



| Case Study

Planning to Adapt – the Marks Point and Belmont South Local Adaptation Plan

Background

The City of Lake Macquarie is a community just south of Newcastle, Australia, located along the shores of Lake Macquarie, Australia's largest coastal salt-water lagoon.

Like other low-lying lakeside communities in the area, the 1,200 households of Marks Point and Belmont South are prone to occasional flooding. With rising sea levels, major flooding will become more severe, and more areas will be affected more frequently by minor floods. As well, some areas will be permanently inundated by increasing lake levels.

In 2013 Lake Macquarie City Council initiated a collaboration with the local community to manage these new and increasing risks by developing a Local Adaptation Plan (LAP). The LAP aimed to manage the risks with up to 0.9 metres of sea-level rise (projected to occur by about 2100). This is one of the first such plans in Australia to be developed in such detail at this local scale.

The community suggested 39 possible management actions, ranging from planned retreat to major engineering works to modify floods. The actions were assessed by the community against social, environmental and economic criteria. The assessment showed the best strategy is to manage

the risk of permanent inundation in settled areas is by progressively protecting the lake foreshore while filling low-lying land and raising homes and infrastructure. Natural areas will be managed by planned retreat. Flooding will continue to be managed, as it has been for several years, by requiring new and renovated homes to be built with floor levels above major floods. This includes an allowance for lake level rises during the life of the new asset. Other options, including retreat and a flood levee, were assessed, but failed to meet the criteria. The assessment included a cost-benefit analysis of the proposed strategies.

The Plan identified some areas where new solutions need to be developed, including the financing mechanisms for future protection and modification works, and the coordination and design of the raising of land, roads, drains, buildings and other infrastructure.

Planning to adapt – the Marks Point and Belmont South local adaptation plan

Lake Macquarie, just south of Newcastle, Australia, is one of the largest coastal lagoons on the NSW coast, covering 110 km². Swansea Channel links the lake to the ocean so the lake is subject to the same long-term rises in sea levels as the ocean.







Heavy rain in the lake’s catchments causes the lake to rise, flooding low-lying foreshores and homes. There are 7,500 properties around the lake that would be affected by a major flood, and this rises to 9,500 with 0.90 metres rise in sea level. With this increase in sea level, the number of homes affected by over-floor flooding would increase from about 875 to over 4,000. This makes the Lake Macquarie Local Government Area the most exposed in NSW to the risks from rising sea levels.

The flood risk management plan recommended Lake Macquarie City Council (LMCC) *"undertake a detailed assessment (Local Area Adaptation Plans) for each foreshore management area, in consultation with each affected community, of the implications and adaptation measures available to plan for and mitigate the effects of sea-level rise (flooding and tidal inundation)"*.

Preparation of the first Local Adaptation Plan (LAP) began at Marks Point and Belmont South in August 2013. There will be a review of the experience and outcomes of the LAP before there is a progressive roll-out of plans for other affected foreshore settlements around Lake Macquarie.

Marks Point and Belmont South are well-established settlements on the Pacific Highway, on the eastern shores of Lake Macquarie. This area is residential, with a mix of bungalows and some newer two-storey unit and town house developments. There is a school and a small local shopping centre.

Table 1: Assets at Marks Point and Belmont South at risk from lake flooding and permanent lake level rise. Source: Lake Macquarie City Council 2015.

Assets	Assets at risk from hazard		
	Major (1%AEP) flood	0.9 metres rise in lake levels (permanent tidal inundation)	Major (1%AEP) flood and 0.9 metres rise in lake levels
 Homes 1190	237 homes with over-floor flooding	391 properties with water lying beneath the building	939 homes with over-floor flooding
 Public land 19.83 hectares	13.18 hectares	8.17 hectares	14.75 hectares
 Private land 97.19 hectares	42.91 hectares	14.07 hectares	73.0 hectares
 Roads 23.91 kilometres	10.1 kilometres	4.0 kilometres	17.6 kilometres
 Drains 9.2 kilometres	4.5 kilometres	1.8 kilometres	7.6 kilometres
 Wetlands 234 hectares	126.1 hectares	73.7 hectares	155 hectares



Figures 1 and 2: Lake flooding at Marks Point in 1949 (left) and 2007 (right). The flood level in the photos is roughly equivalent to mean lake levels if there is 0.9 meters of sea-level rise, providing a good proxy for the effects of future permanent. Source: Lake Macquarie City Council 2015.

