

Climate change and the coastal zone: adaptation strategies and practices to promote resilience

adaptation is a long-term agenda and it will take time to quantify risks of climate change impacts and to build capacity to minimise costs and to take advantage of any benefits.¹

Introduction

- 3.1 Chapter 3 focuses on the Committee's terms of reference to investigate the impact of climate change on coastal areas, with particular emphasis on climate change adaptation. Adaptation is defined in the Council of Australian Governments (COAG) National Climate Change Adaptation Framework as 'the principal way to deal with the unavoidable impacts of climate change. It is a mechanism to manage risks, adjust economic activity to reduce vulnerability and to improve business certainty'.²
- 3.2 Australia is in the very early stages of adapting to climate change. As the National Climate Change Adaptation Framework notes 'adaptation is a long-term agenda and it will take time to quantify risks of climate change impacts and to build capacity to minimise costs and to take advantage of any benefits'.³

1 COAG National Climate Change Adaptation Framework, p. 3.

2 COAG National Climate Change Adaptation Framework, p. 3.

3 COAG National Climate Change Adaptation Framework, p. 3.

- 3.3 Chapter 3 looks at the National Climate Change Adaptation Framework and major initiatives as part of the National Coastal Vulnerability Assessment or 'first pass' assessment. It also discusses a number of federal climate change adaptation programs, and the role of state and local government in climate change adaptation in the coastal zone. The chapter then provides an overview of climate change adaptation issues for a range of sectors relevant to the coastal zone, such as water resources, health, industry, disaster management and infrastructure. The chapter concludes with a discussion on coastal Indigenous communities and climate change adaptation.

COAG National Climate Change Adaptation Framework

- 3.4 The National Climate Change Adaptation Framework, endorsed by COAG at its meeting on 13 April 2007, was designed to provide a nationally consistent focus for climate change adaptation action for the next five to seven years.⁴
- 3.5 The framework rests on the acknowledgment that, regardless of mitigation action undertaken with respect to reducing greenhouse gas emissions, changes to the climate are already observable and in order to minimise their impacts in Australia, a coordinated strategy for adapting to them is required.
- 3.6 The Australian Standard for Risk Management (AS/NZS 4360: 2004) provides a generic framework for identifying, analysing and communicating risk. This standard has been adopted throughout Australia.⁵ As the Victorian Department of Sustainability and Environment noted:

4 Department of Climate Change website accessed on 22 July 2009 <<http://www.climatechange.gov.au/impacts/about.html>> The National Climate Change Adaptation Program, established in 2005, was an early federal government initiative predating the COAG National Climate Change Adaptation Framework.

5 The Department of Climate Change recently updated the report, *Climate Change and Adaptation Actions for Local Government*, which adopts the Australian Standard for Risk Management (AS/NZS 4360: 2004) as a means of addressing and managing the risks posed by climate change, and assessing what adaptation work is required. See Department of Climate Change, *Climate Change and Adaptation Actions for Local Government*, 2009, p. 15. See also Australian Academy of Technological Sciences and Engineering, *Submission 28*; Attorney-General's Department and Emergency Management Australia, *Submission 56*; and Surf Life Saving Australia, *Submission 57*.

Whilst there is some variation in methodologies used by agencies to assess risk, recent models developed to better understand the coastal impacts of climate change have drawn on both the national standard AS/NZS 4360:2004 and on national policy frameworks and risk methodologies. In this sense there is some degree of consistency but importantly there has also been modification of standardised methodologies to accommodate local circumstances and specific planning exercises.⁶

- 3.7 The National Climate Change Adaptation Framework establishes principles for understanding and building on Australia's adaptive capacity and highlights themes that are identified as priority areas where vulnerability to climate change impacts should be reduced.
- 3.8 The following themes are identified under the framework for reducing sectoral and regional vulnerability to climate change:
- water resources
 - *coastal regions*
 - biodiversity
 - agriculture, fisheries and forestry
 - human health
 - tourism
 - settlements, infrastructure and planning
 - natural disaster management
- 3.9 As the only regional priority area amongst a list of sectoral themes, 'coastal regions' is relatively incongruous in the list. The coastal zone is at risk not only from the direct impacts of climate change on the environment but also from the threats to all other identified priority areas. As such, adaptation work in other areas is also significant with respect to the coast. This chapter will later examine adaptation work being carried out with respect to the other themes identified in the framework, as relevant to the coastal zone.

6 Victorian Department of Sustainability and Environment, *Submission 90b*, p. 1.

Coastal adaptation in the National Climate Change Adaptation Framework

- 3.10 The National Climate Change Adaptation Framework identifies that coastal regions are:
- vulnerable to sea level rise, increased sea surface temperature, increased storm intensity and frequency, ocean acidification and changes to rainfall, run-off, wave size and direction and ocean currents.⁷
- 3.11 The framework notes that the threats to the coastal zone from climate change are intensified by the significance of the zone to Australia more generally. Coastal regions incorporate the most densely populated areas of the country – holding the vast majority of our population, infrastructure and industry.⁸
- 3.12 The framework recognises the need to assess the vulnerability of Australia’s coastal zone, so that effective adaptation strategies can be implemented, and calls for nationally consistent action on this assessment.

National Coastal Vulnerability Assessment—the ‘first pass’ assessment

- 3.13 The National Coastal Vulnerability Assessment (NCVA) or ‘first pass’ assessment is being undertaken by the Department of Climate Change in response to the National Climate Change Adaptation Framework’s call for a national vulnerability assessment. The ‘first pass’ NCVA is designed to:
- identify national priorities in supporting effective adaptation policy responses in the coastal zone
 - identify key elements of a national coordinated approach to reducing climate risk in the coastal zone
- 3.14 The results will ensure a clearer picture of the level of vulnerability around Australia’s coastline. This will provide a coordinated, national representation of Australia’s coastal vulnerability from which more localised decisions can be made with regard to adaptation.⁹ The work is

7 COAG National Climate Change Adaptation Framework, p. 12.

8 COAG National Climate Change Adaptation Framework, p. 12.

9 Department of Climate Change, ‘Fact Sheet: Assessing the Vulnerability of Australia’s Coasts to Climate Change’ <<http://climatechange.gov.au/impacts/coasts.html#research>>

being undertaken to address the current shortfall in information regarding our coastal vulnerability. The Department of Climate Change's submission to the inquiry noted that:

The current 'first pass' National Coastal Vulnerability Assessment (NCVA) of key assets within Australia's coastal zone will begin to address our knowledge deficit. The NCVA will provide the first, whole of nation understanding of the magnitude and spatial extent of risk and will drive the national development of essential tools for climate change adaptation.¹⁰

3.15 The Department of Climate Change website states the three aims of the assessment as being:

- To identify the risks to Australia's coastal zone from climate change (including the implications of sea-level rise);
- To provide decision makers with a better understanding of the potential risks; and
- To identify priority areas for research.¹¹

3.16 The department identifies the components of the first pass assessment as follows:

- digital elevation modelling (DEM)
- national shoreline mapping: the 'Smartline' project
- assessing the vulnerability of coastal biodiversity
- six case studies that have been selected to assess particular issues caused by specific vulnerabilities:
 - ⇒ Kakadu National Park (NT)
 - ⇒ Pilbara Coast (WA)
 - ⇒ Yorke Peninsula (SA)
 - ⇒ East coast of Tasmania (Tas)
 - ⇒ Central and Hunter Coasts (NSW)
 - ⇒ Pimpama catchment, Gold Coast (Qld)

10 Department of Climate Change, *Submission 85*, p. 2.

11 Department of Climate Change website accessed on 30 July 2009
<<http://www.climatechange.gov.au/impacts/coasts.html#research>>

Digital elevation modelling

- 3.17 A digital elevation model (DEM) provides a digital depiction of the topography and elevation of terrain. Digital elevation modelling is used in assessing coastal vulnerability to sea level rise.
- 3.18 The Department of Climate Change is undertaking two DEM projects under the NCVA:
- the National Elevation Data Framework
 - a high-resolution urban DEM

National Elevation Data Framework

- 3.19 The Department of Climate Change, through the Spatial Information Council (ANZLIC),¹² is working to develop a mid-resolution DEM for the entire Australian coastline through the establishment of a National Elevation Data Framework (NEDF).
- 3.20 To date, DEM work has been undertaken in isolation by local and state governments or for specific projects, without any method for sharing this information nationally. The NEDF will allow all this modelling, as well as modelling undertaken in the future, to be more widely available in one place. As representatives of the Department of Climate Change explained to the Committee:
- the issue is to try to get all of the state, territory and local governments on board with this process so that all the work that they do is consistent with this framework and can be integrated into the framework.¹³
- 3.21 ANZLIC is producing a set of tools or specifications that will allow data collected from future DEM work by state, territory or local governments to be consistent with the framework so that the data will be more widely available. In evidence to the Committee, departmental representatives described the proposed NEDF as follows:

If you think about something like Google Maps, for example, you are able to look at the data and slowly drill down through the data layers until you get more and more resolution. That is the intention.¹⁴

12 The Spatial Information Council is also commonly known as ANZLIC from its former name the Australian and New Zealand Land Information Council.

13 Mr Hopkins, Department of Climate Change, *Transcript of Evidence*, 25 September 2008, p. 3.

14 Mr Hopkins, Department of Climate Change, *Transcript of Evidence*, 25 September 2008, p. 3.

- 3.22 The data available from the NEDF will be mid-resolution (five to 10 metres). This mid-resolution DEM is designed to give consistent coverage of the whole of Australia. However the department admits that this model will 'not give us the level of detail we need in terms of elevation rise'.¹⁵
- 3.23 The Committee welcomes the NEDF initiative, as it will allow for greater national consistency. The availability of an overall picture of the topography of Australia's coastline will be highly valuable. The Committee notes, however, that this mid-resolution modelling is not to the resolution quality required for local application. The Committee also notes the concerns raised by Engineers Australia relating to the NEDF, including:
- the updating of data included in the NEDF – Engineers Australia noted that a 'collect once, use many times' principle was initially adopted¹⁶
 - the slow progress of work relating to the NEDF
 - the quality of data utilised in the NEDF

High-resolution urban DEM

- 3.24 The second DEM project that the Department of Climate Change is undertaking as part of the NCVA is a high-resolution urban DEM. This will map the vulnerability to inundation of priority urban areas in the coastal zone. The CRC for Spatial Information was commissioned in June 2008 to compile all the high resolution DEM data for major Australian cities (all of which are located in the coastal zone) into a framework. Initial work will focus on Perth, Adelaide, Sydney, Brisbane, Melbourne, the Gold Coast and the NSW Central Coast. The Committee understands that the CRC is:
- buying access to existing datasets and recompiling those datasets so that they are consistent with this framework. Those datasets will be available publicly to all levels of government for non-commercial purposes.¹⁷
- 3.25 The Committee draws attention to the need for this information to be made available and accessible to key stakeholders. This data will be of particular assistance in shaping local adaptation plans.

15 Mr Hopkins, Department of Climate Change, *Transcript of Evidence*, 25 September 2008, p. 3.

16 Engineers Australia, *Submission 29*, p. 4.

17 Mr Hopkins, Department of Climate Change, *Transcript of Evidence*, 25 September 2008, p. 3.

National shoreline mapping: the 'Smartline' project

3.26 Another significant element of the first pass assessment is the mapping of Australia's coastal geomorphology. The National Coastal Landform and Stability Mapping tool (dubbed the 'Smartline' project), released on 4 August 2009, was undertaken in collaboration between the Department of Climate Change and Geoscience Australia. The mapping tool visually displays the geology of Australia's coastline, allowing for better understanding of the vulnerability to climate change impacts. So-called 'softer' geology is more susceptible to coastal erosion than 'harder' geology, and therefore the vulnerability to climate change impacts of these areas of the coast is greater. The department explained:

We are collecting information on the littoral and sub littoral zones – so just off the beach and also behind the beach up to 500 metres. We are interested in knowing, for example, what is behind the beach. If it is a low-lying flat plain, it would be easily flooded; if it is a sequence of high dunes, it is better protected.¹⁸

3.27 The Smartline project, for the first time, provides an entire geomorphic map of the Australian coastline. The project was undertaken under contract at the University of Tasmania, coordinated by Mr Chris Sharples. The submission to the inquiry from the University of Tasmania sets out the value of a National Coastal Landform and Stability Mapping tool:

whilst a great deal of relevant geological, geomorphic, topographic and other mapping exists for the Australian coast, this mapping has been prepared for various parts of the coast in numerous different formats, for different purposes, at different scales and using different classifications. There is no one nationally-consistent geomorphic map of the Australian coast suitable for sensitivity assessment, except at scales too coarse to be of real use. This meant it would be very difficult and confusing to consistently assess coastal vulnerability at a national level using the hundreds of disparate data sets in existence.

