Coastal Flood Mapping Tool - Frequently asked questions

Why is coastal flood mapping or sea level rise important?

Sea-level rise is a major risk for many coastal areas of Eyre Peninsula and the Limestone Coast. Sea-level rise is projected to accelerate over the next century, with research indicating that global mean sea level may rise 18–48 cm by 2050, and 50–140 cm by 2100.

The Climate Council of Australia released the *Counting the Costs: Climate Change and Coastal Flooding* (Steffen, Hunter, Hughes) report in 2014, which indicated that a sea-level rise of 1.1 metres could equate to between $22.6 to $28.2 billion damage to commercial and light industrial infrastructure in South Australia, much of which is located in Eyre Peninsula and the Limestone Coast.

Decision-makers (both public and private sector), faced with the problem of adapting to sea-level rise, will need appropriate information to make informed decisions.

There will be increasing pressure in the future on local government and the private sector to provide evidence of sea-level rise considerations in development applications and to meet future insurance requirements.

Why was this tool developed?

Since 2018, the Limestone Coast region (led by the Limestone Coast Local Government Association) and the Eyre Peninsula region (led by the former Eyre Peninsula NRM Board) have worked closely with Department for Environment and Water to improve their coastal development decision making and planning processes to protect and adapt community against coastal flooding, erosion and storm surge. The following work has been undertaken in both regions:

- LiDAR acquisition of the entire coastline (400km for the Limestone Coast and 3,200km for the Eyre Peninsula);

- Development of coastal flood mapping (six sea level rise scenarios);
- Interactive visualisation tool (the coastal flood mapping viewer);
- Engagement across industry, local government and community to encourage adaptation and mitigation planning; and
- Education and awareness programs with coastal community on coastal hazard risks associated with climate change and adaptation options against sea level rise.

As a result of these two regions working together with the Department for Environment and Water and the Coast Protection Board, this Flood Mapping Interactive Tool has been developed, which shows areas in Eyre Peninsula and the Limestone Coast that are vulnerable to inundation by sea level rise and storm surge.

How do I use the tool?

On the Coastal flood mapping tool you will find a link to the Quick Start Guide, which provides guidance and information on how to best use the tool. This information includes the following topics:

- Viewer layout
- Navigating around the system
- Selecting a base map (e.g. topographic, street map or imagery options are available)
- Layer list panel (where you can turn on of the various layers of information to suit your needs)
- Transparency slider
- Address and location search
- Property information

I am having problems with using the tool?

If you experience any functional problems in the use of the Coastal flood mapping tool please refer to the Quick Start Guide provided on the site in the first instance, as this may provide the answers that you need. If your problems still persist then email the coastal flood mapping support team at DEW.OnlineMapping@sa.gov.au who will be able to assist you.

What are the limitations of this mapping?

This flood mapping has limitations which users need to be aware of. Importantly, including there is no allowance in the flood mapping for:

- Connectivity issues (i.e. can sea water actually reach the low lying area);
- Existing or proposed barriers (e.g. sea walls, levees, etc.);
- Hydraulic flow restrictions, such as the width and depth of channel flow paths for flooding (i.e. can enough sea water flow through a restriction to fill the low lying area during the duration of the storm surge event);
- Coastal erosion hazard;
- Future changes to the landform, through uplifting or movement of tectonic plates or through the installation of man-made structures since the original LiDAR was captured;
- Coincident flood risk from inland (e.g. rainfall or river) sources and
- Inland coastal areas on Eyre Peninsula and Limestone Coast beyond the extent captured through the LiDAR, so any land further in-land will not show in the scenarios.

What is LiDAR?
LiDAR stands for Light Detection and Ranging, which is a remote sensing method used to examine the surface of the Earth, providing high resolution topographic mapping using laser reflections of ground and other surfaces.

LiDAR data supports activities such as inundation and storm surge modelling, hydrodynamic modelling, shoreline mapping, emergency response, hydrographic surveying, and coastal vulnerability analysis.

How was the LiDAR captured?
Contractors were appointed to acquire LiDAR data for the Limestone Coast (approximately 400km of coast from the SA/VIC border to the lower Lakes of the Coorong) and Eyre Peninsula (approx. 3,200kms of coast from Whyalla through to Penong).

The LiDAR, with vertical accuracy 0.15m and horizontal accuracy 0.5m, for both regions was delivered in 2018.

Contractors delivered the following products:

- "Bare Earth" Digital Elevation Model (DEM);
- Digital Surface Model (DSM);
- Canopy Height Model (CHM);
- Intensity imagery;
- Raw LAS version 1.2 classified point cloud;
- Foliage Cover Model (FCM) (Limestone Coast only); and
- Natural Colour RGB orthorectified imagery (Limestone Coast only).

How do I access the LiDAR, if I want someone to do more in-depth modelling and hazard mapping?
The LiDAR data is stored and available publicly for download on the Geoscience Australia ELVIS Platform.

What is 'bathtub' modelling?
'Bathtub' model is a common method for identifying areas potentially at risk from coastal flooding. This is a simple method that identifies any land below a certain elevation as being at risk of flooding, like pouring water into a bathtub or bucket. Bathtub flood modelling is a relatively quick and effective method of identifying potential risk at a large or regional scale.

