Not relevant

6 **Cabinet Notes for Discussion**

601 IMPLICATIONS OF A SEVERE COASTAL STORM (Gail Gago) - NOTED

Not relevant

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TO: THE PREMIER FOR CABINET TO NOTE

RE: IMPLICATIONS OF A SEVERE COASTAL STORM

1. PROPOSAL

That Cabinet note that:

1.1. there was minimal damage to the Adelaide coast from the 4 July 2007 storm, due in large part to works undertaken to stabilise and protect the coastline;

1.2. there are coastal settlements historically at risk from a severe (1-in-100 year) storm and that this risk will increase over time due to sea level rise from climate change (see Attachment 1);

1.3. work is being progressively undertaken to obtain more detailed modelling on actual flooding risks and impacts on South Australian coastal settlements; and

1.4. the Coast Protection Board is addressing priorities for necessary coastal protection works over the next four years.

2. BACKGROUND

2.1. The Coast Protection Board is charged with protecting and restoring the coast and works closely with the Department for Environment and Heritage (DEH) and local government to identify and prioritise hazards. It also provides partial funding for protection works to mitigate these hazards.

2.2. In assessing risk, the Coast Protection Board considers that development should be able to withstand a coastal flooding or erosion event with an Average Recurrence Interval of 100 years (an event that could be expected to occur only once in 100 years). This level of risk is commonly used as a benchmark, although in areas subject to events in which consequences are very great, such as tropical cyclones, a 1-in-200 year risk benchmark might be used.

2.3. As 'coastal' Development Plans come up for review, DEH promotes the need to protect new development from undue risk from coastal hazards associated with factors such as storm surge events and climate change-induced sea level rise.

2.4. The Intergovernmental Panel on Climate Change (IPCC) recently released a report entitled *Climate Change 2007: The Physical Science Basis - Summary for Policymakers.* Findings include:

- a warming of the climate system is 'unequivocal' and is demonstrated by 'observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level';

- the warming and expansion of seawater, as well as the melting of glaciers and ice caps, has contributed to sea level rise; and

- even if current greenhouse gas emissions were stabilised, temperature and sea level would continue to rise for centuries, due to the timescales and interactions associated with climate processes.

2.5 Sea level rise is considered to be the most critical factor threatening the viability of coastal development and infrastructure. The midrange of sea level rise projected by the IPCC in 2007 is similar to that published in 2001: a rise of approximately 0.3 metres by the end of the present century. However, this data does not factor in rapid changes in land-based ice sheets, as there remains uncertainty of the rates of melting. There is a growing body of literature that suggests much higher sea level rises, in the order of 7 metres, over the course of this century.

3. DISCUSSION

3.1. On 4 July 2007, Adelaide's metropolitan coastline was hit with a 1-in-20 year storm event, with the highest tide since 1981. Due to effective sand management strategies the potentially damaging effects of this storm were minimised (see Attachment 2). These strategies have been effective but are costly and cannot be replicated along all of South Australia's settled coastline.

3.2. In January 2007, South Australia was subject to two separate weather events that caused infrastructure damage. The first was a tropical rain depression with record rainfalls in some parts of the State, mostly in the far and mid-north. The second was a cold front, which brought severe (for summer) weather conditions to more southern parts of South Australia.

3.3. There has not been a severe (1-in-100 year) coastal storm in South Australia for some years but in the light of recent events, and the threat of increased sea levels due to climate change, it is timely to advise on the likely impacts. A maximum sea water level currently expected only once in 100 years on the Adelaide coast would become a 1-in-5 year event with only a 0.3 metre sea level rise.

3.4. Attachment 1 contains a *qualitative* 'first-pass' risk assessment of the impact a 1-in-100 year storm would have on South Australia's coast *were it to occur now*. It is unlikely that even a severe storm would inflict major damage across the entire coast and so the discussion is split into areas based on State Government Regions. This assessment shows risk in all regions of substantial damage.