The 'Smartline' project has been undertaken ... to remedy this problem by combining several hundred relevant mapped datasets into a single nationally-consistent map, using a mapping format previously trialled successfully in Tasmania.¹⁹

18 Mr Hopkins, Department of Climate Change, *Transcript of Evidence*, 25 September 2008, p. 3.

19 University of Tasmania, *Submission 104*, p. 2.

3.28 On announcing the completion of the mapping tool in August 2009, the Minister Assisting the Minister for Climate Change, the Hon Greg Combet, said:

The mapping tool contains detailed coastal landform information, so it will be of immediate benefit to local planners and decision makers as they make coastal planning decisions.²⁰

3.29 The Committee commends the Australian Government for its work on this important mapping tool, and believes that it will be of great significance in better assessing national coastal vulnerability. Greater understanding of the geological make up of the coastline will also allow better understanding of the risks involved when making planning decisions in the coastal zone. (Planning issues will be discussed in more detail in Chapter 4.)

3.30 The Committee believes this important mapping tool could be better presented and made more accessible and useful to a range of stakeholders. At present, the Smartline maps are hosted on the OzCoasts website.²¹ The website offers very limited explanation of the purpose of the maps, and the instructions are difficult to find and assume prior knowledge.²² The National Climate Change Adaptation Framework highlights the need for not only national coordination of vulnerability data but also effective communication of that data so that best practice adaptation decisions can be made nationally.

3.31 Mr Sharples, in evidence to the Committee, noted the importance of moving beyond the first pass assessment to more detailed second and third pass assessments:

once you have looked at where the soft parts of the coast are – which is the first pass – and where the wave energy is likely to cause erosion – which is the second pass – then, at the next most detailed level – what I call the third pass, which is looking at all the other local variables.²³

3.32 In terms of the second pass assessment, Mr Sharples further commented that:

20 Media release by the Hon Greg Combet AM MP, Minister Assisting the Minister for Climate Change, 'Erosion Potential of Australia's Coasts with a Changing Climate', 4 August 2009.

21 See <<http://www.ozcoasts.org.au>>

22 See <<http://www.ozcoasts.org.au/coastal/smartline.jsp>>

23 Mr Sharples, *Transcript of Evidence*, 28 January 2009, p. 26. See also C Sharples, C Attwater, J Carley, *Exhibit 67*, p. 3.

we should have a look at how the wave climate nationally interacts with those landform types and model the wave climate around the coast to pick the real hot spots.²⁴

Recommendation 5

- 3.33 **The Committee recommends that the Department of Climate Change continue to fund research to:**
- **establish the wave climate around the coast so as to identify those locations most at risk from wave erosion**
 - **examine how the wave climate nationally interacts with varying landform types**

Assessing the vulnerability of coastal biodiversity

- 3.34 A further component of the NCVA is an assessment of the impacts of climate change on biodiversity in the coastal zone. CSIRO is establishing a coastal/marine ecosystems vulnerability framework assessment. The assessment will analyse nine habitats, covering geomorphic (beaches, estuaries, wetlands), supratidal (dune vegetation, mangrove, saltmarsh) and subtidal (sea grass, coral reef, macroalgae) habitats. The framework assessment will use indicators regarding exposure, sensitivity and adaptive capacity which have been developed to create a vulnerability index for each habitat.
- 3.35 The Committee is pleased to see an assessment of the impacts on biodiversity as an element of the first pass assessment, although it did not receive a great deal of evidence on this particular study. The impact of climate change on biodiversity is discussed in more detail in Chapter 5.

Case studies

- 3.36 The last major element of the NCVA is the six case studies. Six different geographical locations around Australia's coastline have been selected for analysis, each to examine particular impacts of climate change on the various coastal environments. The locations selected will provide information regarding specific climate change impacts on activities which occur in the coastal zone. The case studies are as follows:

24 Mr Sharples, *Transcript of Evidence*, 28 January 2009, p. 26.

- Kakadu National Park – Investigating impacts on river system dynamics and management implications
- Pilbara Coast – Investigating impacts on oil and gas infrastructure as well as local communities
- Yorke Peninsula – Investigating impacts on urban development in the coastal zone and identify and evaluate trade offs between development pressures and mitigation costs, and future liabilities.
- East coast of Tasmania – Investigating impacts on the southern rock lobster, as well as associated fisheries and local communities. In particular, examination of the impacts of temperature increases on lobster breeding.
- Central and Hunter Coasts – Investigating land use planning issues around estuaries which are subject to increased flooding and sea level rise, as well as community awareness and resilience.
- Pimpama Catchment, Gold Coast – Investigating ecosystem vulnerability to sea level rise.

3.37 The Committee observes that the six projects will provide a broad scope of data regarding the regional variances in Australia’s coastal vulnerability with respect to various economic and social impacts of climate change.

Australian Government and coastal climate change adaptation programs in the coastal zone

3.38 Of interest to the Committee was the range of national climate change adaptation programs in the coastal zone. The corporate plan for the Department of Climate Change sets out the three ‘pillars’ under which the department operates, including ‘adapting to the impacts of climate change we cannot avoid’.²⁵ The Australian Government administers four programs and facilities in relation to climate change adaptation:

- Climate Change Adaptation Skills for Professionals Program
- Local Adaptation Pathways Program

25 The Department of Climate Change’s three pillars are: reducing Australia’s greenhouse gas emissions, *adapting to the impacts of climate change we cannot avoid* and helping to shape a global solution. The work of the department is focused around these three priorities.

- National Climate Change Adaptation Facility
- CSIRO Climate Adaptation National Research Flagship

Climate Change Adaptation Skills for Professionals Program

3.39 The Department of Climate Change administers the Climate Change Adaptation Skills for Professionals Program, which provides small grants to tertiary education and training institutions as well as professional associations, to revise or develop professional development and accreditation programs for architects, engineers, natural resource managers and planners. This program acknowledges the crucial role these professions will play in supporting Australia's capacity to adapt to the impacts of climate change. The Committee commends the government's support of these important professions via this program, and would like to see continued support. The initial round closed in December 2007, with successful applicants announced in May 2008.²⁶ The Committee notes that the department's website has no information as to whether a second round of funding will take place under the program.

3.40 A number of inquiry participants raised the issue of a shortage of coastal planners and engineers and the consequences of this for ensuring robust climate change adaptation strategies for the coast in the future:

I would make the point that we do need to think about how we will train up professionals or existing professionals with ongoing professional development to deal with these issues in the future ...

I could name on one hand how many courses there are in Australia in coastal planning. Similarly, I have heard from the engineering institute that there is a critical shortage of coastal engineers. If we do not have any coastal planners or coastal engineers in the context of planning for climate change on the coast then we have a looming skills problem in the future.²⁷

26 Department of Climate Change website accessed 7 August 2009
<<http://www.climatechange.gov.au/impacts/about.html#professionals>>

27 Ms Norman, *Transcript of Evidence*, 20 May 2009, p. 33. See also PIA, 'skill shortages exist in the planning profession and related professions especially in Local Governments', *Submission 51*, p. 4.

Recommendation 6

- 3.41 **The Committee recommends that the Australian Government continue funding under the Climate Change Adaptation Skills for Professionals Program. In addition, the Australian Government should liaise with tertiary institutions to ensure an adequate supply of appropriately skilled coastal planners and engineers.**

Local Adaptation Pathways Program

- 3.42 The Department of Climate Change also administers the Local Adaptation Pathways Program (LAPP) which provides funding for local governments to undertake climate change risk assessments at the local level and develop action plans so that results of assessments may be integrated into broader decision-making to thereby build regional capacity to respond to the impacts of climate change.²⁸
- 3.43 In order for effective climate change adaptation to take place, detailed local vulnerability assessments will be required. The Committee strongly supports the Australian Government's Local Adaptation Pathways Program. As noted by the Sydney Coastal Councils Group (SCCG), the program 'offers Local Government the opportunity to identify, trial and implement adaptation actions within a risk management framework.'²⁹ During the course of the inquiry, constructive suggestions were made to strengthen the program's outcomes.
- 3.44 The Local Government Association of NSW argued that information sharing should be made a formal requirement for funding under the program:

Ideally, funding for adaptation action plans should be delivered in such a way as to promote dissemination of the learning and experiences gained from preparing the plans and to promote a regional approach to adaptation planning. The Local Adaptation Pathways grant application required applicants to 'Demonstrate a commitment to provide and share information relevant to the process.' We respectfully suggest that such information sharing should involve a formal, organised dissemination of the outputs

28 Department of Climate Change website accessed 7 August 2009
<<http://www.climatechange.gov.au/impacts/localgovernment/index.html>>

29 SCCG, *Submission 77*, p. 3.

and outcomes of the grant funded projects and the sharing of experiences with processes employed during the projects.

... Without such dissemination there is a danger of duplication of effort, and sub-optimal use of time and resources across councils and communities and a risk that key areas for attention could be overlooked. Conversely, sharing information and insights can lead to more effective, efficient and innovative outcomes for other projects.³⁰

- 3.45 As well as the issue of disseminating and sharing information, concern was expressed about possible fragmentation of outcomes in the absence of a strategic approach to these assessments. Mr Townsend, Immediate Past Chair of the National Committee on Coastal and Ocean Engineering from Engineers Australia, commented that:

Fragmentation is a serious concern. We are seeing overlap in tasks that are being conducted. We are also seeing a non-strategic approach being taken in some levels.³¹

- 3.46 A further concern is that the Local Adaptation Pathways Program does not call for standardised approaches in climate change vulnerability assessments. Councils are not required to undertake any specific assessments with the funding they receive. The Department of Climate Change acknowledged this in evidence to the Committee:

there would be value in trying to give them some standardised approaches to conducting risk assessments in local government.³²

30 Local Government Association of NSW, *Submission 31a*, p. 1.

31 Mr Townsend, Engineers Australia, *Transcript of Evidence*, 12 March 2009, pp. 10-11. Representatives of the Western Australian Government, in evidence to the Committee, also raised concerns regarding the program, calling for greater collaboration between state and federal government and pointing to a lack of coordination in the program – see *Transcript of Evidence*, 7 April 2009, pp. 11-12.

32 Mr Carruthers, Department of Climate Change, *Transcript of Evidence*, 18 June 2009, p. 6.

Recommendation 7

- 3.47 **The Committee recommends that the Australian Government:**
- **continue the Local Adaptation Pathways Program as a competitive funding program**
 - **review the program's guidelines to secure better outcomes by:**
 - ⇒ **use of consistent methodology for vulnerability assessments**
 - ⇒ **evaluation of the outcomes of the projects that are undertaken with the grants**
 - ⇒ **encouraging regional applications from local councils whenever possible**

Recommendation 8

- 3.48 **The Committee recommends that the Department of Climate Change share all data collected through vulnerability assessments undertaken as part of the Australian Government Local Adaptation Pathways Program on the proposed National Coastal Zone Database (see also recommendation 42).**

National Climate Change Adaptation Research Facility

- 3.49 The National Climate Change Adaptation Facility (NCCARF), established in 2007, is a collaboration of academic facilities addressing broad issues of adaptation from a research perspective. It is hosted by Griffith University, with funding from the Department of Climate Change. NCCARF leads the national interdisciplinary research effort to 'generate the information needed by decision-makers in government and in vulnerable sectors and communities to manage the risks of climate change impacts.'³³
- 3.50 The National Climate Change Adaptation Framework identified a need for the establishment of a body that would coordinate Australia's research resources to produce targeted research to assist in adaptation decision making, which led to the establishment of NCCARF.
- 3.51 NCCARF outlines its key roles as:

33 National Climate Adaptation Research Facility website accessed on 7 August 2009 <<http://www.nccarf.edu.au>>

- developing National Adaptation Research Plans to identify critical gaps in the information available to decision-makers
- synthesising existing and emerging national and international research on climate change impacts and adaptation and developing targeted communication products
- undertaking a program of integrative research to address national priorities, and
- establishing and maintaining adaptation research networks to link together key researchers and assist them in focussing on national research priorities.³⁴

3.52 NCCARF will produce a research plan on various themes. Each plan will be produced by a network of academics coordinated by various research bodies, as follows:

- Terrestrial Biodiversity – James Cook University
- Water Resources and Freshwater Biodiversity – Griffith University
- Marine Biodiversity and Resources – University of Tasmania
- Settlements and Infrastructure – University of NSW
- Disaster Management and Emergency Services – RMIT University
- Social, Economic and Institutional Dimension – University of Melbourne
- Health – Australian National University
- Primary Industries – Land and Water Australia³⁵

3.53 The work of the NCCARF is supported by the Committee. At the time of writing only the health research plan³⁶ has been finalised and released by NCCARF and announced by the Minister for Climate Change.³⁷ The Committee looks forward to the release of further plans.

