2.2.1. Risk to built assets

The Supplement to the 2011 *First Pass National Assessment of Climate Change Risks to Australia's Coast*[20] provides an estimate of the number of assets exposed to the combined impacts of inundation and erosion risks as a result of a sea-level rise of 1.1m. The analysis allowed for a modelled high water level (tide) and identified an erosion risk for those assets located within 110m of potentially erodible shorelines. The analysis does not take into account existing coastal protection.

The replacement value of these exposed assets (based upon 2008 asset values) was calculated to provide an indication of the financial implications of the risk. It should be noted that total replacement of all built assets may not be required as a result of temporary inundation.

Table 2.2 shows the number and estimated replacement value of assets in South Australia at risk from 1.1 metres of sea level rise at 2100.

Table 2.2 South Australian assets at risk from a sea level rise of 1.1m at 2100[21]

Asset Type	Number at risk from combined impact of inundation and shoreline recession	Estimated replacement cost
Residential buildings	31,000 to 48,000[22]	$5 billion to $8 billion
Commercial buildings	900 to 1,500	$22 billion to $27 billion
Light industrial buildings	400 to 1,100	$0.6 billion to $1.2 billion
Roads	5400km to 6700km	$9.5 billion
Railways	180km to 200km	$900 million

The Cities of Charles Sturt and Port Adelaide Enfield contain the highest numbers of residential buildings at risk of inundation from a 1.1m sea level rise. Between 8,500 and 14,100 buildings in Charles Sturt and between 5,500 and 10,500 buildings in Port Adelaide Enfield are at risk which represent up to 30% and 23% of each Council's housing stock.[23]

The City of Port Adelaide Enfield also contains the highest number of commercial and light industrial buildings that may be affected by the combined effects of coastal inundation and shoreline recession. Between 265 and 506 commercial buildings, and 200 and 692 light industrial buildings are identified at risk[24].

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[20] Department of Climate Change and Energy Efficiency 2011, *Climate Change Risks to Coastal Buildings and Infrastructure: A Supplement to the First Pass National Assessment*, Commonwealth of Australia.

[21] Department of Climate Change and Energy Efficiency 2011.

[22] Note – The risk to residential buildings considers only sea level rise as reported in the Climate Change Risks to Australia's Coast, Department of Climate Change 2009, *Climate Change Risks to Australia's Coast: A First Pass National Assessment*, Commonwealth of Australia.

[23] Department of Climate Change 2009, p109-110.

[24] Department of Climate Change and Energy Efficiency 2011, p. 12.

The District Council of Yorke Peninsula and The Coorong Council contain the highest lengths of road exposed to sea level rise with between 670 and 765km and 595 and 730km exposed respectively. The City of Port Adelaide Enfield and Port Pirie Regional Council have the highest rail lengths exposed with between 38 and 48km and 30 and 38km exposed respectively.[25]

The consequences of infrastructure exposure to coastal inundation and shoreline recession will be felt at different scales and across different timeframes. Impacts of storm surge and coastal inundation may be experienced first, as high water levels flood homes, businesses and public buildings. Damage to building structure and contents can result, and temporary relocation may be required. Disruption to public infrastructure including road and rail networks can disrupt transport of goods for local and export markets. As sea levels rise, low lying areas may become frequently or permanently inundated, requiring relocation of infrastructure.

As sea levels rise, the frequency of inundation is likely to increase, with subsequent increases in the frequency of insurance claims for structural repairs and contents replacement. Insurance premiums across Australia have been rising in recent years as a result of a rise in claims related to recent weather related and other natural disasters, as well as increasing costs associated with building materials and labour to undertake repair work[26]. Insurance premiums could be expected to continue to rise as the volume and frequency of claims increases.

Shoreline erosion currently threatens infrastructure across South Australia, with some buildings being abandoned and replaced further inland, including Surf Life Saving South Australia club rooms at Semaphore and Moana. Landward migration of the coast may threaten the structural integrity of buildings, roads and railways, requiring additional repair, maintenance and possibly relocation.

2.2.2. Risk to the environment

Sea level rise threatens the estuarine, near-shore and coastal ecosystems that provide natural protection and coast stabilisation.

Mangroves, salt marshes and salt flats occur within tide dependant coastal zones, meaning they occur between the low and high tide water level (see Figure 2.1 for their location across South Australia). Changes in tide levels will therefore change the area suitable for them to grow. These ecosystems are highly productive, provide habitat and breeding areas for local and migratory birds, crustaceans and fish, and commercially important fish species. In addition to their ecological values, salt marshes and salt flats are important carbon sinks.[27]

Tide dependent ecosystems can adapt to slow changes in local conditions including sea level, beach erosion and changes in shallow water tables. The ability of mangroves and other communities to migrate landward however, depends on the rate of sea level rise, elevation, and land use. Barriers to landward migration of

[25] Department of Climate Change and Energy Efficiency 2011.

[26] CGU Insurance Limited 2011, *Why the cost of insurance is rising*, CGU June 2011.

[27] Poloczanska ES, Hobday, AJ, Richardson, AJ (eds) 2012, *Marine Climate Change Impacts and Adaptation Report Card for Australia 2012*

tide dependent ecosystems can be natural features such as steep cliffs however human developments such as roads, bunds and seawalls pose a significant threat to their resilience to sea level rise.[28]

Sea level rise could result in changed composition of marine life on near-shore reefs as the frequency and depth of inundation changes. In addition, increased average sea temperature and acidity of marine waters could have detrimental effects on ecological communities. Increases in coastal erosion may increase off-shore sediment deposition, smothering seagrass and inhibiting growth.[29]

In addition to these direct impacts, secondary impacts may impact the quality of marine, surface and groundwater. Coastal inundation could infiltrate septic and sewerage systems increasing the likelihood of spills and contamination.[30] Sea level rise is projected to increase the risk of saltwater intrusion into groundwater systems with a resultant increase in the salinity of groundwater near the coast. Furthermore, increased sea levels will intrude into near-coastal stormwater management wetlands, reducing their stormwater holding capacity.[31]

2.2.3. Risk to the community

The South Australian coast presents dangers to visitors and users as a result of weather conditions, waves, and currents. The constantly changing beach environment creates different beach patterns which influence the behaviour of the waves and currents. Changing sea level rise and storm surge patterns may increase the rates of change and affect how the beach can safely be used.[32]

In addition to the risks to houses and built assets valued by the community, the displacement of people from their homes, disruption to businesses and health and safety concerns can have large social consequences, including potential loss of life.[33]

Loss of or damage to beaches and associated facilities as a result of sea level rise may have a significant impact upon recreation activities and heritage and amenity values. The use of recreational assets including boat ramps, picnic facilities, jetties, walking and cycling paths and coast parks is likely to be restricted as a result of direct inundation and more frequent damage. As beach areas reduce, there may be conflict over the space available to different groups of beach users. Unmet community expectations of access to the coast and beaches at all times may create challenges for local government.

Across South Australia there are many Aboriginal heritage sites associated with coastal dunes, springs, wetlands and estuaries including the Tjilbruke coastal springs, and areas within the Coorong National Park and Yalata Indigenous Protected Area.

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[28] Poloczanska, Hobday & Richardson 2012.

[29] Poloczanska, Hobday & Richardson 2012.

[30] Department of Climate Change 2009.

[31] Department of Climate Change 2009.

[32] Beachsafe, no date, *Beaches*, http://beachsafe.org.au/surf-ed/beaches.

[33] Office of the Queensland Chief Scientist 2013, *Understanding floods: questions and answers*, Queensland Government.

Coastal erosion and rising sea levels could expose valued sites leading to additional disturbance and damage.

For many South Australians, living along the coast is highly desirable. Restricting, limiting or preventing development along the coast may be necessary, however is likely to be met with community opposition in the short term.

Key message

Sea level rise and its associated effects threaten economic, social and environmental systems in ways that will affect all South Australians.

3.0 Concepts of ideal coastal management

3.1. Integrated Coastal Zone Management (ICZM)

ICZM is an approach to coastal management that can be described as:

> "*a continuous and dynamic process incorporating feedback loops which aims to manage human use of coastal resources in a sustainable manner by adopting a holistic and integrative approach between terrestrial and marine environments; levels and sectors of government; government and community; science and management; and sectors of the economy*".[34]

In a contemporary policy context, the Australian Government's 2006 *ICZM Framework and Implementation Plan*, defines the goal of ICZM as to "maintain, restore or improve the quality of coastal ecosystems and the societies they support ... [and] address both development and conservation needs within a geographically specific place ... within a specified timeframe".[35]

The aims of ICZM are aligned with the aims of sustainable development more broadly in terms of integration of social, environmental and economic factors in coastal management, or "combining environmental, social and economic policy processes with special attention to critical environmental assets"[36].

ICZM also incorporates an integrated governance approach, emphasising close cooperation of all levels of government and across sectors in coastal zone planning and management.[37]

Other characteristics associated with ICZM include a long term view, innovation in policy development, and a participatory approach to both policy development and management.

The ICZM concept has formed the basis of the approach to coastal management in Australia for more than 30 years,[38] and is recognised as the most effective strategic

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[34] Lazarow, N 2006 *Community Participation in ICZM: Lessons and Areas for Improvement in Governance* in Lazarow, N, Souter, R, Fearon, R & Dovers, S (eds), 2006 *Coastal management in Australia: Key institutional and governance issues for coastal natural resource management and planning*, Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management, Inodooroopilly, p. 80.

[35] Natural Resources Management Ministerial Council 2006, *National Cooperative Approach to Integrated Coastal Zone Management: Framework and Implementation Plan*, Commonwealth of Australia, Canberra, p. 7.

[36] Dovers, S 2006, Institutions for ICZM: Insights from Elsewhere in Lazarow, N, Souter, R, Fearon, R & Dovers, S (eds), 2006 Coastal management in Australia: Key institutional and governance issues for coastal natural resource management and planning, Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management, Inodooroopilly, p. 2.

[37] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, *Managing our coastal zone in a changing climate: The time to act is now*, Commonwealth of Australia, Canberra, p. 252; Dovers, 2006, p. 2.

[38] Gurran, N, Hamin, E, Norman, B 2008, *Planning for climate change: Leading Practice Principles and Models for Sea Change Communities in Coastal Australia*, Prepared for the National Sea Change Taskforce.

framework from which to develop a robust coastal management approach.[39] Implementation of ICZM both in Australia and internationally has been the subject of published analysis and discussion. This work provides insight into how aspects of ICZM should be considered in relation to an ideal coastal management system for South Australia that addresses the sea level rise problem.

Practical challenges to ICZM identified in the reviewed literature broadly relate to the ability to consider diverse and conflicting stakeholder interests, and the ability of institutional structures, governance instruments, and practices amongst jurisdictions and sectors to reflect the integration that ICZM aspires to.

In the national context, the Australian Government's 2009 inquiry into climate change and management of the coastal zone reported that since the 2006 release of the *National Cooperative Approach to Integrated Coastal Zone Management: Framework and Implementation Plan*, little progress on implementation had been made, and that the document had "not led to any significant new investment or commitments by federal or state governments ... [and] groups designated to implement actions in the Implementation Plan included a range of committees that has little interest or 'ownership'' of the issues".[40] The lack of interest from the designated groups could indicate a lack of genuine engagement by stakeholders in the Plan, and/or that the committee structure was not a suitable implementation tool. Other reasons for failure of the Implementation Plan cited in submissions to the inquiry included a lack of clarity as to the document's role and purpose, and a lack of associated funding to support implementation.[41]

Other identified challenges for implementation of ICZM that are experienced in a range of policy contexts include:

- A lack of institutional settings that allow integration of environment, social and economic policy;
- Absence of coordination in policy, information sharing and planning across jurisdictions;
- Limited capacity to address long term challenges and a lack of institutional learning and sustained coordinated change;
- "Lack of integrated, robust and accessible information to guide the policy community, and the institutions and human capacity to create and distribute it"; and
- "Sustained participation by civil society and industry in higher-order policy formulation and evaluation (not only in on-ground management)".[42]

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[39] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, p.253.
[40] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, p.16.
[41] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, pp. 252-253.
[42] Dovers, 2006, pp. 8-9.

Opportunities for overcoming these types of challenges include rationalising legislation, overcoming duplications and jurisdictional overlaps, and secondly, placing significant attention on the development of partnerships.[43]

Key message

As is further demonstrated by the discussion of climate change adaptation concepts in Section 3.2, there are strong similarities between ICZM and adaption both in their principles, and barriers to their realisation. The relevance of each to the sea level rise problem indicates that an ideal system to manage sea level rise risk would incorporate aspects of and learnings from each concept.

3.2. Climate change adaptation

Adaptation refers to adjustments to the behaviour and characteristics of ecological, social and environmental systems, and to individual and institutional behaviour, in response to actual or expected conditions, stress, risks and opportunities resulting from climate change.[44]

An adaptive approach to the impacts of climate change has arisen from the uncertainty that climate change brings, and recognition of the shortcomings of a purely scientific approach to natural resources management.[45] In the context of sea level rise, adaptation planning can be seen as a tool or process utilised within the broader practice of ICZM.

Like ICZM, adaptation requires strategies that integrate technical options with the appropriate economic, legal, and institutional context for implementation. [46] The following leading principles of climate change adaptation have been identified:

- Uphold the principals of ecologically sustainable development in adaptation strategies, including "environmental integrity, social equity and participation, economic viability and the precautionary principle";
- Prioritise actions that are "worth doing anyway" and have multiple benefits that might relate to environment, amenity, social cohesion, and efficiency in infrastructure provision;
- Base decisions on evidence, noting that some stakeholders will require support to access, interpret and apply scientific information; and
- Plan now, to prevent exacerbation of climate change risks.[47]

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[43] Lazarow, 2006, p. 82.

[44] Smit, B & Wandel, J 2006, *Adaptation, adaptive capacity, and vulnerability*, Global Environmental Change, Vol. 16, pp. 282-292, p. 282.

[45] Smith, TF & Smith, DC 2006 *Institutionalising Adaptive Learning for Coastal Management* in Lazarow, N, Souter, R, Fearon, R & Dovers, S (eds), *Coastal management in Australia: Key institutional and governance issues for coastal natural resource management and planning*, Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management, Inodooroopilly, p. 102.

[46] Klein, RJT, Nicholls, RJ & Mimura N 1999, *Coastal Adaptation to Climate Change: Can the IPCC Technical Guidelines be Applied?* Mitigation and Adaptation Strategies for Global Change, Vol. 4, pp. 239-252, p. 95.

Closely linked to the concept of adaptation is the concept of resilience, similarly defined as an ability of systems and institutions, communities and individuals to respond readily and positively to change, and retain or even enhance their core functions. [48] The Intergovernmental Panel on Climate Change (IPPC) has noted that conceptually, "resilience shifts attention from purely growth and efficiency to needed recovery and flexibility". [49]

Emerging approaches to adaptation involve managing uncertainty by planning for various scenarios, or identifying future critical decision points at which a number of different adaptation options could be implemented.[50]

A decision pathway model of adaptation addresses the uncertainty and long timeframes associated with climate change risks by mapping both incremental and transformative adaptation options against climate change scenarios. In this approach "shorter term decisions are nested within a longer term framework that explicitly identifies key thresholds and options for dealing with much larger extents of change" and there is flexibility on the timing and introduction of different options and interventions".[51] Figure 3.1 illustrates this approach.

In the policy context, a national framework was developed in 2006 that places the steps involved in adaptation in a risk management framework - this approach summarised in Figure 3.2.

The national framework has provided context for substantial adaptation research, planning and projects.[52] Amongst these are examinations of the current challenges and barriers in place to effective adaptation.

The experience of 20 state, regional, and local adaptation initiatives across Australia (including South Australia) has recently been examined with the aim of understanding the challenges to implementing adaptation within the national framework context.[53]

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[47] Gurran, N, Hamin, E & Norman, B 2008, *Planning for climate change: Leading Practice Principles and Models for Sea Change Communities in Coastal Australia, prepared for the National Sea Change Taskforce,* The University of Sydney Faculty of Architecture, p. 24.

[48] City of Onkaparinga 2013, *Institutional Resilience and Climate Change – a Focused Review*, prepared by the Australian Workplace Innovation and Social Research Centre as part of the Resilient South consultancy led by URPS for the Cities of Onkaparinga, Holdfast Bay, Marion and Mitcham in association with the Government of South Australia and the Australian Government.

[49] Hamin, EM & Gurran, N 2009, *Urban form and climate change: Balancing adaptation and mitigation in the U.S. and Australia*, Habitat International, 33, pp238-245, p. 239.

[50] Gibbs, M & Hill, T (Blake Dawson) 2011, *Coastal Climate Change Risk – Legal and Policy Responses in Australia*, Commonwealth of Australia Department of Climate Change and Energy Efficiency, Canberra, Stafford Smith, M, Horrocks, L, Harvey, A, & Hamilton, C 2011, *Rethinking adaptation for a 4°world*, Philosophical Transactions of the Royal Society, Vol. 369, pp. 196-216.

[51] Stafford Smith, Horrocks, Harvey& Hamilton 2011, p. 211.

[52] Webb, RJ, McKellar, R & Kay, R 2013, *Climate Change Adaptation in Australia: experience, challenges and capability development*, Australasian Journal of Environmental Management, Vol. 20, No. 4, pp. 320-337, p. 321.

[53] Webb, McKellar & Kay 2013.

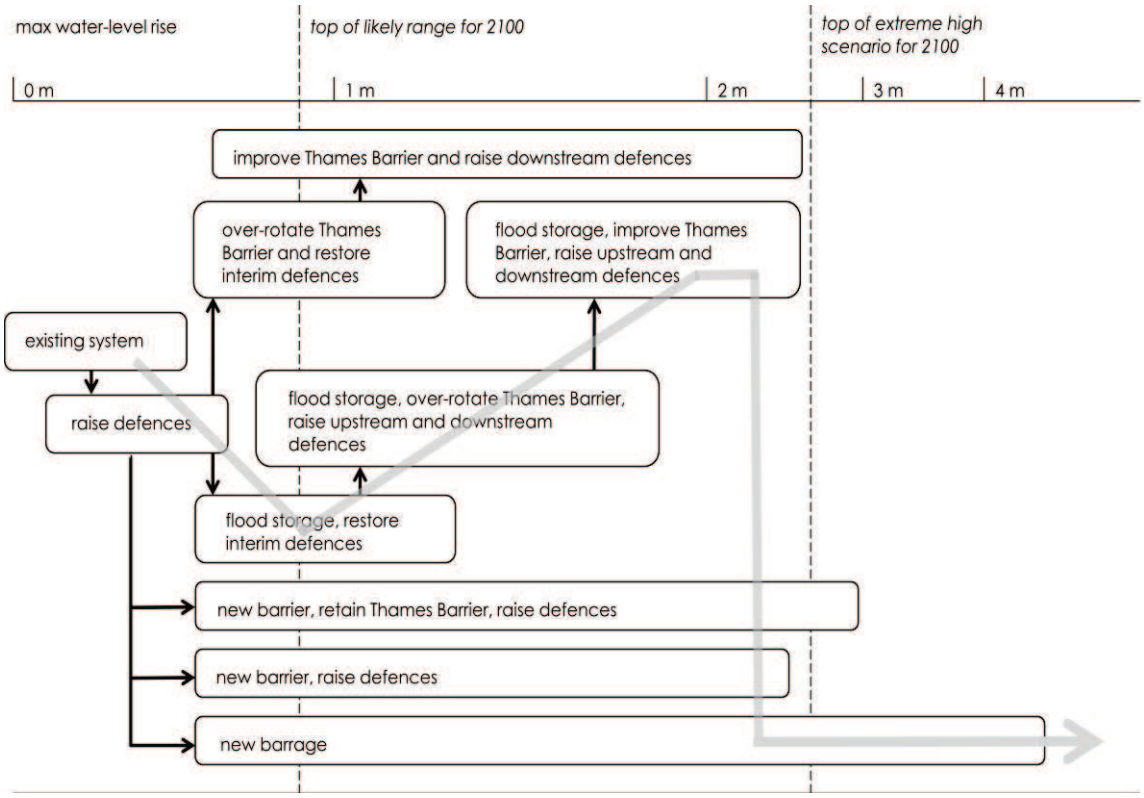

Figure 3.1: Adaptation options and a decision pathway for flood risk management in the Thames Estuary. The dashed lines indicate the extents of water level rise projected for 2100 under different scenarios. The think grey line shows one possible pathway for introducing different options to address rising water levels[54]

Eight broad challenges were identified, with some applying to one phase of the framework, and others applying to multiple or all. These challenges are to achieve:

- Strong and consistent leadership, particularly in framing problems, scoping adaptation projects, and collaborating to overcome resource scarcity;
- Integrated goals and outcomes that consider a broad spatial, social and institutional context, and reflect non-climate related policy perspectives and drivers of change;
- Institutional coordination and integration including rules (legal, regulatory, market), policy instruments, and the roles, responsibilities and governance arrangements of organisations;
- Embedded mechanisms for knowledge sharing about adaptation between projects and regions;
- Genuinely participatory stakeholder engagement and communication through adaptation projects, and the resources involved to deliver this;

[54] Reproduced from Stafford Smith, Horrocks, Harvey& Hamilton 2011, p. 211.

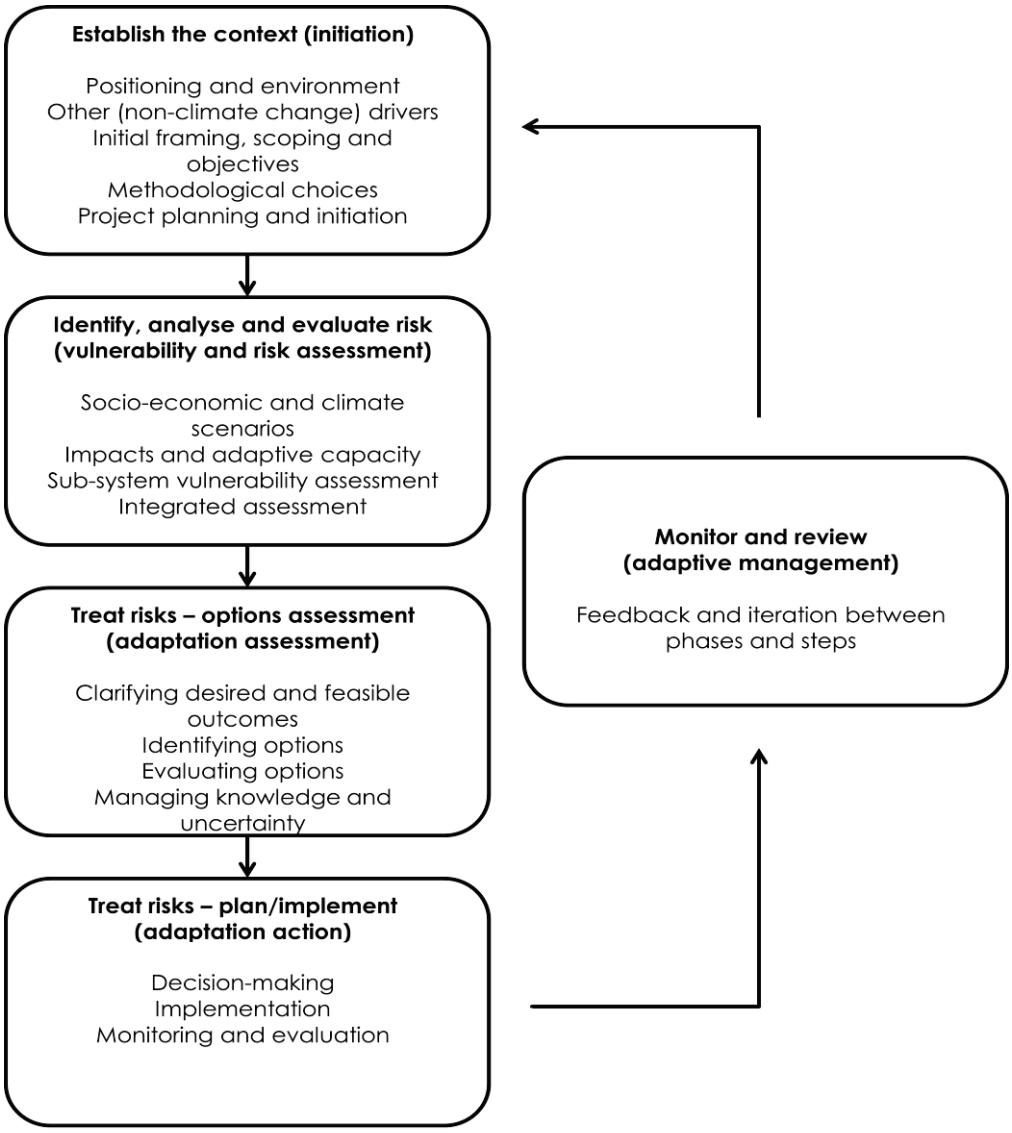

Figure 3.2: Adaptation phases and the national risk management framework[55]

- Frameworks, methodologies, and tools for decision making that recognise that adaptation is not 'one size fits all', and support transition from vulnerability assessment to adaptation assessment and action;
- Identification, development and management of data and knowledge including scientific data, relevant local and community knowledge, and lessons learnt from adaptation projects; and
- An iterative and adaptive management approach that carries through from scoping to implementation.[56]

[55] Reproduced from Webb, RJ, McKellar, R & Kay, R 2013, *Climate Change Adaptation in Australia: experience, challenges and capability development*, Australasian Journal of Environmental Management, Vol. 20, No. 4, pp. 320-337, p. 325.

[56] Webb, McKellar & Kay 2013, pp. 324-329.

The research further found that the interdependencies between these challenges are such that they are best addressed collectively on any adaptation project, rather than individually.[57]

In 2012 the Productivity Commission reported on its inquiry into the regulatory and policy barriers to effective climate change adaptation.[58] The Commission defined a 'barrier' as something that "restricts people's ability to identify, evaluate or manage risks in a way that delivers the highest level of community wellbeing", and identified that barriers may result from one or a combination of conditions relating to market failures, policy and regulation, governance and institutional arrangements, and behavioural and cognitive factors.[59]

The Commission recommended reforms at all levels of government to address barriers to adaptation. Recommendations relevant to state and local governments are summarised in Table 3.1. While the Productivity Commission's research to identify barriers has been a useful source of information, to date there has been limited action to progress its recommendations.

An analysis by researchers at the National Climate Change Adaptation research Facility (NCCARF) of more than 800 pages of submissions from key stakeholders to the Productivity Commission's inquiry found that barriers identified amongst these stakeholders from around Australia fell under five themes:

- Governance - including clarity of roles and responsibilities, leadership, coordination, political practices, and difficulty managing policy tradeoffs;
- Policy – including uncertainty around liability, inconsistent or weak legislation, and difficulties reconciling regulation with innovation, and focusing on the right aspects of the problem (e.g. focus has been on mitigation rather than adaptation, disaster recovery rather than prevention);
- Uncertainty – in relation to impacts, a lack of data at varying scales, a lack of knowledge about appropriate tools and methods, inadequate data interpretation and communication to various audiences;
- Resources – including lack of staff, skills and expertise particularly in local government, high capital and program costs and limited investment markets, and lack of funding; and
- Psychosocial factors – including contested views about climate change, a lack of public understanding of climate change risks, fear of the unknown, a short term and individualistic approach, the adversarial nature of politics, and the 'desirability' of living in high risk locations.[60]

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[57] Webb, McKellar & Kay 2013, p. 333.

[58] Productivity Commission 2012, *Barriers to Effective Climate Change Adaptation*, Report No. 59, Final Inquiry Report, Commonwealth of Australia, Canberra.

[59] Productivity Commission 2012, pp. 6-7.

[60] Barnett, J, Walters, E, Pendergast, S, Puleston, A 2013 *Barriers to adaptation to sea-level rise*, National Climate Change Adaptation research Facility, Gold Coast, p. 1.

Table 3.1: Productivity Commission priority reforms for addressing barriers to climate change adaptation[61]

	Current climate risks	*Future climate risks*
Characteristics	*Reasonably well understood*	*Uncertainty about timing, nature and/or magnitude of climate impacts and the assets at risk and their value*
Effective adaptation	*Take action today to improve risk management and build adaptive capacity*	*Begin taking preparatory actions*
	Reform priorities	
All levels of government	• Embed consideration of current climate risk sand future climate change in agencies' risk management practices • Pursue ongoing reforms to enhance flexibility and adaptive capacity including to: o Taxes that act as barriers to adaptation o Regulations that inhibit adaptation o Transfer payments that reduce incentives for businesses and households to adapt	• The COAG Building Minister's Forum should develop a work program to consider climate change projections in the National Construction Code • COAG should commission a separate inquiry to develop an appropriate response to manage risks to existing settlements
State government	• Clarify roles, responsibility and legal liability of local governments • Better align building and planning regulation • Replace inefficient taxes with less distortionary taxes	• Ensure land use planning frameworks facilitate a risk management approach to responding to climate change impacts • Establish guidelines to support local governments to manage risks to existing settlements
Local government	• Improve communication of hazard information to residents	• Consider new planning instruments to flexibly manage climate change risks

[61] Partial reproduction of Productivity Commission 2012, p. 24.

The LGA recently reviewed their Climate Change Strategy 2008-2012 and identified five barriers likely to be preventing implementation of climate change measures in South Australia's local governments.[62] These are:

- Inadequate processes for risk management;
- Poor access and use of climate change data;
- Lack of definition of roles and responsibility;
- Uncertainty surrounding legal liability; and
- Funding and resource restrictions.

The review found that barriers were often related to decision makers' access to information, and ability to interpret it in a risk management context. It also identified the need for a framework to monitor and evaluate progress of climate change adaptation projects and initiatives. The review concluded that LGA climate change activities should focus on:

- Identifying and ameliorating barriers to implementation;
- Improving access to climate change data and building capacity;
- Identifying gaps in information and filling those gaps; and
- Supporting implementation of climate change initiatives.

