5.1.7 South Australia

Key findings

- Between 25,200 and 43,000 residential buildings in South Australia may be at risk of inundation from a sea-level rise of 1.1 metres.
- The current replacement value of the residential buildings at risk is between $4.4 billion and $7.4 billion.
- Based on this analysis, South Australia has the fourth highest number of residential buildings at risk in Australia.
- In this assessment, the neighbouring local government areas (LGA) of Charles Sturt and Port Adelaide-Enfield collectively represent around 55 per cent of residential buildings at risk in South Australia (upper range estimate).
- There are approximately 7,000 residential buildings within 110 metres of 'soft' erodible shorelines of which approximately 1,600 are within 55 metres of 'soft' coast.

The population context

The majority of South Australia's population (over 90 per cent) live near the coast[109] and almost three quarters live in Adelaide.[110] The largest population increase in 2007–08 occurred in the Adelaide LGA's of Salisbury, Playford, Onkaparinga and Port Adelaide-Enfield adjacent to the Gulf St Vincent.[111] However, the fastest growing area was Victor Harbor (3.5 per cent) on the Fleurieu Peninsula. The Copper Coast recorded 2.7 per cent growth, and the coastal LGAs of Alexandrina (2.6 per cent) and Yankalilla (1.8 per cent) on the Fleurieu Peninsula also showed relatively high rates of population growth, continuing a trend of recent years.[112]

The coast has been subject to increasing levels of development over recent decades, as shown in Figure 5.35 of Victor Harbor. Between 1996 and 2000, the number of new residential dwellings constructed within 500 metres of the shoreline in South Australia increased from roughly 500 to 855 per year. The number was still almost 700 per year in 2006.[113] Population growth, 'sea change' retirees and increasing investment in holiday homes is expected to continue to drive coastal development into the future.[114]

