Coastal Climate Change Risk Assessment and Adaptation planning
City of Greater Geelong (CoGG)

Understanding and considering the potential impacts from sea level rise is critical for planning for CoGG's coastline over the next 100 years.

So CoGG joined with the Borough of Queenscliffe to undertake a process to build a detailed understanding of sea level rise and then design a plan for response. While this is a process fraught with difficulty – limited direction from State Government, no clear methodology to follow, and a large number of stakeholders – they have succeeded in building their own understanding as well as the understanding of stakeholders of sea level rise along their coastlines and defined a robust process for others to follow.

Why: Infrastructure, cultural and environmental assets along with our way of life are at risk from rising sea levels

Sea level rise represents a significant risk across Australia due to our love of living close to the beach. While the risk is not immediate, like heatwaves, we are currently building infrastructure today that will shape our vulnerability to sea level rise in future, therefore, sea level rise risk must be understood so our response can start now.

Reference: https://www.environment.gov.au/science/soe/2011-report/11-coasts/4-risks/4-3-sea-level-rise

The journey: Risk and opportunities merged to form the Geelong Queenscliff Coastal Adaptation Project

The Borough of Queenscliff and the City of Greater Geelong, have partnered to understand and respond to the risk of sea level rise in the region. Sea level rise risks were found to be high climate change risks when both organisations undertook adaptation planning in 2009 and 2010.

Then in 2011, the Federal Government completed modelling of hard assets at risk from sea level rise. This first pass assessment was based on a simple bath tube model of sea level rise, which did not take into account the local ocean dynamics or existing coastal protection structures.

With the release of the first pass assessment, the Victorian Government wanted to pilot undertaking some third pass assessments of sea level rise. This pilot was part of the Future Coasts program. Four pilots were chosen with the Corio Bay and Bellarine Peninsula being one of them.

This pilot was the first step in a larger program to understand and respond to the risk of sea level. The entire program that CoGG and BoQ are now committed to includes:

- Local Coastal Hazard Assessment (completed)
- Coastal climate risk assessment (in progress)
- Adaptation planning and community engagement (commenced in 2016).

Other program partners include: with the Department of Environment, Land, Water and Planning (DELWP), the Corangamite Catchment Management Authority (CCMA), Bellarine Bayside Foreshore Committee of Management, and the Barwon Coast Committee of Management.

Local Coastal Hazard Assessment

The local coastal hazard assessment (LCHA) area includes the Bellarine Peninsula and Corio Bay, extending from Point Wilson to Breamlea.

The assessment included:

- Initial modelling of waves and water levels throughout the study area. This provided the model of erosion, inundation and sediment transport.
- A geomorphology assessment used previous work to understand the area in terms of geology, land forms, shoreline types and geomorphic processes.
- An assessment of historical aerial imagery from the 1930s to present was also completed to understand the short term variability and long term trends of the shoreline.

The coastal hazard mapping has collated over 200 sources of data from across all partner agencies, and plotted this against various levels of sea level rise.

The mapping outlines were sea levels might reach under various sea level rise projections and 1% AEP storm surge event.

Taking into considerations current coastal protections within the region, the maps show that under all SLR scenarios, there is much less inundation from SLR than originally mapped as part of the first pass SLR mapping completed by the Federal Government.

The differences between this pilot and the other regions was the mapping of various levels of sea level rise, independent of time. This will enable tipping points and thresholds to be used in the adaptation planning stage, a strategy encouraged as best practice adaptation planning.

Coastal Climate Risk Assessment

The Coastal Risk Assessment is the follow on project. It is utilising the information collected during the LCHA, and now seeking to understand what this means for the region.

The risk approach has been designed based on the Australian Standard 5334 – Climate change adaptation for settlements and infrastructure, but also incorporates components from City of Greater Geelong's risk system.

Stage 1: Establish risk context

Stage 2: Risk identification

Stage 3: Risk analysis

Stage 4: Detailed risk analysis

Stage 5: Risk evaluation

Stage 6: Reporting

Innovative workshop tools were also used to ensure that workshops captured the detailed discussions.