A current initiative of the LGA and DEWNR that responds to the findings of the Climate Change Strategy review is the Science to Solutions project. This project seeks to develop a more detailed understanding of institutional, policy and information barriers to integrating climate adaptation into the strategic and operational management processes of local governments and natural resources management and regional development organisations. Improved understanding of the barriers at the local level will assist the LGA to best tailor its efforts to build the capacity of decision makers and develop tools to support climate change adaptation.[63]

Key message

Concepts and models of adaptation are continually evolving and providing new conceptual approaches and tools to prepare for climate change, including sea level rise. At the same time, review and evaluation of current approaches to adaptation are providing guidance to improve implementation of adaptation planning. Recent research shows some consistency in the identification of barriers to adaptation on the national scale.

In South Australia, work is underway to more specifically define and respond to barriers to adaptation in a local and regional context.

[62] Review summary provided by the LGA.

[63] LGA and DEWNR, *Science to Solutions Project Information Paper One – Project Background and Research*, 6 March 2014.

3.3. Coastal adaptation strategies

Table 3.2 describes the contemporary typologies that have been identified for adaptation to coastal climate change impacts, by providing examples of the types of adaptation options each is associated with.

In a given location, coastal adaptation can involve one or more options from one or more typologies, and can be either reactive (after impacts are experienced) or anticipatory, and either autonomous or planned.

Table 3.2: Summary of strategic adaptation options[64]

Typology	Adaptation options	Comments
Build adaptive capacity	Develop and share information, resources and decision making tools regarding adaption options Clearly communicate potential risks when the information becomes available Share understanding within the community on the need to adapt	Seeks to address behavioural aspects of adaptation Does not address physical risks directly, but would ideally result in a shared willingness amongst stakeholders to implement options within the retreat, accommodate or protect typologies
Planned retreat	Relocate or abandon assets in high risk areas Prevent development in coastal areas through land use restrictions including buffers/setbacks f Establish rolling easements that allow development but only with condition that it will not be protected from sea level rise and will be abandoned if necessary. Withdrawal of government subsidies for development in vulnerable areas Prohibit reconstruction of development damaged by storms and sea level rise Provide detailed and accurate information on associated risks Acquire land in high risk areas Provide relocation subsidies in the form of low interest loans or grants for relocation of dwellings and domestic services (e.g. septic tanks) Provide grants for demolition of homes	Options in strength from planning restrictions to acquisition and removal of infrastructure Can result in social, economic and environmental benefits by reducing the sensitivity of the coast Acquisition and removal is financially expensive Often not supported by property owners and community members, social costs translate into significant governance difficulties for decision makers Increases public safety Lower ongoing maintenance costs than protection measures Reduces need for future adaptation if risks increase Can better facilitate horizontal adaptation of ecosystems
Accommodate	Implement building codes and design standards that require development to be able to withstand periodic inundation, for example through minimum flood heights, foundation design requirements, enhanced drainage and evaporation provisions, building on pilings, demountable homes Adapt drainage schemes to allow flood waters to drain more quickly without impacting receiving environments Build emergency flood shelters in high risk areas as well as early warning and evacuation systems Require designated forms of insurance for all properties at risk Require home buyers to be informed of risk at property purchase Change agricultural crops or pasture to more salt tolerant species in areas prone to coastal inundation Prohibit clearance of coastal vegetation, damage or disturbance to coastal wetlands	Often applied to meet context specific conditions, and can be controversial in the basis of inconsistency of application between locations and jurisdictions Can create a lack of clarity regarding liability More research is required to understand which techniques are best suited to different circumstances Land and infrastructure remains in use Generally cheaper and having a lesser environmental impact than protective measures Increases public safety Promotes risk management
Protect	Install appropriate *hard* protection measures such as dikes, seawalls, groynes, breakwaters, storm tide barriers Install appropriate *soft* protection measures such as beach sand nourishment, dune restoration, living shorelines (use more natural stabilisation techniques including revegetation and small structural measures)	Generally reactive and diminishes the coast's ability to regulate naturally Often considered most appropriate for urban areas with high economic and socio-cultural value Often high complexity and cost, unplanned negative consequences, and long term economic, engineering and social viability Increases expectation of perpetual protection and reduces likelihood of retreat
Do nothing	Buildings are seen to have reached their 'expiry date' once sea level rise has encroached Properties abandoned and losses and damages are owners' responsibility	Can be considered a 'de facto' retreat option Likely to be perceived by many as a failure of management Many governments default to this approach by failing to adequately address coastal risks

[64] Fletcher, CS, Taylor, BM, Rambaldi, AN, Harman, BP, Heyenga, S, Ganegodage, KR, Lipkin, F & McAllister, RRJ 2013, *Costs and coasts: An empirical assessment of physical and institutional climate adaptation pathways*, National Climate Change Adaptation Research Facility, Gold Coast; Niven, RJ & Bardsley, DK 2013, *Planned retreat as a management response to coastal risk: a case study from the Fleurieu Peninsula, South Australia*, Regional Environmental Change, Vol. 13(1), pp.193-209, pp. 196-198; Balston, JM, Kellett, J, Wells, G, Li, S, Gray, A & Western, M 2012, *Climate change decision support framework and software for coastal councils*, Local Government Association of South Australia, Adelaide, South Australia, Appendix 2, p. 9; Gibbs & Hill 2011, p.45; Nicholls 2011; Wang, X & McAllister, RRJ 2011, *Adapting to heatwaves and coastal flooding* in Cleugh, H, Smith, MS, Battaglia N & Graham, P (eds) Climate Change: Science and Solutions for Australia, CSIRO, Canberra ; Intergovernmental Panel on Climate Change (IPCC) Working Group III 1990, *The IPCC Response Strategies*, Chapter 5, Coastal Zone Management.

4.0 Coastal zone management in South Australia

The existing arrangements and mechanisms in place in South Australia for managing the coastal zone and within that, sea level rise, fall across numerous regulatory systems at all levels of government relating to coastal management, land use planning, natural resources management, climate change adaptation, emergency response, and management of public assets.

Many aspects of the management system intersect or impact upon each other, either formally - for example where the *Development Regulations 2008* create a role in the land use planning system for the Coast Protection Board which is established under the *Coast Protection Act 1972*; or informally – for example where a Regional Climate Change Adaptation Plan recommends changes to a Council's Development Plan.

Linked to, but not formally a part of these systems, sectors with a relationship to coastal management include private infrastructure owners and the insurance industry. The social and political context in which these systems and sectors operate also has an impact on coastal zone management.

This section of the Issues Paper describes each of these aspects of the current arrangements for coastal management that apply in South Australia.

4.1. Roles and responsibilities of coastal stakeholders

In South Australia, like other states, coastal management is primarily the role of State and local governments, with the Commonwealth Government having a role in setting directions and facilitating good management through, funding, research and information provision.[65]

State and local responsibilities for coastal management are implemented through legislative frameworks relating to environmental protection and management, land use planning, and public infrastructure.

Similarly, in South Australia climate change adaptation (and therefore coastal climate change adaptation) occurs within a State legislative framework, with funding, leadership and information contributed by the Commonwealth, and a significant role for local government in planning and implementation.

The Australian Government's Select Council on Climate Change has identified that in relation to climate change risk, "Private parties should be responsible for managing risks to private assets and incomes. Governments – on behalf of the community - should primarily be responsible for managing risks to public goods and assets (including the natural environment) and government service delivery and

[65] Good, M 2011, *Technical Report – Government Coastal Planning Responses to Rising Sea Levels, Australia and Overseas*, The Antarctic Climate & Ecosystems Cooperative Research Centre, Hobart.

creating an institutional, market and regulatory environment that supports and promotes private adaptation."[66]

Emergency management/disaster resilience roles and responsibilities between levels of government are also structured in a similar way to coastal management and climate change adaptation.

At State level, land use planning, emergency response, coastal management, and climate change are dealt with under different legislative frameworks by multiple Ministers and agencies. Like in other states, this results in overlap in responsibility for coastal policy making between portfolios.[67] Currently however, coast protection, climate change adaptation, and natural resources management are the responsibility of one Minister and within one agency.

Local government has significant responsibilities for coastal areas relating to land use planning, climate change adaptation, public assets, coast protection infrastructure, and emergency response, and are at the forefront of "direct risks to human safety, property, infrastructure, services, industry and the local environment".[68]

Community organisations, coastal communities, and the broader South Australian community also have both direct and indirect roles in coastal management.

Table 4.1 summarises the roles of the various coastal stakeholders, along with the relevant legislation and policies under which they are involved in coastal management.

Key message

Management of the coastal zone, and within that sea level rise, falls across numerous regulatory systems at all levels of government relating to coast protection, land use planning, natural resources management, climate change adaptation, emergency management, and management of public assets.

Linked to, but not formally a part of these systems, are sectors with a relationship to coastal management including private infrastructure owners and the insurance industry. The social and political context in which these systems and sectors operate further influence the management of sea level rise.

[66] Select Council on Climate Change 2012, *Roles and responsibilities for climate change in Australia*, paper released at the second meeting of the Council 16 November 2012, http://climatechange.gov.au/roles-and-responsibilities-climate-change-australia.

[67] Gibbs & Hill 2011, p.33.

[68] Gurran, Hamin & Norman 2008, p. 15.

Table 4.1: Stakeholder roles in coastal management in South Australia

Stakeholder	Roles	Legislation under which coastal management occurs	Policies through which coastal management occurs
Commonwealth Department of the Environment	Leadership on climate change adaptation Funding and support for climate change adaptation Research and information distribution to support climate change adaptation	No coastal management legislation *Environment Protection and Biodiversity Conservation Act 1999* can apply to coastal areas	Intergovernmental Agreement on the Environment 1992 Commonwealth Coastal Policy 1995 National Cooperative Approach to Integrated Coastal Zone Management: Framework and Implementation Plan 2006 National Climate Change Adaptation Framework
Commonwealth Attorney-General's Department	Developing policy and plans to respond to and minimise the impacts of natural disasters	No legislation	Intergovernmental partnerships – various Australian Emergency Management Arrangements 2009 National Disaster Resilience Framework 2008 National Strategy for Disaster Resilience 2009
Coast Protection Board	Protect the coast from defined impacts and restore the coast where impacts have occurred Develop and fund coast protection infrastructure Develop and manage facilities Contribute to land use planning and development control Management of Adelaide metropolitan beaches	*Coast Protection Act 1972* *Development Regulations 2008* *Harbours and Navigation Act 1993*	Policy on Coast Protection and New Coastal Development1991 Coast Protection Board Policy Document 2012 Coast Protection Board Strategic Plan 2009-2014 Living Coast Strategy for South Australia 2004 Adelaide's Living Beaches: A Strategy for 2005-2025
Department for Planning, Transport and Infrastructure	Land use planning and development control	*Development Act 1993* *Development Regulations 2008*	Planning Strategy Development Plans
DEWNR - Water & Climate Change Branch	Leadership on climate change adaptation Funding and support for climate change adaptation	*Climate Change and Greenhouse Emissions Reduction Act 2007*	Climate Change Adaptation Framework for South Australia 2012 Government Action Plan for the Climate Change Adaptation Framework in South Australia 2012-2017 Sector Agreements Climate Change Adaptation Plans
DEWNR – Natural Resources Management	Care for seascapes Stormwater management Contribute to land use planning and development control Rehabilitate and protect natural resources of the marine and coastal environment – flora and fauna	*Natural Resources Management Act 2004*	State and Regional Natural Resources Management Plans Estuaries Policy and Action Plan 2005 Coastal Action Plans for NRM regions
South Australian Fire and Emergency Services Commission (SAFECOM)	Support the Country Fire Service, Metropolitan Fire Service and the State Emergency Service Undertake strategic policy planning, governance and resource allocation for the overall fire and emergency services sector Support emergency management planning across South Australia	*Emergency Management Act 2004*	SA Fire and Emergency Services Sector Strategic Plan 2010-2015 State Emergency Management Plan 2013
Local government	Develop, own and manage coastal assets Develop, own and manage coast protection infrastructure Own and manage coastal land Land use planning and development control Natural resources management Climate change adaptation Emergency Management	*Local Government Act 1999* *Development Act 1993* *Development Regulations 2008* *Harbours and Navigation Act 1993*	Strategic Management Plans Development Plans Regional Climate Change Adaptation Plans Asset Management Plans Stormwater Management Plans Zone Emergency Management Plans LGA SA Climate Change Strategy 2008-2012 (under review) LGA Guidelines for Developing a Climate Change Adaptation Plan and Undertaking an Integrated Climate Change Vulnerability Assessment 2012 LGA SA Coastal Adaptation Decision Pathway LGA Mutual Liability Scheme Risk Management and Adaptation Program
Non – government organisations e.g. Surf Life Saving South Australia, Coastcare, local Friends groups	Local environmental management Life saving Community education and capacity building	N/A	Surf Life Saving SA Strategic Plan 2012 Impact of Extreme Weather Events and Climate Change on Surf Life Saving Services: A Road Map for Adaptive Action 2011
Coastal communities	Property owner/manager, Property developer, Elector, Funder through rates and taxes, Beneficiary of coastal amenity	N/A	N/A
Broader community	Elector, Funder through rates and taxes, Beneficiary of coastal amenity	N/A	N/A

4.2. National context

The Commonwealth Government's role in sea level rise management relates to providing high level leadership on policy direction, and facilitating good management through funding, research and information provision.[69] This is currently sought through a number of policies and initiatives relating to:

- Coastal management, including the:
    - Intergovernmental Agreement on the Environment 1992;
    - Commonwealth Coastal Policy 1995; and
    - National Cooperative Approach to Integrated Coastal Zone Management: Framework and Implementation Plan 2006.
- Climate change adaptation, including the:
    - National Climate Change Adaptation Framework; and
    - National Climate Change Adaptation Research Facility (NCCARF); and
    - National Coastal Risk Assessment.
- Disaster resilience and emergency management, including the:
    - Australian Emergency Management Arrangements 2009
    - National Disaster Resilience Framework 2008
    - National Strategy for Disaster Resilience 2009

The Commonwealth Government is also party to various agreements with state and local government relating to management of coastal areas.

While the Commonwealth has a strong leadership and planning role in both coastal management and climate change adaptation, like in South Australia, timely transition to implementation has been a challenge.[70]

In 2009 the Commonwealth House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts reported on management of the coastal zone in a changing climate. In its report and recommendations the Standing Committee emphasised the need for a national approach to managing Australia's coastal zone, and noted that "in their evidence to the inquiry, most state and territory governments called on the Australian Government to provide ... stronger

[69] Good 2011.

[70] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, p.16; Webb, McKellar & Kay 2013.

national leadership on coastal management, particularly if the challenge of climate change is to be addressed effectively".[71]

From a South Australian perspective on sea level rise, strengths and opportunities of the national context include that:

- Clarity exists around the role of the Commonwealth in coastal management;
- National reviews and strategies identify issues and approaches that are consistent with the issues and approaches relevant in the South Australian context;
- Funding programs in place empower state and local governments to undertake local coastal management and adaptation. For example, Regional Natural Resource Management Planning for Climate Change Fund (Stream 1 and Stream 2 funding) supports regional natural resources management organisations to plan for climate change, development regional information, and interpret and apply science.
- Leadership is present in the coordination and integration of disaster resilience and climate change adaptation efforts at the national level to meet multiple objectives;
- Commonwealth funded research and dissemination of information supports local adaptation efforts, for example NCAARF publications and OzCoasts mapping;
- The Commonwealth has allocated resources to identifying and responding to issues and barriers to adaptation, for example the 2009 Coastal Zone Inquiry, and the Productivity Commission's 2012 study into barriers to adaptation.

Challenges for South Australia from the national context include that:

- A wide range of issues and locations compete for funding and policy action at Commonwealth level;
- While advantages of national consistency in policy and regulations have been identified (e.g. sea level rise benchmarks), action has been slow; and
- Timeframes for execution of Commonwealth funding can be in conflict with local implementation timeframes.

Key Message

There is clarity and some leadership at the Commonwealth level in relation to coastal management, particularly in relation to the Commonwealth Government's role, funding programs, and research. Key challenges include competition for funding, and in some instances a lack of national action despite policies in place.

[71] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, p. 2.

4.3. South Australian management systems

4.3.1. Coast protection

Legislation

The *Coast Protection Act 1972* defines the coastal zone as State waters to 100 metres inland from the high water mark (HWM), and provides for the conservation and protection of the beaches and coast of South Australia through establishment of the Coast Protection Board. Under Section 14 of the Act, the functions of the Coast Protection Board are to:

- Protect the coast from erosion, damage, deterioration, pollution and misuse;
- Restore any part of the coast that has been subjected to erosion, damage, deterioration, pollution or misuse;
- Develop any part of the coast for the purpose of aesthetic improvement, or for the purpose of rendering that part of the coast more appropriate for the use or enjoyment of those who may resort thereto;
- Manage, maintain and, where appropriate, develop and improve coast facilities that are vested in, or are under the care, control and management of, the Board;
- Report to the Minister upon any matters that the Minister may refer to the Board for advice;
- Carry out research, to cause research to be carried out, or to contribute towards research, into matters relating to the protection, restoration or development of the coast; and
- Perform such other functions assigned to the Board by or under this or any other Act.

DEWNR provides "administrative and technical support to the Coast Protection Board".[72]

The Board is responsible for management of Adelaide's metropolitan beaches under Section 33 of the Act which allows the Board to manage the coast across local government boundaries.

The establishment of the Coast Protection Board and associated legislation in the early 1970s was in response to poor coastal planning that resulted in State and Local Government and some property owners incurring large coast protection costs.[73]

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[72] Good 2011, p. 20.

[73] Coast Protection Board South Australia 1991, *Policy on Coast Protection and New Coastal Development*.

Policies and Plans

The Coast Protection Board's *Policy on Coast Protection and New Coastal Development* was endorsed by the South Australian Government in 1991. This policy is current in 2014, and has been under review by the Board since 2011.[74]

The Policy sets standards for protection against flooding, coastal recession and storm erosion, with consideration of projected sea level rise, specifically:

- That generally,[75] development should not be approved where building sites are lower than a height determined by adding 0.3m (0.25 for commercial buildings) to the 100 year ARI water level and making a local adjustment (if appropriate) for land subsidence or uplift to the year 2050, and capable by reasonably practical means, of being protected or raised to withstand a further 0.7m of sea level rise;
- That development should generally not occur on sand dunes nor close to soft, erodable coastal cliffs; and
- That development should be safe against coastal recession and storm erosion and the effect that a 0.3m rise in sea level would have on these. Also, development should not be approved unless it can be protected by practical measures against additional erosion that would be caused by a further 0.7m sea level rise.[76]

Standards set out in the Policy were incorporated into Development Plans by Ministerial Development Plan Amendment in 1994.[77]

The *Coast Protection Board Policy Document (revised 22 May 2012)* sets out the Board's positions with regard to the coastal, estuarine and marine areas of South Australia in relation to: development; hazards; protection works; conservation; heritage; access and amenity; partnerships, integration and capacity building; and research reporting, monitoring and assessment. Key aspects of each policy are set out in Table 4.2.

[74] Good 2011, p. 21.
[75] Exceptions apply for flood protected sites and major developments
[76] Coast Protection Board South Australia 1991.
[77] Good 2011, p. 21.

Table 4.2: Key elements of Coast Protection Board Policies

Coast Protection Board Policy	Key policy elements
Development	• Seek integrated coastal management • Base planning advice on an assessment of hazard exposure and impacts on coastal: ecological and physical processes, environments, visual amenity and public open space • Identify coastal areas requiring particular management actions relating to flooding and erosion, acid sulfate soils, conservation significance and landscape amenity value, and seek inclusion of these areas in Coastal Zones of Development Plans • Minimise exposure of new and existing development to risk of damage from coastal hazards and risks to development on the coast • Minimise impact of stormwater discharge to coast and nearshore waters • Maintain adequate buffer distances between development and the coast • Protect the environment, heritage, and visual amenity of the coast. • Minimise development on public land • Oppose coastal development that is linear or scattered, subject to coastal hazards or impacting areas of significance, located in sand dunes, wetlands, coastal estuaries and marine vegetation, not orderly and increases the number of allotments abutting the coast, involves aquaculture over sensitive habitats, or significantly affects coastal processes • Seek removal of unauthorised coastal development inconsistent with Board policies

Coast Protection Board Policy	Key policy elements
Hazards	• Formulate state hazard standards based on IPCC and Commonwealth recommendations • Facilitate use of legal agreements to manage risk of damage to development • Ensure adequate buffer zones are provided to accommodate public infrastructure, use and access in light of predicted physical processes • Advise hazard standards for development proposals in coastal areas for flooding, erosion, and acid sulfate soils using IPCC scenarios, 100 Year Average Return Interval (ARI) protection standards, and design periods of 50 years for minor development, 100 years for strategic planning in existing settled areas and 200 years for new settlements. • Assist with identifying public risk areas associated with unstable cliffs, storm inundation, and long to medium term erosive trends.
Protection works	• Encourage maintenance of beach levels adequate to prevent storm damage and allow recreation • Not oppose beach and nearshore protection structures where in the public interest and unacceptable coastal process, ecosystem, flooding and erosion impacts can be avoided • Provide grants to local government to undertake approved coast protection works • Not fund stormwater drainage works, protection of property and installations owned by other government agencies, or protection of private property unless there is an associated public benefit, simultaneous protection of public property, a large number of separate properties at risk or where the cause cannot be easily identified

Coast Protection Board Policy	Key policy elements
Conservation	• Instigate or participate in conservation of coastal biodiversity • Instigate or participate in investigations into development impacts n coastal, marine and estuarine environments • Identify, protect and manage high conservation value environments, acquiring land where necessary • Provide grants to local government to undertake approved conservation works
Heritage and landscape	• Support identification and protection of landscape cultural and scientific significance and marine heritage, and acquire land where necessary to ensure protection of areas • Oppose development that significantly impacts on coastal significance, heritage or landscape value • Recognise and involve Aboriginal people • Provide grants to local government to undertake approved heritage and landscape works
Access and amenity	• Support sustainable access to the coast, giving preference to public use over private use, uses that need to be located close to the coast, and public safety • Support rationalisation of nodal access roads to the coast • Oppose vehicular access to beaches and new development that limits public access to the coast • Provide grants to local government to undertake approved access works
Partnerships, integration and capacity building	No current policies
Research, reporting, monitoring and assessment	No current policies

The *Coast Protection Board Strategic Plan 2009-2014* sets out how the Board will pursue sustainable use of the South Australian coast through supporting adaptation of existing development to coastal risks and the impacts of climate change, ensuring new development is not at risk under current and future conditions, and planning for resilience in coastal ecosystems to adapt to the impacts of climate change. Actions associated with these priorities are summarised in Table 4.3.

Table 4.3: Coast Protection Board Strategic Plan 2009-2014 priorities and actions

Strategic priority	**Actions**
Ensure new development is not at risk from current and future hazards	• Ensure that coastal development occurs consistent with the hierarchy of adaptation: avoid, accommodate, adapt • Seek increased powers to control development potentially at risk from coastal hazards • Maintain the currency and relevance of Coast Protection Board policies, including allowances for sea level rise, by reviewing as appropriate • Seek the Government's adoption and inclusion of these policies in South Australia's development control system. • Better engage with the emergency management sector to exploit areas of joint interest regarding the impacts of climate change on coastal development • Prepare guidance for planning authorities, developers and the community on appropriate landscapes and criteria for specific types of development (i.e. marinas, ports, boat ramps) • Provide advice to the Minister, Government, local government and the community on sustainable coastal development

Strategic priority	Actions
Adaptation of existing development to coastal hazards and the impacts of climate change	• Support the implementation of the National Climate Change Adaptation Framework 2007, in particular, the acquisition of the national coastal DEM and coastal vulnerability assessment • Assist Governments prepare coastal vulnerability assessments and adaptation plans • Assist Local Government devise, prioritise and implement protection strategies for coastal settlements • Provide advice to the Minister, Government, local government and the community on adaptation of coastal development
Adaptation of existing development to coastal hazards and the impacts of climate change	• Support the implementation of the National Climate Change Adaptation Framework 2007, in particular, the acquisition of the national coastal DEM and coastal vulnerability assessment • Assist Governments prepare coastal vulnerability assessments and adaptation plans • Assist Local Government devise, prioritise and implement protection strategies for coastal settlements • Provide advice to the Minister, Government, local government and the community on adaptation of coastal development
Plan for resilience in coastal ecosystems to adapt to the impacts of climate change	• Engage with planning authorities in developing land use frameworks, Planning Strategies and Development Plans that recognise and allow for adaptation (including retreat and migration) of tide-dependent ecosystems • Ensure that development does not create additional pressures on at-risk ecosystems • Provide advice to the Minister, Government, local government and the community on sustaining coastal ecosystems

The *Living Coast Strategy for South Australia 2004* is a framework for integrated management of marine, estuarine and coastal environments. An objective of the strategy is to protect coastal environments based on best understanding of physical coastal processes. Actions and tasks the Strategy identifies to meet this goal are set out in Table 4.4.

Table 4.4: Living Coast Strategy for South Australia: Actions under Objective 4 - *To protect our coastal, estuarine and marine environmental assets based on best understanding of physical coastal processes*[78]

Action 4.1 Develop a strategic vision for coast al development
• Develop a clear strategic vision for the State on coastal planning and development • Identify quality landscapes on the coast at risk of development • Protect landscape qualities and amenity values through appropriate polices in Development Plans through the Plan Amendment Reports process
Action 4.2 Protect coastal assets
• Review the Adelaide Metropolitan Coast Protection Strategy. • Manage risks to Adelaide metropolitan coastal assets by beach replenishment and using structures to slow littoral drift. • Develop a Coast Protection Strategy for the whole of the South Australian coast. • Determine risks to South Australia's coastal assets from physical changes through surveys and monitoring. • Undertake a risk assessment of coastal hazards such as coastal erosion, flooding, cliff collapse and coastal acid sulfate soils. • In conjunction with local government and the Commonwealth, develop a clear policy for government to management of sea level rise. • Establish principles for development in coastal acid sulfate soils areas to guide coastal development. • Provide technical advice to support property owner involvement in developing coastal protection strategies for at risk properties. • Provide technical advice and assistance to local government to manage coastal erosion and public access to coastal areas.

[78] Department for Environment and Heritage 2004, *Living Coast Strategy for South Australia*, Government of South Australia, pp. 74-75.

Action 4.3 Establish effective development controls
• Ensure coastal zoning is undertaken with regard to the vision for coastal areas, including ecological, social and economic values. • Provide for an Authority with greater powers of direction over coastal and marine development. • Ensure adequate compliance controls for local councils and the Government to deal effectively with planning and coastal development. • Implement an environmentally responsible framework for coastal and marine tourism development management by both the private sector and government.
Action 4.4 Establish effective management of coastal lands
• Amend the Crown Lands Act 1929 to provide for single ministerial responsibility for care control and management of Crown lands and improve administration and management of marine, coastal and river front Crown holdings. • Assist proposed NRM Boards to address the protection of coastal and estuarine assets.

Adelaide's Living Beaches: A Strategy for 2005-2025 sets out a plan for future management of Adelaide's metropolitan beaches including consideration of sea level rise. Key elements of the strategy are:

- Continued beach replenishment to maintain a sandy foreshore;
- Build up dune buffers, and protect coastal infrastructure;
- Sand recycling using sand slurry pumping and pipelines;
- Importing coarse sand from external sources;
- Construction of coastal structures such as groynes and breakwaters at strategic locations; and
- Integration of sand bypassing at harbours with the beach replenishment activities.

Prospering in a Changing Climate: A Climate Change Adaptation Framework for South Australia assigns the Coast Protection Board responsibilities for adaptation in addition to its management of existing coastal risks, specifically:

- Maintaining and updating policies to guide sustainable development and biodiversity conservation on the coast;
- Providing guidance to planning authorities and other organisations on coastal development and land use;
- Working with regional partners and sectors to develop regional Integrated Vulnerability Assessments; and

- Working with regional partners and sectors to develop and implement regional adaptation plans.[79]

Managing coastal shack settlements

A key issue for South Australia' coast protection system is the legacy of coastal shack settlements, originally established on Crown land, and subsequently granted freehold tenure in the 1990s despite known flooding and erosion risk, and poor performance in relation to coastal management policies in place at that time.[80]

During the freeholding process, in locations where shacks did not meet the state government's criteria for freehold classification on the basis of flooding and erosion risks, the then state government required shack owners to enter into Land Management Agreements (LMAs) indemnifying local and state government, and placing full responsibility for coastal protection on the land owners. Planning provisions were applied that exempted creation of freehold allotments and additions to or replacement of shacks in these locations from assessment against risk minimisation policies.[81]

Settlements under LMAs and without a coast protection strategy in place are subject to ever increasing risks that will be exacerbated by sea level rise. At the same time, in some of these locations property values have increased and development of sites has intensified, simultaneously increasing the potential impact of known risks, and entrenching the notion of shack owners right to occupy and redevelop the land.[82]

This situation has created a number of challenges for the coast protection system, and continues to draw significantly on resources of the Coast Protection Board to manage. Case studies in Boxes 1 and 2 detail the issues in specific contexts, but generally the challenges for the coast protection system associated with the legacy of shack freeholding are:

- Addressing development of ad hoc, unauthorised protection works by shack owners that do not achieve whole of settlement protection, and in some cases exacerbate impacts;
- Addressing development of unauthorised protection works involving unauthorised (and therefore unregulated) occupation of Crown land;
- Conflict surrounding roles and responsibilities for planning, construction and maintenance of coast protection infrastructure in relation to not only legal responsibilities but capacity to meet those responsibilities;
- A complexity of regulatory processes and relevant legislation associated with establishment of coast protection infrastructure, particularly in relation to the ownership, care and control of land on which infrastructure is developed;

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[79] Government of South Australia 2012, p. 60.

[80] Broom, A, Hadji, G & Townsend, M, no date, *Coastal Protection Considerations; Rogues Point Case Study*

[81] Broom, Hadji & Townsend 2013 p. 14.

[82] Broom, Hadji & Townsend, 2013 p. 14.