34 National Climate Adaptation Research Facility website accessed on 7 August 2009 <<http://www.nccarf.edu.au/about-facility>>

35 The Australian Government has announced that as part of the 2009-10 Budget, it will be abolishing Land and Water Australia (LWA). LWA will be fully wound-up by December 2009. In that context, LWA is currently negotiating the completion or transfer of projects it administers. LWA website accessed 14 September 2009 <<http://lwa.gov.au/land-and-water-australia/closure-and-wind-information>>

36 NCCARF, *Human Health and Climate Change: National Adaptation Research Plan*, December 2008.

37 Media release by Senator the Hon Penny Wong, Minister for Climate Change; the Hon Nicola Roxon MP, Minister for Health and Ageing; and Senator the Hon Kim Carr, Minister for Innovation, Industry, Science and Research, '\$10 million for research into health and climate change', 27 January 2009.

- 3.54 The Committee was surprised to learn that there is not a coastal research network within NCCARF. Most of the other themes highlighted in the National Climate Change Adaptation Framework are covered by the work of the research facility. This omission should be rectified.

Recommendation 9

- 3.55 **The Committee recommends that the Australian Government establish a coastal zone research network within the National Climate Change Adaptation Research Facility and that it complete a coastal zone research plan.**

CSIRO—Climate Adaptation National Research Flagship

- 3.56 CSIRO has established the Climate Adaptation National Research Flagship to address the national challenge of climate change adaptation in Australia. The flagship is working to develop adaptation responses to counter the expected effects of climate change in Australia and deliver strategies to manage their impact, as well as develop new ways to combat and potentially benefit from these challenges.³⁸
- 3.57 Research at the flagship is being conducted under four themes designed to help increase Australia's adaptive capacity. They are:
- Pathways to adaptation
 - Sustainable cities and coasts
 - Managing species and natural ecosystems
 - Adaptive primary industries and communities
- 3.58 Under the 'Sustainable cities and coasts' theme, the flagship is addressing climate change adaptation in the coastal zone. The flagship's website states that:

Researchers are developing planning, design, infrastructure and management solutions to help Australia's cities and coasts adapt to a changing climate.³⁹

38 CSIRO Climate Change Adaptation National Research Flagship website accessed 10 August 2009 <<http://www.csiro.au/org/ClimateAdaptationFlagship.html>>

39 CSIRO Climate Change Adaptation National Research Flagship website accessed 10 August 2009 <<http://www.csiro.au/org/ClimateAdaptationFlagshipOverview.html>>

- 3.59 The Committee is pleased to see this scientific focus on adaptation in Australia's coastal zone, and believes there is a great need for further scientific engagement in developing Australia's coastal adaptive capacity.

Role of state and local government in climate change adaptation in the coastal zone

- 3.60 State and local governments play a vital role in climate change adaptation. The COAG National Climate Change Adaptation Framework states that:

risks should be managed by those best equipped to understand the context and likely consequences of action, and there is a clear need to build capacity at local and regional scales. There is an important role for business and the community in addressing climate change risks, and governments will pursue a partnership approach to adaptation to manage risks and identify any opportunities.⁴⁰

- 3.61 As Mr Sharples explained, there are significant factors of 'regional and local variability' such as 'climatic, oceanographic, geological, geomorphic and topographic factors' that define the Australian coastal zone and will significantly determine the regional impacts of climate change around the coast.⁴¹ The Committee strongly endorses the framework's statement that adaptation is most effectively carried out by those best placed to do so.
- 3.62 The Committee notes that the first pass NCVA will provide a broad national vulnerability assessment of the Australian coast, with a selection of more in depth analyses of the local impacts of climate change drawn from the six case studies.
- 3.63 The Committee believes that it is these more detailed, localised assessments of the coastal zone that will be of greatest value into the future. The Committee also notes the Integrated Assessment of Climate Change Impacts on Human Settlements and Infrastructure initiative being funded in part by the Department of Climate Change, in collaboration with state, territory and local governments, as well as research institutions and local communities. Case studies have taken place in Western Port,

40 COAG National Climate Change Adaptation Framework, p. 4.

41 C Sharples, for Tasmanian Department of Primary Industries and Water, *Indicative Mapping of Tasmanian Coastal Vulnerability to Climate Change and Sea-Level Rise: Explanatory Report* (second edition), May 2006, p. 4.

Victoria; Clarence, Tasmania; Gold Coast, Queensland and Sydney, NSW.⁴²



Committee members with Town of Cottesloe council officials at a site inspection of Cottesloe foreshore, WA

3.64 The study entitled, 'Three pass approach to coastal risk assessment,' highlights the need not only for a first pass assessment which establishes coastal 'sensitivity' to climate change impacts but also for second and third pass assessments. These further assessments involve looking at the 'exposure' of different regions of the coast to the impacts of climate change (second pass) and then undertaking site-specific assessments of vulnerable locations (third pass).⁴³ The Committee is aware that a large number of coastal councils and state governments are already undertaking their own vulnerability assessments, and have been doing so for some time. While it is beyond the scope of this report to consider these local coastal adaptation

42 See Western Port Greenhouse Alliance, *Impacts of Climate Change on Settlements in the Western Port Region*, October 2008; Clarence City Council, *Exhibit 97*; Griffith University, *Climate Change, Health Impacts and Urban Adaptability: Case Study of Gold Coast City*, February 2009; and Sydney Coastal Councils Group – *Exhibit 105*.

43 C Sharples, C Attwater, J Carley, *Exhibit 67*, p. 3.

studies in detail, several that were drawn to the attention of the Committee during the inquiry are listed in Figure 3.1.

- 3.65 The Committee would like to highlight the Victorian Government's 'Future Coasts' project. They noted:

Victoria is undertaking a major project, Future Coasts, to develop comprehensive vulnerability assessments for the whole Victorian coastline worth in excess of \$8 million. This project will also develop planning and policy guidance and adaptation strategies for decision making. The Victorian State Government will be working closely with land managers and local government on this work.⁴⁴

- 3.66 Through this project, the Victorian Department of Sustainability and Environment is collecting high resolution DEM data for both sea depth and topographic elevation – within a range of 20m below and 10m above sea level. The topographic DEM is currently available for the entire Victorian coastline.⁴⁵ 'Future Coasts' also involves a coastal policy and planning project, focused on how planning and management of coastal areas could better incorporate the impacts of climate change. The project will involve engagement with coastal stakeholders to identify the policy and decision-making guidance needed to support better planning and management outcomes on the coast. The third element of 'Future Coasts' is a coastal asset database that will seek to provide an inventory of the key assets and infrastructure located within the Victorian coastal zone.⁴⁶

Figure 3.1 Examples of local coastal adaptation studies

Sydney Coastal Councils, NSW

The Sydney Coastal Councils Group (SCCG) received funding from DCC to commission CSIRO to work in collaboration with the University of the Sunshine Coast to undertake a 2 year research project on regional approaches to managing climate vulnerability in the Sydney region.

The goal of the 'Systems Approach to Regional Climate Change Adaptation Strategies in Metropolises' project was to explore climate change risk management, specifically in relation to climate change adaptation in the SCCG region. The project focuses on the capacity of the 15 SCCG member councils to adapt to climate change.

44 Victorian Government, *Submission 90*, pp. 9-10.

45 Victorian Government website accessed 19 August 2009
<<http://www.climatechange.vic.gov.au/futurecoasts>>

46 Victorian Government, *Future Coasts Newsletter*, December 2008, p. 2.

The project involved the production of a report mapping the climate change vulnerability in the SCCG region.⁴⁷

Gippsland Coastal Board, VIC

In 2005-06, commissioned CSIRO, with funding assistance from National Heritage Trust, to undertake three reports on impacts of climate change on weather patterns, storm surges, and extreme sea levels in Gippsland region.⁴⁸

The studies have been used to assist communities and coastal managers in understanding and preparing for more extreme storm events which are likely to occur in that region.

The Board has also commissioned a final report which gives greater detail regarding the location of the most vulnerable communities and assets in the Gippsland region.⁴⁹

Lake Macquarie City Council, NSW

One of the first local government areas to establish and implement coastline and estuary management plans based on draft NSW state government estuary and coastal management manuals.

In 2008, council also resolved to exhibit a proposal to adopt a sea level rise figure for the year 2100 of 0.91m, based on NSW Department of Environment and Climate Change projected upper level sea level rise figure.⁵⁰

Tasmanian State Government

In 2006, Chris Sharples released a report, commissioned by the Department of Primary Industries and Water, outlining the vulnerability of the Tasmanian coastline to the impacts of climate change and sea-level risk.⁵¹

Subsequent to Sharples' report, the Tasmanian Government is conducting the Climate Change and Coastal Risk Assessment Project, to develop tools and resources to assist with risk-based management and planning for various assets and values in the coastal zone.⁵²

47 Sydney Coastal Councils Group, *Systems Approach to Regional Climate Change Adaptation Strategies in Metropolises: Mapping Climate Change Vulnerability in the Sydney Coastal Councils Group*, 2008 – Exhibit 105.

48 Gippsland Coastal Board, *Climate Change in Eastern Victoria: the Effect of Climate Change on Coastal Wind and Weather Patterns – Stage 1 Report*, June 2005; Gippsland Coastal Board, *Climate Change in Eastern Victoria: the Effect of Climate Change on Storm Surges – Stage 2 Report*, June 2005; Gippsland Coastal Board, *Climate Change in Eastern Victoria: the Effect of Climate Change on Extreme Sea Levels in Corner Inlet and the Gippsland Lakes – Stage 3 Report*, August 2006.

49 Gippsland Coastal Board, *Exhibit 44*.

50 Lake Macquarie City Council, *Submission 44*, p. 5. See also NSW Department of Planning, *Exhibit 37*.

51 Tasmanian Department of Primary Industries and Water, *Indicative Mapping of Tasmanian Coastal Vulnerability to Climate Change and Sea Level Rise: Explanatory Report* (second edition), May 2006.

52 Tasmanian Department of Primary Industries, Parks, Water and Environment website accessed on 12 August 2009 <<http://www.dpiw.tas.gov.au/inter.nsf/WebPages/PMAS-6B56BV?open>>

3.67 The Australian Government intends to hold a 'National Coastal Climate Change Forum' on completion of the first pass assessment.⁵³ The Department of Climate Change states that the forum will:

bring together the key stakeholders and provide the information and tools so that the participants can develop a clear and consistent set of guidelines that coastal communities can use in adapting to climate change impacts.⁵⁴

3.68 The Committee supports the involvement of coastal councils, local government associations and state governments in this forum, as dialogue between jurisdictions is paramount in ensuring the best coastal climate change adaptation guidelines are set. Mr Beresford-Wylie, ALGA Chief Executive, noting that there are several hundred coastal councils, observed that:

Councils in a forum will be able to articulate exactly what it is that they, as individual councils, will be looking for, and there will be a whole variety of different experiences they put on the table. ... Then, in a sense, it will hopefully be up to the Australian government to identify what it might do, and what it might contribute, in terms of helping councils address the issues that come forward.⁵⁵

3.69 The Committee believes that a regional approach to climate change adaptation in the coastal zone is an efficient method of undertaking vulnerability assessments and implementing adaptation plans. Cooperation between local government areas can be particularly beneficial as the climate change threats to neighbouring areas are often similar and may be more efficiently addressed through a collaborative approach.