3.5. As part of better understanding the extent of this risk, DEH and Planning SA are collaborating with the Australian Government on a quantitative flood risk study for selected high-risk settlements on the Yorke Peninsula to identify and assess coastal flooding hazards in low-lying areas.

3.6. The Coast Protection Board has taken a lead role in climate change awareness and adaptation since the early 1990s, releasing a coastal hazards policy that included an allowance for sea level rise in 1991. South Australia became the first State to incorporate consideration of climate change in planning policy and development assessment when the Coastal Area provisions, based on the Coast Protection Board's policy, were inserted into Development Plans in 1994. Since 1991, the Coast Protection Board has ensured that protection works along the coast have incorporated the same allowance for sea level rise as new coastal developments: 0.3m to the year 2050 and the future ability to protect against a further 0.7m to 2100.

3.7. DEH and the Coast Protection Board keep abreast of current climate change science and policy development through the expertise represented in the agency and on the Board, formal and informal professional networks and up-to-date publications. To formally provide an objective, informed and balanced picture, the Coast Protection Board will soon convene a new mean sea level committee to advise it on reviewing its sea level rise policies in light of the latest information: the final 2007 IPCC report is due in November. The last such committee informed the 1991 policy development. Should there be a need to revise the policy as translated into Development Plans, this could be achieved by Ministerial amendment, as was done in 1994.

3.8. While sea level rise is already factored into new development via the Coast Protection Board's policies, large areas of existing development remain at risk and some difficult choices may need to be made about what can and should be protected in coming years, should the more dire sea level rise projections be confirmed. This would require a sound scientific consensus on which to base a retreat policy, and the development of accurate coastal mapping, such as the National Digital Elevation Model (DEM) proposed by COAG: South Australia is liaising with the Australian Government in the development of such mapping.

3.9. In South Australia, there are nominated leaders for each broad hazard category, responsible for coordination of strategy and responsibility. Flood covers any event in which water is the cause, whether that is from rivers, storm water, sewage, mains, or sea. The flood hazard leader is the Department of Water, Land and Biodiversity Conservation. DEH is assisting the flood hazard manager to ensure that actions, responsibilities and capabilities are clearly defined and understood.

3.10. Over the next four years, high priority protection works, with funding assistance from the Coast Protection Board, are planned to stabilise cliffs in the City of Onkaparinga and at Moonta Bay-Port Hughes, where there are risks to life. Similarly, St Kilda and Victor Harbor are also considered to require flood and erosion protection works as a priority because of the current potential risks to infrastructure and houses. Levee construction works to mitigate flooding risk at Port Augusta have been staged, due to the scale of the project, and are partially completed and levee banks around Port Pirie are to be completed this year.

4. SUMMARY

It is recommended that Cabinet note:

4.1. there was minimal damage to the Adelaide coast from the 4 July 2007 storm, due in large part to works undertaken to stabilise and protect the coastline;

4.2. there are coastal settlements historically at risk from a severe (1-in-100 year) storm and that this risk will increase over time due to sea level rise from climate change (see Attachment 1);

4.3. work is being progressively undertaken to obtain more detailed modelling on actual flooding risks and impacts on South Australian coastal settlements; and

4.4. the Coast Protection Board is addressing priorities for necessary coastal protection works over the next four years.

HON GAIL GAGO MLC
MINISTER FOR ENVIRONMENT AND CONSERVATION

Date: 6/9/07

RECEIVED
06 SEP 2007
CABINET OFFICE

In Cabinet

10 SEP 2007

NOTED
PREMIER

RISK ASSESSMENT OF A 1-IN-100 YEAR STORM ALONG THE SA COAST

General

This assessment is by necessity qualitative in nature. It is informed by the skills and expertise of officers of the Department for Environment and Heritage (DEH), many of whom have detailed site-specific knowledge.

DEH has conducted long-term monitoring of the coast on behalf of the Coast Protection Board, which is a major contributor to this assessment.