- The substantial resources required to develop whole of settlement protection strategies that meet the requirements of the Coast Protection Board, and a lack of capacity amongst shack owners to meet these requirements despite their responsibilities under LMAs. This leads to pressures on both the Coast Protection Board and regional local governments with limited resources of their own to provide time, knowledge and financial support.
- Significant allocation of Coast Protection Board resources to facilitate integrated whole of settlement protection strategies. While the LMAs make shack owners responsible for protection works, the Board must approve the works. To achieve a protection strategy that is in accordance with the Board's policies currently requires the Board to invest in information provision, capacity building, and negotiation with shack owners, and engage in navigation of complex land tenure arrangements associated with construction of protection infrastructure.
- Long timeframes and high costs associated with all of these issues;
- The opportunity cost of the substantial resources involved in managing these issues, including the pursuit of sustainability outcomes with broad benefits, and proactive, strategic coastal adaptation planning.

Box 1: Pelican Point Case Study

Pelican Point in the southeast of the State in the area of the District Council of Grant is comprised of approximately 50 properties in a linear form adjacent the coast. Dwellings comprising the settlement were constructed on Crown land, but the land is now freehold and subject to a Land Management Agreement between property owners and the State Government. The properties are variously subject to extreme coastal erosion.

In 2012 three land owners constructed a rock sea wall to protect each of their dwellings. Each lodged retrospective development applications with the Council which and were refused at the direction of the Coast Protection Board on the basis that the work was ad hoc and did not form part of a fully engineered integrated settlement-wide coast protection strategy.

The Board indicated that all owners of property at risk should devise and implement a coordinated, engineered strategy for the whole settlement to the satisfaction of the Board, including resolution of licences and legal arrangements that may be required for works outside the freehold property boundaries (e.g. on adjacent Crown land).

On the Board's advice, Council took enforcement action against the three landowners, who subsequently appealed the action in the Environment, Resources and Development Court. Through conciliation, Council has agreed to attempt to facilitate an outcome that will be required to consider the multiple stakeholder interests, tenure negotiations, and roles and responsibilities for funding and implementation of protection works.

In this case the Board is attempting to fulfil its statutory responsibilities under the Coast Protection Act, land owners are unwilling to work together to achieve protection, and the Council are engaged in a significant long term role and commitment of resources to progress to an acceptable outcome.

Box 2: Fisherman's Bay Case Study

Fisherman's Bay is a township of approximately 400 dwellings north of Port Broughton in the District Council of Barunga West. The township was developed on a single holding owned by a private company, Fisherman's Bay Management Pty Ltd (FBM), who grant annual licences to dwelling occupants. For around a decade FBM has been seeking development approval for the division of the existing township to provide a separate allotment for each of the existing dwelling

Fisherman's Bay was identified in the 2009 Commonwealth Department of Climate Change Assessment as one of the most susceptible settlements in Australia to flooding risk from sea level rise, and the township has no coastal protection, storm water system nor modern waste disposal system. FBM's proposed land division would finance new public roads, upgraded services, and coast protection infrastructure.

The Development Assessment Commission placed assessment of the land division on hold subject to FBM constructing and maintaining a sea wall to the satisfaction of the Coats Protection Board. The subsequent proposed sea wall was sited primarily on Crown land, some of which is under the care and control of Council, as well as in part on FBM land. The seawall proposal raised significant issues relating to land tenure and responsibility for construction and future maintenance, with Council ultimately agreed to an infrastructure deed which would see it accept the vesting of and responsibility for the future maintenance of coast protection infrastructure for Fisherman's Bay, including the proposed sea wall. Having obtained planning consent, the seawall will now require approval under numerous other statutory processes relating to the Crown Land Management Act, Local Government Act Native Title Act and Native Vegetation Act. With resolution of these processes and the infrastructure deed, assessment of the land division application can resume.

This case highlights the significant complexity and volume of considerations in defending existing development that is the legacy of past decisions. While State Government agencies involved have generally worked well together and with Council, the project has and will continue to draw heavily on the resources of Council's resources which comprise an annual operating budget of $4.4million.

Key strengths and challenges for coastal management and adaptation

Key strengths

- Clear policy positions on new development and coastal protection works, and consistent objectives and strategies amongst various documents
- Strategies support integration with the land use planning system and local government
- The Coast Protection Board possesses significant data, knowledge and expertise in relation to coastal risks
- Membership of the Board represents various interests in the coastal zone

Key challenges

- Achievement of system objectives requires substantial engagement with various systems, stakeholders and governance structures that have different objectives (e.g. the planning system, land tenure arrangements)

- The need to manage the legacy of freehold shack settlements consumes significant resources and makes proactive coast protection activities more difficult to achieve
- Attempts to achieve system objectives through the planning system have met with varying success (refer Section 4.3.2)

4.3.2. Land use planning

Legislation

South Australia, like other Australian states, has utilised mechanisms within the existing planning system to give legal effect to policies associated with the coastal impacts of climate change.[83] This approach applies specifically to management of new development on the coast.

South Australia's planning system is governed by the *Development Act 1993*, under which the Planning Strategy and local Development Plans are prepared. The main elements of the planning system under the Act and Regulations are summarised in Figure 4.1.

The system is designed to facilitate consideration of a variety of relevant issues at strategic planning, policy development, and development assessment stages. Government agencies are consulted in the formulation of Planning Strategies (though this is not a statutory requirement), on the updating of Development Plans (under Sections 25 and 26 of the Act), and in certain instances on the determination of development applications under Schedule 8 of the Regulations.

Figure 4.2 shows how Coast Protection Board policy (refer Section 4.3.1 of this Issues Paper) can influence the planning system.

[83] Gibbs & Hill 2011.

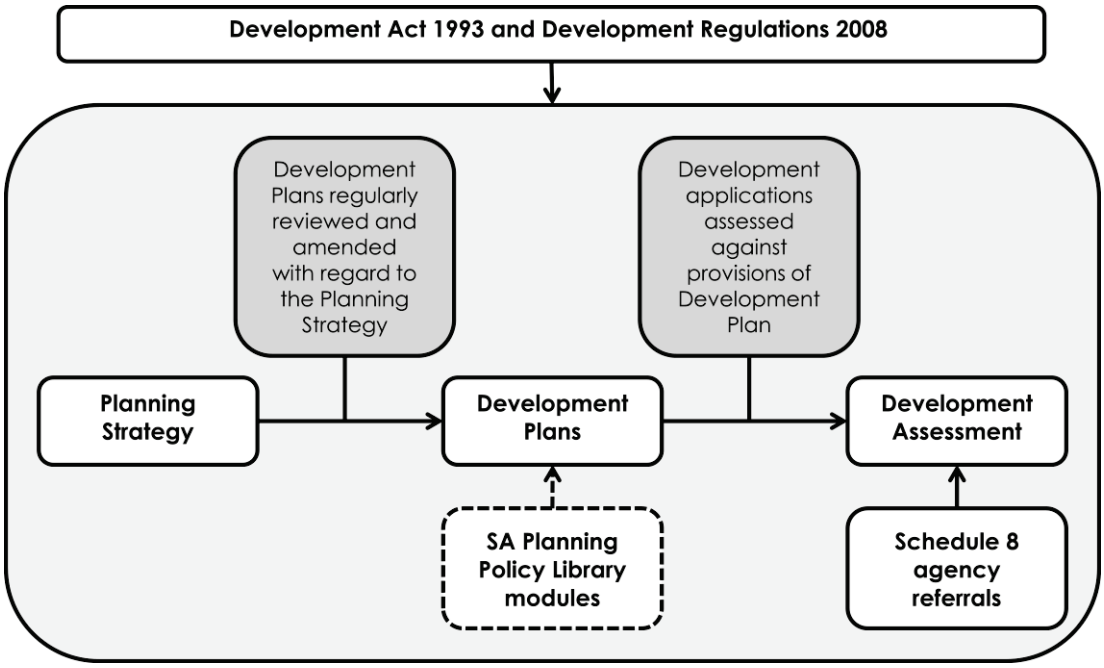

Figure 4.1: South Australia's planning system[84]

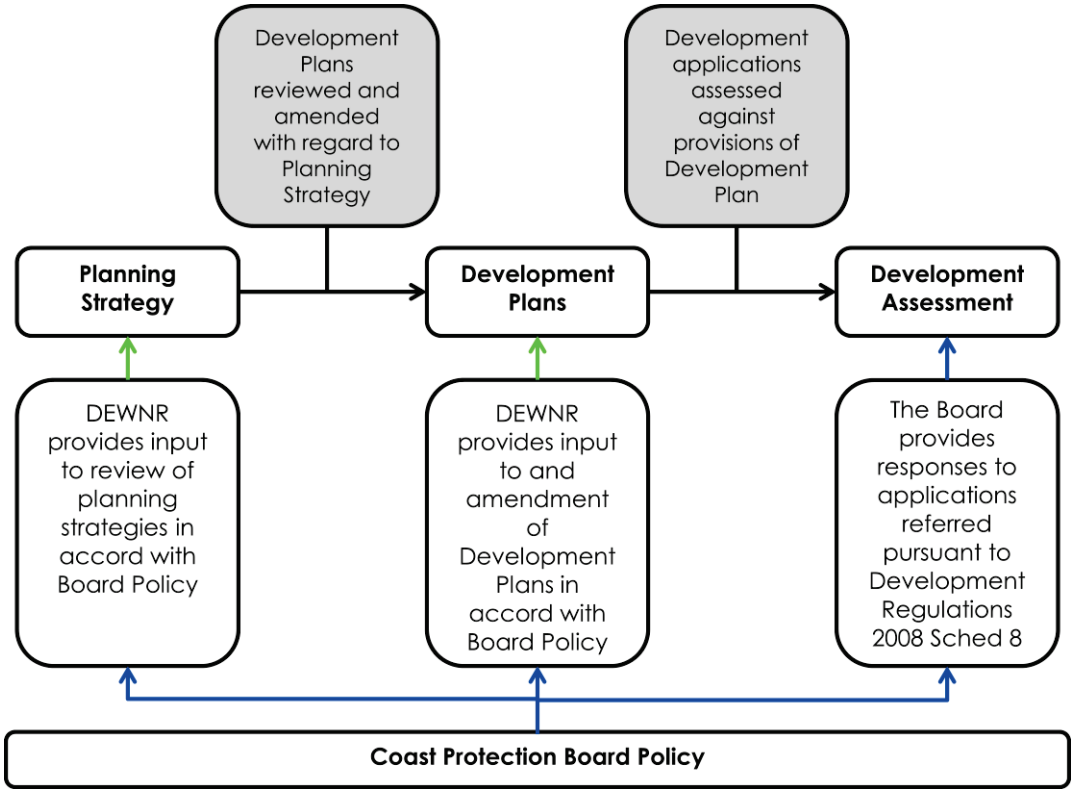

Figure 4.2: Coast Protection Board Policy and the planning system[85]

[84] Adapted from Coast Protection Board 2013, *Submission to Expert Panel for Think Design Deliver: South Australia's Planning Reform*, p. 5

Planning Strategy

The Planning Strategy sets out the State Government's vision for land use and future development in South Australia. Volumes of the Strategy are prepared for metropolitan Adelaide, the State's seven regions, and major regional centres. Under the Development Act, changes to Development Plans must be consistent with the current Planning Strategy.

Policies from selected current volumes of the Planning Strategy relating to coastal areas and coastal climate change adaptation are summarised in Table 4.5.

Table 4.5: Selected Planning Strategy coastal and climate adaptation change policies

30-Year Plan for Greater Adelaide 2010
Climate change - Policies – Adaptation 15 – Reduce the risk of damage from predicted sea level rise and associated storm surges and coastal erosion by continuing to incorporate adaptation measures (such as location, construction and design techniques) into relevant Development Plans based on the recommended sea level rise allowances adopted nu the South Australian Government from time to time 16 – Require new development and/or land divisions in areas at risk from predicted sea level rise to provide for protection and/or adaptation measures (such as appropriate sitting and construction techniques, seawalls and/or levee banks) 17 – Ensure critical infrastructure (such as hospitals, telecommunications and transport systems, and energy and water services) is protected from inundation from predicted sea level rise 18 – Sustain the marine and estuarine environment by providing, where appropriate, for the retreat of the beach, dune, mangrove and saltmarsh communities in response to predicted sea level rise and land subsidence **Emergency management and hazard avoidance – Policies** 4 – Integrate adaptation to climate change, disaster risk reduction and hazard avoidance policies, standards and actions into strategic plans, Development Plan policies and development assessment processes using best- practice models 5 – Minimise risk to people, property and the environment from exposure to hazards (including, ... flooding, erosion, dune drift and acid sulfate soils) by designing and planning for development in accordance with the following hierarchy: Avoidance – avoid permanent development in and adjacent to areas at significant risk from hazards unless it can be demonstrated that there is an overriding social, economic or environmental benefit Adaptation – design buildings and infrastructure to minimise long term risk Protection – undertake works to protect existing development or facilitate major new

[85] Adapted from Coast Protection Board 2013, p. 5

developments

Emergency management and hazard avoidance – Targets

A – Early adoption of emergency management and climate change national adaptation research plans and other hazard guidance and standards in land-use planning strategies and statutory plans

Infrastructure – Policies

10 – Continue to take measures to protect coastal development, maintain beach amenity, and manage stormwater discharges

Biodiversity – policies

8 – Protect coastal features and biodiversity by establishing coastal zones that incorporate high value/sensitive habitats, geological and natural features, and scenic landscapes

9 – Integrate into Development Plans coastal management requirements relating to the *Coast Protection Act 1972*, *Marine Parks Act 2007*, *Adelaide Dolphin Sanctuary Act 2005*, *Fisheries Management Act 2007*, *River Murray Act 2003*, and *Natural Resources Management Act 2004*

Greater Adelaide Open Space System – Policies

1 – Provide for a Greater Adelaide open space framework ... [including] coastal linear parks

Eyre and Western Region Plan 2012

Recognise, protect and restore the region's environmental assets - Coastal, estuarine and marine environments –Policies

1.7 – Avoid adverse impacts of development on the ecological health of coastal, estuarine and marine environments

1.8 - Protect coasts, dunes, estuaries and marine areas of conservation, landscape value and environmental significance by limiting development in these areas. In limited circumstances development may require such a location—such as development of state significance—in which case the social and economic benefits must be demonstrated to outweigh the adverse environmental and amenity impacts

Recognise, protect and restore the region's environmental assets – Scenic landscapes – Policies

1.17 - Manage development that may detract from significant landscapes that can be viewed from tourist routes, walking trails, the beach and/ or the sea to: protect views to, from, and along the ocean and scenic coastal areas; minimise the alteration of natural land forms; be visually compatible with the character of surrounding areas; restore and enhance visual quality in visually degraded areas where feasible

Protect people, property and the environment from exposure to hazards – Policies

2.1 – As for *30 Year Plan for Greater Adelaide* Emergency management and hazard avoidance policy 5

2.3 – As for *30 Year Plan for Greater Adelaide* Emergency management and hazard avoidance policy 4

2.8 – Identify and map coastal areas at risk of inundation due to sea level rise, storm surge, flooding and wave activity, and develop necessary management plans

Protect and strengthen the economic potential of the region's primary production land - Policies

5.5 - Avoid grazing and other rural activities on dune systems or other sensitive coastal areas where they are likely to damage native vegetation and/or create coastal erosion, increased sedimentation or pollution of coastal waters

Reinforce the region as a unique and diverse tourism destination – Policies

8.1 - Protect, enhance and promote the assets and activities that attract tourists and that are of value to the community, including ... coastal landscapes ... coastal dunes and beaches

8.3 - Ensure high-quality design of developments to protect scenic landscapes and productive coastal areas

Plan and manage township growth, and develop Structure Plans for key growth centres - Discussion

Coastal shack areas should be rationalised and not expanded to ensure people and property are not unduly exposed to hazards [Stated in the discussion but not expressed explicitly within the policies]

Yorke Peninsula Regional Land Use Framework 2007

Protect people, property and the environment from exposure to hazards – Strategies

3.1 – Similar in effect to *30 Year Plan for Greater Adelaide* Emergency management and hazard avoidance policy 5

3.2 - Plan development to prevent the creation of hazards - including through erosion ... disturbing or mobilising acid sulphate ... or impeding the flow of flood waters

Environmental and cultural assets – Areas of Focus

Establish and/or review Coastal Zones in Development Plans in conjunction with planning growth of coastal settlements - Edithburgh to Clinton; Wallaroo to Moonta/Port Hughes; Tickera to Port Broughton (also see Population and Settlements)

Incorporate information from environment studies (e.g. sea level variation including effects of climate change, landscape mapping, conservation assessments) to inform the review/development of 'Coastal Zones' in Development Plans

Environmental and cultural assets – Coastal, estuarine and marine environments – Strategies

1.4 - Establish Coastal Zones and manage development to: Minimise the impact of development and land uses, including cumulative impacts, on natural processes and systems; Limit development in areas of natural coasts of high conservation or landscape value unless the proposal has a neutral or beneficial effect (refer Eyre Peninsula Coastal Development

Strategy); Prevent disturbance of natural coastal habitats and native vegetation; Provide buffer areas of sufficient width to separate new development from; the foreshore and sensitive coastal features, accommodating long term physical coastal processes (i.e. that may result in the movement of the coastline)

1.5 - Developments such as marinas and port facilities should be considered as special cases which require specific and detailed studies, including environmental impact assessments

Environmental and cultural assets – Scenic Landscapes – Strategies

1.9 - Preserve areas of high landscape and amenity value and areas forming an attractive background or entrance to towns or tourist developments, and along the coast

1.10 - Prevent or design development to retain high quality landscapes that can be viewed from tourist routes, walking trails or the sea, including by addressing the location, height, material and colour of buildings

Economic Dev elopement – Reinforce Yorke Peninsula as a preferred coastal and nature-based tourist destination

13.1 - Protect, enhance and promote those qualities of the Region that attract tourists and are of value to the community, including: coastal landscapes, marine environment, foreshore, jetties and boat ramps; open space, trails networks, scenic tourist drives; natural and rural landscapes

Population and Settlements – Areas of Focus

Undertake master planning for settlements along the eastern coast of the peninsula and Port Broughton, to establish Coastal Zones and identify constraints, opportunities and future directions for growth

Population and Settlements - Strategically plan and manage township growth, with master planning for coastal areas a priority – Strategies

18.1 - Focus development in existing towns and settlements based on role and Function

18.2 - Base expansions of towns on clear and structured master planning that: ... prevents linear development along the coast ... in coastal settlements, retains public access to the coast, promotes strong linkages with the coast, and better defines 'coastal zones'

18.3 - Cluster activities along the coast in distinctive and compact coastal towns, and strongly discourage linear development

While the relationship between the Planning Strategy and Development Plans is clear in legislation, stakeholder engagement undertaken for the review of the planning system that is currently progressing[86] has identified that there is a need for greater clarity, and possible legislative clarity, around the relationship between the Planning Strategy and other government plans, for example the Climate Change Adaptation Framework for South Australia and Natural Resources Management Plans. Regional Councils in particular expressed the layering of policies being "complicated and onerous".[87]

Development Plans and South Australia's Planning Policy Library

Each local government area has a unique Development Plan, but all Development Plans must be consistent with the Planning Strategy. The Department for Planning Transport and Infrastructure (DPTI) maintains the South Australian Planning Policy Library (SAPPL), a good practice guide for councils to utilise in updating their Development Plans (refer Figure 4.1).

The current version of the SAPPL includes provisions applicable to Coast Areas in the General section – applicable across the entire council area, as well as 4 coastal zone modules at listed in Table 4.6.

Table 4.6: SAPPL Coastal Zones

Zone	Key objective	Envisaged development
Coastal Conservation	Enhancement and conservation of coastal visual amenity, landforms, flora and fauna	Conservation work, interpretive development, visitor facilities and nature based tourist accommodation in some locations
Coastal Marina	Provide for marina and maritime development	Marinas, and boating facilities and associated infrastructure, and activities, small tourists development, coastal protection works
Coastal Open Space	Passive outdoor recreation, open space, conservation, preservation of scenic coastal and foreshore character	Coastal protection works, conservation, facilities, associated with coastal recreation
Coastal Settlement	Protect the coast from inappropriate development, enhanced amenity and environmental performance of existing dwellings	Coastal protection works, detached dwellings and associated outbuildings, visitor facilities

[86] Think Design Deliver: South Australia's Expert Panel on Planning Reform, http://www.thinkdesigndeliver.sa.gov.au/

[87] South Australia's Expert Panel on Planning Reform 2013, *What we Have Heard So Far*, p. 43.

Box 3: Extract from South Australian Planning Policy Library Version 6 – General Section: Coastal Areas

Objective 5 - Development only undertaken on land which is not subject to or that can be protected from coastal hazards including inundation by storm tides or combined storm tides and stormwater, coastal erosion or sand drift, and probable sea level rise.

Objective 6 - Development that can accommodate anticipated changes in sea level due to natural subsidence and probable climate change during the first 100 years of the development.

Principles of Development Control

20 Development including associated roads and parking areas, other than minor structures unlikely to be adversely affected by flooding, should be protected from sea level rise by ensuring all of the following apply:

(a) site levels are at least 0.3 metres above the standard sea flood risk level

(b) building floor levels are at least 0.55 metres above the standard sea flood risk level

(c) there are practical measures available to protect the development against an additional sea level rise of 0.7 metres, plus an allowance to accommodate land subsidence until the year 2100 at the site.

25 Where a coastal reserve exists or is to be provided it should be increased in width by the amount of any required erosion buffer. The width of an erosion buffer should be based on the following:

(a) the susceptibility of the coast to erosion

(b) local coastal processes

(c) the effect of severe storm events

(d) the effect of a 0.3 metres sea level rise over the next 50 years on coastal processes and storms

(e) the availability of practical measures to protect the development from erosion caused by a further sea level rise of 0.7 metres per 50 years thereafter.

26 Development should not occur where essential services cannot be economically provided and maintained having regard to flood risk and sea level rise, or where emergency vehicle access would be prevented by a 1-in-100 year average return interval flood event, adjusted for 100 years of sea level rise.

There is no statutory requirement for councils to adopt the SAPPL format, or to maintain up to date versions of the SAPPL zone modules (the current version is Version 6). While the SAPPL is strongly encouraged by the State Government and nearly two thirds of councils have adopted the SAPPL format, few councils are up to date with all of the most recent zone modules, because each update requires a full Development Plan Amendment process under the Development Act.[88] Addressing this issue has been identified as a priority by the LGA and will be the subject of an upcoming LGA project.

[88] South Australia's Expert Panel on Planning Reform 2013, p. 56.

Coastal provisions based on the Coast Protection Board's 1991 Policy were incorporated into all Development Plans in the state in 1994 via a Ministerial Development Plan Amendment which is both compulsory and the same for all councils. The policies have been maintained right through to the current SAPPL policy, extracts of which are shown in Box 3. The policies relating to protection against projected sea level rise were recently upheld in an appeal in the South Australian Supreme Court. [89]

Given that one third of Development Plans are not in SAPPL format and many more are at varying stages of currency in their modules, there is an argument that for maximum consistency, future changes to provisions relating to coastal zone management and sea level rise adaptation should be applied via another Ministerial DPA. However, the varying conditions along the state's coasts means that depending on the content of the policy, local differentiation may be more appropriate. The right approach is likely to depend on the nature of the policies being proposed, and what form they would take within the Development Plan – i.e. General provisions applicable to all coastal land, Coastal Zones, localised Policy Areas, or overlays.

In its submission to the review of South Australia's planning system, the Coast Protection Board expressed the view that Development Plans do not currently include all coastal features and risks within appropriate Coastal Zones. A 2010 audit showed that approximately 38% of areas identified as coastal flooding, erosion and acid sulfate soils are outside of Coastal Zones. The mapping does not consider sea level rise, but sea level rise increases the coastal flooding and erosion risk (see Section 2.0 of this Issues Paper).[90]

The Board identified impacts of the exclusion of land subject to coastal risks or containing sensitive coastal features from Coastal Zones to include:

- Approval of inappropriate development in locations subject to coastal risks, with ensuing remedial action required at a cost to land owners, governments, and the community;
- Negative impacts on sensitive coastal features such as dunes and saltmarsh;
- Determination of applications without the benefit of specialist coastal advice from the Board (i.e. no referral is triggered under Schedule 8 of the Regulations); and
- Differing policies and levels of protection in different jurisdictions amongst coastal areas with similar qualities or risks.[91]

The Board also identified recent examples where rezoning has occurred that is inappropriate in the context of existing coastal risks, and/or has not adequately considered coastal risks, specifically:

[89] Good 2011, p. 21.
[90] Coast Protection Board 2013, pp. 8-9.
[91] Coast Protection Board 2013, p. 9.

- At Sims Cove on the Yorke Peninsula where a Draft Development Plan Amendment currently proposes land adjacent eroding cliffs within a Residential Zone; and
- At Smoky Bay south of Ceduna where in 2008 land at risk of coastal erosion was rezoned from Urban Coastal to Residential without the risk being adequately addressed.[92]

Development assessment

Local governments, and the State government in some instances, are responsible for determining applications for new development with reference to the Development Plan and the *Development Regulations 2008*.

Analysis of coastal climate change risk management planning policies nationally has found that "in most jurisdictions there is little guidance as to the relative weight that should be given [to the policies]".[93] Within the South Australian Planning system, a number of mechanisms give guidance to assessing planners as to the potential weight of particular issues. These include the wording of policy provisions, the presence of overlays and Policy Areas within Zones in Development Plans, and referrals to specialist agencies for their input where applications meet specified criteria under Schedule 8 of the *Regulations*.

Under Schedule 8, a referral to the Coast Protection Board is triggered when proposed development is situated on "coastal land" defined as:

(a) land situated in a zone or area defined in the relevant Development Plan where the name of the zone or area includes the word "Coast" or "Coastal", or which indicates or suggests in some other way that the zone or area is situated on the coast;

(b) if paragraph (a) does not apply -

i. land that is situated in an area that, in the opinion of the relevant authority, comprises a township or an urban area and that is within 100 metres of the coast measured mean high water mark on the sea shore at spring tide; or

ii. land that is situated in an area that, in the opinion of the relevant authority, comprises rural land and that is within 500 metres landward of the coast from mean high water mark on the sea shore at spring tide,

if there is no zone or area of a kind referred to in paragraph (a) between the land and the coast;

(c) an area 3 nautical miles seaward of mean high water mark on the sea shore at spring tide;

[92] Coast Protection Board 2013, Attachment 6.

[93] Gibbs & Hill 2011, p.1.

The Coast Protection Board's role in determination of an application involving coastal land under the planning legislation is described in Figure 4.3. In the case of development applications involving coastal protection works or fill or excavation over nine cubic metres, the Board directs the planning authority in their determination of an application. In other development applications on the coast, the planning authority must have regard to the Board's advice as part of an on balance planning decision. The significant majority of development applications (approximately 85%) are referred to the Coast Protection Board for advice, rather than for direction.[94]

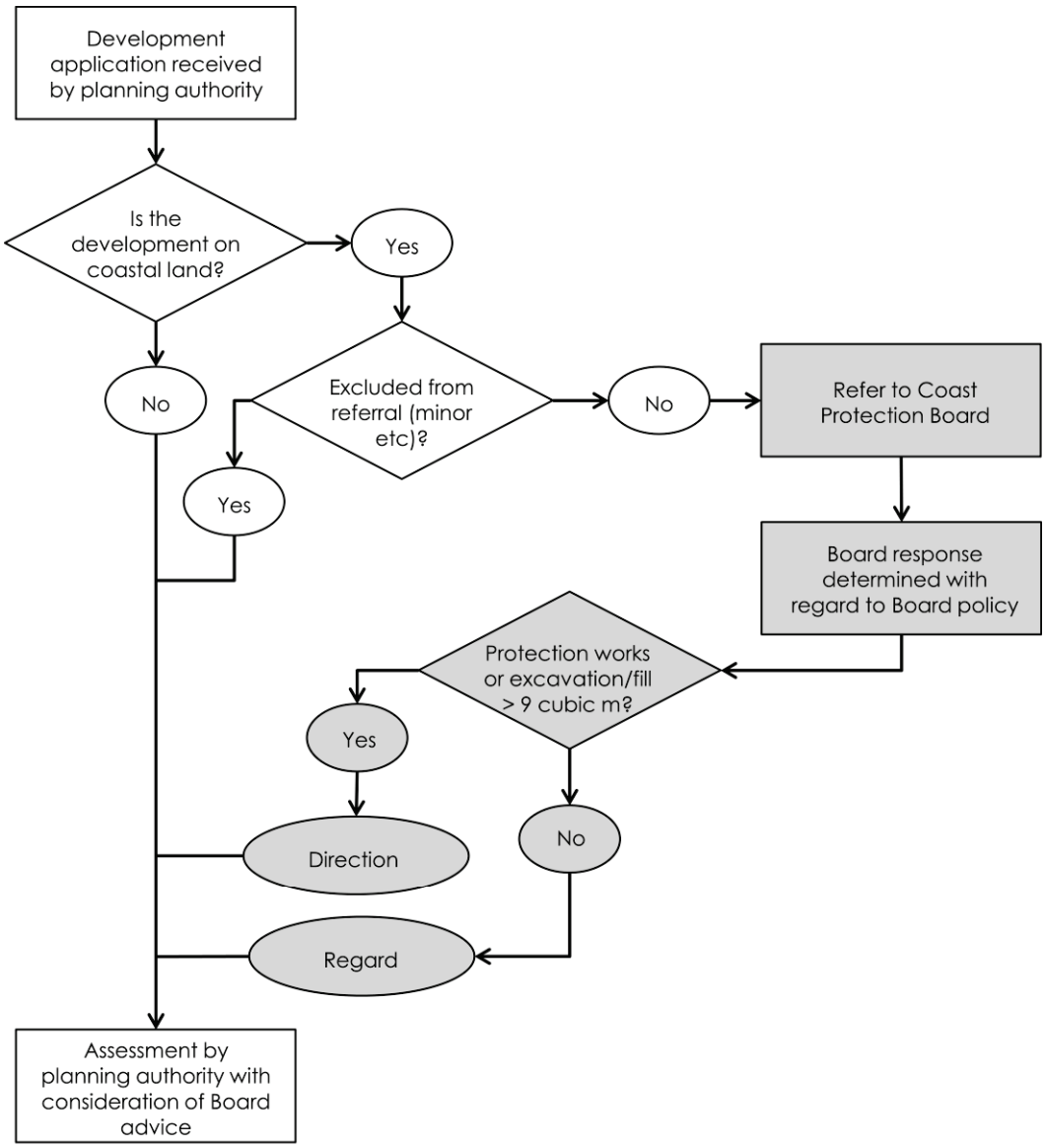

Figure 4.3: Coast Protection Board role in development assessment[95]

[94] Coast Protection Board 2013, Attachment 3.