3.70 The Summary of Outcomes from the June 2009 meeting of the Australian Council of Local Governments (ACLG) supports this approach:

Across the board, councils stressed the need to work in a more coordinated way with state and federal governments and their communities to adapt to climate change. Areas for greater coordination included managing risk and liability and agreement between different spheres of government on roles and responsibilities.⁵⁶

53 Department of Climate Change, *Submission 85*, p. 2.

54 Department of Climate Change, *Submission 85*, p. 2.

55 Mr Beresford-Wylie, ALGA, *Transcript of Evidence*, 16 October 2008, p. 5.

56 Australian Council of Local Governments, *Summary of Outcomes, June 2009*
<http://www.aclg.gov.au/meetings/jun_09/session_outcomes.aspx>

- 3.71 While the initial first pass assessment is rightly being undertaken federally, it is the states and local governments that will be most active in coastal climate change adaptation plans.
- 3.72 The National Sea Change Taskforce recommended that ‘a mechanism be established to encourage and enable collaboration between neighbouring local councils in responding to climate change.’ This will become yet more significant once the ‘second’ and ‘third’ pass data becomes available in greater volume.
- 3.73 In its submission to the inquiry, CSIRO discussed the benefits of a coordinated national approach:
- Development of adaptation options needs to be done in partnership with policy makers, industry and communities to avoid perverse outcomes. The costs of adaptation will in many instances be significant, and uncoordinated or inappropriately targeted adaptation will consequently cost the economy severely in inefficiencies, costs of missed opportunities and downside risk. The development of a common and consistent conceptual approach to adaptation across agencies, tiers of government and in the research community will greatly reduce these costs.⁵⁷
- 3.74 The Queensland Government raised the concern about the capacity of some local government bodies to plan for and adapt to climate change impacts, noting:
- not all local governments have the capacity, expertise and resources to adequately address the impacts of climate change through the planning process, management activities and capital works. In particular, there are likely to be significant financial costs associated with the need to undertake ‘coastal hardening’ (build or upgrade shoreline protective structures to protect infrastructure and other development from increased erosion as a result of climate change).⁵⁸
- 3.75 Dr Townsend, Immediate Past Chair of the National Committee on Coastal and Ocean Engineering, Engineers Australia, commented that:
- The capacity for various jurisdictions to deal with [climate change adaptation] varies widely across the country ... when you delve down [to]... various local government districts ... Some are

57 CSIRO, *Submission 49*, p. 17.

58 Queensland Government, *Submission 91*, p. 9.

extraordinarily well equipped and raring to go to take on these issues whereas others are dealing with large areas of coast, very small ratepayer bases and very small populations. They have almost no ability to take on any additional issues. The cost to some local governments is well above their capacity to deal with these matters.⁵⁹

3.76 The Committee notes the importance of building capacity in local government for effective climate change adaptation. The Department of Climate Change, in a June 2009 report, acknowledged this need, calling for improvement in public sector capabilities through capacity building activities for local government.⁶⁰ Professor McIlgorm, of the National Marine Science Centre, suggested in his submission that:

A study is required of the human capacity needs in local government and the requirements to assist local government staff to plan and to face climate change impacts. This is a priority. Scholarship programs could be offered.⁶¹

Recommendation 10

3.77 The Committee recommends that:

- the Department of Infrastructure, Transport, Regional Development and Local Government undertake a study into the human and resourcing needs of local governments to effectively plan for and adapt to the impacts of climate change
- this study be carried out in conjunction with the Australian Local Government Association and the National Sea Change Taskforce

Concluding remarks

3.78 As discussed above, a significant concern raised repeatedly throughout the course of the Committee's inquiry is the current lack of coordination of vulnerability assessments in Australia. Stakeholders were supportive of

59 Mr Townsend, Engineers Australia, *Transcript of Evidence*, 12 March 2009, p. 3.

60 Department of Climate Change, *Climate Change Adaptation Actions for Local Government*, 2009, p. 52.

61 Professor McIlgorm, *Submission 47*, p. 1.

the Australian Government's activities in beginning to assess coastal vulnerability to climate change, calling for national coordination to ensure best practice, to prevent duplication and reduce costs.

3.79 The Committee notes the key challenge identified in Working Paper 2 of CSIRO Climate Change Adaptation Flagship that:

At present, we have too many case studies using different methods in different regions/sectors, but not the same methods in multiple cases or different methods in the same case, thus hindering generalisation.⁶²

3.80 The WA Government noted that:

There is currently no dedicated central repository of the various coastal assessments and hence there has been limited comparative analysis to date.⁶³

3.81 The Committee believes that these issues of communication and coordination of the first pass NCVA data, as well as the vulnerability assessment data from the states and NT, could be effectively rectified by the establishment of an online coastal database. The database would include all information collected through the NCVA, as well as other coastal adaptation information collected from various sources. All data should be loaded to the new national coastal zone database, and should be made fully accessible to all, with clear instructions and explanations of the available tools and data.

62 CSIRO Climate Adaptation Flagship, *Working Paper 2*, 2009, p. 30.

63 WA Government, *Submission 89*, p. 15.

Recommendation 11

3.82 **The Committee recommends that the Australian Government establish a National Coastal Zone Database to improve access to and consistency of information relevant to coastal zone adaptation. The National Coastal Zone Database should be an online portal that allows ready access to:**

- **'first pass' National Coastal Vulnerability Assessment data**
- **state and local Digital Elevation Modelling**
- **National Climate Change Adaptation Research Facility reports**
- **federal Local Adaptation Pathways Program reports**
- **state and local coastal vulnerability assessment results**

3.83 The Committee notes that the first pass NCVA is indeed the *first* national assessment of Australia's coastal vulnerability, and that more in depth, regional assessments should be undertaken. As representatives of the Department of Climate Change pointed out:

The current 'first pass' National Coastal Vulnerability Assessment (NCVA) of key assets within Australia's coastal zone will begin to address our knowledge deficit. The NCVA will provide the first, whole of nation understanding of the magnitude and spatial extent of risk and will drive the national development of essential tools for climate change adaptation.⁶⁴

3.84 The Committee believes that, once the first pass assessment has addressed that initial 'knowledge deficit', Australia will require greater detail of vulnerability assessment data to allow for the best adaptation decisions to continue to be made throughout the coastal zone. The Committee believes that the completion of the first pass assessment should not mark the end of Australia's efforts to assess coastal vulnerability to climate change impacts but rather the beginning. The question therefore posed is that, once the first pass assessment is complete, what comes next?

64 Department of Climate Change, *Submission 85*, p. 2.

Recommendation 12

3.85 **The Committee recommends that, following the completion of the ‘first pass’ National Coastal Vulnerability Assessment, the Australian Government consider the resourcing and financing of second and third pass assessments, in conjunction with state, territory and local government authorities.**

3.86 The Committee notes that the vast majority of responses to its term of reference examining climate change adaptation in the coastal zone have focused on coastal vulnerability assessment rather than implementing possible strategies or solutions. As Engineers Australia made clear in its submission to the inquiry:

Research dominates the climate change policy landscape and for good reason. There are many issues where further information is required. However, action using what is known can proceed in parallel with research.⁶⁵

3.87 Assessment is, of course, a crucial element in establishing a good climate change adaptation policy; however, it is only the initial step. Acknowledging that *climate change is happening now*, the Committee is concerned about any delay in moving from the vulnerability assessment phase of adaptation to the implementation of adaptation solutions around the coastal zone. As a representative of the Western Australian Department of Planning and Infrastructure observed, the move to the implementation phase is not likely to be an easy one but is nonetheless an urgent one:

the last stage is the policy, the adaptation, the adoption of change. That is a very difficult step, as you would probably all understand, because that actually requires change. One of the problems which I see is that very few people actually get into the last step of this process. On a Commonwealth scale, from the work that I see, there is data collection and there are frameworks in place to that. There is classification and seeing what are vulnerable areas. ... As we get down to the end and are setting up frameworks for policy, having adaptation and actually doing change, these are very difficult things, and this goes down to a local level.⁶⁶

65 Engineers Australia, *Submission 29*, p. 1.

66 Mr Bicknell, WA Department of Planning and Infrastructure, *Transcript of Evidence*, 7 April 2009, pp. 5-6.

- 3.88 Coastal adaptation is of course a subset of a broader climate change adaptation framework. Larger issues exist, for example, regarding resourcing for the significant technological and skills requirements in carrying out a 'protect, redesign, rebuild, elevate, relocate or retreat' policy.⁶⁷ There is clearly a need for a national climate change adaptation policy, which would seem to be the logical outcome of the work being conducted to date by the Department of Climate Change. This is a larger issue than just the coastal zone and therefore beyond the scope of this inquiry.
- 3.89 The Committee commends the Australian Government for beginning to provide the information and tools that will be required for coastal adaptation, through the National Climate Change Adaptation Framework and the first pass NCVA. The Committee points to the need for definition of the roles and responsibilities of different levels of government and other stakeholders in coastal adaptation and notes that at present there is no formal mechanism for monitoring and evaluation of adaptation policies.

Other themes identified in the National Climate Change Adaptation Framework relevant to the coastal zone

Coastal water resources

- 3.90 The National Climate Change Adaptation Framework, as discussed above, has identified 'water resources' as a key sector for attention. Climate change will severely impact Australia's already limited water resources. Increased droughts will lead to a decline in replenishment of groundwater aquifers, which provide a large amount of Australia's water. Rainfall is also likely to be concentrated in more extreme rainfall events, affecting water availability and quality.⁶⁸
- 3.91 The Committee notes that the National Climate Change Adaptation Research Facility is facilitating an Adaptation Network on Water Resources and Freshwater Biodiversity, hosted by Griffith University. The network brings together water scientists with interests and skills in water resources and freshwater biodiversity, and the implications of climate change.⁶⁹ The network has identified an urgent need to understand the

67 Victorian Coastal Council, *Submission 83*, p. 9.

68 COAG National Adaptation Framework, p. 10.

69 NCCARF website accessed 13 August 2009 <<http://www.nccarf.edu.au/water>>

risks to Australia's surface and groundwater resources due to climate change as well as the technical and policy interventions that will be required to meet future human water needs.⁷⁰ The network is, at the time of writing, drafting a national adaptation research plan which will identify critical gaps in the information available to decision-makers, set national research priorities and identify science capacity that could be harnessed to conduct priority research.⁷¹ The Committee looks forward to the findings of this research plan.

3.92 The Committee's particular interest is in coastal water resources in terms of climate change impacts and adaptation strategies. Coastal water resources are of particular concern in Australia because of the potential for sea level rise to cause salt water intrusion into freshwater aquifers, jeopardising our already restricted water supply. Indeed, water supplies, storage and infrastructure may be susceptible to extreme sea level and rainfall events and upgrading of water delivery systems may be required to protect against sea level rise impacts.

3.93 Salt water intrusion into fresh groundwater was raised by several inquiry participants. The submissions from SGS Economics and CSIRO noted that '[s]alt water intrusion into fresh groundwater can make water supplies unusable'⁷² and that 'impairment of water quality' is a significant potential risk.⁷³ The Australian Network of Environmental Defender's Offices (ANEDO) commented on the potentially damaging impacts of salt water intrusion to the biodiversity and ecology of the coastal zone:

increased salt water intrusion into aquifers has the potential to impact not only on freshwater reserves (used to support the environment and the increasing population), but additionally cause major shifts in coastal ecosystem dynamics. Tomago Sands Beds provides much of the water supply for the Newcastle area, and has been identified as being vulnerable to saltwater intrusion from rising sea levels.⁷⁴

3.94 A number of inquiry participants also highlighted that the low-lying coastal plains in Kakadu National Park are particularly vulnerable to

70 NCCARF website accessed 13 August 2009 <<http://www.nccarf.edu.au/water>>

71 NCCARF website accessed 13 August 2009 <<http://www.nccarf.edu.au/national-adaptation-research-plans>>

72 SGS Economics and Planning, *Submission 105*, p. 17.

73 CSIRO, *Submission 49*, p. 14.

74 ANEDO, *Submission 73*, p. 36.

saltwater intrusion, posing a significant threat to its freshwater wetland systems. This issue is further discussed in Chapter 5.

- 3.95 The Committee notes that the issue of climate change and water is a significant area of national policy concern, with several specific initiatives underway in this area, including work to address climate change adaptation with respect to water resources. The Australian Government's \$12.9 billion Water for the Future program highlights 'Taking Action on Climate Change' as the first of its four base principles, noting that there is a need for 'scientific and technical expertise to understand how much water Australia's river and groundwater systems are capable of providing into the future.'⁷⁵
- 3.96 The Committee notes this significant government initiative and the extent to which it is addressing climate change adaptation with respect to water resources.
- 3.97 As the driest inhabited continent, Australia's water resources are precious and limited. Any added threat to water resources from salt water intrusion due to sea level rise in the coastal zone is therefore highly significant. The Committee is pleased to see the focus on adaptation to climate change impacts on water resources through the publication of the research plan on Water Resources and Freshwater Biodiversity from NCCARF, and in particular the emphasis on climate change and water in government programs such as the National Water Initiative, being advanced by the Water for the Future program. The Committee believes that these government initiatives must focus specific attention on the issues surrounding water adaptation in response to climate change in coastal regions.

