5.1.6 Tasmania

Key findings

- Between 8,700 and 11,600 residential buildings in Tasmania may be at risk of inundation from a sea-level rise of 1.1 metres and storm tide from a 1-in-100 year storm event.
- The current replacement value of the residential buildings at risk is between $2.4 billion and $3.3 billion.
- Local government areas (LGA) of Clarence, Central Coast, Break O'Day and Waratah/ Wynyard LGAs collectively represent 50 per cent of residential buildings at risk in Tasmania (upper range estimate).
- Between 1,850 and 2,250 residential buildings in the LGA of Clarence may be affected by sea-level rise and storm tide inundation by 2100, equivalent to approximately 10 per cent of the existing residential stock within the LGA.
- There are approximately 6,100 residential buildings located within 110 metres of 'soft' erodible shorelines, of which approximately 1,800 are within 55 metres of soft coast.

The population context

Tasmania's population of almost 500,000 people is largely concentrated along the coast, with around 75 per cent of Tasmanians residing in coastal local government areas.[94] In the year to 2008, the coastal LGAs of Kingborough and Sorrell in south-east Tasmania recorded the largest population increase and highest growth rate, respectively, of all local government areas.[95] In addition to being home to most of the population, the coast is also where major industries are located, highlighting the social and economic significance of the coastal region.[96]

The nature of the coast

Compared to other states a very high proportion of Tasmania's open coast is hard rocky coast (about half), and much of this is cliffed. This reflects Tasmania's exposure to high wave energies and relatively limited sand supply to large sections of the coast, and means that large sections of coast are unlikely to recede significantly due to erosion related to sea-level rise within human lifetimes.[97]

Sandy coasts make up most of the other half of Tasmania's open coast, and these are dominated by sandy shores backed by soft sediments (which are potentially prone to significant recession with sea-level rise). At least 20 per cent of these are sandy shores backed by bedrock, which may erode with sea-level rise but are less at risk of significant shoreline recession.

Photo credit: A.D. Short

Cape Pillar.

Soft rock and muddy coasts are a very minor component of Tasmanian's open coast.[98]

Existing risk

Coastal areas in Tasmania already have some exposure to storm surge, erosion and other natural hazards without the compounding effects of climate change. For example, approximately 240 square kilometres of coastal area in Tasmania is currently vulnerable to storm surge flooding (average 2-year return period).[99]

As in many areas around Australia, residential development within 100 metres of the coast has continued over recent decades. Some of this development has been sited in areas prone to erosion.[100] For example, the house in the below photo is located on a coastal cliff that is prone to slumping, with this kind of event likely to be exacerbated by climate change. There are also some shacks located on freehold land (previously Crown Land) that are vulnerable to coastal erosion or slumping, such as in Boat Harbour and Anson's Bay.[101]

A recent study of coastal locations in Clarence in south-east Tasmania identified four areas in which there is existing risk of erosion, inundation and high water tables.[102] These include the areas of Lauderdale and Roches Beach, Cremorne, Bicheno Street in Clifton Beach and South Arm Neck (Box 5.11).

Photo credit: Chris Sharples

House sited on a coastal cliff that is prone to slumping.

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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.

Climate change risk to settlements

Inundation analysis suggests that between 8,700 and 11,600 residential buildings in Tasmania may be at risk of inundation from a sea-level rise of 1.1 metres and storm tide associated with a 1-in-100 year storm event. Based on this analysis, Tasmania has a relatively small number of residential buildings at risk in comparison to other states. The current replacement value of the residential buildings at risk is between $2.4 billion and $3.3 billion.

The local government areas that have the greatest level of risk are Clarence, Central Coast, Break O'Day and Waratah/Wynyard on the north and east coasts, which collectively represent 50 per cent of residential buildings at risk in Tasmania (upper range; Figure 5.30). Inundation footprints of the Central Coast LGA and Kingston in the LGA of Kingborough are shown in Figure 5.31 and 5.32.

Between 1,850 and 2,250 buildings in the LGA of Clarence may be affected by inundation associated with sea-level rise and storm tide inundation by 2100. This represents an exposure risk to approximately 10 per cent of the existing residential dwellings within the LGA (upper range). A recent study for the Clarence City Council[103] assessed the erosion and inundation risks to 18 coastal locations. The report identified those areas that are currently at risk and those that have medium and longer-term risks associated with climate change (Box 5.11).