What bathtub models have been completed to date and included in the Coastal mapping tool?
In 2019, bathtub modelling was undertaken over the coastal areas of the Limestone Coast and Eyre Peninsula. The modelling utilised the recently acquired LiDAR DEMs, to map areas vulnerable to flooding for six sea level rise scenarios:

1. 2019: 2019 mean high water spring tide level.
2. 2050: 2019 mean high water spring tide level + 30 cm sea level rise allowance.
3. 2100: 2019 mean high water spring tide level + 1 m sea level rise allowance.
4. 2019: 2019 1 in 100 (ARI) storm surge.
5. 2050: 2019 1 in 100 (ARI) storm surge + 30 cm sea level rise allowance.
6. 2100: 2019 1 in 100 (ARI) storm surge + 1 m sea level rise allowance.

Scenarios 1, 2 and 3 represent water levels that would regularly occur at high tides for the current (2019 baseline) level as well as the two sea level rise projections (2050 and 2100 respectively). The data for the mean high water spring (MHWS), was derived from the Tide Tables for SA Ports.

Scenarios 4, 5 and 6 represent extreme 100 year average recurrence interval (ARI) storm surge levels with the current (baseline) level as well as two sea level rise projections. The 1 in 100 year ARI water level heights were obtained from a database of storm surge estimates for all coastal locations in the state.

What is the difference between sea-level rise (bathtub modelling) and relative sea-level rise?
The Coastal flood mapping was developed using LiDAR overlaid with bathtub models (inundation maps). This is commonly referred to as 'absolute' or 'eustatic' Sea Level Rise modelling, which in effect tells the first part of the story. It assumes the land terrain (as captured through the LiDAR) will stay the same for the next 50 to 100 years and shows how global warming or storm surge will influence sea level rise.

'Relative' Sea Level Rise (RSLR) uses the same information to accurately predict sea level changes, however its goes a step further and also factors in any potential changes to the land terrain (as a result of tectonic plate movements or other factors) over the next 50 – 100 years. Over time the land terrain may be rising or falling, which could offset or exacerbate the effects of rising sea levels. Our challenge is that we don't have access to any data or published peer reviewed scientific research for the region at this stage to understand what effect this might have on the data.

Due to the slow rate of change of land elevation, many years of research and monitoring would be needed to enable analysis to separate the land movement data from any "noise" in the data.

How was the Mean High Water Springs and storm surge information prepared?
For long term planning, development and engineering projects, it is normal to consider the likelihood of extreme events, expressed in terms of return periods (i.e. the average time interval between events that exceed a particular height). The 1 in 100 year average recurrence interval (ARI) storm surge used for this project is the estimated average time between storm surge events of this magnitude to occur. For example, a 100 year storm surge event has a 1% chance of being exceeded in any one year. The 1 in 100 year ARI values include the storm surge and wave setup estimates but do not include wave runup.

The estimates were prepared based on analysis of tidal records at locations where sufficient historical tidal data exists, interpolation between these locations, and corrections for survey observations following significant storm surge events. These values change along the coast and the study area has been divided into 8 cells in the Limestone Coast and 19 cells in Eyre Peninsula each representing particular MHWS and 100 yr ARI storm/set up values.

Will other regions of the State be added in future?
As more data becomes available across the State, this will be incorporated in to the tool, broadening the coverage available to users.

This is fairly high level information, how do I get more detailed information?
This is a tertiary 'bathtub model'. If users need more detailed information they will need to undertake further investigation or planning including: the assessment of protection measures and land use zoning or detailed hydrodynamic modelling using local data to inform decision making.

Where can I find more information in regard to coastal management and developments in SA?
If you are interested in finding out more in regard to coastal management in SA, there are a range of resources, information and tools freely available on the internet.

Coasts on the Department for Environment and Water website has a range of climate change information, including:

- Protecting our coastal environment.
- The role of the Coast Protection Board.
- How sea level rise impacts coastal developments.
- Coastal development applications.
- Grants and opportunities.
- The site also has a huge array of links to research, reports journals and policies.

You can contact the Coast and Marine Branch at DEWcoasts@sa.gov.au to discuss these matters further.

If you are after more localised coastal management information the best source of information is your local Landscape SA Board – visit the Landscape SA website for a link to the Landscape Board for your region.

Where can I go to find out more about climate change and its impacts on the coast?
If you are interested in finding out more in regard to climate change and its effects on the coastal environment, there are a range of resources, information and tools freely available on the internet. Here are just a few that you could take a look at:

- Climate Smart SA on the Department for Environment and Water website has a range of climate change information, including:
    - Directions for a climate smart South Australia
    - Details of how climate change is affecting SA
    - Programs and initiatives
    - SA's greenhouse gas emissions
    - Climate change legislation, and the
    - Premiers Climate Change Council.
- Check out array of tools and checklists on the CoastAdapt website, National Climate Change Adaptation Research Facility.
- The Intergovernmental Panel on Climate change, is the world's leading body that assesses the impact of climate change on a global scale. Information on the latest climate change science is available on the IPCC website.

Other links include:

- CSIRO – Atmosphere and Climate
- Bureau of Meteorology – Annual Climate Report
- Intergovernmental Panel on Climate change – Assessment report
- World Meteorological organisation
- United Nations Framework Convention on Climate Change
- Australian Academy of Science – Climate Change
- NASA – Global Climate Change