[95] Adapted from Coast Protection Board 2013, Attachment 5.

In its 2013 submission to South Australia's Expert Panel on Planning Reform, the Board expressed concern at "the number of development applications that are approved at odds with its advice on coastal hazards".[96]

Recent audits by the Coast Protection Board show that amongst development applications where the planning authority must have regard to advice of the Coast Protection Board, there is a trend toward applications being approved contrary to Board advice: "between 10% and 18% of decisions are not in accord with the Board's advice, with more than half of these involving advice on coastal hazards".[97]Data presented in that submission shows that between 2006 and 2012, the Board advised refusal of between 10% and 19% of all applications referred for their advice.

The most recent audit of adoption of Board advice in the determination of applications by the relevant authority showed that between 2004 and 2010, 14% of the applications for which the planning authority required to have regard for the Board's advice, were approved at odds with that advice. Of that 14%, the significant majority were applications for dwellings and land division, resulting in 250 individual dwellings and 120 additional allotments approved contrary to the Board's coastal hazard policy.[98] No summary or analysis of these planning decisions is provided in addition to the fact that they were at odds with Board advice. Analysis of the planning assessment reports for each application would clarify the reasoning applied in each case, and the weight given to the Board's advice in the context of all planning issues and policy provisions considered in the assessment. It would be useful to understand any geographic trends within these decisions, and whether the decisions were made by councils' Development Assessment Panels or under delegation by planning staff. [99]

South Australia's Draft Climate Change Adaptation Framework stated that "Consistent with the Living Coast Strategy (2004) the Government is pursuing improved coastal zoning in development plans and increased powers of direction for the Coast Protection Board over applications for development subject to unaddressed coastal hazards".[100] The coastal management section of the final version of the Framework does not include this statement[101], however the Board's desire to have increased powers to control development potentially subject to coastal risks remains evident in their more recent Strategic Plan 2009-2014.

In its submission to the planning review the Board also identified current provisions within the Development Act and Regulations that have the effect of some development on coastal land being potentially exempt from referral in locations where land is subject to unaddressed coastal risks. The Board sought review and

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[96] Coast Protection Board 2013, p. 3.

[97] Good 2011, p. 21.

[98] Coast Protection Board 2013, pp. 10-11.

[99] Under Section 56A of the Development Act each council must establish a Development Assessment Panel that has responsibility for determining development applications delegated to it by the council, and in accordance with any policies of that council relating to delegations. Panels consist of elected members of council and council staff, and independent members with appropriate qualifications.

[100] Government of South Australia 2010, *Prospering in a Changing Climate, A Draft Climate Change Adaptation Framework for South Australia – Draft for Community Consultation*, p. 35.

[101] Government of South Australia 2012, p. 35

amendment of these provisions, and also noted that recent changes to the Regulations had not given due consideration to the impacts on coastal development control.[102]

Under section 33 of the *Development Act*, development approval involves favourable assessment against the building rules as well as the Development Plan. The Building Code of Australia (BCA) is a nationally consistent, performance based technical standard that can be applied by councils or private certifiers to grant building rules consent.

The BCA has been considered as a mechanism to support climate change adaptation, including to sea level rise, with the Australian Building Codes Board (ABCA) recommending in 2010 that the adequacy of BCA provisions relating to structural capacity and height of floors be reviewed for adequacy. ABCA also noted the role of the planning system in applying zoning that accounts for expected sea level rise, noting that where buildings are located in areas affected by sea level rise, "any building measures relating to structural adequacy, selection of appropriate water resistant materials, location of services etc. should be located in the BCA not in planning instruments".[103]

The Productivity Commission's inquiry into barriers to effective climate change adaptation identified aligning building and planning standards in their approach to managing environmental risks as a priority for reform. The Commission cited duplication and gaps between planning and building regulation as problems, as well as reliance on out of date information, noting these issues are under consideration in work arising from the National Strategy for Disaster Resilience.[104]

Key strengths and challenges for coastal management and adaptation

Key strengths

- The integrated nature of the system facilitates consideration of a range of issues in strategic planning and development assessment, and numerous tools are available through the Development Plan and Regulations to effect policy outcomes (provisions at whole of Council area, zone and policy area levels, overlays, and referrals to specialist agencies)
- Coastal management and sea level rise considerations are identified at Planning Strategy, Development Plan, and development assessment stages (through referral to the Coast Protection Board)
- Strong policy guidance for addressing sea level rise is present in the Planning Strategy, SAPPL modules, and General provisions of all Development Plans through the 1994 Ministerial amendment that incorporated Coast Protection Board policies

[102] Coast Protection Board 2013, pp. 13 & 16.
[103] Australian Building Codes Board 2010, *Investigation of Possible BCA Adaptation Measures for Climate Change*.
[104] Productivity Commission 2012, p. 20.

Key challenges

- Coast Protection Board advice being fed into the land use planning system via Schedule 8 of the Development Regulations is not being implemented in all cases, including where advice relates to coastal risks
- Development Plan policies that apply to areas containing coastal risks and sensitive coastal features are not consistent across the state due to different Development Plan formats (including pre-SAPPL and various SAPPL versions), and in some cases deliberate rezoning decisions
- Interaction between the Planning Strategy and other State strategic documents (e.g. the Climate Change Adaptation Framework) is not clear
- The Development Regulations allow some development applications in locations subject to coastal risks to be exempt from a sufficient assessment process
- Application of policy in decision making relies heavily on planners' capacity to integrate a range of relevant information into a decision making process, and interpret that information to apply the policy. This can be considered as a strength of the system in its ability to be non-prescriptive and make on balance decisions, as well as being a challenge

4.3.3. Climate change adaptation

Legislation

The *Climate Change and Greenhouse Emissions Reduction Act 2007* requires the Minister to develop policies that promote or implement adaptation to climate change impacts. This requirement is currently addressed by the Climate Change Adaptation Framework for South Australia.

Under Section 16 of the Act, the Minister can enter into voluntary agreements with individuals, companies, or groups to pursue targets set under the Act, including its objectives for adaptation. These agreements are the basis on which Climate Change Adaptation Plans are prepared.

Adaptation Framework

Prospering in a Changing Climate: A Climate Change Adaptation Framework for South Australia provides the basis for delivering "cohesive and coordinated responses to a changing climate[105]" in South Australia, and for guiding "action by business, the community, non-government organisations, the research sector, local governments and state government agencies to develop well-informed and timely adaptation responses"[106].

The Adaptation Framework is underpinned by guiding principles and four objectives and identifies the need for State Government, local government, business, non-

[105] Government of South Australia 2012, p. 5.
[106] Government of South Australia 2012, p. 5.

government organisations, the research sector and communities to work together to achieve these objectives.

The Adaptation Framework's objectives comprise:

- Leadership and strategic direction for building a more resilient state;
- Policy responses founded on the best scientific knowledge;
- Resilient, well-functioning natural systems and sustainable, productive landscapes; and
- Resilient, healthy and prosperous communities.

The Adaptation Framework provides for adaptation planning to occur on a regional basis to ensure that "future adaptation strategies take into account the knowledge of local communities and the differing circumstances and impacts in each region", and to utilise regional leaders to address social, economic and environmental drivers at the local level in the formulation of adaptation responses.[107] Other identified benefits of a regional approach to adaptation include the ability of local governments to share resources while achieving consistent adaptation responses between their areas, and the opportunity for knowledge sharing and capacity building between different Councils' staff – a particular benefit for smaller local governments.[108]

For many of these regions, these adaptation planning processes are underpinned by sector agreements between various parties (e.g. between Local Governments and/or Local Government Associations, Regional Development Australia, Natural Resources Management Boards and the State Government). These sector agreements provide the basis for commitment by the partners to develop climate change adaptation plans that will assess risks and identify adaptation options associated with climate change. Assessing and identifying adaptation responses to sea level rise and coastal inundation form part of this adaptation planning process for those regions with coastal areas.

In preparing a regional adaptation plan the Adaptation Framework advocates the completion of an integrated vulnerability assessment (IVA). The IVA provides a process for understanding and assessing "not only the potential impacts of climate change on regional economies, communities and natural environments but also their capacity to adapt to the changes, and the interconnections between the sectors."[109] Through understanding those sectors or systems that are most vulnerable "appropriate adaptive responses can be planned, prioritised and programmed into investment strategies."[110]

To assist regions to undertake an IVA, the Local Government Association in partnership with the State Government has prepared the *Guidelines for Undertaking an Integrated Climate Change Vulnerability Assessment as Part of Developing an*

[107] Government of South Australia 2012, p. 56.
[108] Gurran, Hamin & Norman 2008, p. 58.
[109] Gurran, Hamin & Norman 2008, p. 27.
[110] Gurran, Hamin & Norman 2008, p. 27.

Adaptation Plan[111]. These Guidelines set out a process for identifying and assessing sectors or systems in terms of their likely exposure to the impacts of climate change, their sensitivity to those changes and level of adaptive capacity. In this way, the vulnerability (or otherwise) of different sectors or systems can be determined. Figure 4.4 summarises this relationship.

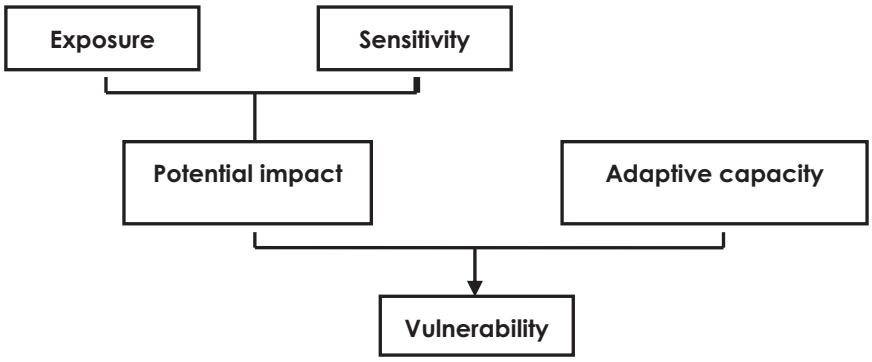

Figure 4.4: Relationship between climate change exposure, sensitivity, adaptive capacity and vulnerability[112]

Assessing vulnerability to sea level rise and coastal inundation and identifying adaptation responses form part of this adaptation planning process for those regions with coastal areas.

In South Australia two regional Adaptation Plans have been completed to date (for the Yorke and Mid North region and the Eyre and Western Region) with a number of others underway in the Southern Adelaide, Western Adelaide, Adelaide Hills, Fleurieu and Kangaroo Island, South Australian Murray Darling Basin and Barossa regions. Table 4.7 summarises the current status of adaptation planning across the regions.

Table 4.7: Current status of regional adaptation planning in South Australia

Region	Current status
Yorke and Mid North	Adaptation Plan released 8 October 2013 Implementing target projects
Northern Adelaide	Negotiations underway for DEWNR grant funding to assist in the commencement the adaptation planning process
Western Adelaide	Estimated completion date of Adaptation Plan is July 2014
Adelaide Hills, Fleurieu and Kangaroo Island (two regions)	Regional profile - Stage 1 of adaptation planning process – currently underway

[111] The Local Government Association is currently in the process of reviewing and updating these Guidelines.

[112] The Allen Consulting Group 2005, *Climate change risk and vulnerability: promoting an efficient adaptation response in Australia*, Australian Government, Canberra.

Region	Current status
Murray and Mallee	IVA underway
Eyre and Western	Adaptation Plan released 13 February 2014
Barossa	Estimated completion date of Adaptation Plan is June 2014
Eastern Adelaide	Negotiations underway for DEWNR grant funding to assist in the commencement the adaptation planning process
Southern Adelaide	Estimated completion date of Adaptation Plan is August 2014
Limestone Coast	Undertaking planning discussions to consider linkages with NRM planning for climate change processes.
Far North	Negotiations underway for DEWNR grant funding to assist in the commencement the adaptation planning process.

For the IVA undertaken as part of Yorke and Mid North Regional Climate Change Action Plan, coastal ecosystems and activities adjoining or dependent on the coast such as urban development or tourism were identified as being vulnerable to sea level rise and coastal inundation. This vulnerability is reflected in the Yorke and Mid North Regional Climate Change Action Plan which identifies the need to undertake coastal digital elevation modelling as one of three priority projects for the region. It is anticipated that this modelling once completed will provide a "comprehensive basis to understand sea level rise and storm surge impacts on our communities, industries and environment."[113]

This priority project stems from key adaptation actions identified by the Yorke and Mid North Regional Climate Change Action Plan including:

- Extend Digital Elevation Modelling of the coast to inform regional planning strategies and asset risk assessments; and
- Identify climate change risks within the regional planning strategies and provide adaptation policies on land for food production, bushfire protection areas, coastal protection, biodiversity buffers and transition zones, community development and emergency management.[114]

Given that many Adaptation Plans are still being completed or are in the early stages of implementation, a clear understanding of the role regional adaptation plans will play in managing sea level rise across the State is still emerging.

That said, it is known that the Western Adelaide region which will soon commence the second stage of its adaptation planning process, and will be seeking detailed

[113] Central Local Government Region of South Australia, Regional Development Australia Yorke and Mid North, & Northern and Yorke Natural Resources Management Boards, no date, *Yorke and Mid North Regional Climate Change Action Plan-Summary*, p. 4.

[114] Central Local Government Region of South Australia, Regional Development Australia Yorke and Mid North, & Northern and Yorke Natural Resources Management Boards, p. 4.

sea level rise and storm surge inundation modelling for the region and investigations into the governance regarding management of the coast as part of that task.

The Eyre Peninsula Regional Climate Adaptation Plan has similarly identified sea level rise as a key issue for coastal communities in its region, along with the need for local government in particular to consider how it will manage impacts into the future on existing and future development.

The Eyre Peninsula adaptation planning process has utilised an adaptation pathways approach (refer Section 3.2) and as such has considered what decisions will/could be made today that will have long term consequences, and how these decisions may relate to projected climate impacts. This approach is particularly illuminating for sea level rise impacts where long term consideration is required. For the Eyre Peninsula, the need to prevent development occurring in areas vulnerable to sea level rise, as well as determining adaptation responses in relation to existing development is a priority identified by the regional adaptation plan that requires more detailed consideration and planning by local government.

The Adaptation Framework draws on the twelve "adaptation sectors"[115] identified at a national level, of which coastal management is one. For each of the adaptation sectors identified, more detailed issues and opportunities associated with climate change are described. In relation to coastal management, the Adaptation Framework identifies a range of impacts for the coast associated with sea level rise, increased coastal flooding, storm surges, coastline erosion, reduced sediment production through ocean acidification and aridification. Opportunities identified by the Adaptation Framework for the coast include:

- Maintaining SA's leading role in coastal policy development and application, and further developing the state's expertise in climate change adaptation;
- Integrating coastal adaptation policy and measures across sectors, particularly with emergency management and the state's planning system, to secure new settlements from foreseeable sea level rise and other coastal impacts of climate change, and guide the adaptation of existing communities to the impacts of climate change;
- Strategically allocating land adjacent to the coast to allow sea level rise-induced retreat of tide-dependent ecosystems (e.g. mangroves and saltmarsh); and
- Regulating coastal dredging and discharges.[116]

The Adaptation Framework articulates a key role for various state government departments in coordinating, supporting, and participating in adaptation planning (refer Table 4.8).

In addition, the Adaptation Framework identifies that the government will aggregate the outcomes from the regional IVAs to identify overlapping issues and concerns of

[115] Central Local Government Region of South Australia, Regional Development Australia Yorke and Mid North, & Northern and Yorke Natural Resources Management Boards, no date, p. 30.
[116] Central Local Government Region of South Australia, Regional Development Australia Yorke and Mid North, & Northern and Yorke Natural Resources Management Boards, no date, p. 35.

state-wide significance, which will help inform the development of the State Government's own adaptation planning responses.

Table 4.8: Key roles for State Government departments in adaptation planning[117]

Organisation n	Major Role
Department of Environment, Water and Natural Resources, Sustainability and Climate Change Branch	Coordinating adaptation responses across state government Coordinating development of regional agreements Coordinating implementation of the Framework, preparing budget submissions, overseeing regional governance arrangements and developing regional strategies and plans
Other State Government agencies	Either leading or partnering in the implementation of state-wide actions Working with regional partners and sectors to develop and implement regional IVAs Working with regional partners and sectors to develop regional adaptation plans Working with sectoral partners to address key themes Developing chief executive-level agreements on implementation actions
Coast Protection Board	Maintaining and updating policies to guide sustainable development and biodiversity conservation on the coast Providing guidance to planning authorities and other organisations on coastal development and land use Working with regional partners and sectors to develop regional IVAs Working with regional partners and sectors to develop and implement regional adaptation plans

The Adaptation Framework as its title suggests is focussed on the successful implementation of adaptation planning on a regional scale in South Australia. It identifies that the successful implementation of this approach "will depend upon:

- Effective membership on steering committees;
- Regions engaging with peak bodies, government agencies and business to ensure that regional adaptation plans consider the needs of, and impacts on, sectors relevant to the regional economy;
- The various business and community sectors developing adaptation responses consistent with regional adaptation plans regions working together to develop adaptation responses, particularly to minimise duplication of effort and address issues that cut across more than one region;
- Regions learning from one another and building on these lessons; and

[117] Central Local Government Region of South Australia, Regional Development Australia Yorke and Mid North, & Northern and Yorke Natural Resources Management Boards, no date, p. 60.

- Governments, business and peak bodies influencing and learning from regional findings and decisions."[118]

The Adaptation Framework does not however, provide guidance on the transition from adaptation planning to implementation of actions.

Decision tools

Coastal Adaptation Decision Support Pathways[119]

In 2012 the LGA undertook the Coastal Adaptation Decision Support Pathways Project support councils to understand the effects of coastal inundation and erosion on their assets, and identify decision pathways to guide adaptation. The project produced a decision map and financial simulation model to guide councils through a process of determining costs and liabilities associated with climate change impacts on coastal assets, and vaulting costs associated with implementing different adaptation options. For this project, "assets" related to both infrastructure and development on the coast in public and private ownership.

Development of the decision map identified the key problems faced by councils in coastal adaptation are not only the physical impacts of inundation and erosion, but also issues of legal liability associated with adaptation action or inaction, the role of politics in decision making, and scarcity of resources with which to implement adaptation policies. The decision map developed with appreciation of this context involves 6 steps:

- Analyse the climate impact – including considering site conditions and selecting a future scenario to plan for;
- Analyse existing protection structures and strategies – including history and performance of existing structures, and adequacy in relation to future impacts;
- Establish the profile of the assets at risk – quantify assets in both private ownership and public ownership by all levels of government;
- Determine council liability – both legal and political;
- Determine monetary value of assets at risk – through site inspections and valuation information; and
- Analyse actions – on the basis of upfront and ongoing costs for various adaptation options.

The decision map and financial model were piloted by 2 South Australian councils, with key findings from the trials including that:

- The decision map proved useful indentifying key decision points and their implications;

[118] Central Local Government Region of South Australia, Regional Development Australia Yorke and Mid North, & Northern and Yorke Natural Resources Management Boards, no date, p. 57.
[119] Balston, Kellett, Wells, Li, Gray & Western 2012.

- Legal advice on council liability is central to accurately costing adaptation strategies;
- Technical data required to input into the decision map are numerous, and will require specialist expertise for example by climatologists and coastal engineers;
- Accuracy of data inputs to the model such as flood modelling is critical to accurately identifying costs and policy options; and
- Councils should beware of simply taking the least cost solution as the preferred option, and assessment of costs should be accompanied by more integrated multi-criteria assessment to reflect the complex social, environmental and economic value of coastal areas.

Resilient Coastal Communities – A Pilot Study: Preparing for Sea Level Rise in the Upper Spencer Gulf[120]

The Resilient Coastal Communities project was initiated by the Eyre Peninsula Natural Resources Management Board under the Eyre Peninsula Regional Sector Agreement which proposes a cooperative approach to responding to the impacts and opportunities of climate change. The purpose of this pilot study was to better understand how to engage with communities across the peninsula about climate change related issues, while at the same time developing tools that can assist community members to participate in decision making. The emphasis of the project was on gathering information to inform the facilitation of broad community participation in planning for climate change.

Three key tools were developed to assist community members to consider the possible impacts and opportunities of climate change, identify and assess options for response and determine a preferred approach. These were:

- A values assessment matrix - Provides guidelines or criteria against which options can be assessed or filtered in order to identify preferred options, and provides a structured process for making a first pass assessment of options;
- A checklist and associated worksheet - Provides prompts or triggers for the collection and consideration of information to assist with identification of adaptation options relating to climate change, and provides structured format for collation and documentation of information; and
- Sea level rise and storm surge mapping for 2030, 2070 and 2100 for the City of Whyalla coastline - Provides understanding of possible, projected elevations of storm surge and mean sea level into the future

The tools were developed and piloted with strong community involvement via local "project champions". Key learnings from this engagement for adaptation planning included that:

[120] URPS in association with SKM, Dr Mark Siebentritt, SGS Economics and Planning, Bell Planning & Norman Waterhouse Lawyers 2012, *Resilient Coast Communities – A Pilot Study: Preparing for Sea Level Rise in the Upper Spencer Gulf*, prepared for the Eyre Peninsula Natural Resources Management Board.

- The provision of "evidence" of projected changes that might occur as a result of climate change was an important tool for communicating with community stakeholders. Mapping was considered a useful tool for initiating discussion;
- Choice of language and framing of issues are important to engaging with the community in a constructive way;
- Decision making tools that incorporate community values provide a strong basis for balanced decisions and community supported outcomes; and
- Information about climate change should be broadly disseminated in the community, but with appropriate context and explanation.

Key strengths and challenges for coastal management and adaptation

Key strengths

- The State Adaptation Framework provides strong guidance as to how to progress regional adaptation, and empowers regions to deliver adaptation
- Tools to assist with implementation of adaptation planning have been developed, for example the *Integrated Vulnerability Assessment and Adaptation Planning Guide*
- The State Adaptation Framework reflects the complexity of stakeholders and interests that must be involved in effective adaptation, and this has particular relevance to the coastal environment and objectives of ICZM (refer Section 3.1)
- The adaptation planning process provides a direct mechanism for progressing sea level rise management and adaptation

Key challenges

- Most regions are in planning or pre-planning stage and little implementation and evaluation of adaptation actions has occurred
- The State Adaptation Framework does not provide specific guidance on how to transition from planning to implementation of adaptation actions
- Sea level rise is one of numerous impacts of climate change to be considered and addressed in an adaptation plan, and may not take primary focus where a range of impacts will be experienced sooner than the impacts of sea level rise
- The integrated nature of adaptation under the State Framework is closely links it's implementation with other systems and planning processes, causing coordination to be potentially unwieldy and slow
- Responsibilities for actions arising from regional adaptation planning will be voluntary and are undefined, and in this could be a barrier to implementation

4.3.4. Natural resources management

Legislation

The objects of the *Natural Resources Management Act 2004* (NRM Act) are to promote sustainable and integrated management of the State's natural resources, and make provision for the protection of the State's natural resources.

Under the NRM Act, the Natural Resources Council and the regional natural resources management (NRM) Boards have legislative responsibility to plan for the management of natural resources in a holistic integrated way for the whole state for all aspects of NRM.

This legislative responsibility includes planning for coastal, estuarine and marine environments and each NRM Board in developing its Regional NRM Plans must plan in an integrated way both for the land and for the seas out to the State water limits (at least 3 nautical miles).

Policies and plans

The State NRM Plan is prepared by the NRM Council and provides the overarching framework for NRM in South Australia.

The preparation of the State NRM Plan must take into account the provisions of the Planning Strategy and may identify changes (if any) considered by the NRM Council to be desirable to the Planning Strategy (section 74(4)). This integration of NRM with other legislation is a key feature of the NRM Act, reflecting the desire to achieve better integration between NRM and the delivery of other legislation such as the Development Act.

Regional NRM Plans prepared by the eight NRM regions must be consistent with the State NRM Plan and provide more detailed and specific strategies regarding the management of NRM for their region. Similar to the State NRM Plan, in preparing Regional NRM Plans, Boards must:

> *75 (f) identify any policies reflected in a Development Plan under the Development Act 1993 that applies within its region that should, in the opinion of the board, be reviewed under that Act in order to promote the objects of this Act or to improve the relationship between the policies in the Development Plan and the policies reflected in the board's plan; and*
>
> *(fa) identify the changes (if any) considered by the board to be necessary or desirable to any other statutory instrument, plan or policy (including subordinate legislation) to promote the objects of this Act and, insofar as the plan may apply within a part of the Murray-Darling Basin, the objects of the River Murray Act 2003 and the Objectives for a Healthy River Murray under that Act; and*
>
> *(g) identify the changes (if any) considered by the board to be necessary or desirable to—*
>
> > *(i) any activity or practice of another person or body; or*

(ii) the manner in which, or the means by which, any other person or body performs any function or exercises any power, to further the objects of this Act

In preparing Regional NRM Plans, the NRM Act requires that they

S75 (5) should, as far as practicable, be consistent with—

(a) any relevant management plan under the Coast Protection Act 1972

(b)any relevant Development Plan under the Development Act 1993 (subject to any proposal to amend such a plan)

As demonstrated by the excerpts above, the NRM Act contemplates and articulates a role for NRM Boards in identifying changes to policy, plans and strategies that reside with other agencies, organisations or stakeholders and influence NRM actions that can be delivered through the delivery of other Acts.

A number of projects have been undertaken by the former Catchment Water Management Boards and NRM Boards in South Australia which have involved the review of council development plan policy in relation to catchment water management and natural resources management. These projects include:

- Water Catchment Regional Plan Amendment Report (now referred to as Development Plan Amendment) prepared by the Northern Adelaide and Barossa Catchment Board. This project involved developing water resources related policies for inclusion in the five council development plans for Northern Adelaide and Barossa. Water quality and quantity management polices developed by this project were eventually introduced to council development plans via the Northern Adelaide and Barossa Catchment Water Management Development Plan Amendment (DPA) in 2003.
- Water Catchment Regional Plan Amendment Report prepared by the Onkaparinga Catchment Water Management Board. This project involved identification of relevant polices and their introduction into participating Council's Development Plans.
- Review of constituent council development plan policy as a component of preparing regional NRM Plans[121]

There has also been the initiation of planning policy review projects such as the Environmental/Natural Resources Management/ Sustainability Gaps, Constraints and Opportunities Discussion Paper initiated by DEWNR. This Discussion Paper identified a range of recommended changes to planning policy associated with conservation, native vegetation protection, natural resources management, sustainability and climate change perspectives. A recommendation of this project was that in relation to climate change, relevant modules of the SAPPL be reviewed to ensure that those

[121] URPS 2007, *Adelaide & Mt Lofty Ranges NRMB: Review of Strategies, Plans & Policies*, prepared for the Adelaide and Mt Lofty Ranges Natural Resources Management Board; URPS 2008, *Review of Council Development Plans and Relevant Strategies, Plans and Policies as Input to the Eyre Peninsula Regional NRM Plan*, prepared for the Eyre Peninsula Natural Resources Management Board.

impacts of climate change that can be appropriately dealt with under planning policy are included in the SAPPL.[122]

These types of projects demonstrate the processes available to identify changes to planning policy that would further NRM objectives. However, apart from the policy amendments that resulted from the catchment water management in the early 2000s, limited changes have occurred to council planning policy as a result of policy review work undertaken by NRM Boards or DEWNR.

This lack of progression on the implementation of findings of review processes initiated by the NRM sector reflects challenges that are experienced more generally in the management of the coastal zone and in relation to sea level rise more specifically. These challenges include that organisations (such as councils and state government agencies that might be responsible for implementing policy change) are dealing with a wide range of issues of which sea level rise is one of many, and there can be competing objectives and priorities including for the allocation of resources and funding. These factors are compounded by a lack of information and understanding regarding the importance of sea level rise as an issue.

Coastal Action Plans

Of the eight NRM regions in South Australia, seven contain coastal areas. A number of NRM Boards such as the Eyre Peninsula, Adelaide and Mount Lofty Ranges and South East NRM Boards have prepared Coastal Action Plans for the coast in their region (or parts thereof). These Action Plans provide information to understand and facilitate the conservation, protection and maintenance of natural coastal resources and establish conservation priorities for places and areas within the region and associated actions. In undertaking these action planning processes, a range of threats are considered including climate change impacts such as sea level rise and relevant actions identified. For some NRM regions, actions are identified at a regional and local (council specific) scale.

The Action Plans also involve undertaking some form of assessment process to highlight areas of conservation priority or value within the coastal zone and assess these in relation to perceived threats to pinpoint areas in need of more protection or management and/or to identify actions in response. Refer Boxes 4 and 5 for examples of actions identified by Coastal Action Plans relating to sea level rise.

Box 4: Recommendations relating to sea level rise identified by the Eyre Peninsula Coastal Action Plan 2011

Facilitate a review throughout the region of areas suitable as buffer zones for salt marsh retreat, together with tidal flows and potential tidal flows in those areas. Also to review establishment of buffer zones for dune retreat. To establish setback buffer areas on the Council Development Plans in order that development now does not compromise adaptation to sea level rise in the future.

[122] URPS 2013, *Environmental/Natural Resources Management/ Sustainability Gaps, Constraints and Opportunities Discussion Paper*, prepared for the Department of Environment, Water and Natural Resources.

Investigate opportunities to obtain LIDAR data coverage for the Eyre Peninsula coast to assist in identifying areas vulnerable to sea level rise and climate change.