Whilst many locations are discussed below, the list is not exhaustive and there are areas that have not been covered. In many places, the erosion of the coast is causing the loss of the Crown land reserve, the maintenance of which is critical for continued public access to the coast.

There are two main types of coast that are particularly vulnerable to storm damage: sandy beaches and mangrove / saltmarsh areas. Sandy beaches will erode when subject to elevated water levels (storm surge) and large storm waves. Where there are not adequate dunes to absorb this erosion, or where these dunes have been built on, any risks are enhanced. In some areas, dunes provide a flooding and erosion buffer to settlements behind them. If they are breached, then flooding is likely in low-lying areas. In locations where development is on the dunes, erosion of the dunes could cause the loss of, or damage to, this development.

Mangrove and saltmarsh areas are inherently low-lying and subject to either regular or occasional inundation. Many settlements in the upper Gulf St Vincent and Spencer Gulf have been built in saltmarsh areas and are potentially vulnerable to flooding.

There are many kilometres of soft, erodible cliffs along the South Australian coast. For example, the cliffs at Ardrossan on the Yorke Peninsula are very soft and have the potential to rapidly erode during a severe storm.

South East and Murray Lands Regions

Much of the South East is flat and low-lying. The coast is scattered with shack areas, most of which are now freeheld. Many of these are at risk of flooding and, in some cases, damage from erosion during a severe storm.

Port Macdonnell is low-lying and would be at risk of flooding, particularly if the storm included significant rainfall.

Towns such as Southend, Beachport, Robe and Kingston all have sandy foreshores, and adjacent development, which would be eroded to varying degrees. Southend and Beachport have been subject to erosion and have required significant protection works in the past. Further works are required at Beachport, some of which are described in the Rivoli Bay Recreational Boat Launching Facility Management Plan, (Cabinet endorsed, 2006). Emergency protection works were required at Beachport in 2006, but there remain areas of the foreshore that are vulnerable.

The coast along the southern Coorong is subject to ongoing erosion. This would be exacerbated by a severe event. An elevated sea and large waves would push large volumes of sand into the Murray Mouth, increasing the risk of closure, especially with low river flows.

Fleurieu, Kangaroo Island and Greater Adelaide Regions

The beaches between the Murray Mouth and Victor Harbor would be subject to significant erosion, depending on the storm direction. In some locations the Goolwa to Victor Harbor railway is very close to the beach. Foreshore areas at Victor Harbor are vulnerable, particularly west of the Granite Island causeway where only a small, eroding dune presently provides a buffer against flooding.

On Kangaroo Island, Brownlow, to the east of Kingscote is low-lying and has suffered flooding in the past. A levee bank has been constructed in the past, which will have incorporated an allowance for sea level rise, the maintenance of which is uncertain - there would be considerable erosion from there, east to American River.

Nepean Bay is low-lying, without flood protection and is at risk. Some areas at American River, Sapphiretown and Island Beach might be subject to minor flooding. On the west coast, a small freeholded shack settlement at Point Tinline would be threatened by the exacerbation of an existing erosion and flooding problem, mitigation of which is vested with the landowners. Some other shack areas or isolated developments could be considered vulnerable.

The Crown land-leasehold shack area at Lady Bay, near Normanville is low-lying and vulnerable to both erosion and flooding. Dunes between Cape Jervis and the Metropolitan Adelaide coast at Kingston Park would be severely eroded. The foreshore at Moana suffered minor flooding on 28 January 2007, a minor event. A major storm would produce far more significant flooding.

The cliffs along the City of Onkaparinga's coast might be subject to increased erosion, increasing the risk of cliff collapse in some areas.

The Adelaide metropolitan beaches have been actively managed and protected for over 30 years by the Coast Protection Board; *Adelaide's Living Beaches: A Strategy for 2005-2025* continues this work. Dune erosion would be noticeable along the foreshore, particularly at West Beach, Henley and Grange, Semaphore Park (an actively eroding area) and Semaphore.