Much of the area is low-lying and poorly drained, having been built on reclaimed hind-dune and foreshore wetlands. This makes it vulnerable to lake flooding, with local roads, the Pacific Highway, and foreshore areas frequently inundated by minor floods. With rising sea and lake levels, minor floods will become more frequent, major floods will become higher, and low-lying land will become permanently inundated.

Making a plan

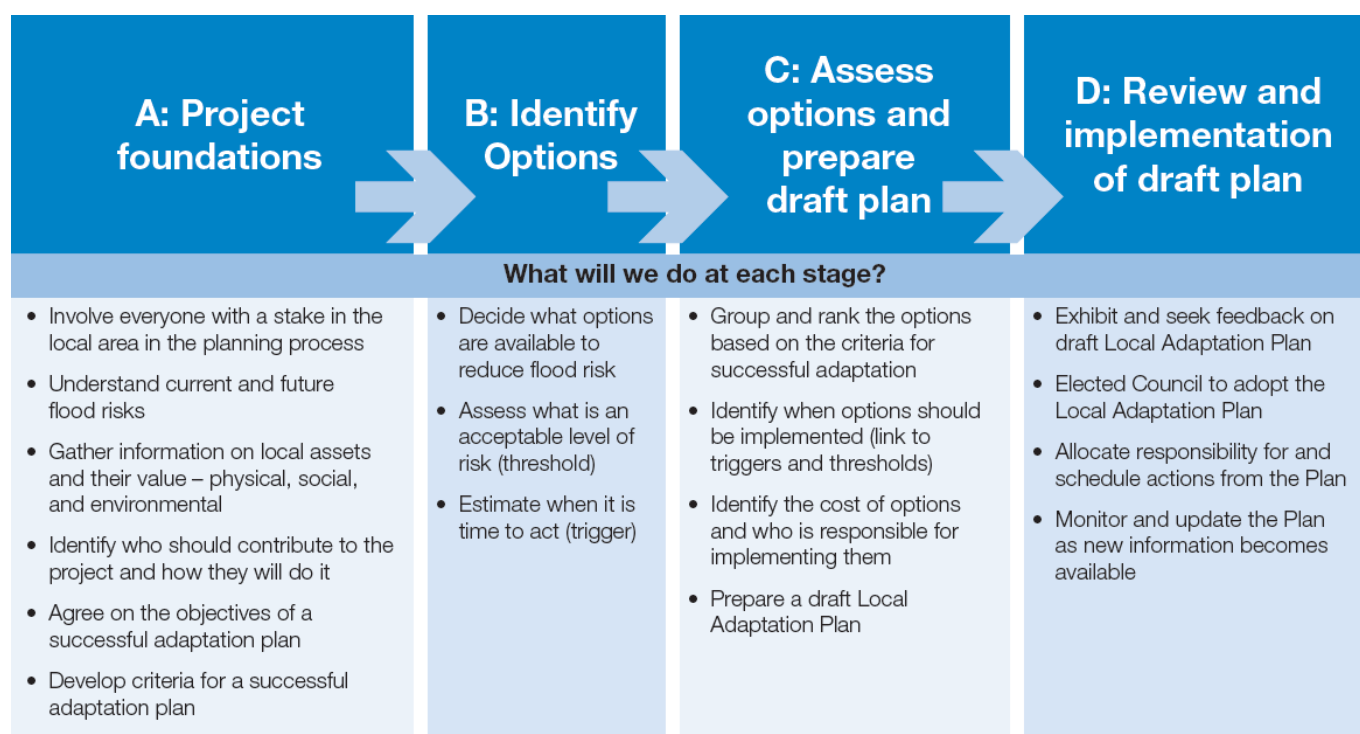
Hazard and uncertainty are likely to be a source of contention in any community, especially when mixed with climate change. In anticipation of community concerns, LMCC committed to developing the LAP in collaboration with the community.