Review the coverage of the DENR (Department for Environment and Natural Resources) beach and salt marsh profiles to ensure that adequate monitoring of shoreline, dune and salt marsh changes is carried out. The existing network of DENR profiles of beaches, foredunes, and wetlands will need to be extended to include more locations vulnerable to change resulting from sea level rise/ climate change. Such locations are proposed within the cell descriptions.

Investigate cliff retreat rates for various cliffs and cliff types around the region (eg. Establish surveyed marker points).

Undertake a climate change vulnerability assessment on flora and fauna species and vegetation communities.

Currently change in the region is described, in certain aspects, by the existing time series of aerial photography. Because of changing technology in imaging it will be necessary to ensure that future imagery is of appropriate resolution to track coastal changes, such as dune, salt marsh and swamp migration, together with shoreline and cliff edge change.

Support and/or undertake research into the hydrological and ecological requirements of wetlands, swamps, soaks, lakes and groundwater ecosystems, the possible impacts of climate change on these areas and recommended management actions to conserve these areas.

Responsibility for implementing these actions is assigned to NRM, Councils, EP LGA, DPLG, Dept Premier and Cabinet, DENR, Coast Protection Board by the Action Plan.

It is intended that the information contained in the Action Plans can be used by local councils, agencies, and community groups to prioritise coastal work aimed at protecting coastal conservation assets such as animals, heritage sites and coastal habitats. These types of plans prepared by NRM Boards reflect the Boards' broader role and responsibilities as established under the NRM Act to influence NRM actions delivered by other responsible stakeholders.

Box 5: Select recommendations relating to sea level rise identified by the Metropolitan Adelaide and Northern Coastal Action Plan 2009

Regional

To facilitate a review throughout the region of areas suitable as buffer zones for saltmarsh retreat, together with tidal flows and potential tidal flows in those areas. The review is to include development plan provisions for buffer zones regionally.

To establish setback buffer areas on the Council Development Plans in order that development now does not compromise adaptation to sea level rise in the future.

Council specific

(City of Onkaparinga, Sellicks Beach)

Ensure minimisation of run-off from clifftop reserve (Current instability threatened by runoff from peak storm events (likely to increase with climate change), and – long term – by sea level rise

(City of Onkaparinga, Port Noarlunga)

Monitor and actively deal with blow out development using brush matting, sand drift fences and seasonal planting (current instability, (increasing with accelerated sea level rise) in an area of high conservation values)

Digital terrain model to 15cm resolution needed to assess threat (and flood hazard planning issues (floodplain habitats threatened by sea level rise)

Stakeholders responsible for implementing these actions are identified within the Action Plan.

Key strengths and challenges for coastal management and adaptation

Key strengths

- The Natural Resources Management Act charges NRM Boards with holistic and integrated land use management that encompasses influencing NRM actions that are outside the direct jurisdiction of the NRM system – for example land use planning
- The NRM system can identify and addresses coastal management priorities within regional NRM planning processes and coastal action plans, and can engage other stakeholders and allocate actions toward delivering on objectives (refer previous bullet point)
- The system's functions generate large amounts of data about environmental assets including coastal assets. Regional NRM Plans are a good source of information about natural resources and vulnerability, particularly value based assessments of threats including sea level rise in coastal areas
- Mechanisms are in place to incorporate adaptation strategies into NRM instruments such as regional plans and action plans

Key challenges

- While NRM instruments can allocate responsibility to various stakeholders, this is not necessarily supported by formal or consistent processes for engagement of these stakeholders in delivery
- NRM plans often identify numerous stakeholders to be responsible, but provide less guidance on who drives action or how it will be funded– which may in turn result in inaction
- The system can experience challenges transitioning from analysis and data gathering to implementation. Similar challenges to implementation are widely recognised in ICZM and adaptation (refer Section 3.0)
- Similarly to councils, NRM Boards are funded by a levy collected from their area of jurisdiction. In the context of sea level rise risk, more vulnerable areas may have fewer resources with which to undertake adaptation planning and implementation, and therefore be more reliant on external resources and funding sources

4.3.5. Emergency management

Legislation

The South Australian Government has primary operational responsibility for response to an emergency or disaster in South Australia. South Australia is committed to the Council of Australian Governments (COAG) recommendation to shift the focus of emergency management beyond response and reaction, to anticipation and mitigation. This means that emergency management planning now provides another avenue to progress adaptation action in relation to identified risks.

The *Emergency Management Act 2004* establishes the framework for the management of emergencies in South Australia. This includes the establishment of the Emergency Management Council, State Emergency Management Committee and the preparation of the State Emergency Management Plan.

Policies and Plans

Of particular relevance to adaptation planning is the establishment of Zone Emergency Management Committees (ZEMC). There is a ZEMC for each of the South Australia Local Government Regions. The State Emergency Management Plan requires that each ZEMC develop a Zone Emergency Management Plan. Zone Emergency Management Plans identify and assess a range of risks and identify treatment responses. There are a number of risks which will be exacerbated by climate change and therefore overlap with adaptation planning being undertaken by the regions.

This overlap between Zone Emergency Management planning and adaptation planning is recognised and reflected in the funding of adaptation projects under the Natural Disaster Resilience Program by the Commonwealth government. The regional adaptation planning projects Resilient South and the Western Adelaide Region Climate Change Adaptation Plan projects currently underway have both received funding from this program. Figure 4.5 shows the relationship and overlap between the Zone Emergency Management planning and regional adaptation planning processes.

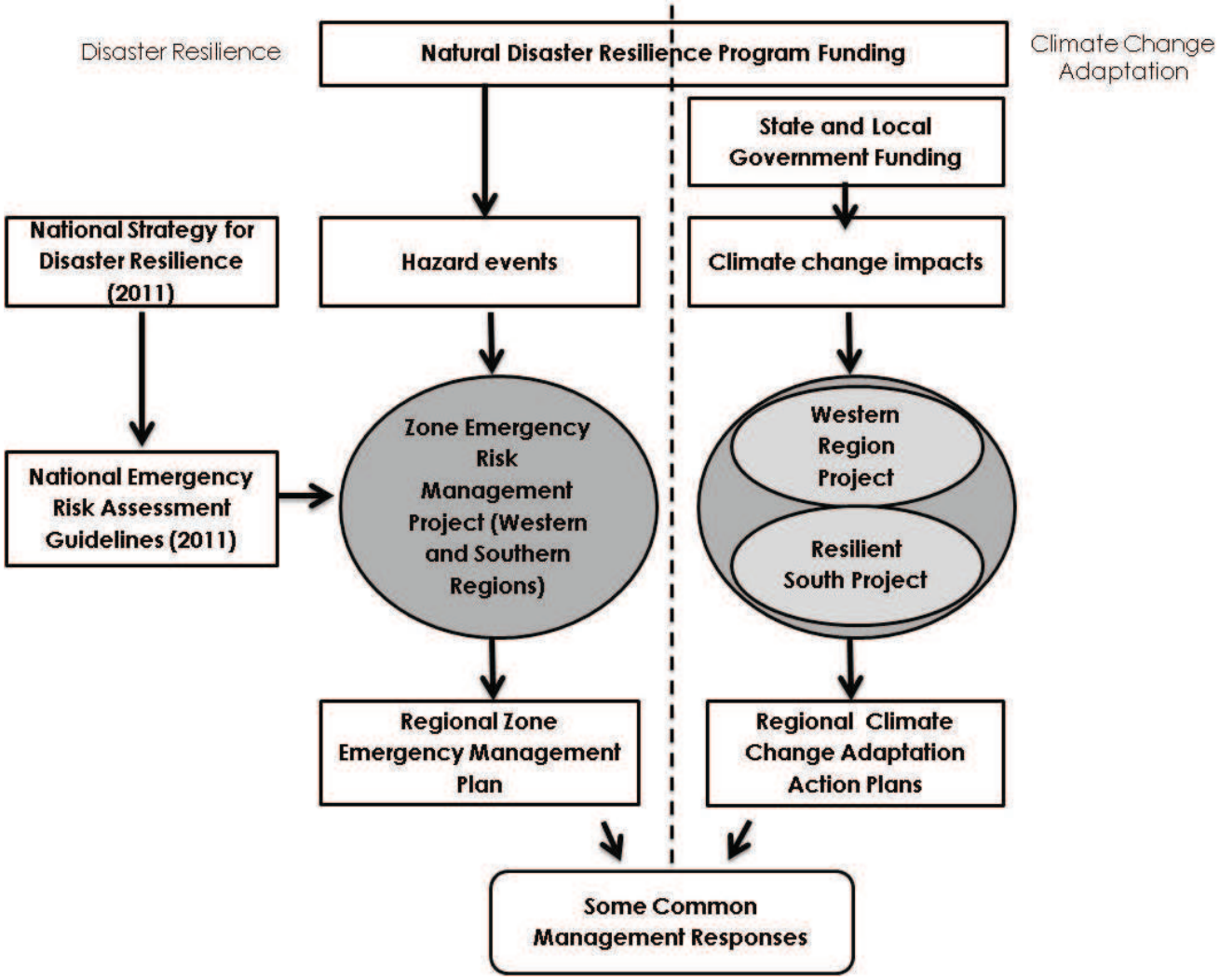

Figure 4.5: Relationship between the Zone Emergency Management planning and regional adaptation planning processes

Flood and extreme weather as a result of climate change will be experienced in the coastal zone. Sea level rise as a result of climate change will exacerbate risk of flooding and extreme weather events for which emergency management planning is undertaken.

Although there is some overlap between emergency management planning and adaptation planning for flooding and extreme weather, there are also some fundamental differences between the two planning processes.

These differences in approach include the risk assessment process undertaken in emergency management planning which is focussed on current experiences of risks and management responses, drawing on climate projections to understand changes in the frequency or intensity of events over the longer term. This is in contrast to adaptation planning where climate change projections are central to considering exposure, sensitivity and potential impacts and drive adaptation responses.

Emergency management and land use planning

As discussed in section 4.3.2, under Schedule 8 of the Development Regulations that deals with agency referrals, planning authorities must seek specialist input from particular bodies for applications that meet specified criteria. From the emergency management perspective, development applications must be referred to the South Australian Country Fire Service for:

> Dwellings in Bushfire Protection Areas
>
> Dwellings, tourist accommodation and other forms of habitable buildings in a High Bushfire Risk Area in a Bushfire Protection Area, identified by the relevant Development Plan[123]

The South Australian Country Fire Service has power of direction in these circumstances.

Direction means that the prescribed body may direct the relevant authority

a) to refuse the relevant application; or
b) if the relevant authority decides to consent to or approve the development—(subject to any other Act) to impose such conditions as the prescribed body thinks fit, (and that the relevant authority must comply with any such direction)[124]

From a development assessment perspective, the emergency services sector does not have a referral role other than in relation to the assessment of proposed development in bushfire protection areas.

Other opportunities for involvement of the emergency management sector in land use planning include making voluntary submissions on development plan amendments and the Planning Strategy. In relation to the management of sea level rise, there is a limited role for the emergency management sector other than in relation to the events that are exacerbated by sea level rise such as flooding and coastal inundation and extreme storms.

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[123] *Development Regulations 2008* Schedule 8, 2 Table

[124] *Development Regulations 2008* Schedule 8, (2)(d) iii

At a national level, a review of land use planning and the Building Code of Australia with an emergency management lens is being driven by the National Emergency Management Committee (NEMC). A key component of this work program has been the preparation of *The Roadmap: Enhancing Disaster Resilience in the Built Environment 2012*. The objective of this work has been to enhance disaster resilience in the built environment by establishing a common understanding of land use planning and building polices, regulations and codes across Australia, undertaking a gap analysis of the current instruments and preparing an issues paper that provides a roadmap for key improvements to be implemented.

The *Roadmap* identifies recommended improvement activities to enhance disaster resilience in the built environment should be progressed:

- Immediately - such as integrated legislation, process enhancements, comprehensive data and mapping, and collaborative vendor disclosure of risk information; and
- In the medium term – such as governance partnerships, lifelong education and training, and inter-jurisdictional collaboration.

Priority activities identified by *Roadmap* that are of particular relevance management of sea level rise in relation to land use planning and building include:

- Preparation of national guidelines for integrating land use planning, building and emergency management functions for all risks within legislation, governance arrangements and development assessment processes;
- Identifying opportunities for streamlining integration of best practice risk information into legislation and policy;
- Implementing the National Flood Risk Information Portal for use by stakeholders and, when and as appropriate, expand the portal to include all risks using the principles outlined in the *National ePlanning Strategy*. The National Flood Risk Information Project includes development of national guidelines covering the collection, comparability and reporting of flood risk Information, and a National Technical Risk Framework which provides nationally consistent technical regulations and 'fit for purpose' research, mapping, modelling and data standards for all risks.
- Engagement with stakeholders on development of a vendor disclosure framework in each jurisdiction subject to consistent principles; and
- Review of arrangements relating to liability for government agencies when releasing all hazard information to stakeholders, implementation of recommendations to resolve identified barriers.

Key strengths and challenges for coastal management and adaptation

Key strengths

- The consistency of interests and considerations of Zone Emergency Management Plans and Regional Adaptation Plans is reflected in funding arrangements in place
- The Standing Council for Emergency Management has endorsed national flood mapping including coastal inundation
- Emergency management planning processes provide an additional avenue by which to consider, assess and fund action to address risks associated with climate change, including coastal inundation that will be exacerbated by sea level rise

Key challenges

- Emergency management risk assessment involves some consideration of long term risks, but is ultimately focussed on current risk
- Zone Emergency Management Plans are still in planning stages, with none either completed or evaluated
- While mechanisms exist for the emergency management sector to influence the land use planning system through Schedule 8 of the Development Regulations, the degree of influence is not high in relation to sea level rise. As noted in the previous section, national programs are in place to address alignment of emergency management, planning and building systems

4.3.6. Management of public assets

State government assets

Crown land in South Australia is administered by the Department of Environment, Water and Natural Resources under the *Crown Land Management Act 2009*. According to Section 5 of the Act, principles of ecologically sustainable land management should be observed including consideration of long-term economic, environmental and social considerations which should thereby capture the impacts of sea level rise.

Large sections of the coast are protected within reserves proclaimed under the *National Parks and Wildlife Act 1972*. Under Section 37 of the Act, the management of Reserves must have regard to the preservation of features of geographical, natural or scenic interest as well as structures and objects of historic or scientific interest. Many coastal parks contain features and structures which could be threatened by sea level rise.

The Strategic Asset Management Framework1999[125] applies to State Government controlled assets with a capital value in excess of $10,000, noting that a State

[125] Government of South Australia 1999, *Strategic Asset Management Framework*

agency does not need to own or possess an asset to control it. This framework requires consideration of significant costs over the life of an asset including maintenance and insurance, as well as risk management. This framework would apply to road, rail and jetty infrastructure along the coast.

Across South Australia, jetties are owned by both the State Government and councils. Some jetties owned by the State, are maintained by councils (for example the Brighton and Port Noarlunga jetties), whilst maintenance and repair costs for others are funded by DPTI.

In 2001 South Australian ports were privatised and the infrastructure of the seven State ports is now owned by Flinders Ports. Flinders Ports also has a 99 year land lease for these ports.

Local government assets

Asset and infrastructure management has been identified as the greatest challenge to local government in South Australia arising from climate change, in terms of both financial sustainability and community expectation.[126]

Under section 7 of the *Local Government Act 1999*, the functions of a council include: to provide services and facilities that benefit its area, its ratepayers and residents, and visitors to its area; to provide infrastructure for its community and for development within its area; and to manage and, if appropriate, develop, public areas vested in, or occupied by, the council. Also under the Act, councils are required to prepare Infrastructure and Asset Management Plans, and Long Term Financial Management Plans considering their asset management commitments, covering a period of at least 10 years.

These responsibilities mean that council has responsibility for a range of public assets in the coastal zone, including but not limited to dedicated open space and reserves, roads, footpaths and cycling paths, car parks, community buildings, stormwater drainage systems, wastewater management systems, and recreational facilities.[127] These assets are at risk from sea level rise, as described in Section 2.2 of this issues paper.

Councils are also responsible for the maintenance of coast protection infrastructure within their areas, including that which has been developed by the Coast Protection Board.

The LGA MLS recently completed a Guide to Coastal Management for Local Government to assist South Australian councils to manage their coastal assets and infrastructure. The Guide provided an overview of coastal risks that should be considered and managed by councils, with the intent of consistently informing local and regional strategies to manage specific risks.[128]

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[126] Local Government Association Mutual Liability Scheme (LGAMLS) 2012, *Local Government South Australian Climate Adaptation Programme Final Report*, p. 7.

[127] LGAMLS 2012, p.7.

[128] LGAMLS 2012, p.21.

Key strengths and challenges for coastal management and adaptation

Key strengths

- Responsibilities of asset managers under specific legislation are clear (though this doesn't in itself necessarily support integrated coastal management)
- Mechanisms for long term planning that can take into account sea level rise are in place under legislation and policy
- Tools and guidance have been developed such as the Guide to Coastal Management for Local Government and the asset focused Coastal Adaptation Decision Support Pathways Project (refer Section 4.3.3)

Key challenges

- In some councils the number, nature and value of assets in the council area is not well understood, limiting the ability to effectively develop asset management plans
- In coastal areas, land tenure and infrastructure ownership and maintenance responsibilities can be complex and involve multiple stakeholders. This creates practical challenges and time and cost impacts for adaptation responses to support public assets
- High social and economic value of some public assets, and high community expectations of service and access means complex interests and values must be considered in developing management responses

4.3.7. Summary of strengths and challenges in South Australian systems

Table 4.9 summarises the strengths as well as key challenges of each of South Australian management systems in place that have a role in coastal and sea level rise management.

Table 4.9: Summary of strengths and issues in South Australian management systems in relation to coastal management and sea level rise

Key attributes in relation to coastal management and sea level rise	South Australian management system					
	Coast protection	**Land use planning**	**Climate change adaptation**	**Natural resources management**	**Emergency management**	**Management of public assets**
Strengths	Clear policy positions on new development and coastal protection works, and consistent objectives and strategies amongst various documents Strategies support integration with the land use planning system and local government The Coast Protection Board possesses significant data, knowledge and expertise in relation to coastal risks Membership of the Board represents various interests in the coastal zone	The integrated nature of the system facilitates consideration of a range of issues in strategic planning and development assessment, and numerous tools are available through the Development Plan and Regulations to effect policy outcomes (provisions at whole of Council area, zone and policy area levels, overlays, and referrals to specialist agencies) Coastal management and sea level rise considerations are identified at Planning Strategy, Development Plan, and development assessment stages (through referral to the Coast Protection Board) Strong policy guidance for addressing sea level rise is present in the Planning Strategy, SAPPL modules, and General provisions of all Development Plans through the 1994 Ministerial amendment that incorporated Coast Protection Board policies	The State Adaptation Framework provides strong guidance as to how to progress regional adaptation, and empowers regions to deliver adaptation Tools to assist with implementation of adaptation planning have been developed, for example the Guidelines for Undertaking an Integrated Climate Change Vulnerability Assessment as Part of Developing an Adaptation Plan The State Adaptation Framework reflects the complexity of stakeholders and interests that must be involved in effective adaptation, and this has particular relevance to the coastal environment and objectives of ICZM The adaptation planning process provides a direct mechanism for progressing sea level rise management and adaptation	The Natural Resources Management Act charges NRM Boards with holistic and integrated land use management that encompasses influencing NRM actions that are outside the direct jurisdiction of the NRM system – for example land use planning The NRM system can identify and addresses coastal management priorities within regional NRM planning processes and coastal action plans, and can engage other stakeholders and allocate actions toward delivering on objectives (refer previous bullet point) The system's functions generate large amounts of data about environmental assets including coastal assets. Regional NRM Plans are a good source of information about natural resources and vulnerability, particularly value based assessments of threats including sea level rise in coastal areas Mechanisms are in place to incorporate adaptation strategies into NRM instruments such as regional plans and action plans	The consistency of interests and considerations of Zone Emergency Management Plans and Regional Adaptation Plans is reflected in funding arrangements currently in place; The Standing Council for Emergency Management has endorsed national flood mapping including coastal inundation; and Emergency management planning processes provide an additional avenue by which to consider, assess and fund action to address risks associated with climate change, including coastal inundation that will be exacerbated by sea level rise	Responsibilities of asset managers under specific legislation are clear (though this doesn't necessarily support integrated coastal management) Mechanisms for long term planning that can take into account sea level rise are in place under legislation and policy Tools and guidance have been developed such as the Guide to Coastal Management for Local Government and the asset focused Coastal Adaptation Decision Support Pathways Project

Key attributes in relation to coastal management and sea level rise	South Australian management system					
	Coast protection	**Land use planning**	**Climate change adaptation**	**Natural resources management**	**Emergency management**	**Management of public assets**
Challenges	Achievement of system objectives requires substantial engagement with various systems, stakeholders and governance structures that have different objectives (e.g. the planning system, land tenure arrangements) The need to manage the legacy of freehold shack settlements consumes significant resources and makes proactive coast protection activities more difficult to achieve Attempts to achieve system objectives through the planning system have met with varying success	Coast Protection Board advice being fed into the land use planning system via Schedule 8 of the Development Regulations is not being implemented in all cases, including where advice relates to coastal risks Development Plan policies that apply to areas containing coastal risks and sensitive coastal features are not consistent across the state due to different Development Plan formats, and in some cases deliberate rezoning decisions Interaction between the Planning Strategy and other State strategic documents (e.g. the Climate Change Adaptation Framework) is not clear The Development Regulations allow some development applications in locations subject to coastal risks to be exempt from a sufficient assessment process Application of policy in decision making relies heavily on planners' capacity to integrate a range of relevant information into a decision making process, and interpret that information to apply the policy. This can be considered as a strength of the system in its ability to be non-prescriptive and make on balance decisions, as well as being a challenge	Most regions are in planning or pre-planning stage and little implementation and evaluation of adaptation actions has occurred The State Adaptation Framework does not provide specific guidance on how to transition from planning to implementation of adaptation actions; Sea level rise is one of numerous impacts of climate change to be considered and addressed in an adaptation plan, and may not take primary focus where a range of impacts will be experienced sooner than the impacts of sea level rise. The integrated nature of adaptation under the State Framework is closely linked with other systems and planning processes, which can involve a lot of time and resources and be difficult to manage; Responsibility for actions arising from regional adaptation planning is undefined and in this could be a barrier to implementation.	While NRM instruments can allocate responsibility to various stakeholders, this is not necessarily supported by formal or consistent processes for engagement of these stakeholders in delivery NRM plans often identify numerous stakeholders to be responsible, but provide less guidance on who drives action or how it will be funded – which may in turn result in inaction The system can experience challenges transitioning from analysis and data gathering to implementation. Similar challenges to implementation are widely recognised in ICZM and adaptation (refer Section 3.0) Similarly to councils, NRM Boards are funded by a property levy collected from their area of jurisdiction. In the context of sea level rise risk, more vulnerable areas may have fewer resources with which to undertake adaptation planning and implementation, and therefore be more reliant on external resources and funding sources	Emergency management risk assessment involves some consideration of long term risks, but is ultimately focussed on current risk; Zone Emergency Management Plans are still in planning stages, with none either completed or evaluated; and While mechanisms exist for the emergency management sector to influence the land use planning system through Schedule 8 of the Development Regulations, the degree of influence is not high in relation to sea level rise, though national programs are in place to address alignment of emergency management, planning and building systems	In some councils the number, nature and value of assets in the council area is not well understood, limiting the ability to effectively develop asset management plans In coastal areas, land tenure and infrastructure ownership and maintenance responsibilities can be complex and involve multiple stakeholders. This creates practical challenges and time and cost impacts for adaptation responses to support public assets High social and economic value of some public assets, and high community expectations of service and access means complex interests and values must be considered in developing management responses

4.4. Influences on implementation of South Australian management systems

Each of the systems described in Section 4.3 are applied in social, economic, cultural, and legal contexts that influence the systems' implementation and ability to achieve desired outcomes. The sections below summarise some of the more significant influences on systems that seek to manage sea level rise, specifically the context of community expectations and the political considerations in decision making, and the role of insurance markets and real and perceived liability for sea level rise management outcomes.

4.4.1. Political context of decision making

Coastal management systems operate in a complex environment of differing priorities and beliefs about nature, science, and risk, overlaying diverse cultural meanings ascribed to the coast.[129] Strong public affinity with the coastal zone creates high community expectations for both maintenance and development of the coastline for residential, recreational, and industrial uses, along with simultaneous conservation of natural features".[130]

Competing interests and community expectations also impact on the viability of different coastal adaptation responses, with governance bodies globally faced with "the dilemma of selecting the most appropriate responses to reduce emerging coastal risk while ensuring their political positions are not undermined".[131] As risks increase with climate change, governments will face increased conflicts in managing the coast to the expectations of different stakeholders. [132]

It has been noted that retreat is often a last resort response to sea level rise on the basis of both social and economic costs, with both real and perceived costs of retreat strategies creating "significant governance difficulties for decision-making bodies that identify significant risks to established infrastructure".[133]

The practical and political challenges of implementing a retreat strategy are illustrated by Byron Shire Council's experience of a planned retreat policy that was put in place in 1988, and recently amended under ongoing political pressure and economic pressure due to the capital value of the affected properties. While the policy was originally developed with a significant level of community consultation, inconsistent application of the policy led to legal action against the Council. This in turn generated substantial public debate, including within local media.[134]

It has been recognised in the South Australian context that there can be a mismatch between the stated objectives of coastal management systems, and the extent to

[129] Wang, Xu, Pearson, Xue, Morrison, Liu & Shi 2011, pp. 8-9.
[130] Niven & Bardsley, 2013, p. 199.
[131] Niven & Bardsley, 2013, p. 195.
[132] Niven & Bardsley, 2013, p. 200.
[133] Niven & Bardsley, 2013, p. 197.
[134] Niven & Bardsley 2013, p. 200.

which those objectives are supported in the actions and decisions of governing bodies – in other words, "the political challenge to generate and sustain the will to act" has been a barrier to implement strategies and plans that have been put in place to provide clear direction to manage sea level rise. [135]

The first report of the current review of the South Australian planning system summarises the findings of consultation with government, professional bodies, and the community, and similarly identifies the perceived influence of political factors in system functioning. Stakeholder feedback raised issues including:

- "A need for more decisions to be guided by professional expertise rather than political factors" in relation to planners, other professionals involved in the planning system, and politicians responsible for high level decision making;
- Difficulties in regional areas where planning staff wear multiple hats such as planning and economic development, or planning and community groups. Some regional elected members "alluded to difficulty in conducting their elected duties and serving as unbiased members of development assessment panels";
- That "professional staff in the planning system feel their integrity is often under question" in the course of performing their role. [136]

4.4.2. Insurance and liability considerations

Throughout Australia, the insurance industry has a role in financial recovery from catastrophic weather events. The frequency of such events is expected to increase with climate change, and the coastal zone will be particularly vulnerable to the combined effects of sea level rise and storm surge/flooding events (refer Section 2.0 of this Issues Paper).[137]

As calculation of insurance premiums involves evaluation, pricing and spreading the risk of weather related catastrophes, with climate change, changes to the likelihood and severity of weather events could increase the costs of and thereby limit people's access to insurance. In 2009 around 23 percent of Australia's households had no building or contents insurance. Should the number of uninsured households increase as the result of decreased insurance affordability, more of the cost of disaster recovery would fall to governments.[138]

The Local Government Association Mutual Liability Scheme (LGAMLS) has noted that insurance pricing can influence individual behaviour in ways that can support managing risks from climate change, for example by "providing incentives for people to take actions that reduce exposure to climate change impacts".[139]

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[135] Niven & Bardsley, 2013, p. 205.

[136] South Australia's Expert Panel on Planning Reform 2013, pp. 34-35.

[137] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, p. 114.

[138] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, p. 115.

[139] LGAMLS 2012.

Private property insurance

In 2009 the Commonwealth House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts reported on management of the coastal zone in a changing climate. In the course of this inquiry, the Insurance Council of Australia (ICA) confirmed that there are no geographic areas in Australia for which no insurance products are available. However, the ICA also identified that some risks including storm surge, landslip and sea level rise are not generally covered by insurance products. This is further complicated by the fact that no common definitions of risks (inclusive of storm surge, landslip and sea level rise) are adopted across the insurance industry. Policies generally deal with "saltwater risks or action of the sea" via exclusions.[140]

Also in response to the inquiry, multinational insurance company Insurance Australia Group (IAG) has submitted to the Commonwealth Government that "Australia faces an "insurance gap" because land values are not currently insured". While in coastal locations land value forms a significant component of overall property value, even if "the value of coastal buildings may be protected to some extent by insurance, the land value of properties is not insured at all." IAG recommended development of a coastal land value insurance scheme to which low lying coastal property would contribute in order to receive compensation when rising sea levels force abandonment of the land. It was further noted that this type of scheme would "introduce a 'user pays' price signal to owners of vulnerable waterfront land that they should be responsible for funding the cost of potential compensation payable to them should that land become unusable rather than expecting future compensation to come from some other source".[141]

A recommendation arising from the inquiry was for the Productivity Commission to undertake a report on the projected impacts of climate change and related insurance matters, with a particular focus on:

- Insurance coverage of coastal properties, given the concentration of Australia's population and infrastructure along the coast;
- Estimates of the value of properties potentially exposed to this risk;
- Insurance affordability, availability and uptake;
- Existing and emerging gaps in insurance coverage, with a particular focus on coverage of coastal risks such as storm surge/inundation, landslip/erosion and sea level rise (including the combined effects of sea inundation and riverine flooding);
- The need for a clear definition of the circumstances under which an insurance claim is payable due to storm surge/inundation, landslip/erosion and sea level rise, as well as due to permanent submersion of some or all of the land;
- The possibility of a government instrument that prohibits continued occupation of the land or future building development on the property due to coastal risks;

[140] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009 p. 116-118.
[141] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009 p. 120-122.