Health in coastal communities

- 3.98 Human health is identified in the National Climate Change Adaptation Framework as a key sector for attention. Health can be impacted by climate change through increases in mortality from thermal stress due to increased temperatures (in particular during heat waves), extreme weather events, and food-borne and vector-borne diseases. Changes in climate events like droughts have also been identified as causing mental health problems in rural communities.⁷⁶ The National Climate Change Adaptation Framework called for a National Action Plan on Climate

75 DEWHA, website accessed 13 August 2009
<<http://www.environment.gov.au/water/australia/priorities.html>>

76 COAG National Climate Change Adaptation Framework, p. 16.

Change and Health, which is underway at the time of writing.⁷⁷ Figure 3.2 below shows the expected impacts on human health from climate change.

Figure 3.2 Expected climate change impacts on human health

- Mortality and morbidity are likely to increase due to more frequent and intense extreme weather events including storm surges, cyclones and bushfires.
 - Drought is likely to lead to an increase in mental health problems, particularly in rural communities.
 - Morbidity and mortality associated with more frequent and severe heatwaves is likely to increase affecting the elderly in particular.
 - Morbidity and mortality from increased exposure to ground-level ozone and other air pollutants (eg nitrogen oxides, particulate matter) and aeroallergens such as pollens is likely to increase. People with pre-existing illness, particularly respiratory and cardiac, will be at particular risk.
 - Vector-borne infectious diseases are likely to increase due to changing conditions for vectors and hosts. Geographic ranges of some diseases are likely to change, putting new populations at risk.
 - Food- and water-borne disease outbreaks are likely to increase, including, for example, diarrhoeal disease following floods and increased temperature-sensitive food-borne diseases such as salmonellosis. Algal blooms that cause human disease are also likely to increase.
 - Water scarcity is likely to increase and reduce food availability, particularly fresh fruit and vegetables.
 - Internal migration and immigration, particularly from neighbouring island countries, is likely to increase, most likely from coastal areas that are inundated by sea level rise.
- Source Department of Health and Ageing, Submission 100, p. 1*

3.99 The IPCC AR4 report identifies the health vulnerabilities of coastal communities:

Climate change could affect coastal areas through an accelerated rise in sea level; a further rise in sea-surface temperatures; an intensification of tropical cyclones; changes in wave and storm surge characteristics; altered precipitation/runoff; and ocean acidification. These changes could affect human health through coastal flooding and damaged coastal infrastructure; saltwater intrusion into coastal freshwater resources; damage to coastal ecosystems, coral reefs and coastal fisheries; population displacement; changes in the range and prevalence of climate-sensitive health outcomes; amongst others. Although some Small

77 COAG National Climate Change Adaptation Framework, p. 16; and see Mr Coburn, Department of Health and Ageing, *Transcript of Evidence*, 14 May 2009, p. 5.

Island States and other low-lying areas are at particular risk, there are few projections of the health impact of climate variability and change. Climate-sensitive health outcomes of concern in Small Island States include malaria, dengue, diarrhoeal disease, heat stress, skin diseases, acute respiratory infections and asthma.⁷⁸

3.100 The Committee received evidence from the Department of Health and Ageing, which identified key health issues in coastal regions as:

- Mosquito-borne disease

- ⇒ In particular, the re-emergence of *Aedes albopictus* and *Aedes aegypti* in Northern Territory. These mosquitos are capable of carrying dengue fever and have normally only appeared in Queensland.

- ⇒ The Northern Territory Department of Health and Community Services confirmed in late February 2004 that *Aedes aegypti* were breeding in Tennant Creek, NT. This was the first time in 50 years that this mosquito has established breeding sites in the NT. Some \$1.3 million of federal funds were used to eradicate this infestation.

- ⇒ Subsequent discoveries of this mosquito have been recorded on Groote Eylandt, NT and the Torres Strait.⁷⁹

- Mental health

- ⇒ Mental health issues caused by drought in rural coastal areas have been identified by the department as an issue of concern.

3.101 The National Climate Change Adaptation Research Facility, hosted by Griffith University, is facilitating a network on 'Human Health', hosted by Australian National University (ANU). As mentioned earlier in this chapter, the network has finalised its national adaptation plan for human health, entitled *Human Health and Climate Change: National Adaptation Research Plan*. The plan highlights current knowledge gaps in Australia's vulnerability to the health implications of climate change. In areas significant to health of coastal communities, the plan identifies knowledge gaps in dealing with:

- Vector-borne disease

- ⇒ The plan identified current threats from: Ross River Virus, dengue fever, chikungunya fever⁸⁰ and malaria.

78 IPCC, *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Chapter 8: Human Health, p. 414.

79 Department of Health and Ageing, *Submission 100*, p. 4.

- ⇒ The plan identified gaps in:
 - ... understanding of baseline relations between climate and infectious disease incidence; the need for better predictive models agreed to by all professional groupings involved in the area; and methodologies for the assessment of adaptive strategies for changes in the range, seasonality or incidence of infectious disease under climate change.⁸¹
- ⇒ The Committee notes the National Adaptation Plan also discusses the need for surveillance and early warning systems for vector-borne disease. The plan highlights the need to 'improve current short term forecasting, while also creating capacity to develop longer-term scenario-based predictive modelling.'⁸²
- Mental health
 - ⇒ The plan identifies climate change impacts on human health from an increase in natural disasters (such as storm surges, cyclones or floods, for example) as well as the socioeconomic effects of drought on rural communities, and the implications this can have on mental health.

3.102 Departmental representatives, in evidence to the Committee, outlined current responses to these health issues:

- Vector-borne disease
 - ⇒ The department is working with the states and territories towards a more structured framework in response to mosquito outbreaks.⁸³
- Mental health
 - ⇒ The department funds the Mental Health Services in Rural and Remote Areas program which covers coastal areas, providing mental health assistance to those affected by severe weather events and droughts.⁸⁴

80 Chikungunya fever is a tropical disease not yet present in Australia. The first non-tropical outbreak of the disease was in Italy in 2007. This has implications for Australia, as the *Aedes albopictus* and *Aedes aegypti* mosquitos can carry this disease as well as dengue, and are becoming more prevalent in northern Australia and the Torres Strait.

81 *Human Health and Climate Change: National Adaptation Research Plan*, 2008, p. 24.

82 *Human Health and Climate Change: National Adaptation Research Plan*, 2008, p. 24.

83 Ms Halbert, Department of Health and Ageing, *Transcript of Evidence*, 14 May 2009, p. 3.

84 Ms Krestensen, Department of Health and Ageing, *Transcript of Evidence*, 14 May 2009, pp. 11-12.

- 3.103 Finally, the Committee notes the large quantity of evidence suggesting that Indigenous communities may be more at risk from climate change related health concerns than other sectors of society due to their remoteness and socioeconomic conditions.⁸⁵
- 3.104 The Committee believes that immediate action should be taken to provide for better early warning of threats from vector-borne disease, as well as long term modelling for earlier forecasting of threats. The significant outbreak, in early 2009, of dengue fever in Cairns, Queensland, with over 1,000 cases marks a cause for concern. The Committee believes that the increased likelihood of chikungunya virus entering Australia should be combated with increased biosecurity measures.

Recommendation 13

- 3.105 **The Committee recommends that the Australian Government take urgent action to protect Australians from the threats of dengue fever and chikungunya virus. The knowledge gaps identified by the National Climate Change Adaptation Research Facility research plan with regards to the relationship between climate variation and vector-borne disease should be urgently addressed. The Australian Government should:**
- **undertake research into the relationship between climate change and vector-borne disease**
 - **produce modelling to allow for advanced early warning of impending threats from vector-borne disease**
 - **continue to work towards producing a structured national framework for dealing with mosquito outbreaks in Australia**
 - **increase biosecurity measures to better protect against chikungunya virus entering Australia**

Coastal industry

- 3.106 The Committee received limited evidence relating to climate change adaptation in coastal industries. The potential impacts of climate change on industries like tourism, agriculture, and fisheries and aquaculture were

85 See Department of Health and Ageing, *Submission 100*; ANEDO, *Submission 73*; and Western Australian Local Government Association, *Submission 53*.

noted by the Committee.⁸⁶ The National Climate Change Adaptation Framework identifies agriculture, fisheries and tourism as key industry sectors for attention. Agriculture will be affected by greater seasonal weather variability, while fisheries will be impacted by rising ocean temperature, changes to ocean currents and changed rainfall patterns. Tourism is likely to be significantly affected by the impacts of climate change on infrastructure and the natural environment.⁸⁷

- 3.107 The National Climate Change Adaptation Research Facility, hosted by Griffith University, is facilitating a Primary Industries Research Network hosted by Land and Water Australia⁸⁸ and a Marine Biodiversity and Resources Research Network hosted by the University of Tasmania.
- 3.108 The Adaptation Research Networks for both Primary Industries and Marine Biodiversity and Resources are bringing together researchers and stakeholders with an interest in the impacts of climate change on these significant industry sectors. The Committee notes that both networks are working towards the finalisation of Adaptation Research Plans which will identify critical gaps in the information available to decision makers in this sector and set national research priorities for greater understanding of the threats to these industries from climate change.⁸⁹
- 3.109 The CSIRO Climate Adaptation Flagship is also undertaking research in this area. Under the research theme 'Adaptive primary industries, enterprises and communities', the Flagship is developing adaptation options for Australia's primary industry and resource sectors to reduce the vulnerabilities and enhance opportunities created by climate change and variability.⁹⁰

86 *Submissions 18* (Ports Australia), 32 (Port of Melbourne Corporation) and 80 (Maritime Union of Australia) also highlighted issues relating to ports and shipping. The Committee received a submission from the National Farmers Federation highlighting the impacts of climate change on agriculture in Australia – see *Submission 92*.

87 COAG National Climate Change Adaptation Framework, p. 16.

88 The Australian Government has announced that as part of the 2009-10 Budget, it will be abolishing Land and Water Australia (LWA). LWA will be fully wound-up by December 2009. In that context, LWA is currently negotiating the completion or transfer of projects it administers. Website accessed 14 September 2009 <<http://lwa.gov.au/land-and-water-australia/closure-and-wind-information>>

89 NCCARF website accessed 15 August 2009 <<http://www.nccarf.edu.au>>

90 CSIRO Climate Adaptation Flagship website accessed 17 August 2008 <<http://www.csiro.au/science/AdaptivePrimaryIndustries.html>>

Tourism

3.110 The tourism sector in Australia's coastal zone is a highly significant contributor to Australia's economy. The Great Barrier Reef alone contributes a \$6.1 billion tourism industry and an estimated 63 000 jobs.⁹¹

3.111 The submission from the Great Barrier Reef Marine Park Authority (GBRMPA) outlines the impacts of climate change on the tourism industry, centred on the Great Barrier Reef:

Within the Great Barrier Reef, the marine tourism industry are particularly susceptible to the effects of climate change, namely loss of coral reef due to bleaching, and changes to abundance and location of fish, marine mammals and other iconic species. Increasing intensity of storms and cyclones will impact passenger and tourism operator safety, industry seasonality (and opportunities for Great Barrier Reef experiences), tourism infrastructure and associated tourism industry development.⁹²

3.112 The Quicksilver Group of Companies listed the impacts as:

- Water quality – our industry believes this is the single largest issue impacting the Great Barrier Reef. In simplistic terms, nutrient-enriched run-off from rivers has a deleterious impact on the reef systems, making them less resilient to environmental changes, such as climate change, coral bleaching or outbreaks of pests or diseases.
- Coastal Development and the potential impact this has on declining water quality.
- Climate change, the potential impact of rising sea temperatures and sea levels, and most recently, ocean acidification.
- Conflict with the growing numbers of recreational users - as indicated above, the tourism industry (which accounts for approximately 1.9 million visitors to the reef) is one of the most regulated/managed user groups within the Great Barrier Reef. Compare this to recreational users (approximately 2.1 million visitors) who are far less managed but growing rapidly in numbers and there is a high potential for conflict, particularly in areas like the Whitsunday's.
- The ability of the Great Barrier Reef Marine Park Authority (GBRMPA) to effectively enforce compliance.
- The ability of industry to access funds quickly to assist in addressing outbreaks of marine pests/diseases such as Crown-

91 GBRMPA, *Submission 81*, p. 2.

92 GBRMPA, *Submission 81*, p. 11.

of-thorns Starfish (COTS), Drupella Snails and coral disease (White-band Syndrome) when they occur.⁹³

- 3.113 The Committee notes the Tourism and Climate Change Action Framework, endorsed by the Tourism Ministers Council in July 2008. The framework was designed to reduce the tourism industry's contribution to climate change and also to prepare the tourism industry to respond to the physical, economic and social impacts of climate change.⁹⁴
- 3.114 The Committee notes in particular the 'Destinations Adaptation Project', which is one element of the research underpinning the tourism framework. The project is being undertaken through the Sustainable Tourism CRC and was designed to increase understanding of climate change impacts (economic and noneconomic) on regional tourism destinations and to inform and prioritise adaptation strategies which can be undertaken by destinations and by tourism businesses for the next 10, 40 and 60 years.⁹⁵ The project is examining five regional tourism destinations, including the Cairns region and Kakadu National Park in the coastal zone, in order to make projections about the impacts of climate change over these time periods. The Committee welcomes this vital study and notes that the final reports have yet to be released.

