Coastal Climate Change Adaptation Planning for Councils

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Module 2 Risk Assessment

1. MODULE OVERVIEW

This module outlines the *risk assessment* phase of community-based coastal adaptation planning within council. The primary aim is to develop an understanding of the extent of risks from coastal hazards in the project area – under both present day and projected climate change scenarios – including consideration of the value of occupation and use.

It is important to note that the risk assessment undertaken as part of this process should be considered as a first-pass assessment, and council should undertake further technical analysis upon completion of this work to determine the full extent of risk and impact.

MODULE CONTENTS

OBJECTIVES

- Understand the risks from coastal hazards both at present day and under projected climate change scenarios for the project area by identifying the assets at risk and the associated costs.
- Understand the value of the project area beyond physical infrastructure.
- Determine the effectiveness of the planning controls in place for dealing with coastal hazards in the project area, and provide recommendations for amendments if required.
- Provide a framework to begin considering possible adaptation options (dealt with in the next module).

OUTPUTS

The outputs will be:

- hazard maps for the project area.
- a detailed risk assessment that informs the delivery of the Interim Local Area Report (Module 3).

2. RISK ASSESSMENT

HAZARD MAPPING ANALYSIS

Hazard mapping is an effective way to inform council and the community about the risks from present day and future coastal hazards. Coastal inundation and erosion maps have been developed by the Tasmanian Government, and these can be adapted for the purpose at hand. The coastal hazard area maps produced should show the present day risks and the projected changes for future dates (for example 2050 and 2100).

Coastal inundation maps have been developed for most of Tasmania's settled areas using remote sensing LiDAR (Light Detection and Ranging) elevation data. Aerial mapping using a LiDAR instrument is a cost-effective method of generating digital terrain models and contours. The coastal inundation mapping for Tasmania can be accessed via the *Land Information Systems Tasmania* (LIST). Coastal erosion maps have been developed for all of Tasmania's coastline and have been made available to Tasmanian

councils. These should be utilised as part of this process. *www.thelist.tas.gov.au/app/content/home.*

Inundation mapping should be produced based on LiDAR-derived inundation mapping and related GIS (geographic information system) layers. A GIS expert will be able to prepare consistent maps that integrate various GIS layers, showing the projected new shoreline based on sea level rise and erosion; the maximum extent of erosion from 1% AEP (annual exceedance probability) storm events; the maximum extent of flooding from a 1% AEP event, and the depth of flooding across the project area.

It is important to note that hazard information will always be subject to a degree of inaccuracy for both present day and projected future hazards, and the mapping should be viewed as part of a first-cut risk assessment that will require more technical analysis. Consequently, the basis for making any estimates or limitations should be made clear to all users and noted on any maps published.

The coastal hazard maps and any other available supporting material should form the basis of a written commentary that briefly explains the modelling behind the hazard data, expected accuracy, and any limitations. The commentary, which will be included in the Interim Local Area Reports and Final Local Area Reports (see Module 3 for more details) should also focus on what the main hazards are, where and when they are expected to occur, and may also be supported by any photographs showing the impacts of present and past events.

DETERMINE COST OF RISK

In order to plan for and adapt to coastal hazards, councils need to establish how the risks to property and other assets develop, and what the likely cost of such risks may be. In this instance, risk is defined as the result of total damage, multiplied by the probability of an event occurring. In financial terms, while the total damages of an event may be substantial, the likelihood of the event occurring may be quite low, and the total risk in dollars may be well below the total damages of an extreme event.

In determining risk it is important to consider that a focus on risk alone fails to account for the range of benefits derived from living in and using coastal areas. It may also result in adaptive responses that are too precautionary and that may, for example, prohibit development, or lead to a loss of value in residential property due to loss of beachfront access within areas of risk. In acknowledging both the values and benefits these areas of risk may provide – such as enabling tourism-related businesses, aquaculture and port activities – adaptive responses are more likely to extend the use of such areas for as long as the risks are managed to an acceptable level.