Areas of Port Adelaide and around the Port River and Barker Inlet have been identified in the Port Adelaide Seawater-Stormwater Flooding Study as being vulnerable and many areas would be flooded. Also on Barker Inlet, St Kilda would experience significant flooding, and possibly erosion, because the seawall is inadequate.

Barossa and Yorke and Lower North Regions

The small, nearshore settlements between Port Gawler and Port Wakefield (eg Middle Beach, Port Parham, Thompson's Beach, etc) are built in mangrove or saltmarsh areas and are extremely vulnerable to flooding. Port Wakefield itself is an area for which the Coast Protection Board specifies site and building levels to mitigate flooding risks, but areas of older, existing development would be at risk.

Many shack sites around the Yorke Peninsula would be subject to flooding and erosion, which might threaten development. Areas such as Sheoak Flat and the Pines are protected by levees against flooding. Marion Bay is relatively low-lying and has historically been subject to flooding and erosion, as have a number of other settlements between it and Hardwicke Bay.

North of here, many settlements have been located above cliffs, some of which are subject to slow erosion, which could be exacerbated by a major storm. At Port Hughes and Moonta Bay, there are areas of unstable cliff, which the District Council of the Copper Coast is currently working to stabilise. Further north, settlements such as Fishermans Bay are at risk of flooding, as are many sites in the upper Spencer Gulf, which have been built on saltmarsh. Port Pirie is a major township that has been flooded a number of times since it was settled. In 1934, two people died in a major flood. Levees have since been constructed with the Coast Protection Board's support and these are due for completion this year.

Port Augusta is at risk of flooding and staged construction of levees is taking place with completion some years in the future. A major storm would flood around and behind the incomplete structures. A major shack settlement exists at Blanche Harbor, south-west of Port Augusta. New dwellings are being built to an appropriate standard, but older shacks are at risk from flooding and long-term erosion.

Eyre and Western Region

A number of shack settlements in this region would be at risk from erosion and flooding. A notable example is Lucky Bay, which is surrounded by low-lying salt marsh and is built on sand on an unstable sand spit. A major storm could threaten development. Cowell, in Franklin Harbor would be at risk of flooding and cliffs at Port Gibbon (with shacks built above) would be at risk of increased erosion and collapse.

The Arno Bay foreshore was recently the subject of a protection strategy. It consists of a long beach backed by small dunes that protect the dwellings behind from flooding. A major storm could erode the southern end of these dunes. Furthermore, the sea could flood the saltmarsh behind the dunes via a tidal creek and cause flooding in and around the hotel. The foreshore at Tumby Bay has required erosion control measures in recent years and would remain at risk of erosion. South of Port Lincoln, the settlement at Tulka has recently had a seawall constructed, with Coast Protection Board support, to protect against erosion, but a flooding risk remains.

The settlement at Baird Bay lies immediately at the top of the beach and is at risk of flooding. Although recent development at Smoky Bay has extended over saltmarsh, site and floor levels have been raised to withstand flooding. However, shacks along the foreshore would be at risk from erosion of the beach.

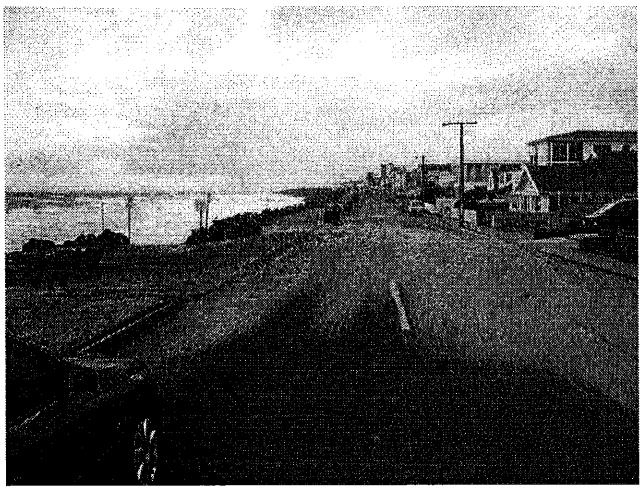
4 July 2007 Storm compared with 1981 storm
Metropolitan Adelaide