Agriculture, fisheries and aquaculture

- 3.115 The Committee notes the National Climate Change Adaptation Research Facility's Network on Primary Industries and Marine Biodiversity and Resources, and looks forward to the release of the research plans in these areas.⁹⁶

93 Quicksilver Group of Companies, *Submission 11*, p. 2.

94 Department of Resources, Energy and Tourism website accessed 15 August 2009 <http://www.ret.gov.au/tourism/policy/tourism_climate_change_framework_for_action/Pages/TourismandClimateChangeAFrameworkforAction.aspx>

95 'The impact of climate change on Australian tourism destinations – developing adaptation and response strategies', Sustainable Tourism website accessed 15 August 2009 <<http://www.crctourism.com.au/Page/Research/Innovations/Climate+Change+Project.aspx?p=destinations%20OR%20adaptation>>

96 CSIRO Wealth from Oceans Flagship is also undertaking research under five research themes, including 'The dynamic ocean: building foundations for climate, national security and sustainable marine industries', which is researching the impacts of climate change on marine industries and methods for adaptation in this area. CSIRO Wealth from Oceans Flagship website accessed 15 August 2009 <<http://www.csiro.au/science/TheDynamicOcean.html>>

- 3.116 The Committee is aware that the CSIRO Climate Adaptation Flagship released a preliminary assessment of the impacts of climate change on fisheries and aquaculture.⁹⁷
- 3.117 The Committee also notes that a major House of Representatives inquiry into agriculture and climate change is currently underway, examining the extent to which climate change will impact on the agricultural sector. The Committee looks forward to the findings of this report.
- 3.118 The GBRMPA submission highlighted the impacts of climate change on the fishing and other industry:
- The fishing industry is also heavily dependent on climatic conditions. Changes in ocean circulation, wave generation, cyclones and air and sea temperature may impact productivity with resultant effects for the fishing industry and aquaculture. In addition, declining water availability will greatly impact catchment industries such as agriculture, horticulture and mining, as well as urban centres.⁹⁸
- 3.119 The Committee also received evidence from the Fisheries Research and Development Corporation (FRDC), highlighting two initiatives currently underway:
- the National Climate Change Research Strategy for Primary Industries
 - the National Climate Change and Fisheries Action Plan

Coastal disaster and emergency management

- 3.120 The National Climate Change Adaptation Framework identifies 'natural disaster management' as a key sector for attention.⁹⁹ The Committee notes that COAG recently agreed on the:

urgent need for governments to re-examine Australia's arrangements for managing natural disasters and identify any further strategies aimed at building greater resilience. COAG noted such efforts would be critical to Australia's ability to deal with the expected increase in the frequency and severity of natural

97 A Hobday, E Poloczanska, and R Matear, CSIRO Climate Adaptation Flagship, *Implications of Climate Change for Australian Fisheries and Aquaculture: a Preliminary Assessment*, Report to the Department of Climate Change, August 2008.

98 GBRMPA, *Submission 81*, p. 11.

99 COAG National Climate Change Adaptation Framework, p. 19.

disasters arising from extreme weather events linked to climate change.¹⁰⁰

3.121 Emergency Management Australia (EMA) is positioned within the Commonwealth Attorney General's Department. The Director-General of EMA explained to the Committee:

State and territory governments have primary responsibility for emergency management in their jurisdiction and providing response in that context. The Australian government's role is to provide leadership and coordination.¹⁰¹

3.122 The Committee is concerned that Australian coastal communities are equipped to manage the threat posed by more severe and frequent extreme weather events.

3.123 The National Climate Change Adaptation Framework identifies the threat of natural disasters in the coastal zone as of special importance, stating:

The high concentration of people and infrastructure in urban areas, especially along the coast and coastal lowlands are likely to result in severe economic losses with changing exposure to extreme events. Remote settlements can be particularly vulnerable to natural disasters.¹⁰²

3.124 The National Climate Change Adaptation Research Facility is facilitating a network on 'Emergency Management', hosted by RMIT University. The network is working on a national adaptation plan for emergency management which will examine Australia's disaster mitigation, preparedness, response and recovery procedures in light of the likely changes, due to climate change, in the frequency and intensity of extreme weather events.

3.125 The Natural Disaster Mitigation Program (NDMP), designed to build community resilience to natural disasters, was described in EMA's

100 COAG, Communique, 30 April 2009, p. 2.

101 Mr Pearce, Emergency Management Australia, Attorney-General's Department, *Transcript of Evidence*, 18 September 2009, p. 1. See also Attorney-General's Department website: 'While recognising that the Constitutional responsibility for the protection of lives and property of Australian citizens lies predominantly with the States and Territories, the Australian Government accepts that it has a broad responsibility to support the States in developing emergency management capabilities'
<http://www.ema.gov.au/www/emaweb/emaweb.nsf/Page/AboutEMA_PolicyInitiatives_AustralianGovernmentEmergencyManagementPolicyStatement>

102 COAG National Climate Change Adaptation Framework, p. 19.

submission to the inquiry.¹⁰³ The program offers grants to communities to be better able to withstand the effects of floods, storms, bushfires, earthquakes, cyclones and other rapid onset natural disasters. Projects that qualify for funding include risk management studies, early warning systems, community awareness and readiness measures, property buy-back schemes and structural works to protect against damage.¹⁰⁴

3.126 EMA also highlighted the potential benefits of their Critical Infrastructure Protection Modelling and Analysis (CIPMA) program for disaster management in the coastal zone. Critical infrastructure includes energy, communications, water, health, banking and finance. The CIMPA program is:

a computer based capability which uses an 'all hazards' approach to undertake computer modelling to determine the consequences of different disasters and threats (human and natural) in critical infrastructure. The extensive amount of data held under this capability could assist analysis of the impact of climate change on key infrastructure that coastal communities rely on each day.¹⁰⁵

3.127 The CIPMA program is the flagship of the Critical Infrastructure Protection (CIP) initiative. CIP works by bringing together:

existing strategies and procedures that deal with prevention, preparedness, response and recovery arrangements for disasters and emergencies ... a blending of existing specialisations such as law enforcement, emergency management and national security and defence. CIP relies on the active participation of the owners and operators of infrastructure, regulators, professional bodies, industry associations, all levels of Government and the public to identify critical infrastructure, analyse vulnerability and interdependence to protect from and prepare for all hazards.¹⁰⁶

3.128 The CIPMA program uses this information to model for vulnerabilities of critical infrastructure and can test the business continuity planning of industry and government at all levels.¹⁰⁷ EMA state that CIPMA could be used for assessing:

103 The Committee notes that as part of the 2009-10 Budget, the Australian Government announced the new Disaster Mitigation Program to amalgamate the National Disaster Mitigation Program (NDMP), the Bushfire Mitigation Program (BMP) and the National Emergency Volunteer Support Fund (NEVSF).

104 Attorney-General's Department, *Submission 56*, p. 3.

105 Attorney-General's Department, *Submission 56*, p. 2.

106 Attorney-General's Department, *Submission 56*, p. 2.

107 Attorney-General's Department, *Submission 56*, p. 2.

- the impacts on infrastructure from coastal population growth;
 - the impact of climate change on coastal area critical infrastructure to inform strategies to deal with climate change adaptation, particularly in response to projected sea level rise; and
 - governance and institutional arrangements for the coastal zone.¹⁰⁸
- 3.129 The Committee strongly advocates the use of the CIPMA program in analysing coastal disaster management capacity.
- 3.130 The Committee received evidence from the Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA), the lead agency for disaster recovery, concerning its Community Resilience Strategy currently being considered by government. The strategy will aim to promote community, organisational and individual resilience.¹⁰⁹
- 3.131 The department also raised with the Committee the concern that Indigenous communities may be more at risk than others from extreme events, due to their location and socioeconomic conditions. The impacts of climate change on coastal Indigenous communities will be addressed in more detail in the section below. However, it is worth highlighting the 2007 National Emergency Management Strategy for Remote Indigenous Communities, *Keeping our Mob Safe*.¹¹⁰ The document, prepared by the Remote Indigenous Communities Advisory Committee (RICAC), a sub-committee of the Australian Emergency Management Committee, sets five strategic objectives, to:
- Develop knowledge and skills in Indigenous people and organisations to enhance emergency management in remote communities.
 - Improve the level and appropriateness of emergency management-related services in the area of prevention, preparedness, response and recovery provided by relevant agencies in remote Indigenous communities.
 - Build the capacity of remote Indigenous communities to improve community safety through sustainable emergency management.

108 Attorney-General's Department, *Submission 56*, p. 1.

109 Ms Hunt, FaHCSIA, *Transcript of Evidence*, 19 March 2009, p. 2.

110 Remote Indigenous Communities Advisory Committee, *Keeping our Mob Safe: a National Emergency Management Strategy for Remote Indigenous Communities*, 2007.

- Increase government commitment and accountability to address issues impacting on effective emergency management in remote Indigenous communities.
- Promote effective partnerships between emergency management agencies, Indigenous organisations, government and other agencies to improve community safety outcomes for remote Indigenous communities.¹¹¹

3.132 The Committee supports the strategy and its continued implementation in remote Indigenous communities.

3.133 The submission to the inquiry from the Territories and Native Title division of the Attorney-General's Department raised a particular issue relevant to Jervis Bay. The submission points out that there is:

only one access road into the Jervis Bay Territory. If this road was closed due to wildfire or storm damage, residents would be unable to evacuate via the road into New South Wales.¹¹²

3.134 This issue is of significant concern to the Committee in that many regional coastal communities would have single access roads. The Committee notes that during the recent Black Saturday bushfire disaster in rural Victoria, evacuation routes were a significant contributing factor to the extent of the tragedy. A reliable evacuation route is vital in a disaster management strategy. It is therefore imperative that evacuation routes and methods be examined when developing community emergency responses.

3.135 The Committee concurs with Geoscience Australia (GA) that a further matter of critical importance is the need for data to be updated in technical risk assessments. Dr Schneider of GA explained that once an analysis of the risk at a particular site is undertaken, the data upon which the risk was assessed is not updated unless expressly requested:

If we do an analysis of the potential for waves to hit a particular community, the potential impact on houses and the potential loss of life, and if there are then changes in demographics, changes in the underlying data or even a refinement in the model, it is in the best interests of everyone that we be able to provide updates for that. But there is not necessarily a mechanism for that to be done.