Establishing the expected cost of risk for inundation is usually calculated by external consultants and involves the following activities:

- estimating the elevation level of each property within each project site, by overlaying the Geocoded National Address File (G-NAF) points to the earth surface image (LiDAR);
- obtaining the present-day water surface profile of each area that gives the depth of forecast coastal floods (and riverine floods in some areas) by their return interval or exceedance probability;
- adding the expected sea level rise over time to derive the future water surface profile;
- deriving the current and future inundation depth from floods of certain frequencies by differencing the water surface with the earth surface plus the floor height above the ground;
- estimating the expected costs of inundation risks over time, in consideration of the likelihood of occurrence of different flood events and potential damage at different depths (damage curve);
- discounting the expected damages over time back to today's value, with or without depreciation depending on the circumstances.

The resulting estimated cost of risk gives an indication of how much could be spent on hazard reduction works. It would be considered unrealistic to spend more than the damage avoided. Also, variations on the calculation can be used to determine at what time in the future the risk is high enough to justify expenditure (or increased expenditure) on accommodation or protection works if not justified at present.

ASSESS VALUE OF OCCUPATION OR USE OF HAZARD AREA

Residents in hazardous areas may derive a private property benefit from living in coastal areas. It is important therefore to assess the likely impacts of adaptation measures on the value of such properties, and how they will change over time.

To exclude development from these areas could damage the land value of properties susceptible to inundation. It is therefore worth considering the option of spending money on adaptation options that will reduce risk by an amount commensurate with the amount of lost property value without compromising the amenity of a waterfront location.

Other coastal values such as natural beauty, providing habitat for threatened species, providing opportunities for beach recreation, and providing jobs in areas such as coastal fishing and tourism need also to be given due consideration in assessing the values of the hazardous area. Identifying and assessing many of these values may require external expertise.

These calculations and estimates identify whether the value of occupancy exceeds the cost of risk or protection/accommodation. If it does not, it suggests that retreat would be appropriate. It also identifies the larger values of the area that any approach to adaptation should be protecting or supporting, not undermining. For example, if the beach is highly valued, protection works such as a seawall should not cause it to be lost unless it is effective in protecting something of even higher value.

PLANNING SCHEME REVIEW

In order to analyse how the local government planning framework addresses emerging coastal hazards and assets that may be at risk, a review of the local planning scheme is required. An increased understanding of the draft interim planning scheme may also form the basis for any suggested amendments or improvements. Past evidence has also identified aspects of the Tasmanian planning system that may support or hinder the capacity of local planning schemes to manage coastal hazards.

The review should consider any planning directions the draft interim planning scheme and the regional land use strategy may provide to manage coastal risks. More specifically, the review should consider how the local government planning scheme defines acceptable levels of risk, as well as how it deals with coastal risks that may change and increase over time. Schemes should respond to the identified coastal hazard as specifically as possible using available information, and apply broad-brush rules only in the absence of better information.

The review should conclude with recommendations and suggested changes to the interim planning scheme.

For more information see *Tasmania's planning schemes online. www.schemes.planning.tas.gov.au/Pages/XC.Home/Default.aspx*

3. MODULE CHECKLIST

- ☐ Identified at-risk assets and areas, associated costs, and current planning controls
- ☐ Produced hazard maps of the relevant areas
- ☐ Produced and disseminated risk assessment

4. RESOURCES

Lacey, M.J., Hunter J.R. and Mount R.E., 2012 Coastal Inundation Mapping for Tasmania – Stage 2. Report to the Department of Premier and Cabinet by the Blue Wren Group, School of Geography and Environmental Studies, University of Tasmania and the Antarctic Climate and Ecosystems Cooperative Research Centre: *www.dpac.tas.gov.au/divisions/climatechange/adapting/adaptation_tools/planning_for_sea_level_rise_and_coastal_hazards*

Sharples C., Walford H. and Roberts L., 2013 Coastal Erosion Susceptibility Zone Mapping for Hazard Band Definitions in Tasmania. Report to the Department of Premier and Cabinet by the Blue Wren Group, School of Geography and Environmental Studies, University of Tasmania and the Antarctic Climate and Ecosystems Cooperative Research Centre: *www.dpac.tas.gov.au/divisions/climatechange/adapting/adaptation_tools/planning_for_sea_level_rise_and_coastal_hazards*

Tasmanian Climate Change Office, Department of Premier and Cabinet, 2012 Derivation of the Tasmanian Sea Level Rise Planning Allowances: *www.dpac.tas.gov.au/divisions/climatechange/adapting/adaptation_tools/planning_for_sea_level_rise_and_coastal_hazards*

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