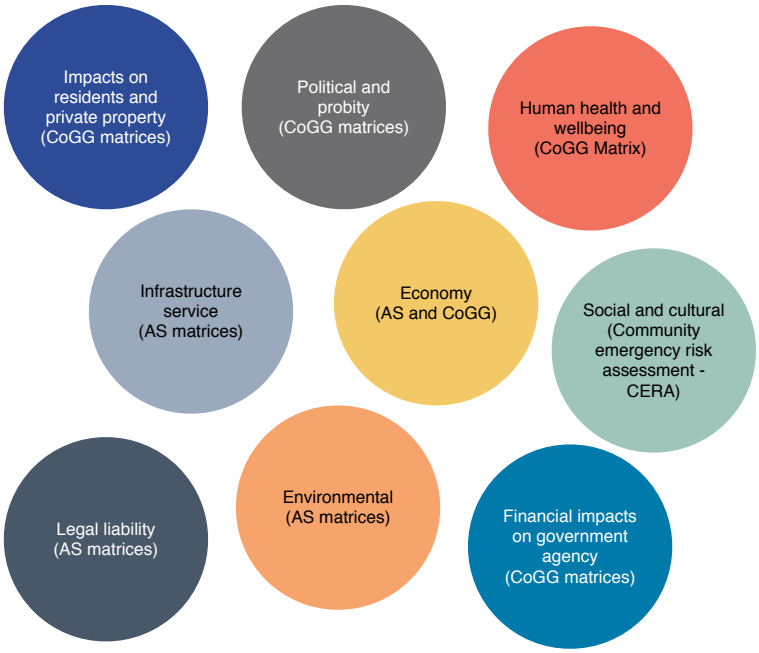
For more information see:
http://www.ourcoast.org.au/resources/Risk%20methodology%20report.pdf

The process

Stage 1: Establish risk context

A broad scope of the risk assessment was set.

To reflect the broad scope, the AS 5334 example risk matrices were updated to capture the broader consequences of concern. The consequence types are listed below.



Likelihood ratings were also developed. These were difficult to develop due to the high level of uncertainty of projections of storm surge.

Linked: Risk assessment matrices

Stage 2: Risk identification

The risk identification workshops were important, as this was the first time most of the workshop participants saw the hazard maps.

The project team tested the workshop methodology with the Project Control Group. The key finding of the test was how easy it was for people to become fixated on the maps, while they were just a tool for risk identification.

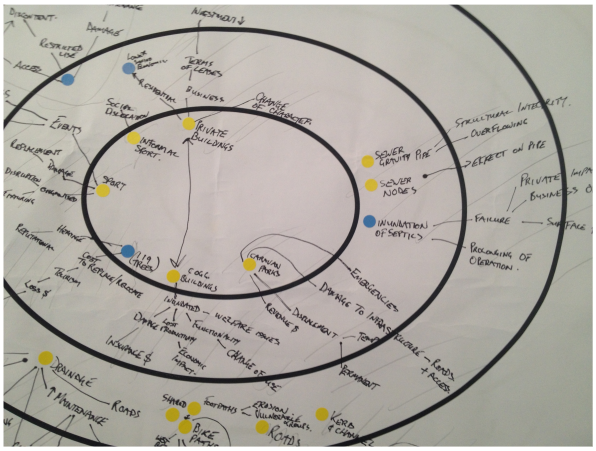
There were 2 risk identification workshops. The region was split into 6 locations, with 3 locations were completed per workshop.

The introductory activity introduced the participants to the maps – focusing on how to read the maps, the different colours for different SLR scenarios, and how to read the legend.

The most important component of risk identification is to specify the risk appropriately.

A risk must be written as:
There is a risk that _____(*uncertain event*) caused by inundation and storm surge at _____m SLR will result in _____ *(consequence)*.

To ensure that the detail of each risk was captured appropriately, concentric circles were used.



The uncertain event is written in the middle circle. The consequences of that event are then listed in the other circles, with the direct impacts captured in the inner circles and the indirect impacts in the outer circles.