The initial community workshops sought community agreement on the principles and process for adaptation planning. The workshops agreed that an adaptation plan should:

- acknowledge that risks are location specific and are best addressed at the local level
- recognise that being prepared requires input from landowners, business owners, residents, special interest groups, community organisations, Council, and state government agencies
- be timed so the actions are implemented when they are required to accommodate increases in risk
- identify the criteria for a successful outcome (economic, social, environmental)
- provide a level of certainty about how and when future actions will be required, yet be flexible enough to change with changing information.

The participants adopted a four-step program for the development of the plan and the collaboration process. In practice, the program was more iterative in its application than indicated by the linear flow in the diagram, with the participants often revisiting and revising actions taken earlier on in the process.

Table 2: The community engagement process for adaptation planning, agreed between residents, Council and other agencies. Source: Lake Macquarie City Council 2013.



Project foundations

LMCC prepared a large number of background studies, in addition to the flood study, prior to engaging the community. These included:

- wave run-up, overtopping, and foreshore recession assessment
- groundwater response to sea-level rise
- wetland retreat assessment
- guidelines for adaptable flood-resilient housing
- resilience of housing stock to natural disaster and the impact on insurance premiums
- design for adaptable foreshore protection works
- historic changes in lake levels
- effect of sea-level rise on the tidal range in the lake
- monitoring of improved and unimproved property values.

Identifying the options

Through surveys and workshops, the community was asked to suggest potential ways to manage the risks from flooding and rising lake levels. The 39 options suggested by the community covered proposals ranging from flood mitigation using big engineering works, such as modifying the lake entrance, to incremental changes to accommodate the risk, such as using more flood-resilient materials in house and infrastructure construction.

Assessing the options

The community suggested the options could be screened using four 'showstopper' criteria:

- Will it work?
- Will it help maintain community lifestyle?
- Will the environmental impacts be acceptable and manageable?
- Will the benefits outweigh the costs?

Community volunteers worked for nearly a year to review the options against these criteria. In some cases, specialist external advice was requested, or additional studies were commissioned. Twenty-two of the proposed options were assessed as

'warranting further consideration', with the remaining 17 failing to meet the showstopper criteria.

Mitigating lake flooding is impractical, so three main management strategies were considered:

1. Retreat – relocate or abandon assets as they become affected by rising water levels
2. Protect – prevent the land from becoming inundated by building levees, dykes or filling land
3. Accommodate – by adapting buildings and services to function even when they are sitting above water

The protect strategy was preferred. It met, in particular, the criteria to maintain community lifestyle and wellbeing, and that benefits should exceed costs. The business as usual/retreat option was disruptive to lifestyle and the costs outweighed benefits due to the high value of land and assets abandoned or damaged.

The plan

The Marks Point and Belmont South LAP addresses two main hazards as lake levels rise: lake flooding, which will increase in frequency and severity; and the permanent inundation of low-lying land and assets.

Managing the increased flood risk is 'business as usual', using measures already adopted for flood-affected communities around the lake including:

- construction levels for new assets based on the increased flood hazard over the life of the asset
- avoid placing new assets in high hazard areas
- encourage innovative, adaptable, and flood-resilient asset design.

Permanent inundation is managed by the 'protect and raise' strategy, designed to raise land levels and infrastructure roughly in step with, but ahead of, increases in mean lake levels, ensuring there is no increase in risk despite the progressive increase in hazard.

Actions to manage the risks from changing lake and flood levels are best delayed until they are required; 'plan for the worst, but only act when necessary'.

This has the added advantage of addressing some of the uncertainty, and even disbelief, around the threat from sea-level rise; if levels don't rise as fast or as far as projected, then the actions won't be necessary.