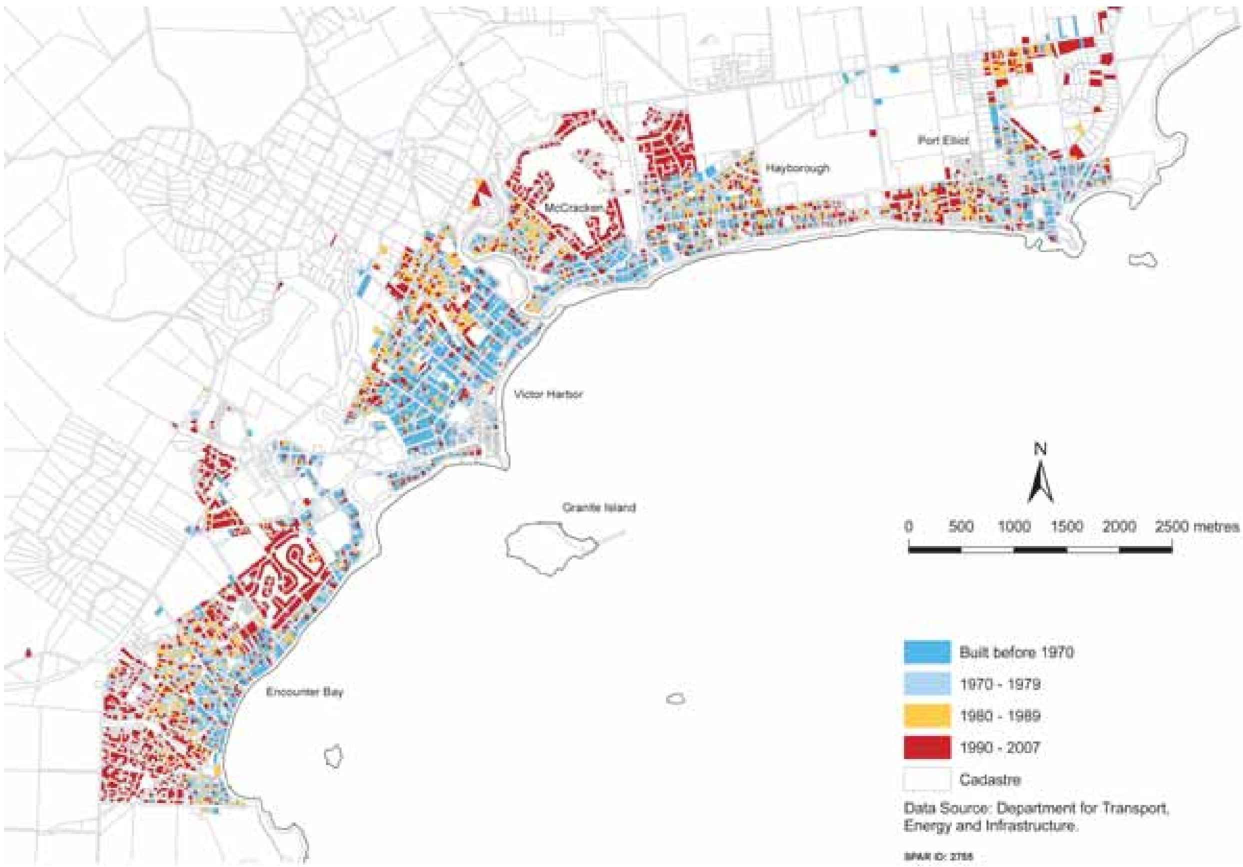

Figure 5.35 Coastal development in Victor Harbor and surrounding areas. Source: SA EPA 2008[115]

The nature of the coast

Nearly half of the South Australian coast is sandy beaches (47 per cent). Over half of these sandy coasts are backed by soft sediment plains rather than bedrock, and hence have significant potential for shoreline recession and foredune destabilisation with sea-level rise.[116]

A moderate proportion of open coast shores are classified as muddy shores, including those at the head of the Spencer Gulf and Gulf St. Vincent.

Hard rock shores form a considerable proportion (34 per cent) of the South Australian coast. This reflects much of South Australia's exposure to high wave energies. Only a small portion of this (4 per cent) is robust gently-to-moderately sloping rocky coast, with the majority (30 per cent) being steep cliffs such as those of the Nullarbor coast, Eyre Peninsula and Kangaroo Island.[117]

Existing risk

Some coastal areas in South Australia are already exposed to natural and human forces without the compounding effects of climate change. Coastal erosion has been an issue for some years, particularly along Adelaide's metropolitan beaches. This is thought to be due to a combination of factors, including the natural movement of sand from south to north.[118] Other contributing factors include coastal development on foredunes and the substantial loss of seagrass meadows.[119] The construction of seawalls and beach replenishment since the 1970s has been used to protect coastal development and amenity.[120] The cost of beach management, including sand replenishment and sea-wall maintenance and upgrading, was around $1.7 million per year in 2005, with additional costs of approximately $1.9 million per annum for sand bypassing at Glenelg and West Beach Harbours.[121]


Murray River and the Coorong.

Photo credit: Photolibrary

Box 5.12 Port Adelaide seawater stormwater flooding study

The Port Adelaide flooding study assessed risks from seawater and stormwater flooding, with consideration of land subsidence and sea-level rise over the next century.

The Port Adelaide-Enfield peninsular is located between the Gulf St Vincent and the Port River near Adelaide. The study area covers approximately 10,000 hectares, and predominantly lies below the highest astronomical tide level. Sea walls and other flood mitigation measures protect the banks of the Port River.

Various studies have found that the Port Adelaide area has a history of land subsidence, which is believed to be largely the result of wetland reclamation and groundwater extraction from the aquifer. The combined impacts of local land subsidence and contemporary sea-level rise have led to net land subsidence of around 2.1mm/yr within the study area.

The study involved analysis of the 100 year storm tide level and simulation of inundation from three future scenarios of sea-level rise and land subsidence (Table 5.2). Upper and lower estimates were modelled for each scenario with the difference being the extent of water storage capacity in the non-tidal areas. For instance, if a non-tidal area has been exposed to rainfall before the storm tide event, there is a reduced capacity to store incoming inundation waters and so could lead to greater inundation (upper case).

Table 5.2 Future scenarios of sea-level rise and land subsidence.

Scenario	Sea-Level Rise (m)	Period of land subsidence (years)	Description
S0	–	–	Existing case – no sea-level rise or subsidence
S1	0.30	50	Complies with current requirements for infill development
S3	0.50	100	Based on IPCC projections for sea-level rise using medium values in the IPCC range +subsidence
S4	0.88	100	Based on IPCC projections for sea-level rise using high end values in the IPCC range +subsidence

Figure 5.36 indicates the extent of flooding for a current 1-in-100 year storm tide event (Scenario S0; blue shades), as well as the predicted extent of inundation for each of the upper case scenarios (S1–S4). The area of inundation increases to affect larger areas of residential and commercial buildings and roads.

Box 5.12 continued...

The estimated damage costs rise significantly with each scenario. The study suggests that damage costs from a 1-in-100 year storm tide could increase from an estimated $8–28 million for a current day event to $180–310 million with future scenarios of sea-level rise and land subsidence.

The study explored a range of abatement options, particularly sea defence measures. For example, a concept design involving the construction of a system of sea walls to protect against inundation would cost an estimated $24–31 million.