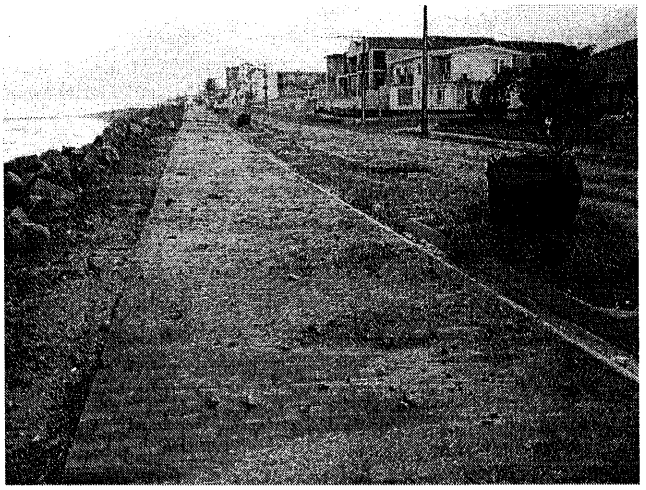
On the evening of 4 July 2007, Adelaide's metropolitan coastline was hit with a 1-in-20 year storm event, with the highest tide since 1981. There was very little damage to coastal properties as a result of the storm, thanks to the protective sand dunes and other coastal protection works that have been built along Adelaide's Metropolitan Coastline.

Although beach replenishment had commenced by 1981, the coast protection works were by no means as advanced as they are today. The damage from the 1981 storm required $1.3 million spent on protection works. The sand dune buffers and protection works carried out to date have kept the coast in very safe condition, with minimal damage from the storm.

Sand that came off of the beaches during the storm has not been lost, but rather has washed in the near shore area. In the near shore area this sand will assist in breaking wave energy, thereby protecting beaches from erosion. This sand will return onto shore in calmer periods.

Beach replenishment is a key part of *Adelaide's Living Beaches: A Strategy for 2005-2025*, ensuring southern and central metropolitan beaches remain sandy. Sand carting contract costs, excluding harbor management dredging, have been approximately $1.6 million per year since 2005-06. The expected cost in 2007-08 is $1.9 million, with the increased allocation provided to build a more substantial sand buffer to the dunes at West Beach.

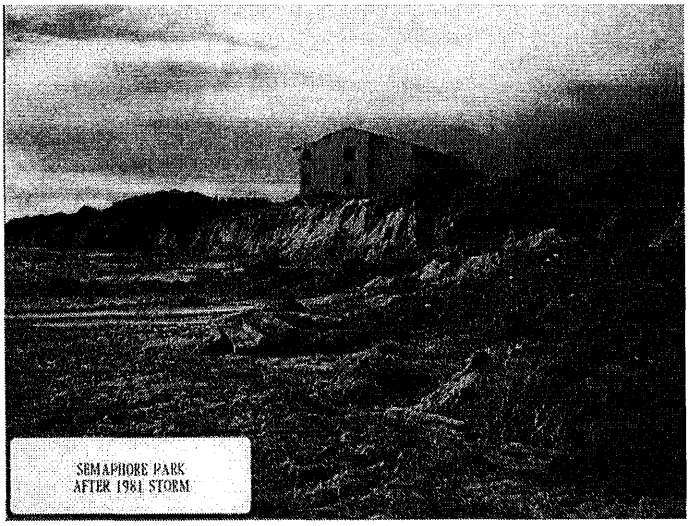




There was very little damage to coastal properties following the 4 July 2007 storm.

$1.3 m of coast protection works.

Damage from the 1981 storm required



SEMAPHORE PARK
AFTER 1981 STORM