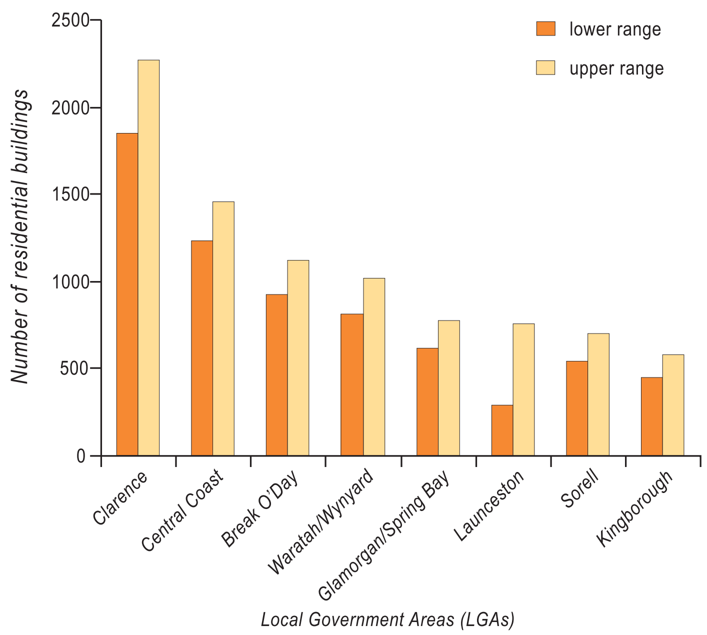

Figure 5.30 Estimated number of existing residential buildings in Tasmania at risk of inundation from a sea-level rise of 1.1 metres and a 1-in-100 storm tide.

Figure 5.31 Images of Kingston (Kingborough LGA) in 2009 and with simulated inundation from a sea-level rise of 1.1 metres and a 1-in-100 year storm tide using medium resolution elevation data (not suitable for decision-making). © CNES 2009 / imagery supplied courtesy of SPOT Imaging Services and Geospatial Intelligence PTY LTD.

Figure 5.32 Images of Ulverstone in the Central Coast LGA in 2009 and with simulated inundation from a sea-level rise of 1.1 metres and a 1-in-100 year storm tide using medium resolution elevation data (not suitable for decision-making). © CNES 2009 / imagery supplied courtesy of SPOT Imaging Services and Geospatial Intelligence PTY LTD.

A significant proportion of the existing building stock in the LGAs of Central Coast and Break O'Day may also be at risk of inundation, with upper estimates of 16 per cent and 23 per cent respectively. The local government area of Flinders has a relatively small number of buildings at risk (approximately 170) and is therefore not captured in Figure 5.30; however the number represents over 30 per cent of the existing residential stock in the LGA.

This inundation analysis has not included information on commercial buildings and transport infrastructure, although these assets will also be at risk of inundation. In 2008, the Tasmanian Government assessed assets at risk using a range of sea-level rise scenarios (Table 5.1)[104]. Assets identified at risk include critical infrastructure and services, such as emergency service facilities and sewerage and wastewater systems. Inundation or failure of these assets would significantly impact communities and coastal ecosystems.

Sea-level mark at Port Arthur

In 1841, a sea level mark of historical significance was made by Lempriere and Ross at Port Arthur. It is one of the earliest reference points in the world against which changes to sea level can be scientifically measured. Taking account of vertical movement of the land, the rate of sea-level rise is between 0.8mm/year and 1mm/year, with approximately 13 centimetres of sea level rise since 1841. This is consistent with rates of change recorded at Fort Denison in Sydney Harbour based on 82 years of data.[105]