Source: Tonkin WBM 2005.[122]

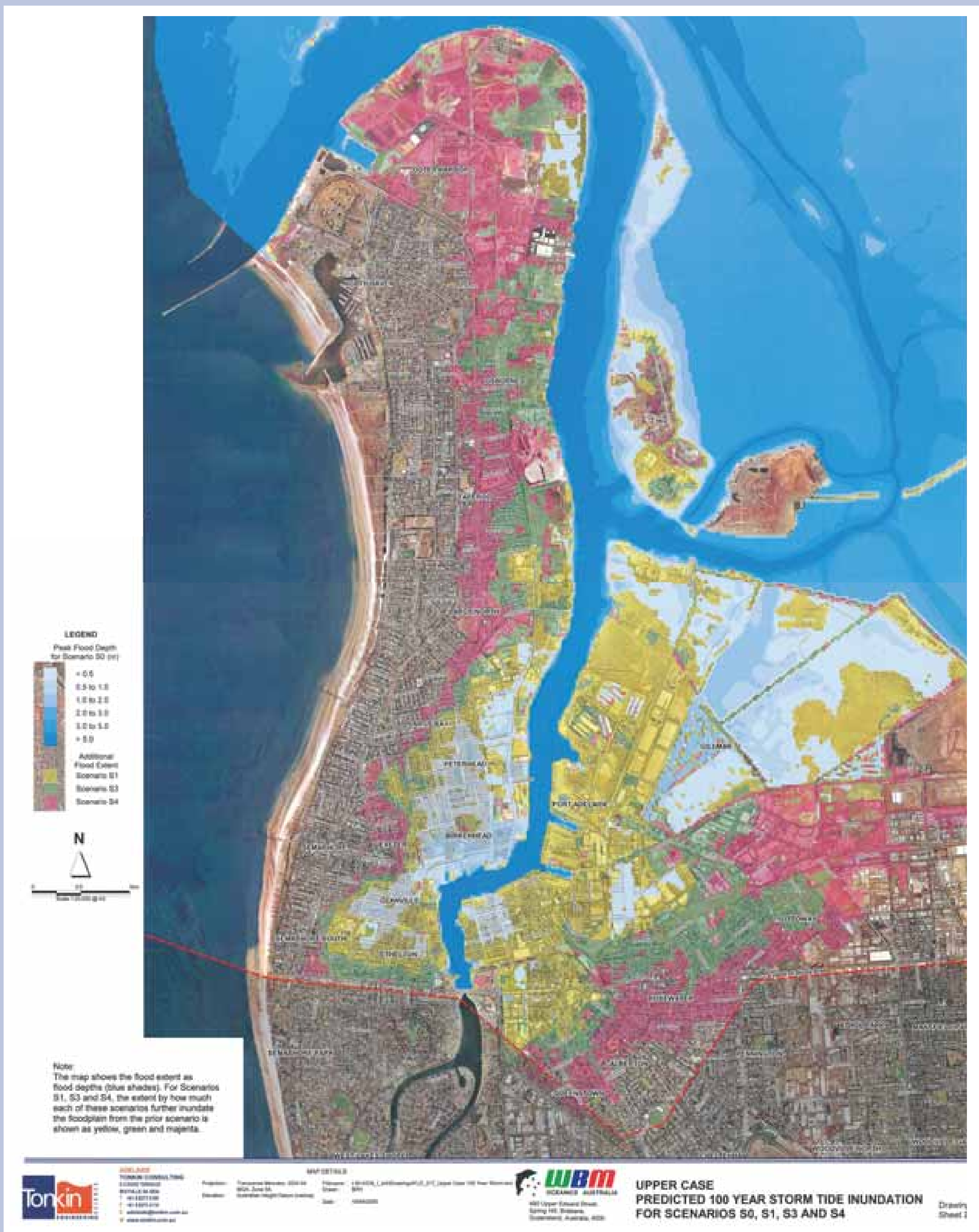

Figure 5.36 Extent of flooding in the City of Port Adelaide Enfield study area for a current 1-in-100 year storm tide event (Scenario S0; blue shades) and for each of the upper case scenarios (S1–S4).
Source: Tonkin WBM 2005.[123]

Photo credit: Department for Environment and Heritage SA

Rogues Point, Yorke Peninsula.

Substantial risks from sea and stormwater flooding also exist in the Port Adelaide-Enfield local government area, where significant redevelopment is underway. A recent flood risk management study[124] estimated that inundation from a 1-in-100 year storm could result in flood damage costs in the order of $8 million to $28 million under the present climate.This is expected to increase under climate change (Box 5.12).