111 Emergency Management Australia website accessed 18 August 2009
<http://www.ema.gov.au/www/emaweb/emaweb.nsf/Page/EmergencyManagement_Communities_NationalEmergencyManagementStrategyforRemoteIndigenousCommunities>

112 Territories and Native Title Division, Attorney-General's Department, *Submission 40*, p. 3.

So a report is done but we are not necessarily in a position to update the models continually.¹¹³

- 3.136 The submission to the inquiry from the Insurance Council of Australia (ICA) focuses on the issue of promoting resilient coastal communities in the light of extreme weather events due to climate change. The submission raises the importance of 'risk disclosure' to community members in promoting more resilience in the community. The ICA wishes to see greater sharing of the best known risk data to communities, allowing individuals to make informed decisions regarding 'the weather risks they are prepared to tolerate in a location and most importantly, decisions regarding the adaptive behaviours they may undertake to accommodate those risks.'¹¹⁴
- 3.137 The Committee notes the severity of the potential impact from climate change on Australia's emergency response, particularly in the coastal zone. As Professor Woodroffe remarked, 'the impact of such catastrophes seems certain to increase in the future, primarily because ... the growing coastal populations mean larger numbers of people and more intense development concentrated in the coastal zone'.¹¹⁵ There is therefore a desperate need to build resilience in coastal communities to the increased severity and frequency of extreme weather events.
- 3.138 Issues such as access and evacuation routes in the event of a storm surge or extreme sea level rise require urgent examination, as does the need for accurate and up-to-date assessments of vulnerable sites. The Committee supports the promotion of early warning systems through the NDMP and believes this should be a national requirement in all vulnerable communities.
- 3.139 The Committee notes the intergovernmental Bushfire Mitigation Program (BMP), which aims to identify and address bushfire mitigation risk priorities for Australia,¹¹⁶ and believes that a similar program should be established for extreme weather events specifically on the coast. As made clear by EMA in its submission to the Committee, with over 80 per cent of the country's population and 25,000 properties located in the coastal zone,

113 Dr Schneider, Geoscience Australia, *Transcript of Evidence*, 4 September 2008, p. 8.

114 ICA, *Submission 12*, p. 7.

115 Professor Woodroffe, *Submission 24*, p. 2.

116 EMA, Attorney-General's Department, *Submission 56*, p. 3.

there could be more than \$25 billion of assets at risk from natural disasters.¹¹⁷

- 3.140 The Committee believes that *all* the climate change vulnerability assessments and adaptation work currently underway will go towards producing greater resilience in coastal communities. However, the emergency response must be adequate to defend against the worst case scenarios. It is therefore imperative that a specific program be established to identify risk and bolster emergency responses in the coastal zone.
- 3.141 The Committee notes that the Australian Government – through agencies such as Emergency Management Australia, FaHCSIA and Geoscience Australia – and state, territory and local governments have comprehensive arrangements in place for disaster and emergency management. The Committee also recognises the important role of the Australian Emergency Management Committee (AEMC) in providing advice and direction on national, strategic emergency management issues. The AEMC reports to the Ministerial Council for Police and Emergency Management.
- 3.142 The Committee also understands that the Department of Climate Change is currently ‘updating and improving the Australian Disaster Mitigation Package to take into account severe weather and storms due to climate change’.¹¹⁸ The package focuses on disaster risk assessments, nationally consistent data and research, disaster mitigation strategies, resilient infrastructure, and community awareness and warnings. It incorporates the Natural Disaster Mitigation Program, the Natural Disaster Relief and Recovery Arrangements, the Regional Flood Mitigation Program and the Bushfire Mitigation Program.
- 3.143 The Committee’s particular concern is Australia’s preparedness to deal with sudden onset coastal natural hazards as a result of extreme weather events combined with sea level rise. As discussed earlier, sea level rise will cause a disproportionately large increase in the frequency of flooding, inundation and erosion in association with high tides and storm surges.
- 3.144 The Committee concludes that, while there are some significant programs already in place to build resilience, such as the Natural Disaster Mitigation Program, more needs to be done, and quickly, to adequately equip our coastal communities to manage the increased risks due to climate change. The Committee notes that the success of these initiatives will depend on continued effective collaboration between Australian, state, territory and local governments.
-

117 EMA, *Submission 56*, p. 1.

118 Department of Climate Change, *Submission 85*, p. 7.

Recommendation 14

3.145 To further enhance Australia’s disaster mitigation, preparedness, response and recovery arrangements in the event of possible major coastal disasters, the Committee recommends that the Australian Government establish a grants program, the Coastal Natural Disaster Mitigation Program, to fund natural disaster mitigation projects in the Australian coastal zone.

The Committee also recommends that the Australian Emergency Management Committee (AEMC) consider the following issues:

- **improved data on coastal disaster risk assessment and vulnerable coastal sites**
- **improved access and evacuation routes for coastal communities**
- **improved coastal community awareness of and resilience to natural disasters**
- **improved coordination of coastal disaster mitigation arrangements with other initiatives currently underway, such as reviews of the Australian Building Code and land use planning policies to take into account climate change impacts**
- **improved early warning systems for coastal areas in the event of an extreme sea level event (storm surge, erosion, flooding)**

The Committee further recommends that the AEMC provide a report on these matters to the Ministerial Council for Police and Emergency Management.

3.146 In its submission, Surf Life Saving Australia (SLSA) highlighted that access to and use of beaches for recreation ‘will be impacted by ongoing extreme weather events. Beach hazards will change and will pose a greater risk of injury unless monitored, mapped and communicated’.¹¹⁹ SLSA suggested that the integration of the SLSA network into emergency services system in states and across Australia would ‘enhance Australia’s capacities and capabilities in responding to domestic and international disasters’.¹²⁰

119 SLSA, *Submission 57*, p. 5.

120 SLSA, *Submission 57*, p. 11.

3.147 SLSA explained that it has an 'extensive network of 305 volunteer lifesaving services, 50 support services that includes rescue helicopters and jet rescue boats and a further 66 lifesaving services through its Australian Lifeguard Service network across Australia'.¹²¹ SLSA's membership base is 'now in excess of 140,000, 40,000 of whom are trained lifesavers able to respond in an emergency'.¹²²

3.148 SLSA noted that a number of opportunities existed for this extensive network to be engaged in coastal zone management and monitoring, emergency preparedness, response and care. However, 'the integration of this network into governmental emergency service networks is ad hoc in some areas and non existent in others'.¹²³ As Mr Farmer from SLSA commented:

I think we have a growing capacity and capability to harness those networks to be involved in preparing communities for climate change and its water safety aspects.

It is not widely known that our membership often responds to disasters, although very much in an unofficial way as surf lifesaving is not recognised in a number of states by legislation as a formal emergency service. But we do respond to emergencies ... We could use that capacity and capability in a greater sense if there were some formality about the inclusion of it within the network of emergency services operations.¹²⁴

3.149 The Committee recognises the value of SLSA's coastal safety services to coastal communities and visitors and the increasing role that SLSA could potentially play in responding to coastal emergencies as a result of climate change impacts. The Committee also notes SLSA's role in monitoring and mapping the changing conditions of Australia's beaches and coastline through Coastwatch and the Australian Beach Safety and Management Program. For example, the Committee understands that SLSA 'has completed an extensive mapping of all known beaches in Australia, which to date number 11,748, each of which has been given a modal beach hazard rating'.¹²⁵

121 SLSA, *Submission 57*, p. 3.

122 Mr Farmer, SLSA, *Transcript of Evidence*, 19 August 2009, p. 19.

123 SLSA, *Submission 57*, p. 11.

124 Mr Farmer, SLSA, *Transcript of Evidence*, 19 August 2009, p. 19.

125 SLSA, *Submission 57*, p. 11.

Recommendation 15

- 3.150 **The Committee recommends that the Australian Government, through the Ministerial Council for Police and Emergency Management, recognise the extensive Surf Life Saving Australia network and take appropriate steps to integrate this network into emergency services preparedness, planning, and response systems and activities.**

Coastal infrastructure

- 3.151 NCCARF, as discussed above, has identified infrastructure¹²⁶ as a key sector for attention. Climate change impacts such as rising sea level and extreme weather events will impact infrastructure by accelerating degradation of materials and structures and increasing damage and repair costs.
- 3.152 The Australian Academy of Technological Sciences and Engineering report, *Assessing the Impacts of Climate Change on Australia's Physical Infrastructure* (July 2008), pointed to 'significant challenges arising from the effects of climate change for security and operation of various categories of Australia's physical infrastructure'.¹²⁷
- 3.153 Coastal infrastructure is of particular concern as much of Australia's population and infrastructure is in the coastal zone, increasing vulnerability to climate change.
- 3.154 The Committee notes that several major initiatives are currently underway to provide more information on the tolerance of existing and planned infrastructure, including coastal infrastructure, to climate change impacts to ensure appropriate and cost-efficient adaptation strategies. These include:
- the Department of Climate Change's National Infrastructure Climate Change Adaptation Risk Assessment

126 This encompasses commercial and domestic buildings, as well as energy (gas, electricity, oil and coal), transport (road, rail, airports, sea ports), water and telecommunication structures.

127 Australian Academy of Technological Sciences and Engineering, *Assessing the Impacts of Climate Change on Australia's Physical Infrastructure*, 2008, p. i. See also Engineers Australia, *Guidelines for Responding to the Effects of Climate Change in Coastal and Ocean Engineering: 2004 Update*, National Committee on Coastal and Ocean Engineering (NCCOE), 2004 – *Exhibit 100*; and Engineers Australia, *Coastal Engineering Guidelines for Working with the Australian Coast in an Ecologically Sustainable Way*, NCCOE, 2004 – *Exhibit 99*.

- ⇒ the Australian Government is assessing the magnitude of national risks to build the capacity of infrastructure owners, operators and planners in identifying, avoiding and managing the impacts of climate change. The assessment is the first stage in the process of building understanding of the impacts of climate change on infrastructure of national significance. The project will consider the exposure, planning and regulatory settings, and adaptive capacity of water, power, transport, communications infrastructure, buildings and settlements across Australia.¹²⁸ It seeks to improve information on the number and type of buildings in the coastal zone, their proximity to the coast, elevation and erodability.
- NCCARF is facilitating a network on Settlements and Infrastructure, hosted by the University of NSW. This will bring together researchers and stakeholders with an interest in the impacts of climate change on settlements, and public and private infrastructure (including building design and construction).¹²⁹ It is drafting a National Adaptation Research Plan for Settlements and Infrastructure, which will identify critical gaps in the information available to decision-makers in this sector, set national research priorities and identify science capacity that could be harnessed to conduct priority research.
 - the Australian Government is funding the Australian Building Codes Board to review and, as appropriate, revise the Building Code of Australia to ensure that the risks of future climate change are recognised in building practices, and possible climate change adaptation measures are considered.¹³⁰
 - Australian Government funding of Engineers Australia to update the *Australian Rainfall and Runoff* handbook¹³¹ to ensure that all future construction takes into account future changes to heavy rainfall and flooding events. The update will be completed in three stages over four years.¹³²

128 DCC website accessed 7 August 2009

<<http://www.climatechange.gov.au/impacts/settlements.html>>

129 NCCARF website accessed 7 August 2009 <<http://www.nccarf.edu.au/adaptation-research-network-settlements-infrastructure>>

130 Department of Climate Change, *Submission 85*, p. 6.

131 *Australian Rainfall and Runoff*, Engineers Australia, 4th edition.

132 Department of Climate Change, *Submission 85*, p. 6.

- 3.155 The Committee is also aware that the Building Ministers Forum, which reports to COAG, has been engaged in work on the 'building design aspects of responding to climate change'.¹³³
- 3.156 The Committee commends all these initiatives and notes that, at the time of finalising this report, these projects were still in progress.

Recommendation 16

- 3.157 **The Committee notes that major initiatives relating to climate change adaptation risk assessment and infrastructure are currently in progress. Given that much of Australia's infrastructure is in the coastal zone and the particular threats facing the coastal zone from climate change, involving significant socioeconomic costs, the Committee recommends that the Australian Government ensure there is a comprehensive national assessment of coastal infrastructure vulnerability to inundation from sea level rise and extreme sea level events.**

Coastal Indigenous communities

- 3.158 The impacts of climate change on coastal communities will be intensified still further in remote, low-lying communities in the coastal zone. As such, the impacts of climate change on remote coastal Indigenous communities are likely to be severe. As already discussed with regard to health and emergency management, Indigenous communities are more exposed to both health concerns and the impacts of natural disasters.
- 3.159 As custodians of some of Australia's most remote coastal areas, Indigenous peoples have a unique affiliation with the land, the coast and the climate. Impacts such as sea level rise threaten a great many remote coastal Indigenous communities, and with them, a wealth of traditional practices and culture. The submission from FaCHSIA to the inquiry lists some 290 Indigenous communities in very remote Australia which are within 10km from the coastline.¹³⁴
- 3.160 The National Climate Change Adaptation Framework highlights that there are likely to be greater implications for remote and Indigenous communities from climate change, and that these communities may have

¹³³ Department of Infrastructure, Transport, Regional Development and Local Government, *Submission 94*, p. 2.