- Gaps in the information needed to properly assess insurance risk and availability of nationally consistent data on climate change risks;
- Examining the key actions for governments proposed by the Insurance Council of Australia and the Insurance Australia Group in their submissions to this inquiry; and
- Possible responses to a withdrawal of insurance for certain risks or regions, noting the increased burden this could place on government and taxpayers.[142]

While no Productivity Commission inquiry with this specific scope has been undertaken, the Commission has investigated barriers to effective climate change adaptation more broadly. In that report Commission recommended governments support adaptation by minimising distortion to insurance markets, specifically:

- Removing interventions and subsidies in property insurance;
- Supporting functioning of insurance markets by addressing barriers in other systems such as land use planning to ensure development can only occur in locations where risks are adequately managed;
- Producing risk mapping; and
- Providing disaster mitigation infrastructure.[143]

Local government liability

The LGA undertook a Climate Change Risk Management Assessment and Adaptation Program over 2 years during 2009-12, involving 95% of South Australian councils in identifying high priority climate adaptation issues for local government. The assessment identified risks associated with financial management and sustainability as the most important risk area for councils, with introduction of adaptation measures likely to have significant impacts on councils' budgets.[144] The study also found that legal liability uncertainty and concerns appear to be hindering adaptation for many councils.[145]

In South Australia there is a common law limit on liability of local governments in civil litigation. This is a weaker protection than statutory limits that are in place in most other states and territories. It has been contended by the Commonwealth Government and others that national standards and consistency amongst state and territory legislation would reduce the litigation risk to councils.[146]

In the context of climate change, more litigation involving councils is "highly likely" to occur as a result of local governments' decision, functions, and adapted policies

[142] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009 pp. xviii-xix.
[143] Productivity Commission 2012, p. 23.
[144] LGAMLS 2012, p. 6 & 15.
[145] LGALMS 2012, p. 25.
[146] Baker & McKenzie 2011, *Local Council Risk of Liability in the Face of Climate Change – Resolving Uncertainties: A Report for the Australian Local Government Association, p. 4.*

and plans. This will be a drain on resources that in some cases, councils we be unable to insure against.[147]

Appendix A summarises the legal actions related to climate change that could be brought against local governments in South Australia under tort law, administrative law, statutory compensation and other claims. The following mitigation strategies are currently available to local governments in South Australia:

- For tort based actions and statutory compensation claims:
    - Have regard to precautionary matters in decision making;
    - As a minimum, minimise development in highly vulnerable areas;
    - Actively provide access to up to date climate change information; and
    - Exercise reasonable care to ensure all facts are known and understood, relevant law is identified and advice is expressed in clear and accurate terms.
- For administrative actions:
    - Councils should ensure that decisions are reasonable and appropriate decision making procedures are followed and relevant considerations taken into account;
    - Councils should ensure they have the best available evidence and appropriate expertise to interpret policy and technical documents;
    - Limits on third party rights of appeal;
    - Councils should ensure decisions are reasonable and appropriate procedures followed;
    - Councils should ensure they have the best available evidence and information;
    - Councils should be aware of the extent of their legislative power;
    - Councils should ensure decisions are reasonable and appropriate procedures followed and that they do not take irrelevant considerations into account when setting rates and fees; and
    - Care should be taken in defining the scope of works and the landholders that will benefit from such works. [148]

Additional mitigation strategies that have been recommended for adoption by local government are:

- A statutory defence providing that councils are not liable for damage caused by flooding and natural hazards in the coastal zone as a result of the granting or

[147] Baker & McKenzie 2011, p. 5.
[148] Baker & McKenzie 2011, pp. 5-9.

refusal of a development application, or advice, acts or omissions (in good faith) relating to the provision of information with respect to climate change and sea level rise as per s 733(3) of the *Local Government Act 1993 (NSW);*

- An integrated planning system for the entire Australian coast; and
- Statutory limitations on liability in relating to the limited availability of council resources and broad range of council activities.[149]

The State Government is also potentially liable for climate change related actions, but this has not been explored in development of this Issues Paper.

[149] Baker & McKenzie 2011, p. 5.

5.0 An ideal sea level rise management system for South Australia

This section presents ten principles and a model framework that reflect an 'ideal' sea level rise management system for South Australia. The 'ideal system' has been developed on the basis of:

- An understanding of 'ideal' or leading practice concepts of coastal management and climate change adaptation (refer Section 3.0);
- An understanding of current coastal zone management in South Australia and its strengths and challenges in relation to sea level rise management (refer Section 4.0); and
- Views regarding constraints and limitations of current coastal management systems in relation to sea level rise recorded in 13 semi-structured interviews with representatives of state and local government and the development industry (refer Appendix B).

Section 5.1 sets out the rationale for each principle, considers the performance of the current system of coastal management (incorporating aspects described in Section 4.0) in relation to the principle, and identifies options to better achieve the principle - including through the model framework.

Section 5.2 describes the rationale and functioning of the model framework.

5.1. Principles of an ideal system

5.1.1. Principle 1: The system functions to avoid, or mitigate adverse impacts of sea level rise on South Australia's coastal zone in the context of social, environmental and economic values

Rationale for the principle

It is unequivocal that sea level rise is occurring, and will continue to occur, even if the climate were to stabilise through global mitigation efforts.[150] While sea level rise data collected in South Australia has limitations (refer Section 2.1), the potential risks sea level rise presents (refer Section 2.2) as well as the effects that are already being experienced (refer Section 4.3.1), are a sufficient basis for coastal adaptation action to occur in South Australia.

The challenge of adaptation to sea level rise, perhaps more so than for adaptation to other climate risks, is to enact change in the context of a coastal environment rich with social, environmental and economic values, and high expectations for use of the coast that can be both complementary and competing (refer Section 4.4.1). The complexity of priorities and beliefs about nature, science, and risk within the diverse

[150] IPCC 2013.

cultural meanings ascribed to the coast requires that sea level rise management address the challenges of considering diverse and conflicting stakeholder interests.[151]

An effective system to adapt to sea level rise has integrated goals and outcomes that consider a broad spatial, social and institutional context, and are cognisant of non-climate related policy perspectives and drivers of change.[152]

This is consistent with the concept of ICZM that seeks integration of social, environmental and economic factors in coastal management, supported by an integrated governance approach emphasising close cooperation of all levels of government and sectors involved in coastal planning.

What constitutes sufficient mitigation, or appropriate consideration of social, environmental and economic factors, is both laden with value judgements and subject to context. The challenge of understanding sea level rise risk, and more specifically identifying what is an "acceptable level of risk", was raised by a number of stakeholders interviewed for this Issues Paper. Interviewees noted that balancing social, economic and environmental values is complex and in some situations one value might outweigh the others.

The Antarctic Climate Ecosystems Cooperative Research Centre has emphasised that while science can identify probabilities associated with sea level rise impacts, planners and policymakers have the role of deciding what level of risk is acceptable to government and the community. [153] In a planning context, the Productivity Commission has identified that regulation needs to understand the community's acceptable level of risk for different types of land uses.[154]

To avoid or mitigate sea level rise impacts, a management system should have capacity to regulate future development to minimise future risks, and facilitate adaptation in areas where existing development is at risk.

Timely action to respond to future risk, as well as currently experienced risks, is another important element of an effective system of sea level rise management.[155]

Performance of the current system against the principle

The premise of this Issues Paper is that the current system is not functioning to adequately avoid, mitigate and adapt to the impacts of sea level rise. Key challenges and strengths of the current system are described throughout Section 4.3, and summarised in Table 4.9.

Interviewee feedback referred to in discussion of Principles 2 to 10 (Sections 5.1.2 to 5.1.10) provides perspectives on problems with the implementation and practices associated with current systems, which cannot be ascertained from a review of systems "on paper".

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151 Wang, Xu, Pearson, Xue, Morrison, Liu & Shi 2011, pp. 8-9.

152 Webb, McKellar & Kay 2013, pp. 324-329.

153 House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, p. 131.

154 Productivity Commission 2012.

155 Gurran, Hamin & Norman 2008; Productivity Commission 2012.

Overall, there is scope for the system to significantly improve in relation to this principle at both macro (whole of system) and micro levels (day to day decision making).

Assessment: Significant action is required to progress current system performance in relation to the principle

Opportunities to realise the principle

Model system

Given context described in the rationale for this principle, a risk management approach that enables consideration of a range of relevant factors in an integrated way is required to address sea level rise. Such an approach is also consistent with contemporary concepts of ICZM and broader climate change adaptation within both published research (refer Section 3.0) and South Australia's recent adaptation policy directions (refer Section 4.3.3).

Reflection on adaptation efforts over recent years has led to insights around the main challenges to implementation (refer Section 3.2), and identified that interdependencies between the identified challenges are such that they are best addressed collectively on any adaptation project, rather than individually.[156] This is reflected in the model sea level rise management framework set out in Section 5.2 which complements existing coastal management systems.

The model of an ideal sea level rise management system for South Australia developed as part of this Issues Paper (refer Section 5.2) proposes a risk management framework and development of guidance materials that embed involvement of stakeholders and consideration of local conditions in the context of common state-wide objectives for coastal adaptation. This approach is intended to enable consideration of risks and adaptation strategies in a consistent manner, and with reference to social, environmental and economic considerations at state and local levels.

5.1.2. Principle 2: The risks from sea level rise are well understood by all stakeholders

Rationale for the principle

As described in Section 4.1 of this Issues Paper, stakeholders in coastal zone management include all levels of government, coastal communities, and the broader community. It is clear within South Australia's Climate Change Adaptation framework that responsibility for adaptation lies with all South Australians.[157]

While broad stakeholder engagement is essential to effective adaptation, a current lack of public understanding of climate change risks, and a collective tendency

[156] Webb, McKellar & Kay 2013, p. 333.
[157] Government of South Australia 2012, p. 9.

toward "fear of the unknown" are recognised as barriers to adaptation.[158] Submissions to the 2009 national inquiry into climate change and management of the coastal zone identified the need for improved community engagement, education and awareness to increase understanding of coastal issues generally, including those relating to climate change.[159] The level of uncertainty that managing these issues must embrace makes the communication challenge greater, but also increases the importance of effective communication to support public policy decisions.

The LGA Mutual Liability Scheme has identified a role for local government in developing engagement and education strategies to assist the community with prevention, preparedness, response and recovery strategies to address sea level rise risks.[160] This is consistent with the Productivity Commission's recommendation that local governments improve communication of current risk information to residents to address barriers climate adaptation generally.[161]

It is also recognised that to be effective, information should be in a form that is relevant to the purpose and target audience for communication. For example, one way of broadly communicating sea level rise risk could be through Section 7 of the *Land and Business (Sale and Conveyancing) Act 1994*. This provision currently allows for Development Plan zoning to be included on a statement to property purchasers, and could be used in a similar way to communicate risk.[162] While this type of mechanism allows property purchasers direct access to information it does not guarantee that this information will be understood. In the example of the current statement of zoning, the statement directs purchasers to the Development Plan, but does not in itself describe or interpret relevant policies. The onus is on the purchaser to investigate the relevant policies, which themselves may not be easily located or interpreted by the layperson. This is acknowledged in the report on consultation for the review of South Australia's planning system, in which a consultation participant is quoted as stating that "Development plans create an 'us' and 'them' approach – those who understand them, and those who don't".[163]

Effectively communicating the rationale for adaptation to sea level rise to the public provides an essential foundation for navigating the social and political challenges that coastal adaptation will be required to overcome. A general public awareness of sea level rise impacts and risks is likely to be particularly important in circumstances where adaptation affects people's daily lives (for example through displacement of households or increased regulation), requires significant investment of public resources, or does not yield short term benefits.[164]

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158 Barnett, Walters, Pendergast & Puleston 2013, p. 1; Wang, Xu, Pearson, Xue, Morrison, Liu & Shi, 2011, pp. 8-9.

159 House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, pp. 252-253.

160 LGAMLS 2012, p.8.

161 Productivity Commission 2012, p. 24.

162 Gibbs & Hill 2011, p.40.

163 South Australia's Expert Panel on Planning Reform 2013, p. 45.

164 Klein, Nicholls & Mimura 1999, p. 94.

Performance of the current system against the principle

There are varying levels of understanding of sea level rise risk amongst South Australia's various coastal stakeholders.

Within the South Australian government and amongst most local governments, the issue of sea level rise and the need to adapt is generally acknowledged, and is explicit in a wide range of strategic documents including the Planning Strategy, Development Plans, and Natural Resources Management Plans.

Regional adaptation planning processes under the Climate Change Adaptation Framework for South Australia will increase the involved stakeholders' understanding of risks for each planning region, including sea level rise risks. Some local coastal adaptation projects have involved community engagement, and the Eyre Peninsula Resilient Coastal Communities Pilot Study in particular explored opportunities for community members to act as "project champions", spreading awareness of coastal adaptation issues amongst community networks (refer Section 4.3.3).

There is an absence of clear and robust information in a form suitable for broad public consumption that communicates the risks and uncertainties associated with sea level rise.

Interviewees from all sectors emphasised the need to raise awareness and understanding of risk of sea level rise amongst coastal stakeholders including the broader community and land developers. The need for resources to achieve this was also commonly identified. It was suggested by interviewees that without clear messages and increased awareness about the need to adapt to sea level rise, the tightly held expectations community members have about their right to develop land along the coast will never change.

Assessment: Significant action is required to progress current system performance in relation to the principle

Opportunities to realise the principle

Model system

The model of an ideal system (Section 5.2) emphasises communication and stakeholder engagement at all stages. Genuine, thoughtful, and potentially innovative engagement methods are required to facilitate stakeholder involvement, as demonstrated in the Eyre Peninsula Resilient Coastal Communities Pilot Project (refer Section 4.3.3).

Communications initiatives

Communications initiatives that could assist in realising this principle include:

- Implementation of a communications and engagement strategy to broadly communicate coastal risks and coastal adaptation planning. Such a strategy would ideally be:
    - State Government led;

  - Clear and transparent about key issues;
  - Proactive in promoting improved understanding of key issues; and
  - Focused on building capacity to adapt.

- Implementation of broad scale awareness raising programs by state government. These could be associated with implementation of particular coastal management initiatives, including any arising from adopted recommendations of this Issues Paper.
- Improved communication of risk information to residents by local governments facing current climate risks, as recommended by the Productivity Commission.[165]

Property risk disclosure

- Disclosure of coastal risks on Contracts for Sale of Land or Business forms under Schedule 1 of the *Land and Business (Sale and Conveyancing) Regulations 2010* could lead to broader appreciation of sea level risks.

5.1.3. Principle 3: Roles and responsibilities in the system are clear, adequate, and universally understood

Rationale for the principle

A complexity of regulatory systems, roles and responsibilities is recognised as a hallmark of both coastal zone management and climate change adaptation. Within this context, a lack of clarity and differing understandings amongst stakeholders in relation to roles and responsibilities acts as a significant barrier to coastal adaptation.

Research undertaken by the National Climate Change Adaptation Research Facility (NCCARF) into barriers to adaptation to sea level rise found that effective adaptation to sea level rise in Australia requires a particular sequence of action, the first element being governance:

> "Actors need to know what they are responsible for, and what is to be left to others. ... these actors need statements of purpose and statutory support to act. Once these institutional preconditions are in place, uncertainty about risks and responses can be addressed in a more purposeful way, there can be better assessment of the resources needed to adapt, and psychosocial factors can be tackled."[166]

The same study concluded that uncertainty about roles and responsibilities across sectors and tiers of government was considered by stakeholders involved in adaptation to be one of the most important barriers to adaptation.[167] While the scope of this particular research was national, its findings were consistent with

[165] Productivity Commission 2012, p. 24.
[166] Barnett, Walters, Pendergst & Puleston 2013, pp. 64-65.
[167] Barnett, Walters, Pendergst & Puleston 2013, p. 1.

information gathered from stakeholders in South Australian coastal adaptation who were interviewed as part of development of this Issues Paper.

Amongst the various roles within coastal management, one of the most important is the provision of leadership on the issue of adaptation to sea level rise. A leadership role in this context has two important aspects:

- Firstly, absence of coordination and integration in policy, information sharing and planning across jurisdictions has been identified as a barrier to implementation of both ICZM and adaptation.[168] This presents a case for an overarching coordination role across the various systems and issues involved in sea level rise management.
- Secondly, it is established that adaptation occurs in a complex social, political and cultural context, and at times this will require unpopular decisions and controversial tradeoffs to be made. In this context, strong leadership is essential to reinforce policy positions in situations where the issues seem intractable. For policy positions to withstand this scrutiny, part of the leadership role is in ensuring those policy positions are developed with the involvement of a broad range of stakeholders.

It has been recognised that even where roles are clear, in the absence of adequate resources to execute responsibilities, or accountability for fulfilling those roles, implementation is compromised.[169] In defining roles and responsibilities for sea level rise, there is a need to match responsibilities with the ability to deliver on them, or find ways to build capacity and support stakeholders in their roles. Stakeholders should be involved in this definition process.

A shared understanding of defined roles and responsibilities is also required for efficient operation of a management system, and therefore effective communication of roles and responsibilities to stakeholders and the public is a responsibility in itself that should be clarified.

Performance of the current system against the principle

Roles and responsibilities in coastal management are described in various documents associated with coastal management systems (for example DEWNR's recently updated Coastal Planning Package[170]). There is no single, publicly accessible document or location that exhaustively sets out the roles and responsibilities of different stakeholders involved in managing sea level rise in South Australia.

Existing coastal management systems involve defined roles and responsibilities that support the management of the coastal zone and sea level rise, for example:

- Powers of the Coast Protection Board under the Coast Protection Act;

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[168] Dovers, 2006, pp. 8-9; Webb, McKellar & Kay 2013, pp. 324-329.

[169] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, p.16 & pp. 252-253.

[170] DEWNR 2013, Coastal Planning Information Package: A guide to coastal development assessment and planning policy (revised)

- Requirements to apply Development Plan Policy and consider advice of specialist agencies in determination of development applications under the Development Act and Regulations;
- Description of roles for state, regional and local organisations in regional adaptation planning set out in the Climate Change Adaptation Framework for South Australia;
- Requirement for Natural Resources Management Boards to plan for the management of natural resources in a holistic, integrated way under the Natural Resources Management Act; and
- Responsibilities of local government to prepare Infrastructure and Asset Management Plans, and Long Term Financial Management Plans under the Local Government Act.

These roles and responsibilities are defined within the context of separate systems, and under the objects of different legislation. It is established that successful coastal management and adaptation requires integration, but no official guidance currently exists in relation to:

- How sea level rise management objectives are met through the current roles and responsibilities of stakeholders within the various systems;
- Where roles and responsibilities overlap, how responsibility for action is determined;
- Where gaps exist or arise, how responsibility to respond is determined; and
- Where multiple parties have roles and responsibilities in an adaptation response, how this is to be coordinated and managed particularly where different perspectives or interests are at play.

Interview feedback emphasised that roles and responsibilities for managing sea level rise are neither clearly defined nor well understood. This is particularly the case where multiple stakeholders with differing interests are involved. The establishment of protection works was given as an example where confusion and dispute occurs about who should lead an initiative, who should play a supporting role, and who is responsible for implementation and for funding (refer discussion of coastal shack settlements in Section 4.3.1).

Uncertainty and dispute over responsibility for adaptation can be associated with uncertainty and sensitivity surrounding liability for sea level rise risks. Amongst the most commonly identified barriers to effective sea level rise management by interviewees was difficulty defining who is responsible for addressing risks.

Relevant to the notion of a stronger leadership role in sea level rise management, some interviewees suggested the need for a dedicated body to coordinate and oversee the generation of mapping and identification of sea level rise adaptation priorities across the state. This suggestion was tested with several other interviewees

who in theory supported the idea but noted the need for such an authority to "have teeth" [171] in the form of authority to act, supported by adequate resourcing.

Assessment: Significant action is required to progress current system performance in relation to the principle

Opportunities to realise the principle

Model system

The model described in Section 5.2 broadly defined roles and responsibilities for its implementation, specifically a State Government role in leadership, coordination and support, and roles for local and regional organisations in planning and implementation. Application of the model system would involve a leadership role for state government as described below.

State Government leadership role

Whether or not the model system was adopted in some form, there is a need for State level leadership on sea level rise management. This leadership could be in the form of expanded responsibilities of an existing body or creation of a new body[172], with explicit responsibility for coordinating sea level rise adaptation across sectors and jurisdictions, inclusive of:

- Identifying state-wide objectives for sea level rise management and their relationship with various coastal management systems;
- Communicating roles and responsibilities in sea level rise management;
- Engaging with stakeholders to better define roles and responsibilities; and
- Providing guidance, support, and accountability for discharge of responsibilities in relation to sea level rise objectives.

State Government is suited to this leadership and coordination role given the benefits of a consistent approach for the entire coast, and the varying levels of resources and capacity amongst coastal councils.

Commonwealth leadership role

There has been some emphasis on the need for national leadership on coastal management and particularly the impacts of climate change, including funding on a long term and secure basis.[173] South Australia should continue to call on the Commonwealth Government to perform this leadership role.

Statutory clarity around liability

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[171] Where text is in quotation marks within description of an interview response, this represents a verbatim quote from an interviewee.

[172] If a study is commissioned and the outcomes demonstrate that the current framework of government bodies and remits cannot adequately cover the responsibility for coordinating sea level rise adaptation across all sectors and jurisdictions

[173] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, p. 277.

In the context of climate change risks, a national review has recommended that all states enact statutory defences to liability of local government in a manner similar to that in place in New South Wales under section 733(3) of the *Local Government Act 1993 (NSW)*.[174] This type of reform could contribute to clarity around responsibilities for climate change actions, and enable councils to implement adaptation responses from a position of clarity around liability. Conversely, there have been recent indications that statutory limits on liability in New South Wales have been ineffective. Like each opportunity to transition to a more ideal system identified by this Issues Paper, further research and consideration is required to inform legislative or policy change.

5.1.4. Principle 4: Information required to make decisions in the coastal zone is available and accessible, and decision makers have the capacity to use the information appropriately

Rationale for the principle

An identified challenge to ICZM is "lack of integrated, robust and accessible information to guide the policy community, and the institutions and human capacity to create and distribute it".[175] It has also been noted that leading practice adaptation involves basing decisions on evidence, and that some stakeholders will require support to access, interpret and apply scientific information.[176]

In the context of ICZM approaches (refer Section 3.1), the Northern Territory government has identified that "effective management of the coastal zone requires that those developing or making policy decisions in coastal areas have access to diverse types of information including social, cultural, economic, ecological, biophysical and geophysical information and data".[177] This statement emphasises the notion, also expressed through Principle 1, that coastal environments are complex in their social, environmental and economic facets, and scientific information alone cannot be the basis for integrated decision making.

It has been noted that availability of data and information does not directly equate to better knowledge of decision-makers: "it does not become knowledge for decision-makers until they process the information themselves".[178] While new research is constantly generated, the transition to knowledge is not necessarily flowing, with a lack of knowledge and skills within decision making organisations being often identified as a barrier to adaptation.[179]

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[174] Baker & McKenzie 2011, pp. 5

[175] Dovers, 2006, pp. 8-9.

[176] Gurran, Hamin & Norman 2008, p. 24.

[177] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, p. 273.

[178] Souter, R & Fearon, R 2006 *Research to Support Coastal Management in Australia: Generating Better Information and Knowledge in the Current Coastal Management Environment* in Lazarow, N, Souter, R, Fearon, R & Dovers, S (eds), 2006 *Coastal management in Australia: Key institutional and governance issues for coastal natural resource management and planning*, Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management, Inodooroopilly, p. 114.

[179] Barnett, Walters, Pendergst & Puleston 2013p. 1; City of Onkaparinga 2013a, *Social and Institutional Mechanisms for Transitioning to Resilient Practices*, prepared by URPS for the Cities of Onkaparinga,

Submissions to the recent national inquiry into the coastal zone noted that "capacity building, as well as increased resourcing, is urgently required to improve local government's ability to manage the coastal zone effectively ... many councils are struggling to attract and retain staff that have enough knowledge and experience to manage their coasts. Without technical support at the state level for these council officers many poor decisions can be made".[180] This sentiment regarding the need for capacity building of Council staff was also reflected in the interviews undertaken for this Issues Paper.

Within the Model of Receptivity, a conceptual tool for considering various factors influencing organisations' willingness and ability to undertake adaptation, the capacity of organisations to acquire skills, systems, technologies and behaviours is one of four attributes required for adaptation to occur. In this Model, developing characteristics within organisations that are conducive to acquiring new knowledge and skills is a strategy for more effective adaptation.[181]

Interviewees expressed the view that access to consistently generated information about projected sea level rise is critical for decision making. The call for consistently developed state-wide sea level rise mapping to be undertaken and made widely available was identified by several interviewees as a key step necessary to progress the management of sea level rise. As one interviewee stated:

> *"Quantifying the problem is a very important first step, then we can work through the options of what we should do. We need to get a handle on the size of the problem"*

Good decision making depends on not only the required information being generated, but also on the format and distribution of the information, the skills and knowledge of stakeholders to use the information, and the availability of tools to assist in applying the information – for example guidelines, decision maps, and toolkits.

Performance of the current system against the principle

While there is sea level rise data available through national programs such as OzCoasts mapping (refer Section 2.1), quantification and communication of the risk of sea level rise to South Australia in a manner that is useful to decision makers has not occurred consistently. The lack of sea level rise projection mapping available was a recurring theme identified by the interviewees, however there may be a need for a clearer understanding of the nature and extent of information actually required as a basis for decision making – while DEM provides the most accurate mapping, decisions about sea level rise risk can be made without it.

Through the interviews it was noted by some that the Coast Protection Board possesses considerable information that assists them to provide advice on coastal risks, and that this information is openly shared with stakeholders in the course of assessment of development applications, and planning for coast protection works.

Holdfast Bay, Marion and Mitcham in association with the Government of South Australia and the Australian Government, pp. 12 & 21

[180] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, p. 258.

[181] City of Onkaparinga 2013a, pp. 12-13

The possession of information by the Board is appropriate given it is the lead body in assessment of coastal risks. In terms of public access to information, the Coast Protection Board website contains limited resources.[182]

Other interviewees however, including local government and the development sector, expressed that the availability and nature of information that exists and largely kept by the Coast Protection Board, as a basis for decision making in relation to coastal risks is not well understood. A lack of transparency in the method of collection of information was also identified, with one interviewee stating that their sector is "suspicious of dramatic models of the future that have not been the subject to discussion in their development". The view was expressed that data collection and analysis seems to happen "behind closed doors" and is only shared when a process is a long way down the track. A better approach to engaging with stakeholders was considered to be "open communication to create a healthy exchange or ongoing dialogue ... bringing the [sector] along".

In the context of development assessment, a number of interviewees identified that current planning policy in itself is "good", however considered that it was difficult to apply due to a lack of data needed to apply the policy, for example sea level mapping. Several interviewees expressed a view that the majority of coastal councils would not have suitable data to be able to apply the sea level rise provisions in Development Plans (refer Section 4.3.2), because they would not have data to determine what land would be impacted by 0.7 metres of sea level rise. One interviewee had conducted a survey of the planners at a council to understand the degree to which they were aware of the sea level rise related policies, and the extent to which they utilised the policies in assessing development applications. This survey revealed that generally the development assessment planners were aware of the policies but "applied them loosely" due to a lack of "precise" data.

Interviewees also emphasised the importance of development assessment decisions being "defendable", based on the "best available information", and able to withstand scrutiny in the Environment, Resources and Development Court.

Some interviewees described councils as being "heavily reliant" on Coast Protection Board advice in the determination of development applications referred to the Board. Reasons given for this included the value of the knowledge and expertise of the Board to support interpretation of costal policies, as well as perceived benefits of providing distance, in the eyes of the applicant, between the council planner and the planning decision.

One interviewee attributed reliance on referral authorities to councils being "amazingly risk averse" in their approach to coastal development. It was noted that developers can be frustrated by this as in effect, "the decision maker changes", resulting in "faceless people making conservative decisions on the basis of very specialised expertise and perhaps limited knowledge of the context of a proposed development". The view was expressed by a number of interviewees that specialist expertise should be applied in a way that is useful and context relevant, and that

[182] http://www.environment.sa.gov.au/files/72381b99-8d52-4f32-9b62-9e66017b9c24/con-fact-publicationscoastprotect.pdf accessed 23 January 2014 - link opens a bibliography last updated in 1996 containing numerous sources from the 1980s and 1990s; http://www.environment.sa.gov.au/our-places/coasts/Adelaides_Living_Beaches/Resources accessed 23 January 2014 – primarily material of a very general nature or communications materials.

planners need to "ask the right questions" of referral bodies and use the information provided as part of a broader decision making process.

In contrast, other interviewees including representatives of local government advocated expansion of the Coast Protection Board's powers of direction under the referral process, as is reflected in the Board's current Strategic Plan. One interviewee identified that a benefit of this would be to distance council planners from the assessment process. For planners working in regional communities this can be a key issue as "everybody knows everybody".

From its submission to the Planning Review, it can be inferred that the Coast Protection Board itself is likely to see the instances of development assessment decisions not in accord with their advice as an example of decision makers not using available information appropriately – and therefore poor performance of the system in relation to this principle.

It is important to note that these differing views about the role of referral advice as the basis for decision making exist within a context where locally relevant information about sea level rise risk is neither widely accessible, nor broadly understood by stakeholders.

Interviewees noted that the capacity of councils to apply information appropriately in decision making can be influenced by high staff turnover and a lack of financial resources, particularly for regional councils.

In terms of how information is being applied in land use zoning decisions, the Coast Protection Board has identified that around 38% of land that is subject to known coastal risks (not including sea level rise)[183] is located outside of Coastal Zones in Development Plans.[184]

The Eyre Peninsula Coastal Development Strategy undertaken in 2007 provided zoning guidance for coastal land in that region, but has not been reflected in the Development Plans of all the regional councils, indicating that some breakdowns exist between information collection and strategic decision making, and the next step to implementation.

Assessment: Significant action is required to progress current system performance in relation to the principle

Opportunities to realise the principle

Model system

While several interviewees identified a need for state-wide sea level rise mapping, the cost of sea level rise mapping exercises and the length of South Australia's coastline has an impact on the feasibility of detailed mapping to be undertaken across the state. Notwithstanding this, vulnerability to sea level rise risks can be determined to some degree without sea level rise mapping. What is likely to be more

[183] These hazards are likely to be exacerbated by sea level rise, refer Section 2.2.