Linked:

- Pre-workshop slides - http://slides.com/loopandcompany/coastal-risk-assessment-introduction#/

Stage 3: Risk analysis

This phase of work was focused on prioritising the risks that will undergo more in-depth analysis.

There were 2 risk analysis workshops. This time the workshops were split by asset types to enable the workshop participants to look at the risks from a slightly different angle to the first two workshops.

- Workshop 1 – Environment, drains and water, buildings, utilities
- Workshop 2 – Open space, roads, caravan parks and camping, private assets.

Link:

- Pre-workshop slides - http://slides.com/loopandcompany/risk-analysis

Stage 4: Detailed risk analysis

Now that there is a comprehensive list of rate risks by asset type, there are a number of actions that can be done to test the risk ratings and collate some of the risks, all with the view to assist in adaptation planning.

Reviewing the list of risks, it was clear that micro-location assessment was needed. Adaptation planning would be done at a smaller location basis and understanding which locations were higher priority risks was important to inform this next phase of work.

Conclusion of detailed risk analysis
In 2030, there are 43 risks rated as high, this raises to 59 in 2050 with two extreme risks and 149 highly rated risks and 10 extreme in 2100. As expected the risk profile increases rapidly towards the end of the century.

In terms of asset types, drains is the largest asset type effected by sea level rise and the 1% AEP storm event, as shown below in figure 4. Open space, private property and environmental assets have similar number of medium, high or extreme risks.

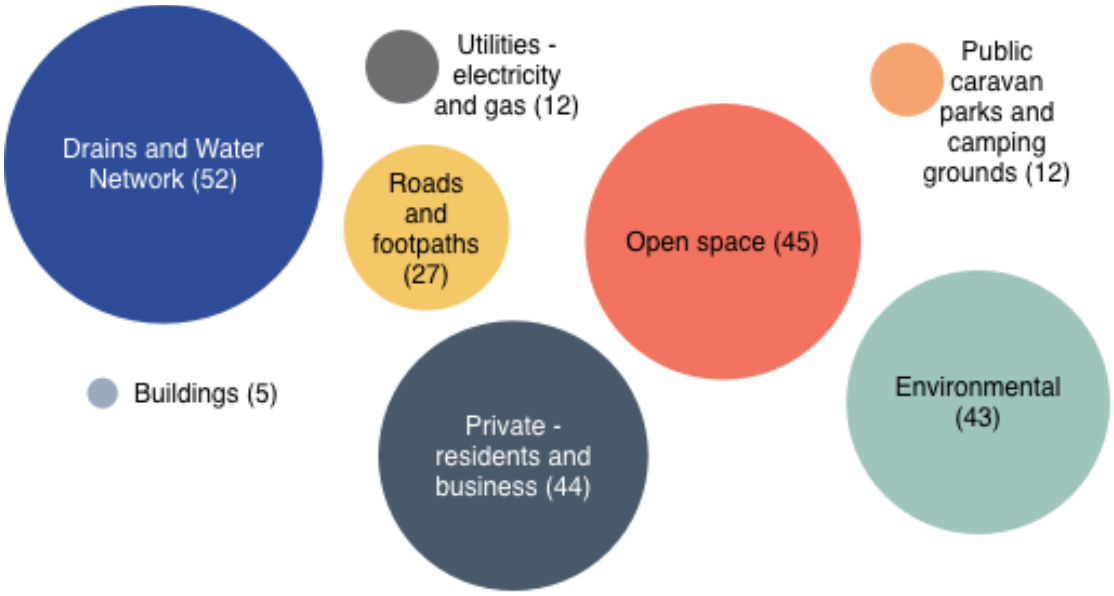


Figure 4: Number of risks by asset type

The number of risks by micro-location is outlined in figure 5. While this shows absolute numbers of risks, this does not demonstrate high risk locations. There more variables that must be considered when determining high risk locations.