Beyond the metropolitan area, there are also concerns with development strips along the regional coast. In particular, some shacks located on freehold land (previously Crown Land) are vulnerable to coastal erosion due to their close proximity to the shore.[125] These are expected to become increasingly exposed with climate change.

Climate change risk to settlements

Inundation analysis suggests that between 25,200 and 43,000 residential buildings in South Australia may be at risk of inundation from a sea-level rise of 1.1 metres. The current replacement value of the residential buildings at risk is between $4.4 billion and $7.4 billion.

Based on this analysis, South Australia has the fourth highest number of residential buildings at risk of inundation in Australia. If the inundation analysis included storm tides for South Australia it is likely that a higher number of properties would have been identified as at-risk.

The neighbouring local government areas of Charles Sturt and Port Adelaide-Enfield have the highest exposure to a sea-level rise of 1.1 metres, collectively representing around 55 per cent of the residential buildings at risk in South Australia (upper range; Figure 5.37). It is important to note that the coast of metropolitan Adelaide is currently protected by a system of sea walls and dunes, with the sea walls designed for a life of 50–100 years, in line with the South Australian sea-level rise policy.[126]

Methodology – key points and caveats

- Inundation analysis is based on 1.1 metres of sea-level rise using medium resolution elevation data.
- A *storm tide allowance* (1-in-100 year event) based on CSIRO modelling is included in the analysis for Tasmania, Victoria and New South Wales, although storm tide values for New South Wales are likely to be underestimates as they do not include a wave setup component.
- For the other states where the CSIRO modelling was not available (Queensland, Western Australia, Northern Territory, and South Australia) an allowance for *modelled high water level* (e.g. high tide) was included in the analysis.
- The analysis does not take account of existing coastal protection, such as seawalls, or riverine flooding associated with intense rainfall events.
- The inundation analysis is of existing residential buildings only (sourced from NEXIS database).
- More detailed analysis may change the relative order of local government areas and the magnitude and timing of projected impacts.
- Refer to Chapter 3 for further details.

An inundation footprint of sections of the Port Adelaide-Enfield and Charles Sturt LGAs is shown in Figure 5.38.

Between 8,850 and 14,100 residential buildings in the Charles Sturt LGA may be affected by sea-level rise by 2100, with the upper range representing over 30 per cent of all current residential buildings within the LGA. Over 24 per cent (higher estimate) of the existing residential building stock in the LGA of Port Pirie may also be at risk of inundation from sea-level rise by 2100. However, the small LGAs of Kingston, Grant and Robe on the south-east coast of South Australia have the highest proportion of at-risk dwellings. While the total number of buildings at risk may be relatively small, between 40–70 per cent of residential buildings in Kingston, around 35 per cent in Grant, and between 40–50 per cent of residential buildings in Robe may be affected by sea-level rise by 2100.

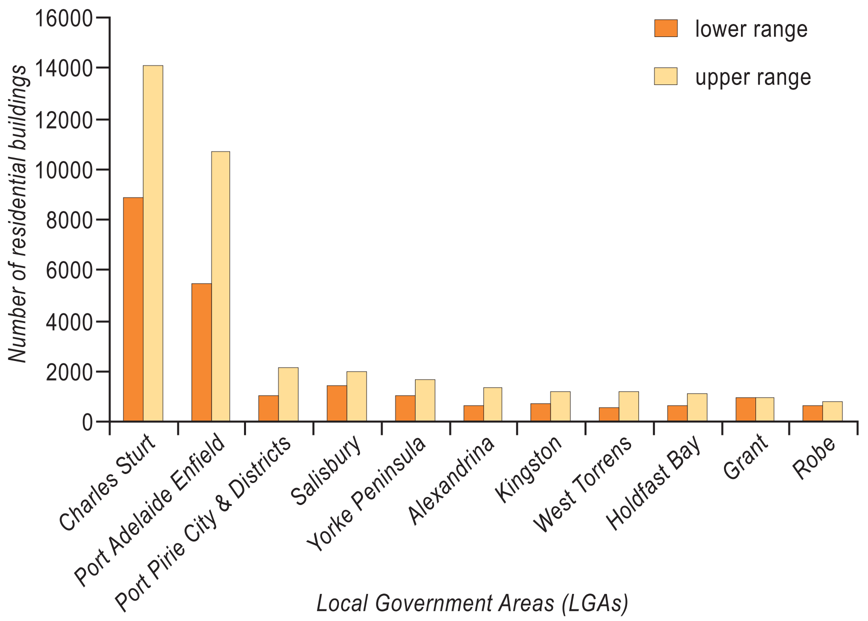

Figure 5.37 Estimated number of existing residential buildings in South Australia at risk of inundation from a sea-level rise of 1.1 metres.