[184] Coast Protection Board 2013, pp. 8-9.

important is making connections between decision makers and relevant available data.

The ideal model described in Section 5.2 involves a risk management approach in which high level assessment of the whole coast identifies locations at high risk and of value in order to trigger more detailed localised assessments. This assessment could involve sea level rise mapping for the entire coastline, or could be undertaken using existing information regarding coastal geomorphology, topography and plans and studies such as coastal action plans to identify priorities for more detailed assessment to be undertaken which could include mapping at certain locations.

This approach is consistent with conclusions drawn by the Investigations into Sea Level Rise Mapping Requirements project initiated by the Eyre Peninsula Local Government Association. This project identified a series of principles and key steps to be applied to assist with determining the level of detail that may be required in sea level rise and storm surge mapping. A key feature of this approach was to utilise existing information to undertake a first pass assessment to identify areas that may require further investigation. This approach recognised that those areas likely to be at risk may already be known, (particularly when consideration is given to existing knowledge about the coast's geomorphology such as low lying areas, sandy versus rocky coastline, tidal ranges, wave sizes, sand movement and dune recession), and that not all locations or decisions relating to those areas will need the same level of mapping detail.

The model also provides for consistent methods to be applied at all levels of risk assessment, for data to be centrally collected and shared to inform the various stages of the model, and for stakeholder engagement and preparation of toolkits and guidelines to be prepared to support the model.

National mapping

National sea level rise mapping has been widely recommended (refer Sections 4.2 and 4.3.5). South Australia should continue to call on the Commonwealth Government to coordinate such mapping, and seek the opportunity to contribute ideas and feedback to the mapping methodology and form of distribution and access.

Sea level rise information hub

The Commonwealth Government inquiry into coastal zone management and climate change recommended a national role in distributing information between the research sector, local governments and other stakeholders (refer Section 4.2). A similarly consistent and proactive approach to gathering and sharing information stored in a central location could be applied at a state level.

A first step could involve negotiating with owners of existing studies to share their information, and make it available in a central repository such as a website. Varying levels of access may be required between governments and the general public, but as much information as possible should be publicly available. Such a repository should be supported by good guidance for interpretation of information, and generation of clear, plain language basic information about sea level rise. Other aspects to consider are use of the information to compile a coastal zone database.

All aspects of information collection, storage, interpretation and distribution should be subject to regular review to keep up to date with new data, technology improvements, and changing information needs of decision makers and the general public.

Capacity building

There is a need for the development of capacity building programs and tools that:

- Direct decision makers to available data
- Provide guidance and build skills in its use; and
- Locate their decisions in the context of sea level rise risks, coastal issues, and their responsibilities in the management system.

Such programs could be developed and delivered by State Government, the LGA, and NRM Boards either independently or in partnership.

5.1.5. Principle 5: Priorities for adaptation along South Australia's coastline are identified, enabling adaptation responses to be strategic and coordinated

Rationale for the principle

Identification of coastal protection priorities in a strategic and coordinated manner allows:

- Informed planning for coastal adaptation based on consistent information;
- Increased certainty amongst stakeholders of where locations of interest 'fit' in a broader coastal adaptation strategy; and
- Resources available for coastal adaptation to be distributed equitably, including with consideration of intergenerational equity.

Identification of priorities should be underpinned by a process that considers a range of social, economic and environmental factors to determine the extent and timing of action and investment of resources required in different locations on the coast (refer Principle 1).

A number of interviewees identified the critical need for locations that play a key role in the economy of the region and state to be protected from sea level rise. Also identified was the need for a mechanism to better coordinate proactive management responses in relation to major infrastructure, intensively developed areas such as the metropolitan coastline, and locations of economic importance such as the Le Fevre Peninsula.

The need to take a more strategic approach to adaptation of regional coastal settlements was also identified by several interviewees. Comments included

concern in relation to the resources required to develop protection strategies for relatively small populations, and a desire to see state-wide identification of risks and "hotspots" where action should be focussed.

Performance of the current system against the principle

Under the South Australian Climate Change Adaptation Framework, preparation of Regional Adaptation Plans will go some way to identifying priorities for broader adaptation action including to sea level rise.

However, the legacy of past decisions relating to relatively small, remote and sparsely populated areas of the state where privately developed Crown land, subsequently granted freehold tenure, is subject to known coastal risks (refer Section 4.3.1) is currently requiring a significant proportion of public resources available for coastal adaptation. Case studies illustrate the time consuming, complex and costly nature of establishing protection works in these locations (refer Section 4.3.1).

Planning decisions being taken now, potentially without due regard to coastal risks (refer Section 4.3.2), or without adequate information to ascertain and effectively manage sea level rise risk (refer Principle 4), further embed a reactive approach to adaptation, and skew future allocation of public resources toward protection works in locations of unknown social, economic and environmental value.

The lack of identification of priorities for action is likely to be linked with the low level of widespread understanding of sea level rise risk and need to adapt, including amongst coastal decision makers (refer Principle 4).

Assessment: Significant action is required to progress current system performance in relation to the principle

Opportunities to realise the principle

Model system

The model framework set out in Section 5.2 proposes a risk and values based approach to identifying adaptation priorities along the entire coast, using consistent criteria and guidance to identify risks and prioritise further action.

Stakeholder engagement is present throughout the model framework, and is especially important early in the process to create a common understanding of values and risks as a basis for identifying priorities.

In identifying priorities within the model framework, a process would be required to determine unacceptable levels of risk in relation to coastal assets (social, economic and environmental). This prioritisation process would enable the specific circumstances of a locality to be considered including reflection on what is important to or valued by the local, regional and state-wide community.

5.1.6. Principle 6: Adaptation responses are tailored to the local context, but reflect a consistent approach to risk management for the entire coastline

Rationale for the principle

It is recognised that frameworks, methodologies, and tools for decision making to manage sea level rise must account for the fact that adaptation is not 'one size fits all'. [185] Coastal adaptation must be implemented in multiple unique and complex contexts, amongst which values, drivers, and expectations differ.

While adaptation responses need local relevance and ownership to work in practice, some consistency is required to ensure adaptation of the whole coastline is occurring in a complementary and orderly manner, and that the efforts toward adaptation are appropriate and equitable at a broader scale.

While not necessarily the case in South Australia, it has been noted more generally that an absence of consistent guidance at State level about how to deal with coastal planning issues, particularly climate change, can lead to:

- Less well resourced councils experiencing further disadvantage through 'falling behind' in adaptation;
- A lack of consistency in policies between councils, particularly in relation to new development, leading to confusion amongst stakeholders; and
- Maladaptation - for example where a local protection response creates negative impacts on another location on the coast.[186]

Performance of the current system against the principle

Several interviewees reflected the view that there is no "one size fits all" response to managing sea level rise, and that the management system should not be "prescriptive". Interviewees also noted that some aspects of the system could benefit from consistency in approach, for example methods of understanding risks as a basis for decision making.

Several interviewees called for guidelines to provide the basis for applying a consistent approach to the issue presented by sea level rise, with one commenting that "there is no perfect solution but there can be a consistent approach".

The issue of balancing local responsiveness with a consistent approach on the broader scale can be considered in terms of "flexibility vs. mandate".

Assessment: Some action is required to progress current system performance in relation to the principle

[185] Webb, McKellar & Kay 2013, pp. 324-329.

[186] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, pp. 126-127.

Opportunities to realise the principle

Model system

The model framework described in Section 5.2 provides for locally driven risk assessment and adaptation in the context of consistent state-wide criteria, assessment tools and guidance.

5.1.7. Principle 7: Legislative and policy instruments are in place to support effective functioning of the system

Rationale for the principle

Where a management system's intent is established through legislation or otherwise, consistency and practicality amongst strategies, policies and governance practices involved in implementing the system is vital for action to occur.

In an integrated system such as coastal management, there should be a consistency of approach amongst the regulatory systems (refer Section 4.3) to the issue of sea level rise, and a common approach to managing those issues that impact on the regulatory systems (refer Section 4.4).

The strategies and policies in place under different regulatory systems should support each other, and utilise intersections between systems as opportunities for more efficient adaptation, rather than propose, or appear to propose, a duplication of efforts which could increase the cost of adaptation to stakeholders, and even act as a disincentive to taking action at all.

Lack of alignment or anomalies between systems can lead to perverse impacts and maladaptation. Regular review is required to ensure consistent objectives are being supported through all legislative and policy instruments that form the system.

Legislative requirements and policy frameworks form the foundation of a management system, but information provision, capacity building, adequate resourcing and accountability structures all have important roles to play in its functioning. The pivotal role of knowledge and capacity is similarly relevant to the application of policy as it is to the application of information, as described in relation to Principle 4 – i.e., good decision making depends on not only the "right "policies being in place, but also the skills, knowledge and data stakeholders have access to in order to apply the policy.

Not all aspects of a management system require statutory force to operate effectively, and capacity building should be considered as a preferable alternative or adjunct to increasing the application or prescriptiveness of legislative requirements.

Performance of the current system against the principle

Many State and council strategic and policy documents clearly set out the imperative for adaptation, and guidance for managing sea level rise risks, and there is general consistency amongst the approach of these instruments to the sea level

rise issue (refer Sections 4.3.1 – 4.4.3 in particular). However progress to act on the basis of such policies has been on balance, slow and inconsistent – this fact being a key driver of the development of this Issues Paper.

While the relationship between the Planning Strategy and Development Plans is clear in legislation, stakeholder engagement undertaken for the review of the planning system that is currently in progress has identified that there is a need for greater clarity, and possible legislative clarity, around the relationship between the Planning Strategy and other government plans, for example the Climate Change Adaptation Framework for South Australia and Natural Resources Management Plans.[187] Any current lack of clarity around precedence of various policies involved in sea level rise management is likely to compromise effective integrated functioning of the systems involved.

Various legislative provisions are in place to allow for coastal land to be brought into the care and control of agencies with a specific focus on sea level rise management – for example the Coast Protection Board, Natural Resources Management Boards, and Ministers of the Crown. While these powers are available to support adaptation, use of them in practice necessitates extensive non-statutory stakeholder engagement and would be subject to community scrutiny.

Generally this study has found that current system breakdowns are more likely to be found in policy and process implementation, than in policies themselves (refer Principles 3, 4 and 8). For example, the mechanism exists in the Development Regulations 2008 for the Coast Protection Board to provide advice to planning authorities on development decisions, however there is some concern around an upward trend in decisions not being in accord with its advice (refer Section 4.3.2).

Some anomalies in legislation exist, for example current provisions within the Development Act and Regulations that have the effect of some development on coastal land being potentially exempt from referral in locations where land is subject to unaddressed coastal risks (refer Section 4.3.2).

The current mechanism for identifying and seeking resolution of these types of inconsistencies in coastal management systems is likely to be broader reviews of those systems and documents to which stakeholders with a key interest in sea level rise management (e.g. the Coast Protection Board, councils) make a submission.

Disadvantages of this approach include the reliance on periodic reviews that may not be responsive to changing conditions around the management of sea level rise; the consideration of such submissions within broader terms of reference that influence the weight given to issues associated with sea level rise; and a reliance on possibly lengthy review processes determined by systems with broad and complex concerns beyond sea level rise.

There is always the opportunity for problems with existing management systems to be raised by stakeholders on an ad hoc basis, but the disadvantages of this approach include stakeholders' differing capacity to influence the systems, no allocation of resources, and absence of a clear framework within which change of the system should be contemplated.

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[187] South Australia's Expert Panel on Planning Reform 2013, p. 43.

Assessment: On balance, existing legislation and policy supports the objects of the existing system. Some action is required to improve system performance and integration.

Opportunities to realise the principle

Model system

The model system described in Section 5.2 is designed to support stakeholders in realising the objectives for sea level rise management set out in numerous strategic and policy documents across existing management systems, and provides for influencing legislation and policy as part of strategies developed through rigorous and consistent adaptation planning processes.

Address current discrepancies in the Development Regulations

Specific provisions of the Development Regulations identified in the Coast Protection Board's submission to Think Design Deliver (refer Section 4.3.2) should be reviewed to ensure referral mechanisms function appropriately in all circumstances.

Regular review of coastal management systems with a focus on sea level rise

Given the integrated nature of sea level rise management across multiple systems and legislative and policy instruments, there may be merit in a program of regular review of these systems with reference to specific state-wide objectives for sea level rise (refer discussion of Principle 3, particularly in relation to leadership on the issue of sea level rise management).

Such a review program would need some status amongst stakeholders in coastal management systems to support integration of review findings into each system, and would require allocation of resources to enable an appropriate level of investigations.

5.1.8. Principle 8: Appropriate resources are allocated to effectively implement the system

Rationale for the principle

In an ideal system, where the objectives and functions of a system are agreed to, adequate resources should be allocated for those functions to be efficiently and effectively performed, and objectives met. Costs of the system should also be fairly distributed, with regard to both responsibility for the objectives, benefit derived from application of the system, and ability to pay.

Nationally, lack of resources has been identified as a barrier to coastal adaptation - specifically lack of staff, lack of skills and expertise, high capital and program costs, limited investment markets, and lack of government funding.[188] Local government submissions to the national inquiry into coastal zone management noted that

[188] Barnett, Walters, Pendergast & Puleston 2013, p. 1.

increased resourcing, including for capacity building is urgently required to improve local government's ability to manage the coastal zone effectively and reduce the risk of poor decisions being made in the planning process, management activities, and development of new infrastructure. [189]

Performance of the current system against the principle

In the absence of a coordinated and strategic approach to adaptation to sea level rise (and the resources to implement such an approach), the "default" management system will be reactive to the most immediate risk – particularly in a context of limited public understanding of sea level rise risks.

Much of the development in South Australia requiring urgent adaptation to sea level rise is situated in regional areas, and comprises small coastal settlements. Many of these are "shack" settlements where development on what was historically Crown land is now in freehold private ownership (refer Section 4.3.1). For many councils, the ability to participate in a coordinated response to protection works is limited by very small operating budgets, resulting in a heavy reliance on State Government support via the Coast Protection Board.

Interviewee comments indicated that regional coastal councils and State Government agencies are concerned with a lack of equity within the current system on the basis that the substantial resources required to protect small sections of the community (e.g. shack owners) to address the legacy of previous decisions, reduces the ability of these organisations/ agencies to undertake activities with broader community benefit.

Some interviewees also questioned whether the Coast Protection Board is well resourced enough to continue to undertake its functions, particularly given the large support role it plays for some regional councils that lack "in house" knowledge and expertise in a range of coastal management issues.

Leadership to drive collaboration to overcome resource scarcity has been found to be necessary for adaptation to occur,[190] and this is evident to some extent in the regional approach to adaptation planning that is being driven under the Climate Change Adaptation Framework for South Australia (refer Section 4.3.3).

Assessment: Significant action is required to progress current system performance in relation to the principle

Opportunities to realise the principle

Model system

The model system described in Section 5.2 proposes an approach to prioritising coastal adaptation and distribution of State Government support that considers risk as well as social, economic and environmental values. Allocation of adequate resources to implement this or some other kind of prioritisation framework enables

[189] House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, pp. 258 & 259.
[190] Webb, McKellar & Kay 2013, pp. 324-329.

more equitable and efficient distribution of resources in the future to implement adaptation where benefits will be greater and more broadly experienced.

Continue to pursue Commonwealth funding

It is widely accepted that the Commonwealth Government is well placed to play a role in providing State and local governments with financial support for coastal adaptation, along with national leadership and information provision. State and local government should continue to pursue such funding from the Commonwealth, including for implementation of State-led adaptation approaches.

Consider levies and differential rates for coastal property

One way of augmenting resources available to manage sea level rise is to collect funds from owners of coastal properties in the context of the benefit they will derive from future investment in adaptation.

Currently councils can choose to apply different rates in the dollar for different localities within their area on the basis of Development Plan zoning or location inside or outside a particular named township.[191]

Such an option requires careful consideration of implications for the socio-economic wellbeing of communities, as well as a broader understanding of different rates structures adopted by different councils. In addition, large areas of coastal land are within local government or Crown ownership, and how this is dealt with would impact on the overall effectiveness of this option.

5.1.9. Principle 9: Stakeholder engagement informs and supports all aspects of the system

Rationale for the principle

The coastal zone is characterised by the presence of tightly held values and multiple, often competing interests, roles and responsibilities. This complexity reflects both the value of the coast, and the challenge of effective coastal management.

In an ideal system, culture and processes in place would support genuine constructive engagement between the various stakeholders (inclusive of residents, property owners, visitors, businesses, industry, government and community organisations)to address the issues presented by sea level rise. There would be a shared willingness to contemplate a broad range of options, focus on outcomes, and resolve issues without compromising the overall objective of adapting to sea level rise.

While no amount of stakeholder engagement will remove the need for difficult and unpopular decisions to be taken in the management of sea level rise, over time, engagement (along with effective communication – refer Principle 2) is essential to overcoming political, cultural and behavioural barriers to adaptation.

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[191] http://www.localgovt.sa.gov.au/how_councils_work/council_rating accessed 3 February 2014.

Early and ongoing genuine stakeholder engagement in adaptation planning is likely to support eventual implementation by building stakeholder understanding and confidence, and integrating values and preferences into the planning process.[192]

Stakeholder engagement is also closely associated with generation and distribution of information on which to make sound adaptation decisions (refer Principle 4), and shared clarity around roles and responsibilities for sea level rise management (refer Principle 3).

Performance of the current system against the principle

Each of the existing coastal management systems (refer Section 4.3) involve statutory and/or informal engagement with key stakeholders and/or the broader community. A full evaluation of these processes has not been undertaken. Findings from initial stakeholder engagement undertaken to inform Think Design Deliver (the current review of the planning system) however provide insights likely to reflect key issues associated with stakeholder engagement within all coastal management systems. These insights include that:

- A lack of explanatory information is available about the system, its role, and the part engagement plays in decision making processes, leading to frustration amongst those seeking to participate;
- Engagement and communication should be central to the system, but there are mixed views about who is responsible for it, what influence it should have, and whether too much engagement reduces the efficiency of the system;
- There is a perception that statutory consultation processes invite input late in decision making processes and thereby generate conflict, but it is also recognised that it is difficult to generate sustained community interest in long term, big picture issues;
- Councils and communities, especially in regional areas feel over-consulted, but a region-based collaborative approach between government organisations is likely to support adoption of integrated plans;
- There is potential for formalised legislative involvement of community and business representative bodies in strategic decision making.[193]

As noted in relation to Principle 2 regarding effective communication of risk, varying levels of understanding of sea level rise issues exist amongst South Australia's various coastal stakeholders. Interviewees from all sectors suggested that without clear messages and increased awareness about the need to adapt to sea level rise, the tightly held expectations community members have about their right to develop land along the coast will remain an insurmountable barrier to adaptation.

In terms of engagement between government stakeholders, the report on initial stakeholder engagement for Think Design Deliver reported perceptions of

[192] Webb, McKellar & Kay 2013, p. 327; Dovers, 2006, pp. 8-9.
[193] South Australia's Expert Panel on Planning Reform 2013,pp. 2 & 43-45.

misalignment between various government agencies engaged in the planning system, and a 'silo' mentality amongst agencies focussed on their own objectives – in contrast to an integrated approach. These types of issues were raised by interviewees for this Issues Paper, are likely to be both relevant to multiple coastal management systems, and may be addressed to some extent by improved engagement and genuine collaboration amongst agencies.

Assessment: Significant action is required to progress current system performance in relation to the principle. Future system improvements in line with other ideal principles and focussed on sea level rise in particular should seek to embed stakeholder engagement.

Opportunities to realise the principle

Model system

The model system described in Section 5.2 seeks to embed stakeholder engagement (including engagement with residents, property owners, visitors, businesses, industry, government and community organisations) and effective communication throughout all stages of the proposed approach to sea level rise management, from high level identification of risks through to delivery of adaptation strategies. A consultative approach is also proposed to determining a standard state-wide risk assessment process and criteria to support application of the framework.

As the challenges for engagement described by participants in the Think Design Deliver consultation (refer previous page) have relevance in a sea level rise management context, the Expert Panel's forthcoming findings on these issues may provide insight as to effective engagement mechanisms to inform the model sea level rise management system.

5.1.10. Principle 10: An adaptive management approach informs and supports all aspects of the system

Rationale for the principle

In addition to the benefits of any program of monitoring and evaluation, adaptive management utilises iterative and risk management based approaches to support decision making under conditions of uncertainty. Such an approach does not require a particular level of information to enable action, but rather provides for objectives to be pursued at the same time that information is gathered to inform future efforts to meet the objectives.

In its focus on flexibility and process in decision making, concepts of adaptive management are consistent with leading practice concepts of climate change adaptation such as resilience and adaptation pathways (refer Section 3.2), and

adaptive management can support adaptation planning from scoping through to implementation stages.[194]

An adaptive management approach is well suited to tackling the uncertainty and complexity associated with sea level rise management, and could contribute to overcoming slow progress in addressing sea level rise, particularly where an actual or perceived lack of information as a basis for decision making is a factor (refer Principle 4).

Performance of the current system against the principle

Some aspects of current coastal management systems are more influenced by adaptive management approaches than others. The South Australian Climate Change Adaptation Framework for example includes adaptive management within its principles to underpin adaptation action, and the approach is reflected in State and Regional NRM Plans and DEWNR practice guidance that seeks identification of assumptions, risks, decision points, key evaluation questions, evaluation processes, evidence and reporting processes to ensure critical NRM decisions are appropriately informed.[195]

The high number of interviewee comments that attributed a lack of action to manage sea level rise to inadequate information and capacity upon which to base decisions indicates that in practice, adaptive management may not be well understood or adopted across coastal management systems.

Assessment: Significant action is required to progress current system performance in relation to the principle

Opportunities to realise the principle

Model system

The model framework described in Section 5.2 provides for monitoring, evaluation, integration of new information, and adjustment of the framework throughout its application.

5.2. Model of an ideal sea level rise management system for South Australia

In response to the objectives of the Issues Paper, a model framework for management of sea level rise in South Australia has been developed, and is summarised in Figure 5.1. The model has been developed in response to the principles of an ideal system described in Section 5.1, and with an appreciation of the current system and its strengths. Table 5.1 describes each component of the system - identified by letters A- G as shown on Figure 5.1 - as well as how it responds to the principles of an ideal system.

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[194] Webb, McKellar & Kay 2013, pp. 324-329.

[195] http://www.environment.sa.gov.au/about-us/our-progress/nrm-guide-overview/monitoring-evaluation-adaptive-management accessed 3 February 2014.

The model framework does not constitute transformational change of the existing system. Each component of the current system generally contains good policies, and mechanisms are in place both for application of those polices, and for integration between the components of the system (for example land use planning and coast protection).

Challenges to the current system are often in the implementation of each component system rather than the system itself, or failure of mechanisms on the basis of external factors - for example where strategy is not translated into applied policy due to lack of knowledge or resources, or the impact of conflicting influences on decision makers.

The more important challenge to the current system, that the model framework does seek to address, is the absence of a strategic, coordinated approach to managing sea level rise as an issue for the whole of South Australia in a way that can identify risks and priorities and coordinate action. While various elements of the current system have processes in place to manage sea level rise (strategies, policies, legal responsibilities), there is currently no program to coordinate sea level rise management on a strategic basis, across the entire coastline and various systems and jurisdictions.

To effectively and efficiently address the sea level rise, having such coordination is vital when each system and jurisdiction is subject to numerous competing priorities. The model framework is intended to provide this strategic coordination, and complement and enhance the ways in which existing systems operate to manage sea level rise.

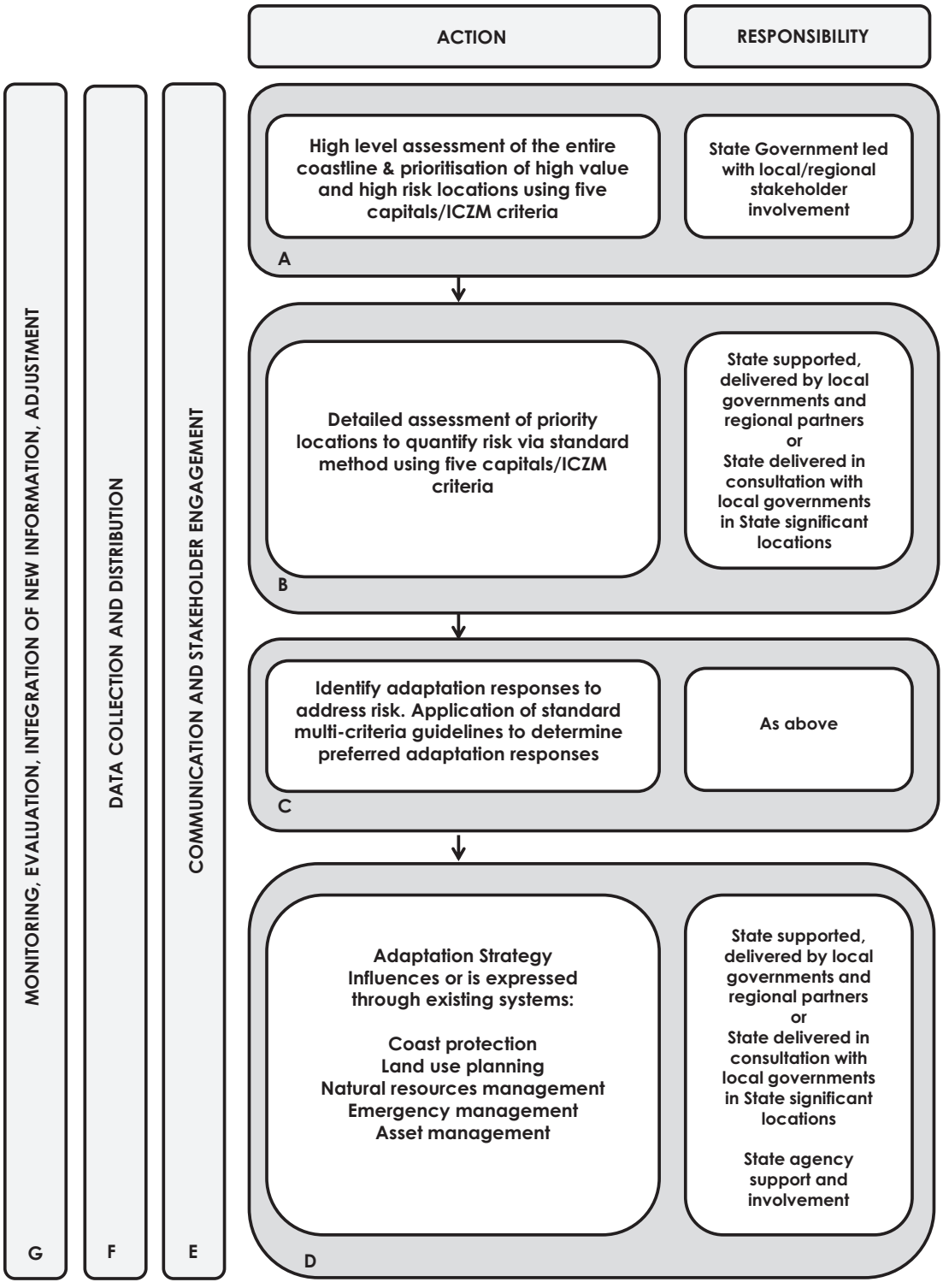

Figure 5.1: Model Sea Level Rise Adaptation Framework

Table 5.1: Explanation of the Model Sea Level Rise Adaptation Framework shown in Figure 5.1

Ref	Description/Rationale	Related Principles
A	<u>High level assessment of the entire coastline and prioritisation of high value and high risk locations using five capitals[196]/ICZM criteria</u> The purpose of this task is to overlay risks and spatial expressions of social, environmental and economic value along the entire South Australian coast, as a basis for determining adaptation priorities. The task would ideally involve sea level rise mapping for the entire coast, to obtain a more precise understanding of risks, but could also be undertaken on the basis of existing information and informed assumptions. This initial high level assessment would be undertaken by State Government, with substantial input from local and regional stakeholders into the scope, method and criteria used in the assessment. The assessment would: • Identify the relationship between value and risk on a regional or localised scale; • Identify adaptation priorities in relation to timing of action, responsibility for action, and allocation of resources to support adaptation; • Identify locations of state significance at risk that justify a greater degree of State Government involvement in progressing adaptation - noting that within the model, state government also play a role in coordinating and supporting (financially and/or non-financially) identified adaptation priorities in locations that do not meet state significance criteria.	1, 2, 3, 4, 5, 7, 8, 9

[196] The Five Capitals Model of sustainable development identifies natural capital, social capital, human capital, manufactured capital and financial capital.