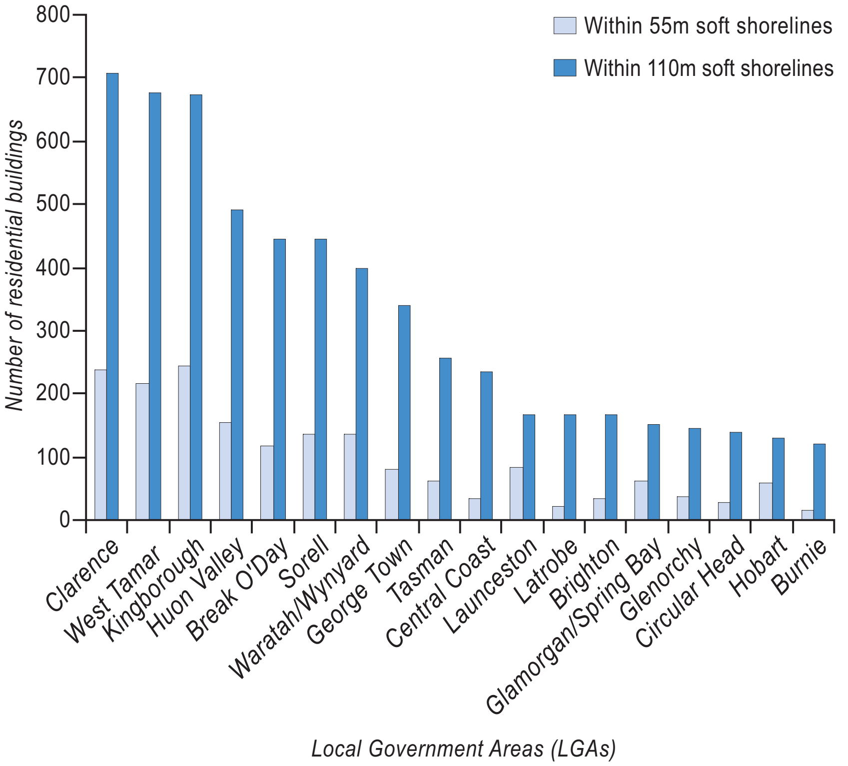

Figure 5.33 Number of residential buildings located within 55 metres and 110 metres of ‘soft’ shorelines in Tasmania.

Coastal erosion is also a key risk associated with climate change, particularly with an increasing frequency of high sea level events that will occur over the coming decades. Along Tasmania’s coastline there are approximately 6,100 residential buildings located within 110 metres of ‘soft’, erodible shorelines, of which approximately 1,800 are located within 55 metres of ‘soft’ coast. Of the coastal LGAs, Clarence, West Tamar and Kingborough have the highest numbers, with between 670 and 700 residential buildings within 110 metres of ‘soft’ shorelines in each local government area, and over 200 within 55 metres of ‘soft coast’ in each LGA (Figure 5.33). Similarly, Huon Valley has close to 500, and Break O’Day and Sorell have around 450 residential buildings within 110 metres of ‘soft’ coast in each area. 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.

Photo credit: Chris Sharples

Eroding soft rock shore (clayey gravels) at Anson’s Bay, north east Tasmania. The photo (2002) shows a poorly constructed ‘coastal defence’ that is collapsing because of undermining of the shore in front.

Box 5.11 Climate change impacts on Clarence coastal areas

The City of Clarence is located to the east of Hobart, Tasmania. Clarence City Council initiated a project in response to Council and community concerns about the potential impacts of a changing climate on coastal areas. The study provides an assessment of climate change risks to coastal areas for 2050 and 2100, based on a 'mid' and 'high' value of sea-level rise.

Sea level rise scenarios	2050	2100
Mid Scenario	0.2m	0.5m
High Scenario	0.3m	0.9m

The study examined 18 locations within Clarence City, identifying those that have existing and longer-term risks, as well as the potential impacts of more frequent and extreme storm surges, coastal erosion, rising ground water and increased flooding in coastal areas. For example, Roches Beach on Frederick Henry Bay has a history of erosion that is expected to accelerate with climate change in the absence of coastal protection measures. Modelling suggests that a 1-in-100 year storm under the 'current climate' could lead to erosion of 25 metres inland and place 19 houses at risk. With climate change, the extent of erosion could increase to about 95 metres inland by 2100 (high scenario) and place 195 houses at risk (125 under the 2100 mid scenario) (Figure 5.34).

The study also considered a range of possible adaptation responses for different climate change scenarios, including potential costs. For example, possible responses to storm surge and erosion at Roches Beach could include beach replenishment, dune protection and hardening, and progressive retreat, among others.

Figure 5.34 Erosion and recession hazard lines along the central section of Roches Beach. Source: Water Research Laboratory, UNSW

The cost of sand nourishment at Roches Beach was estimated at $2.6 million for the present day scenario and up to $23.2 million for the 2100 high scenario. Groynes could also be used to retain sand at an estimated cost of $3.5 million for the main Roches beach.

The use of sea walls along Roches Beach was also considered as a response and deemed not to be cost effective in the short-term. The total estimated cost of sea wall construction ranged from $18.5 million (today) to $34 million (2100 high scenario). The report also noted that the cost of sea walls will increase significantly with sea-level rise due to the costs increasing with the 'square of the height'. For example, doubling the height of a sea wall would quadruple the cost.

A community survey of the range of possible adaptation responses identified retreat as the least acceptable climate change response. Respondents to surveys generally accepted limiting development in higher risk areas, while fewer supported the removal of existing housing.

The report proposes a range of strategies covering the immediate to longer-term. Immediate options entail changes to planning and development controls to address future risks from erosion and inundation for proposed development, and short term works where risks are evident from current hazards. In the medium term, further studies were identified to (1) define hazards and risks to better understand the cost benefits for priority areas; (2) understand engineering design requirements and; (3) implement cost effective, well designed engineering measures. Over the longer-term (up to 25 years) the report noted the need for ongoing studies of actual change and understanding the effectiveness of initial responses and works, in addition to planning for long-term responses to changing (and ongoing) risks.