Actions to be taken over time

A

Construct revetments (sloping rock seawalls) to protect the foreshore from tidal inundation and erosion



Rock revetment protecting filled foreshore land at Speers Point

B

Fill land to maintain ground levels above the lake and groundwater



Units built on filled land at Haddon Crescent, Marks Point

C

Raise and improve the design of infrastructure such as drains and roads to match landfilling and to maintain their function



A stormwater drain at Swansea filled with lake water at high tide. Rising lake levels will make draining low-lying areas more difficult

D

Construct new buildings with floor levels above projected flood levels



A new home at Belmont South with floors built above the 1-in-100-year flood level including an allowance for the projected rise in lake levels

E

Raise remaining old homes above projected flood levels (if required)

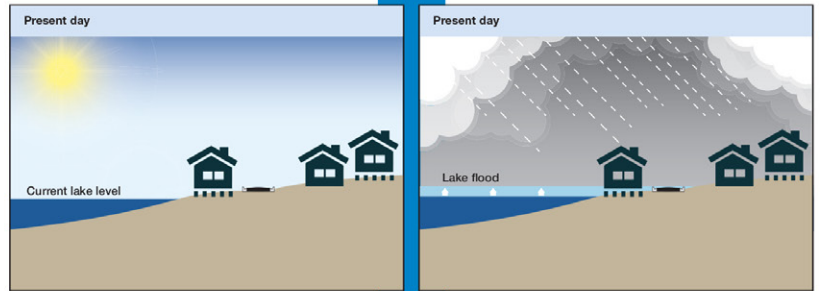


An old home raised above flood levels in Townsville, Queensland

There are 16 additional management actions to reduce current and future hazards from lake flooding, local nuisance flooding, and rising lake levels.

Actions to reduce current and future hazards from coastal erosion and storms are addressed separately in the draft Lake Macquarie Coastal Zone Management Plan.

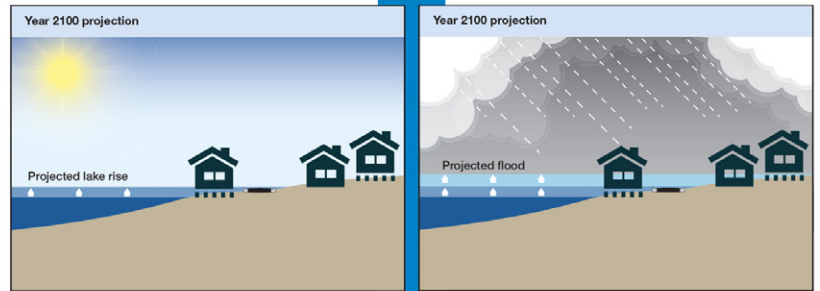
How it will work



Example of a typical foreshore community

New homes are built above the flood level to manage lake flood risk

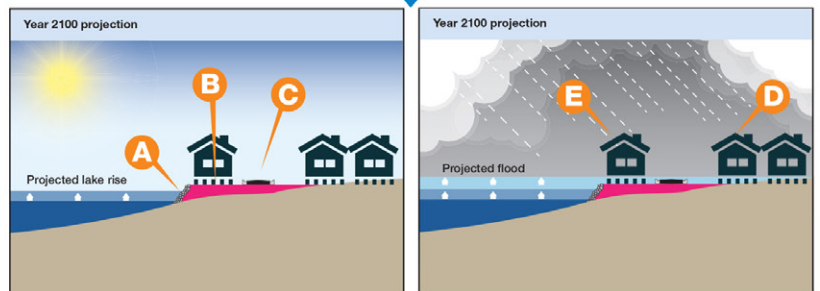
If we do nothing...



Lake levels are gradually rising, a trend that is expected to continue and accelerate, permanently inundating low-lying foreshores

Higher lake levels mean lake floods will worsen, flooding foreshore homes

If we follow the proposed Marks Point and Belmont South adaptation actions...