¹³⁴ FaHCSIA, *Submission 99*, Appendix A.

‘more limited capacity to adapt’.¹³⁵ As such, it is imperative that engagement take place with threatened Indigenous communities to build resilience.

- 3.161 NCCARF is facilitating a ‘Social, Economic and Institutional Dimensions’ Research Network hosted by the University of Melbourne. The network brings together researchers and stakeholders with an interest in developing adaptation strategies for vulnerable communities, particularly Indigenous and remote communities, as well as analysis of issues such as methods for understanding whole of economy impacts of climate change, the effect of social and economic trends on vulnerability to climate change, and institutional challenges in adapting to climate change.¹³⁶ The Committee looks forward to the finalisation of the network’s National Adaptation Research Plan, which will identify critical gaps in the information available to decision-makers on the vulnerability of remote Indigenous communities.
- 3.162 The Committee is also aware that the Department of Climate Change is undertaking a major study into the impacts of climate change on northern Indigenous communities to identify knowledge gaps and priorities for future research and action for Indigenous communities in response to climate change.¹³⁷ The study, being undertaken by the University of New South Wales together with CSIRO, the North Australian Indigenous Land and Sea Management Alliance (NAILSMA) and other research organisations, is being co-funded by the Department of Climate Change, the Western Australian Department of Environment and Conservation and the Northern Territory Department of Natural Resources, Environment and the Arts. The Committee notes that the study will draw upon valuable Indigenous knowledge to assist in adaptation.¹³⁸ Representatives of the Department of Climate Change outlined the work in evidence to the Committee:

My understanding of the research ... is that it is to have a conversation with Indigenous communities about both their perception of and their experience in dealing with climate change risk, realising that they are holders of a great wealth of historical information, as well as working with Indigenous communities to

135 COAG National Climate Change Adaptation Framework, p. 8.

136 NCCARF website accessed 18 August 2009 <<http://www.nccarf.edu.au/adaptation-research-network-social-economic-institutional-dimensions>>

137 Media release by Senator the Hon Penny Wong, Minister for Climate Change and Water, ‘New climate change study for northern Indigenous communities’, 8 September 2008.

138 Media release by Senator the Hon Penny Wong, Minister for Climate Change and Water, ‘New climate change study for northern Indigenous communities’, 8 September 2008.

discuss how they have responded in the past and would look to respond to the impacts of climate change. In relation to the Torres Strait, we would be looking to see what the culture of responding to changes in the climate is, but I think that will need to be supplemented as we move forward with this work on the coast, specifically with some of the more technical details and technical work that will follow on from the first pass national coastal vulnerability assessment. While I think that information is useful for setting a baseline, it will not be sufficient in and of itself to manage the risks going forward.¹³⁹

3.163 The Committee welcomes this study, but notes that the initial deadline for the final report, scheduled for April 2009, has now passed without publication. The Committee wishes to reinforce the significance of the issue and requests that the Department of Climate Change finalise this vital research project at the earliest opportunity.

3.164 In the Committee's view, the communities of the Torres Strait will require greater attention and resource allocation to deal with the impacts of climate change. The Torres Strait Regional Authority (TSRA) called for 'immediate remedial action' to address issues surrounding coastal management and climate change in the Torres Strait, as well as a program to investigate and address the impacts of climate change and coastal issues more thoroughly across the islands.¹⁴⁰ The TSRA submission outlines significant impacts facing communities in the Torres Strait:

The low lying nature of several islands and the extent of current inundation problems suggests that any significant sea level rise due to climate change could potentially threaten the viability of these communities. In addition other potential impacts of climate change including changes to rainfall patterns, ecosystems as well as the spread of disease may significantly impact Torres Strait Island communities.¹⁴¹

3.165 The 2007 PMSEIC Independent Working Group report 'Climate Change in Australia: Regional Impacts and Adaptation – Managing the Risk for Australia' stated that:

139 Dr Greg Picker, Department of Climate Change, *Transcript of Evidence*, 25 September 2008, pp. 9-10.

140 TSRA, *Submission 7b*, p. 1.

141 TSRA, *Submission 7b*, p. 2.

Torres Strait islanders and remote Indigenous communities have the highest risks and the lowest adaptive capacity of any in our community because of their relative isolation and limited access to support facilities.¹⁴²

3.166 The Reef and Rainforest Research Centre (RRRC) outlined the challenges faced by the Torres Strait:

Torres Strait Islanders' capacity to adapt to rapid environmental change is limited by pre-existing social and economic constraints. Cultural issues, such as Islanders' belief in the connections between the health of their 'land' and 'sea' country and their own well-being, significantly increase the complexity of managing climate change impacts on communities in the Torres Strait.¹⁴³

3.167 The submission continues:

The 7000 Australians living on the low-lying islands of the Torres Strait are amongst the most vulnerable in the country to sea level rise. Pre-existing social and economic disadvantages, as well as their cultural connections to country, severely limit these communities' capacity to cope with change. Despite this, there appear to be few strategies at federal or state government level specifically addressing the problems faced by communities in the Torres Strait in adapting to climate change.¹⁴⁴

3.168 TSRA listed a number of studies currently being undertaken, in the Torres Strait, including:

- a rapid assessment shoreline erosion project, examining causes of coastal erosion in the Torres Strait – undertaken by the Environmental Protection Agency (EPA)
- a sustainable land use planning project, education communities on the impacts of development on the natural environment in the Torres Strait
- a Marine and Tropical Research Facility project 'Climate change impacts in the Torres Strait: Building resilience and planning adaptation strategies', which aims to integrate scientific and traditional knowledge for a regional workshop on adaptation

142 Prime Minister's Science, Engineering and Innovation Council (PMSEIC), Independent Working Group, *Climate Change in Australia: Regional Impacts and Adaptation – Managing the Risk for Australia*, 2007, p. 28.

143 RRRC, *Submission 30*, p. 10.

144 RRRC, *Submission 30*, p. 14.

- a research project by James Cook University and University of Wollongong ‘Understanding sea-level change in Torres Strait’, which will survey, sample and date material from reef flat corals to examine sea level changes over time¹⁴⁵
- 3.169 While all these studies are welcomed, the Committee is concerned that no major study is currently focusing predominantly on the Torres Strait.¹⁴⁶
- 3.170 The Committee received compelling evidence from TSRA describing the plight of communities on the islands, and the connection between land and people. Figure 3.3 provides a brief snapshot of the evidence heard by the Committee.
- 3.171 TSRA listed the challenges faced by the Torres Strait communities as a result of climate change:
- Erosion and inundation is already a major hazard threatening communities, cultural heritage sites and infrastructure in the region.
 - The impact of sea level rise in combination with extreme weather events leading to tidal inundation and island erosion is of significant concern for residents of the Torres Strait.
 - Impacts of climate change on marine ecosystems and fisheries and flow on effects to local communities, economy and culture.
 - Impacts of climate change on water supply.
 - Impacts of climate change on health including the potential spread of disease.¹⁴⁷
- 3.172 TSRA also raised the concern with the Committee that the Torres Strait is not included in the first pass NCVA, and valuable DEM work is not occurring at the islands either.¹⁴⁸ The Committee raised these matters with the Department of Climate Change during a public hearing. The department responded that:

Certainly one of the issues that we are mindful of in the NCVA is that we have not looked at islands, for example, particularly in that northern part of Australia. It is obviously a very critical issue for the populations that live there.¹⁴⁹

145 TSRA, *Submission 7*, p. 5.

146 Dr Greg Picker, Department of Climate Change, *Transcript of Evidence*, 25 September 2008, p. 10.

147 TSRA, *Submission 7a*, p. 19.

148 TSRA, *Submission 7*, p. 2.

149 Dr Wilson, Department of Climate Change, *Transcript of Evidence*, 18 June 2009, p. 10.

Figure 3.3 Evidence to the Committee from Mr Walter Mackie, Member for Iama Island and Portfolio Member for Health and Environment, Torres Strait Regional Authority

The Torres Strait consists of the top western islands, which are Boigu, Saibai and Dauan, the western islands of Mabuiag, Badu, Moa and the inner island of Hammond Island, and extend out to the central island where I come from, Iama and Warraber, Poruma and Masig. Extending out further to the Barrier Reef, we have Ugar, Erub and Mer. As you can see by what the map portrays, we have a lot of reefs up there and that is what we refer to as our supermarket. That is where our lifestyle evolved. This is our world I am looking at. This is my world, my people ...

It never crosses our mind to relocate. Relocation is the last avenue for us. You have to understand who we are. I mentioned that this is our world ...

We are keenly aware of the challenges that face us; however, we are also fearful of the loss of our homes—our family homes. Each individual island has its own unique attributes. As an Iama Island person, I cannot live on Saibai, because I will not fit in. We identify with our area. I do not know if you understand, but that is where our identity and everything are derived from. So it would be the last resort for us to leave, because our roots are there.

For generations we have had embedded in our sense of pride that unique identity in our island home. We have found ways to hold onto our traditional practices and our unique culture in this modern day and age. We also have embraced challenges and have adapted to changes in order to protect our island. We have taken whatever steps are needed to ensure our sustainability. We have a traditional saying in the Torres Strait which originated in 1970 during the PNG push for independence: 'Not for one teaspoon of saltwater, not one grain of sand, will we surrender. Border not change.' This determination has ensured a continued existence for each community so far, and I have no doubt that it will do so into the future.

Our region is the frontline in many ways—significantly so due to rising sea levels. We do recognise the urgent need to address climate change and find long-term solutions. Our people are very much aware of the social issues we have—overcrowding, disease and damages and our traditional fishing practices—and we welcome the chance to become involved in a long-term strategy to ensure the protection of our beautiful islands.

In the community of Warraber back in the 1990s, they had to take into their own hands the building of a seawall because the tides were taking skeletal remains from the cemeteries out onto the reefs. They said to themselves, 'We're not going to sit here and wait for research and studies; we've got to take some action; we've got to do something'—and that is what they did. Even with the sea level today the seawall does its job, and it was built 20 or so years ago.

Source Mr Mackie, TSRA, Transcript of Evidence, 20 August 2008, pp. 17-21

3.173 The department also noted the complexity of the issues in the Torres Strait and remote Indigenous communities:

The issues that apply to the Indigenous communities are going to be complex. It is not just about where they are; it is also the current state of infrastructure and the services and the lifestyles that they

would like to maintain. So it is relatively early in our understanding...¹⁵⁰

- 3.174 The Committee agrees that it is 'early in our understanding' but believes that there is little time to waste in increasing our understanding of the impacts of climate change on the islands of the Torres Strait.¹⁵¹ The impacts are already being felt by these communities.

Recommendation 17

- 3.175 **The Committee recommends that the Department of Climate Change, in collaboration with the Queensland Government, CSIRO and Indigenous communities in the Torres Strait, undertake a major study into the vulnerability of the Torres Strait to the impacts of climate change and provide assistance in the development of an adaptation plan.**
- 3.176 The Committee supports the five recommendations proposed in the TSRA submission to the inquiry:
- That there is further support for all Torres Strait Island communities and regional institutions to access information about projected climate change impacts at a locally and regionally relevant scale, to enable informed decision making and adaptive planning.
 - That there are further studies of island processes and projected climate change impacts on island environments, including uninhabited islands with problems such as turtle nesting failures.
 - That reliable data is obtained on island interior heights and elevations to support more accurate predictions of inundation levels.
 - That a feasibility study be undertaken to investigate and recommend the most suitable renewable energy systems for servicing the Torres Strait region, including the investigation of tidal, wind, solar and other systems suitable for the region's environmental conditions and demand for power.
 - That the Torres Strait region is considered as a potential case study for small-scale trials of solutions to coastal erosion and

150 Dr Wilson, Department of Climate Change, *Transcript of Evidence*, 18 June 2009, p. 10.

151 The Committee notes that this issue was brought to the attention of relevant departmental representatives prior to the report being tabled, due to its urgency. See Department of Climate Change, *Transcript of Evidence*, 18 June 2009, p. 10.

inundation problems, as well as sustainable housing and building design and construction for remote communities in tropical environments.¹⁵²

Recommendation 18

- 3.177 **The Committee recommends that the Australian Government give the five recommendations calling for information, studies and data, as proposed by the Torres Strait Regional Authority, early and urgent consideration with a view to their implementation.**

¹⁵² TSRA, *Submission 7*, p. 3.