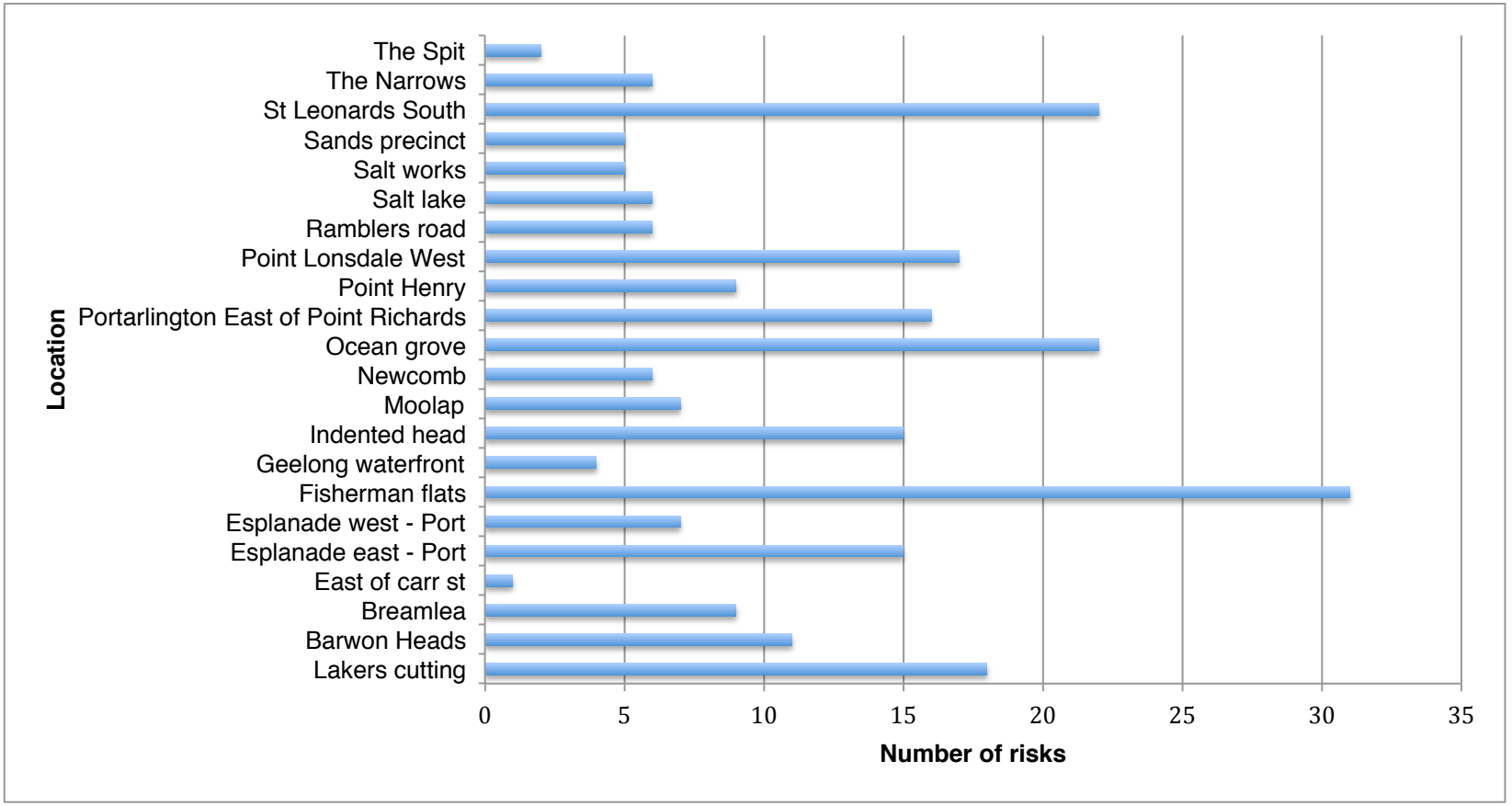


Figure 5: Number of risks by micro-location

The final two steps of the risk assessment process – Risk Evaluation and Reporting – will be completed with the community as they are an important input into the risk evaluation stage, as risk evaluation relies on a subjective assessment as to what is valued in the community.