Source: SGS Economics & Planning 2007[106], SGS Economics & Planning and UNSW Water Research Laboratory 2008[107]

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Table 5.1 Vulnerable assets in Tasmania for a 2100 maximum sea-level rise (2004 level +84 centimetres) inclusive of an additional 50m indicative buffer inland of the high sea-level rise scenario.
Source: Department of Primary Industries and Water 2008[108]

Asset	Risk	Area (ha) or number at risk
Reserves (for natural purposes), including land reserved under the *National Parks* and *Reserve Management Act 2002, Crown Lands Act 1976 and Forestry Act 1920,* 'natural parks' and 'park/reserves' with less formal status.	Large area susceptible, with most of areas containing high natural values (e.g. high conservation value vegetation types and geomorphic features, and threatened species). They are often also highly valued social assets.	Reserves – 37,941 ha State Forests – 427 ha Private reserves – 997 ha Other Public land – 8373 ha
Large Community & Public Buildings Community Care facilities, Hall/Community Centres, Sports Building and Sports Clubs.	Significant community buildings, often items or equipment of significant value that may not be easily removed. Some may be able to withstand periodic flooding, and disruption to services may not be critical, some structural damage is likely and clean up costs may stretch tight budgets. Facilities are generally strong focal points for local communities, resulting in high social impacts and some may also serve as focal points during emergencies, so their placement in a hazard zone may need consideration.	Boating, Surf clubs – 53 Sports clubs – 63 Sports buildings – 48 Churches – 22 Community care – 25 Halls – 28 Libraries – 13 Scouts – 17 Seniors – 4
Picnic areas & facilities both inside the Parks and Wildlife Service managed reserve system and outside, which are usually managed at the local level.	While these areas tend to have low levels of development and disruption from flooding is not usually critical, many are considered valuable community assets with high social value. Many in the formal reserve system are also in areas with high natural values.	Parks – 92 Camping – 37 Picnic – 122
School sites listed in the Tasmanian Street Atlas as a school, including primary, secondary (high) or college/matriculation, most of which are public.	Schools are very high value assets, focal points for the community, and sometimes have a role in emergency situations. Due to land zoning and infrastructure costs, moving schools will not be an option in the short or medium term. However, with such high consequence of impact, high sea-level rise scenarios will require eventual relocation.	12
Service Station sites listed in the Tasmanian Street Atlas as Service Stations, and likely to require an 'environmental permit'.	Flooding would probably cause significant structural damage, and is very likely to cause significant contamination/pollution of the general area.	38
Emergency Services Buildings facilities listed in the Tasmanian Street Atlas as State Police/Emergency Management Services. It does not necessarily include designated emergency service centres such as coordination, evacuation or recovery centres.	Flooding would probably cause some structural damage and to equipment. However, the greatest risks come from the presence of a focus for emergency coordination itself existing in a hazard area.	32
Sewage and Wastewater Treatment Plants Sites described as 'sewage' or 'wastewater', and including lagoons, plants and works. Does not include the sewage pipes and pumping stations.	These are critical community infrastructure, expensive to repair and/or re-locate and the capacity of the managing authority (usually Local Government) to undertake significant redevelopment is often limited, as it is often not just the site itself, but all infrastructure leading to and servicing that site as well.	22

Table 5.1 continued

Asset	Risk	Area (ha) or number at risk
Major Roads Primarily State Government managed roads, including National/State Highway, and major Arterial roads, but may also include some Local Government managed roads.	While road foundation integrity may not be a major issue due to the generally higher standard of construction, disruption to key transportation routes from flooding is likely to be very high. Bridge construction may need review for water flow, clearance levels and foundation/buttress integrity standards.	Highway – 140 km Arterial – 111 km
Local Roads including smaller Arterial, Feeder, and Access roads – Local Government primarily responsible	Social and economic value of roads significant to local communities, as well as often key emergency routes. Foundation integrity potentially subject to damage from flooding, in addition to disruption to accessibility. The primary manager of these assets, Local Government, is likely to require assistance due to their smaller resource base, especially given the potential magnitude of the issue.	Access – 706 km Feeder – 91 km Track – 437 km
Parks and Wildlife Service infrastructure Primarily built infrastructure such as major buildings and toilets	These high value assets are likely to be severely damaged by even minor flooding events, and are often more difficult to repair given their usual remoteness. Given high sea-level scenarios considerably increase the number of assets potentially impacted, there are significant risks to this category.	Buildings – 76 Track, toilets, picnic areas etc – 752
Waste Disposal Sites used for the disposal of waste, not including waste transfer stations, Includes open and closed sites.	Potential contamination and pollution arising from flooding events makes this a high risk category.	6
Storage Tanks and facilities storing materials such as explosives, gas and chemicals, either above or below ground.	These facilities may suffer structural damage from flooding, and there is a high chance of pollution or contamination.	67

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