Ref	Description/Rationale	Related Principles
B	Full assessment of priority locations to determine risk using standard method Locations identified as high priority through the preceding task would be the subject of more detailed assessment to further quantify risk, including sea level rise mapping where required. This task could be undertaken by the State, or by regional or local organisations with varying levels of State support, depending on the assessment in relation to the prioritisation criteria (part A).	1, 2, 3, 4, 6, 8, 9
C	Application of standard multi-criteria guidelines to determine adaptation responses A standard multi-criteria assessment method and criteria would be applied to determine appropriate adaptation responses. This task would be undertaken by the organisation responsible for the full assessment (part B).	1, 3, 4, 6, 8, 9
D	Adaptation Strategy This task would involve identifying and implementing specific actions to progress the preferred adaptation response, including adjustments to existing coastal management systems such as coast protection, land use planning, natural resources management, emergency management and asset management.	1, 3, 4, 6, 7, 8, 9
E	Communication and stakeholder engagement This element of the model framework emphasises the need for effective communication and genuine stakeholder engagement throughout all stages of sea level rise management. Over time, this element is essential to overcoming political, cultural and behavioural barriers to change that adaptation faces. Actively seeking stakeholder input also supports development of locally relevant and supported adaptation strategies that are therefore more likely to be implemented.	1, 2, 3, 7, 8, 9
F	Data collection and distribution This element of the model framework seeks sea level rise information collected through State, regional and local adaptation planning processes to be efficiently shared and distributed for maximum benefit.	1, 3, 4, 7, 8, 9

Ref	Description/Rationale	Related Principles
G	Monitoring, evaluation and adjustment Monitoring, evaluation and adjustment of the operation of the framework should occur consistent with the principles of adaptive management.	1, 3, 7, 8, 9, 10

Published research as well as interviews undertaken for this Issues Paper indicates that local governments and regions seek leadership and support to elevate the importance of the sea level rise issue in their communities, to understand risks and impacts, and to develop adaptation strategies. Lack of strong leadership to encourage, influence and support adaptation is a key breakdown in the current system. As such, the model proposes a stronger leadership role for **State Government** in the management of sea level rise, specifically comprised of:

- Developing standard sea level rise risk assessment and adaptation response assessment processes and criteria for state-wide use;
- Leading a high level assessment of the entire coastline and prioritisation of high value and high risk locations (hot spots) using five capitals/ICZM criteria (refer Figure 5.1 part A);
- Leading further assessment and adaptation planning for identified priority locations of State significance (refer Figure 5.1 parts B, C and D);
- Supporting regions and local governments financially and non-financially to varying degrees in further assessment and adaptation planning for identified priority locations that do not meet State significant criteria (refer Figure 5.1 parts B, C and D);
- Coordinating practices and information associated with:
    - Communications and engagement to elevate the sea level rise issue and involve stakeholders in adaptation processes (refer Figure 5.1 part E);
    - Data collection and distribution (refer Figure 5.1 part F); and
- Monitoring, evaluating, and adjusting the framework in accordance with adaptive management principles (refer Figure 5.1 part G).

Local government and regional bodies such as NRM Boards and Regional Development Australia would be responsible for:

- Contributing to development of standard sea level rise risk assessment and adaptation response assessment processes and criteria for state-wide use, and to the high level assessment of the entire coastline (refer Figure 5.1 part A);

- Undertaking detailed assessment and adaptation planning for identified priority locations (refer Figure 5.1 parts B, C and D);
- Communications, stakeholder engagement, and data collection associated with local and regional adaptation processes (refer Figure 5.1 parts E and F);
- Participating in monitoring, evaluation and adaptive management actions (refer Figure 5.1 part G);
- Undertaking adaptation planning under the Climate Change Adaptation Framework for South Australia, and supporting the model sea level rise management framework where the processes interact (refer Figure 5.2).

Implementation of the model framework would involve development of a series of guidelines and tools by **State government**, in consultation with **local governments and regional partners**. This could involve broader use or further development of existing sea level rise decision tools such as the Climate Change Decision Support Tools for Coastal Councils developed by the LGA, and the Values Matrix and Adaptation Options Checklist developed for the Eyre Peninsula NRM Board's Resilient Coastal Communities Pilot Study. Within the model framework, materials would be developed to support:

- The high level and detailed risk assessment processes and adaptation response assessment process, including standard criteria and guidance for use of criteria;
- Guidance as to circumstances under which different adaptation responses may be appropriate;
- Guidance as to potential options for implementing adaptation responses, subject to local assessment of issues and engagement;
- Particular considerations for regional/urban areas and public infrastructure/private development; and
- Points of intersection within the framework with other system components such as the Planning Strategy, councils' Strategic Management Plans, Strategic Directions Reports and Adaptation Plans.

There is a role for **Commonwealth government** to support the State led intensification and expansion of efforts to manage sea level rise that is proposed by the model framework, particularly in the form of funding support, as well as providing information resources. For example, national sea level rise mapping, if available, would feed into the high level assessment. The requirement of Commonwealth government to play such roles to facilitate coastal adaptation has been widely recognised (refer Section 4.2).

Figure 5.2 describes how the model framework would fit in with the existing coastal management system. As shown, the high level state wide assessment (refer A on Figure 5.1) should occur as a standalone task, after which subsequent actions can occur either independent to or as part of regional adaptation planning processes under the State Climate Change Adaptation Framework, which in turn influence coastal management systems such as land use planning, asset management, and coast protection.

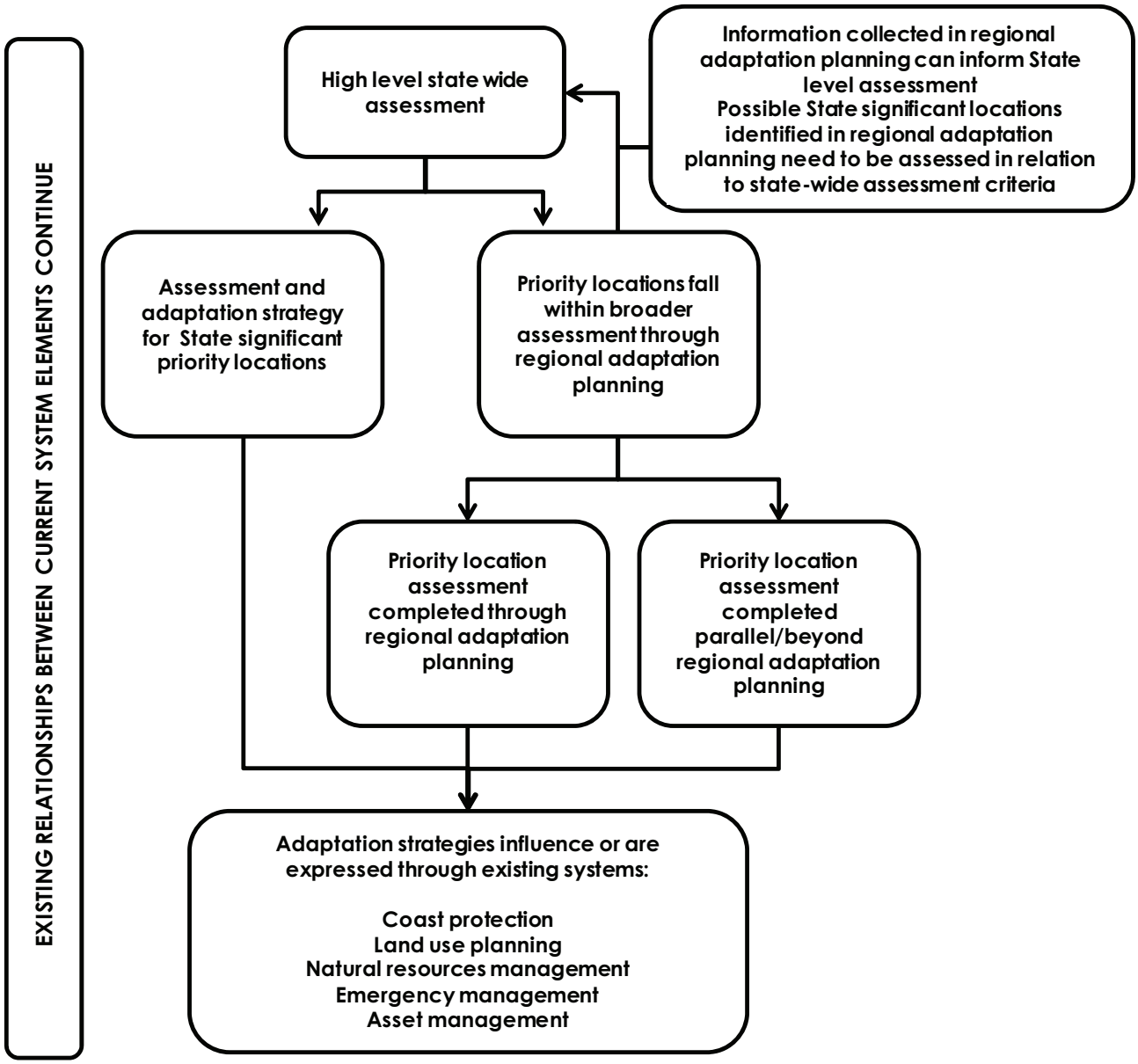

Figure 5.2: Model Framework relationship with existing system

6.0 Recommendations

The following recommendations have been identified with the aim of better aligning South Australia's management of sea level rise with the principles of an ideal management system, and seek to address the challenges identified in the current system identified in Sections 4.0 and 5.0.

The recommendations are subject to further development through consultation with relevant stakeholders, and in some cases further research.

#	Recommendation	Responsibility to progress	Ideal principles supported
1	Further develop and implement the model sea level rise management framework described in Section 5.2 of this Issues Paper. Actions to implement the framework are set out in Table 5.1.	State LGA	All
2	Continue to lobby for/contribute to an improved national approach to sea level rise management, and Commonwealth funding and support for State led management	State LGA	1, 8
3	Expand responsibilities and resources of an existing body or create a new body to, in addition to current coastal management responsibilities, have explicit responsibility for leadership on sea level rise management including: • Coordinating sea level rise adaptation across sectors and jurisdictions; • Identifying state-wide objectives for sea level rise management and their relationship with various coastal management systems; • Communicating roles and responsibilities in sea level rise management; • Engaging with stakeholders to better define roles and responsibilities; and • Providing guidance, support, and accountability for discharge of responsibilities in relation to sea level rise objectives.	State	1, 2, 3, 4, 5

#	Recommendation	Responsibility to progress	Ideal principles supported
4	Implement broad scale communications, engagement and awareness raising programs around sea level rise risks, impacts, and adaptation responses	State Councils	2
5	Disclose known coastal risks on Contracts for Sale of Land or Business forms under Schedule 1 of the *Land and Business (Sale and Conveyancing) Regulations 2010* c	State	2
6	Consider statutory limitations on local and State government liability for climate change related actions	State LGA	3
7	Facilitate access to up to date, effectively communicated sea level rise information and decision making tools	State LGA	2, 4
8	Plan and implement a state-wide program of capacity building to: • Direct decision makers to available data for use in decisions where sea level rise is a relevant consideration; • Provide guidance and build skills in its use; and • Locate their decisions in the context of sea level rise risks, coastal issues, and their responsibilities in the management system.	State LGA	4
9	Undertake research to better understand the reasons for development applications being approved not in accord with Coast Protection Board advice (refer discussion in Section 4.3.2), and identify potential strategies to respond.	LGA	7
10	Review specific provisions of the Development Regulations identified in the Coast Protection Board's submission to Think Design Deliver to ensure referral mechanisms function appropriately in all circumstances	State	7

#	Recommendation	Responsibility to progress	Ideal principles supported
11	Consider levies and differential rates for coastal land to reflect costs and benefits of coastal adaptation	State LGA Councils	8

7.0 References

Australian Building Codes Board 2010, *Investigation of Possible BCA Adaptation Measures for Climate Change*

Australian Bureau of Meteorology 2012, *The Australian Baseline Sea Level Monitoring Project - Monthly Data Report, June 2012*

Baker & McKenzie 2011, *Local Council Risk of Liability in the Face of Climate Change – Resolving Uncertainties: A Report for the Australian Local Government Association.*

Balston, JM, Kellett, J, Wells, G, Li, S, Gray, A & Western, M 2012, *Climate change decision support framework and software for coastal councils*, Local Government Association of South Australia, Adelaide, South Australia

Barnett, J, Walters, E, Pendergast, S, Puleston, A 2013 *Barriers to adaptation to sea-level rise*, National Climate Change Adaptation research Facility, Gold Coast

Beachsafe, no date *Beaches*, http://beachsafe.org.au/surf-ed/beaches

Broom, A, Hadji, G & Townsend, M, no date, *Coastal Protection Considerations; Rogues Point Case Study*

Caton, B, Detmar, S, Fotheringham, D, Laurence, S, Quinn, J, Royal, M, Rubbo, N. & Sandercock, R, 2011, *Eyre Peninsula Coastal Action Plan and Conservation Priority Study, Volume 1,* Eyre Peninsula NRM Board and Department of Environment and Natural Resources, Adelaide

Caton B, Fotheringham D, Krahnert E, Pearson J, Royal M. and Sandercock R 2009, *Metropolitan Adelaide and Northern Coastal Action Plan*, prepared for the Adelaide and Mount Lofty Ranges NRM Board and Department for Environment and Heritage

Central Local Government Region of South Australia, Regional Development Australia Yorke and Mid North, & Northern and Yorke Natural Resources Management Boards, no date, *Yorke and Mid North Regional Climate Change Action Plan-Summary*

CGU Insurance Limited 2011, *Why the cost of insurance is rising*, CGU June 2011

City of Onkaparinga 2013, *Institutional Resilience and Climate Change – a Focused Review*, prepared by the Australian Workplace Innovation and Social Research Centre as part of the Resilient South consultancy led by URPS for the Cities of Onkaparinga, Holdfast Bay, Marion and Mitcham in association with the Government of South Australia and the Australian Government

City of Onkaparinga 2013a, *Social and Institutional Mechanisms for Transitioning to Resilient Practices*, prepared by URPS for the Cities of Onkaparinga, Holdfast Bay, Marion and Mitcham in association with the Government of South Australia and the Australian Government

Climate Change and Greenhouse Emissions Reduction Act 2007

Coast Protection Act 1972

Coast Protection Board, *Coast Protection Board Strategic Plan 2009-2014*

Coast Protection Board 2013, *Submission to Expert Panel for Think Design Deliver: South Australia's Planning Reform*

Coast Protection Board 2012, *Coast Protection Board Policy Document* (revised 22 May 2012)

Coast Protection Board South Australia 1991, *Policy on Coast Protection and New Coastal Development*

Crown Land Management Act 2009

Department of Climate Change and Energy Efficiency 2011, *Climate Change Risks to Coastal Buildings and Infrastructure: A Supplement to the First Pass National Assessment*, Commonwealth of Australia

Department of Climate Change 2009, *Climate Change Risks to Australia's Coast: A First Pass National Assessment*, Commonwealth of Australia

Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education 2013, *Climate Adaptation Outlook: A Proposed National Adaptation Assessment Framework*, Commonwealth of Australia

Department of Planning and Local Government 2010, *The 30-Year Plan for Greater Adelaide*: *A volume of the South Australian Planning Strategy*, Government of South Australia

Department of Planning and Local Government 2011, *South Australian Planning Policy Library Version 6*, Government of South Australia

Department of Planning, Transport and Infrastructure 2012, *Eyre and Western Region Plan: A volume of the South Australian Planning Strategy*, Government of South Australia

Development Act 1993

Development Regulations 2008

Dovers, S 2006, Institutions for ICZM: Insights from Elsewhere in Lazarow, N, Souter, R, Fearon, R & Dovers, S (eds), 2006 Coastal management in Australia: Key institutional and governance issues for coastal natural resource management and planning, Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management, Inodooroopilly

Emergency Management Act 2004

Fletcher, CS, Taylor, BM, Rambaldi, AN, Harman, BP, Heyenga, S, Ganegodage, KR, Lipkin, F & McAllister, RRJ 2013, *Costs and coasts: An empirical assessment of physical and institutional climate adaptation pathways*, National Climate Change Adaptation Research Facility, Gold Coast

Geoscience Australia and the Commonwealth Department of Climate Change and Energy Efficiency 2010, OzCoast Sea Level Rise Maps.

Geoscience Australia website, http://www.ga.gov.au/education/geoscience-basics/dimensions/coastline-lengths.html, accessed 20 January 2014.

Gibbs, M & Hill, T (Blake Dawson) 2011, *Coastal Climate Change Risk – Legal and Policy Responses in Australia*, Commonwealth of Australia Department of Climate Change and Energy Efficiency, Canberra

Good, M 2011, *Technical Report – Government Coastal Planning Responses to Rising Sea Levels, Australia and Overseas*, The Antarctic Climate & Ecosystems Cooperative Research Centre, Hobart

Government of South Australia 2012, *Prospering in a Changing Climate, A Climate Change Adaptation Framework for South Australia*

Government of South Australia 1999, *Strategic Asset Management Framework*

Gurran, N, Hamin, E & Norman, B 2008, *Planning for climate change: Leading Practice Principles and Models for Sea Change Communities in Coastal Australia, prepared for the National Sea Change Taskforce,* The University of Sydney Faculty of Architecture

Hamin, EM & Gurran, N 2009, *Urban form and climate change: Balancing adaptation and mitigation in the U.S. and Australia*, Habitat International, 33, pp238-245

House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009, *Managing our coastal zone in a changing climate: The time to act is now*, Commonwealth of Australia, Canberra

Intergovernmental Panel on Climate Change (IPPC) 2013, *Climate Change 2013: The Physical Science Basis*

Intergovernmental Panel on Climate Change (IPPC) Working Group III 1990, *The IPCC Response Strategies*, Chapter 5, Coastal Zone Management

Klein, RJT, Nicholls, RJ & Mimura N 1999, *Coastal Adaptation to Climate Change: Can the IPCC Technical Guidelines be Applied?* Mitigation and Adaptation Strategies for Global Change, Vol. 4, pp. 239-252

Lazarow, N 2006 *Community Participation in ICZM: Lessons and Areas for Improvement in Governance* in Lazarow, N, Souter, R, Fearon, R & Dovers, S (eds), 2006 *Coastal management in Australia: Key institutional and governance issues for coastal natural resource management and planning*, Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management, Inodooroopilly

Local Government Act 1999

Local Government Association of Australia (LGA SA) 2012, *Guidelines for Developing a Climate Change Adaptation Plan and Undertaking and Integrated Climate Change Vulnerability Assessment*

Local Government Association Mutual Liability Scheme (LGAMLS) 2012, *Local Government South Australian Climate Adaptation Programme Final Report*

National Emergency Management Committee Land Use Planning and Building Codes Taskforce 2012, *The Roadmap: Enhancing Disaster Resilience in the Built Environment*

National Tidal Centre, Australian Bureau of Meteorology 2011, The Australian Baseline Sea Level Rise Monitoring Project Annual Sea Level Data Summary Report for July 2010 – June 2011

Natural and Cultural Heritage, Department for Environment and Heritage 2004, *Living Coast Strategy for South Australia*, Government of South Australia

Natural and Cultural Heritage, Department for Environment and Heritage 2005, *Adelaide's Living Beaches: A Strategy for 2005 - 2025*, Government of South Australia

Natural Resources Management Act 2004

National Parks and Wildlife Act 1972

Natural Resources Management Ministerial Council 2006, *National Cooperative Approach to Integrated Coastal Zone Management: Framework and Implementation Plan*, Commonwealth of Australia, Canberra

Nicholls RJ 2011, *Planning for the impacts of sea level rise*, Oceanography 24(2), pp. 144–157

Niven, RJ & Bardsley, DK 2013, *Planned retreat as a management response to coastal risk: a case study from the Fleurieu Peninsula, South Australia*, Regional Environmental Change, Vol. 13(1), pp.193-209

Office of the Queensland Chief Scientist 2013, *Understanding floods: questions and answers*, Queensland Government

Peters, GP, Robbie, AM, Boden, T, Canadell, PC, Le Quéré, C, Marland, G, Raupach, MRR & Wilson, C 2013, *The challenge to keep global warming below 2°C*, Nature Climate Change, Vol. 3 pp. 4-6

Poloczanska ES, Hobday, AJ, Richardson, AJ (eds) 2012, *Marine Climate Change Impacts and Adaptation Report Card for Australia 2012*

Planning SA 2007, *Yorke Peninsula Regional Land Use Framework: A volume of the South Australian Planning Strategy*, Government of South Australia

Productivity Commission 2012, *Barriers to Effective Climate Change Adaptation*, Report No. 59, Final Inquiry Report, Commonwealth of Australia, Canberra

Select Council on Climate Change 2012, *Roles and responsibilities for climate change in Australia*, paper released at the second meeting of the Council 16 November 2012, http://climatechange.gov.au/roles-and-responsibilities-climate-change-australia

Smit, B & Wandel, J 2006, *Adaptation, adaptive capacity, and vulnerability*, Global Environmental Change, Vol. 16, pp. 282-292

Smith, TF & Smith, DC 2006 *Institutionalising Adaptive Learning for Coastal Management* in Lazarow, N, Souter, R, Fearon, R & Dovers, S (eds), *Coastal management in Australia: Key institutional and governance issues for coastal natural resource management and*

planning, Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management, Inodooroopilly

Souter, R & Fearon, R 2006 *Research to Support Coastal Management in Australia: Generating Better Information and Knowledge in the Current Coastal Management Environment* in Lazarow, N, Souter, R, Fearon, R & Dovers, S (eds), 2006 *Coastal management in Australia: Key institutional and governance issues for coastal natural resource management and planning*, Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management, Inodooroopilly

South Australia's Expert Panel on Planning Reform 2013, *What we Have Heard So Far*

Stafford Smith, M, Horrocks, L, Harvey, A, & Hamilton, C 2011, *Rethinking adaptation for a 4°world*, Philosophical Transactions of the Royal Society, Vol. 369, pp. 196-216

The Allen Consulting Group 2005, *Climate change risk and vulnerability: promoting an efficient adaptation response in Australia*, Australian Government, Canberra.

Think Design Deliver: South Australia's Expert Panel on Planning Reform, http://www.thinkdesigndeliver.sa.gov.au/

URPS 2013, *Environmental/Natural Resources Management/ Sustainability Gaps, Constraints and Opportunities Discussion Paper*, prepared for the Department of Environment, Water and Natural Resources

URPS 2007, *Adelaide & Mt Lofty Ranges NRMB: Review of Strategies, Plans & Policies*, prepared for the Adelaide and Mt Lofty Ranges Natural Resources Management Board

URPS 2008, *Review of Council Development Plans and Relevant Strategies, Plans and Policies as Input to the Eyre Peninsula Regional NRM Plan*, prepared for the Eyre Peninsula Natural Resources Management Board

URPS in association with SKM, Dr Mark Siebentritt, SGS Economics and Planning, Bell Planning & Norman Waterhouse Lawyers 2012, *Resilient Coast Communities – A Pilot Study: Preparing for Sea Level Rise in the Upper Spencer Gulf*, prepared for the Eyre Peninsula Natural Resources Management Board

Wang, X & McAllister, RRJ 2011, *Adapting to heatwaves and coastal flooding* in Cleugh, H, Smith, MS, Battaglia N & Graham, P (eds) Climate Change: Science and Solutions for Australia, CSIRO, Canberra

Wang, XH, Xu, X, Pearson, SG, Xue, G, Morrison, RJ, Liu, D & Shi, P 2011, *Integrated Coastal Zone Management Research in Australia and China*, Labour and Management in Development Journal, Volume 11, pp. 2-17

Webb, RJ, McKellar, R & Kay, R 2013, *Climate Change Adaptation in Australia: experience, challenges and capability development*, Australasian Journal of Environmental Management, Vol. 20, No. 4, pp. 320-337

http://www.environment.sa.gov.au/about-us/our-progress/nrm-guide-overview/monitoring-evaluation-adaptive-management accessed 3 February 2014.

http://www.environment.sa.gov.au/files/72381b99-8d52-4f32-9b62-9e66017b9c24/con-fact-publicationscoastprotect.pdf accessed 23 January 2014

http://www.environment.sa.gov.au/our-places/coasts/Adelaides_Living_Beaches/Resources accessed 23 January 2014

http://www.localgovt.sa.gov.au/how_councils_work/council_rating accessed 3 February 2014

8.0 Appendices

Appendix A: Climate change related legal actions

Table A1: Summary of specific tort-based climate change related actions[197]

Basis of claim against local government	**Possible actions**	**Defences currently available in SA**	**Likelihood of an action being brought (H,M,L)**	**Mitigation strategies currently available in SA**	**Additional recommended mitigation strategies**
Approving development when risk of harm is foreseeable	Negligence	Legislative reforms provide that councils are not liable for decisions unless they are manifestly unreasonable Obvious risk	H – With new scientific developments, it is more likely that a decision will be manifestly unreasonable if it does not consider climate change	Have regard to precautionary matters in decision making	A statutory defence providing that councils are not liable for damage caused by flooding and natural hazards in the coastal zone as a result of the granting or refusal of a development application, as per s 733(3) of the *Local Government Ac 1993 (NSW)*
Failure to include protective standards in planning schemes	Negligence	As above	H – In vulnerable areas such as flood prone, coastal zone or at risk areas Will depend on facts and circumstances of the case	As a minimum, minimise development in highly vulnerable areas	An integrated planning system for the entire Australian coast
Failure to build or maintain infrastructure/conduct coastal mitigation works	Negligence	-	M – In SA, low in jurisdictions that have statutory limits on council liability relating to availability of resources	-	Statutory limitations on liability in relating to the limited availability of council resources and broad range of council activities
	Nuisance	Reasonableness may be a defence but this is uncertain	L – May be difficult to establish whether council has control of the land that caused the damage		As above, applied to nuisance
Failing to provide information	Negligence	Inherent risk Failure to warn defence	M – Defences are only partial	Actively provide access to up to date climate change information	Statutory defence that councils are not liable for advice, acts or omissions (in good faith) relating to the provision of information with respect to climate change and sea level rise, as per s 733(3)(f5) of the *Local Government Ac 1993 (NSW)*
Providing incorrect information	Negligence	-	M – If councils provide incorrect information and residents rely upon it, residents may bring an action	Councils should exercise reasonable care to ensure all facts are known and understood, relevant law is identified and advice is expressed in clear and accurate terms	As above

[197] Edited reproduction of Table 1 in Baker & McKenzie 2011, pp. 5-7.

Table A2: Summary of administrative climate change related actions[198]

Subject of administrative review	**Possible actions**	**Defences currently available in SA**	**Likelihood of an action being brought (H,M,L)**	**Mitigation strategies currently available in SA**
Planning consent decisions	Merits review or judicial review	Provided guidance material relied on is proportionate and reasonable, a decision is unlikely to be regarded as unlawful under judicial review	H – By landholders who may bring an application for merits review in the hope of obtaining a more favourable result M – By community groups who may use merits or judicial review processes to test policy and increase climate change awareness	Councils should ensure that decisions are reasonable and appropriate decision making procedures are followed and relevant considerations taken into account Councils should ensure they have the best available evidence and appropriate expertise to inter[ret policy and technical documents Limits on third party rights of appeal
Development Plan Amendments	Merits review or judicial review	If the final decision to approve the amendment does not rest with council	L – Claims will more likely be made at State decision making level	Councils should ensure decisions are reasonable and appropriate procedures followed Councils should ensure they have the best available evidence and information
Decisions to make by-laws	Merits review or judicial review	Council is exercising its legislative power	L – Likely to be legislative rather than administrative decisions and may not be open to review	Councils should be aware of the extent of their legislative power
Decisions regarding levies, special rates or fees	Merits review or judicial review	The particular works provide a special benefit to the particulate rate-holder levied or also subsidise the cost of associated services, facilities or activities to rateable land that is not the subject of the charge	M – Significant case law exists on this topic but not in relation to climate change	Councils should ensure decisions are reasonable and appropriate procedures followed and that they do not take irrelevant considerations into account when setting rates and fees Care should be taken in defining the scope of works and the landholders that will benefit from such works

[198] Edited reproduction of Table 2 in Baker & McKenzie 2011, pp. 7-8.

Table A3: Summary of statutory compensation and other climate change related actions[199]

Subject of claim/action	Possible actions	Defences currently available in SA	Likelihood of an action being brought (H,M,L)	Mitigation strategies currently available in SA
Failure to provide services	Claim for failure to provide costal protection works	Legislative reforms provide that councils are not liable for decisions unless they are manifestly unreasonable Obvious risk Reasonableness may be a defence but this is uncertain Inherent risk Failure to warn defence	M –Coast Protection Board to policy on protection and funding of protection for private property (refer Issues Paper Section 4.3.1) may prevent Councils from undertaking works which specifically protect private property interests. The Development Act 1993 states that where building work must be performed as a matter of urgency to protect any person or building, a person may perform the building work, and retrospective development approval must be sought. This provision may empower landholders to undertake works in an emergency situation without approval. The provisions under the Act and the Coastal Policy may need to be reconciled at times.[200]	Clear legislative frameworks to facilitate the carrying out of emergency protection works in a coordinated manner.
Statutory compensation claims – planning permits	Failure to grant planning permits	Proper exercise of councils' functions, usually no cause of action beyond administrative review, refer Table A2	L – Only likely to be required if land required for a public process	Councils should ensure that decisions are reasonable and appropriate decision making procedures are followed and relevant considerations taken into account Councils should ensure they have the best available evidence and appropriate expertise to inter[ret policy and technical documents Limits on third party rights of appeal
Statutory compensation claims – planning schemes	Loss of values, development rights associated with planning scheme amendments	-	L	-
Compulsory acquisition	Dispute over compensation amount for resumption of land for public purposes	Where compensation is awarded on just terms	M – Valuation for compulsory acquisition is frequently litigated	Clarify that acquisition as part of climate change adaptation is a public purpose
Boundary adjustments	Loss of value of land due to adjustments where low water mark moves due to erosion	Common law doctrine regarding accretion only addresses gradual change, not sudden events. No equivalent for erosion	L – Limited knowledge of legal boundaries of this area	Consider legislation reform to clarify circumstances in which erosion and accretion give rise to ability of councils to make declarations regarding water boundary

[199] Edited reproduction of Table 3 in Baker & McKenzie 2011, pp. 8-9
[200] Baker & McKenzie 2011, p. 61.

Appendix B: Interview questions

These questions formed the basis of 13 interviews with representatives of state and local government and the development industry. Interviewees were identified by the client group made up of the LGA, Climate Change Unit - Water & Climate Change Branch of DEWNR, and the Coast Protection Board (the Board).

The questions set out below formed a flexible framework to support the general structure and flow of interviews. Interviewers adopted a conversational and exploratory approach to the rather than a strictly question-based approach.

Interview questions:

[Brief project introduction]

1. In your work, what kinds of systems and frameworks do you generally deal with in relation to the coast?
    a. E.g. planning system – zoning, development assessment; infrastructure on the coast – asset management, insurance
2. What is your experience of how each of these systems/frameworks deals with sea level rise?
    a. What mechanisms, policies, tools are in place to address sea level rise?
    b. How well is each of these working?
        i. What are the reasons for your view?
        ii. Can you share any specific examples that demonstrate this?
3. What are the key issues that need to be considered in addressing the challenges of sea level rise?
    a. E.g. property values, the coastal environment, insurance and liability, political context
        i. What challenges and barriers exist to addressing these issues?
4. What are the opportunities to better manage sea level rise in the future?
    a. E.g. Leadership (from whom?), engagement, specific legislative and policy change