Figure 5.38 Images of sections of the Port Adelaide-Enfield and Charles Sturt LGAs in 2009 and with simulated inundation from a sea-level rise of 1.1 metres using medium resolution elevation data (not suitable for decision-making). © CNES 2009 / imagery supplied courtesy of SPOT Imaging Services and Geospatial Intelligence PTY LTD.

The analysis also suggests that 23 per cent of residential buildings in the City of Port Adelaide-Enfield could be affected by sea-level rise by 2100. A recent study[127] of seawater flooding risk to Port Adelaide identified that the estimated costs from flooding damage from the combined effects of sea-level rise (50–88 centimetres) and local land subsidence during a 1-in-100 year storm tide event could increase from $8–28 million for a current day event to $180–310 million under future scenarios (Box 5.12).

The Yorke Peninsula also has a significant number of residential buildings that may be vulnerable to climate change, with almost 20 per cent of the current residential stock at risk of inundation from sea-level rise by 2100 (Figure 5.37). A recent study[128] of four small coastal towns on the Yorke Peninsula suggests that without adaptation, annual average damage costs could reach around $1 million for Moonta Bay and Marion Bay and around $4 million for Port Broughton and Fisherman Bay by 2070 (based on a more conservative sea-level rise scenario of 0.47 metres). The study also noted that approximately 80 per cent of the built environment in Fisherman's Bay may be at high risk, largely due to inundation and wave action during storm surge events.

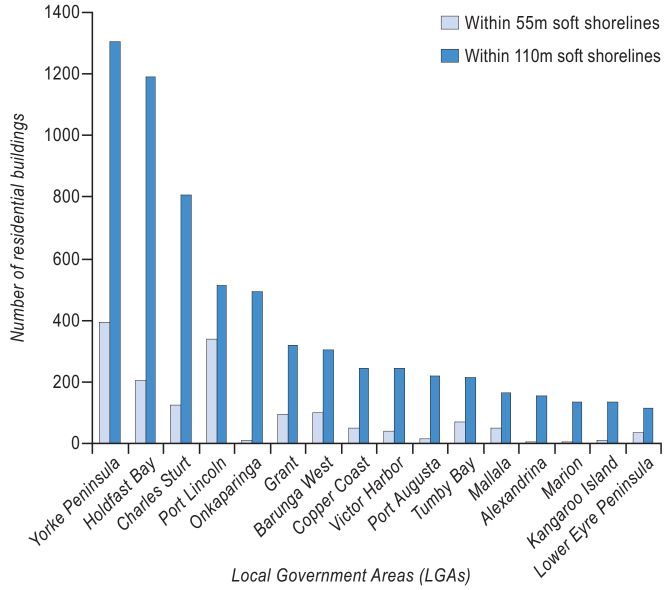

Figure 5.39 Number of residential buildings located within 55 metres and 110 metres of 'soft' shorelines in South Australia.

Management of the Murray mouth, the Coorong and Lower Murray lakes under climate change is complicated by the existence of barrages and controls over water flows in the Murray–Darling Basin. Adaptation responses will need to be informed by further studies to define future impacts associated with rising sea levels, reduced freshwater inputs and various hydrological changes in this estuarine – lagoonal region.

Erosion due to higher sea levels is also a key risk for coastal areas. In South Australia there are approximately 7,000 residential buildings located within 110 metres of 'soft' coast, of which approximately 1,600 are located within 55 metres of the shoreline. Of the coastal LGAs, the Yorke Peninsula and Holdfast Bay have the highest number, with approximately 1,300 and 1,200 residential buildings within 110 metres, of which approximately 400 and 200 buildings, respectively, are within 55 metres of 'soft' shorelines. The LGA of Charles Sturt also has 800 residential buildings within 110 metres of the 'soft' coast (Figure 5.39).

The LGAs of Port Lincoln, Onkaparinga, Grant, Barunga West, Copper Coast and Victor Harbor also have a significant number of buildings located within 110 metres of 'soft' coast. Port Lincoln and Onkaparinga both have approximately 500 buildings, and Barunga West, Grant, Copper Coast and Victor Harbor have between 240 and 320 residential buildings within 110 metres of 'soft' shoreline. In the absence of coastal protection measures or other adaptation responses, these buildings may be at risk of increased erosion with sea-level rise and storm surge due to their location and the nature of the shoreline.

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