Adapted community under normal conditions protects against permanent inundation from increased lake levels

Adapted community raises floor levels above lake floods

Figure 3: The 'protect and raise' strategy adopted at Marks Point and Belmont South. Source: Giles et al. 2015.

The other trigger for implementing adaptation actions is the scheduled renovation or renewal of existing assets. Homes, roads, schools, drains, revetments and playing fields have asset lives of between 30 and 100 years. Over the planning period of the LAP – 85 years – most of the assets in the planning area are likely to be replaced or upgraded, and the new asset will be required to be built with the increased construction standards required to protect against or accommodate the increasing hazard.

Issues remaining and lessons learnt

Climate change science

One of the most common and persistent issues raised by the community was concern about the credibility of climate change science and sea-level rise projections. The Council approach was:

- Council takes its advice from experts and questions about the validity of the science needs to be raised with them
- Council is monitoring local lake levels and beach recession and reports the results regularly to the community
- Council will review their sea-level rise benchmarks in the light of new scientific information or changes in Government policy
- where practical, triggers for adaptation actions will be related to the rates and levels of sea-level rise so, if the projections change, the timing of actions will change accordingly.

This approach seemed to improve acceptance of adaptation planning, even when people were not convinced about climate change. Some participants observed that there appeared to be a link between apprehension about management actions such as planning controls, and denial of the science. It is difficult to determine which one leads to which.

Future discounting

Immediate decisions and experiences are considered more important than ones that may arise in the future. Therefore, future major hazards, such as permanent inundation, are assessed by the community as less important than minor but immediate hazards, such as poor stormwater drainage. This tendency, combined

with short funding and political cycles, means it will be politically difficult to allocate resources to address future hazards such as inundation, especially if it is regarded to be at the expense of drainage maintenance or other immediate concerns.

There is also the effect of future discount rates to the cost benefit analysis. The NSW Treasury recommends a rate of 7%, which makes both costs and benefits realised beyond about 2050 count for little. This makes the timing of large capital works such as seawalls or flood levees critical. If the construction cost is realised a long time before the benefits then the costs will nearly always outweigh the benefits due to the effect of the discount rate.

However, the relatively small scale of the works in the Marks Point and Belmont South LAP, and the ability to stage the works progressively in step with the increasing hazard, makes the discount rate less critical. Some other jurisdictions use lower discount rates (~2%) when assessing major public infrastructure.

Benefits, costs, and who pays?

The effect and acceptability of costs and benefits not only depends on the ratio of one to the other, but also on who pays the costs and who enjoys the benefits. Current arrangements and expectations are that Council and other public authorities will provide the foreshore protection works and infrastructure improvements. While this provides some public benefit, the main beneficiaries are the private owners of foreshore properties.

Implementing the Marks Point and Belmont South Plan requires more work to analyse the distribution of costs and benefits, and the social effects of costs that fall on people who are unable to pay. New financial models are needed to allow councils and other public agencies meet increased maintenance costs and future capital costs of adaptation works. State and Federal Government will be important partners in this discussion.

Property values and insurance affordability

The community formed a direct link between local adaptation planning and perceived falling property values and issues of insurance affordability.

Council monitoring of unimproved land values and real estate sales figures in affected areas showed no clear trend. However local real estate agents reported that some individual property sales have

been affected by talk of future sea-level rise. By providing some certainty and consistency about the management of the hazard from rising lake levels, at least for the next 80-100 years, it is hoped the LAP will help alleviate these concerns.

Similarly, the community attributed increases in the cost of flood insurance to maps of future (2100) flood extents and believed insurers use information on Section 149 certificates to determine which houses are at risk from flooding. This view persists despite numerous assurances from the industry that this is incorrect.

The current 'commercial-in-confidence' secrecy that surrounds the pricing of retail insurance and the inconsistencies in retail pricing confuse consumers and make them distrustful of the methods and motives of the industry.

Considering retreat

Much of the community hostility to local adaptation planning arose from a fear of a retreat strategy. Some in the community demanded Council rule this out before they would consider participating in adaptation planning. To maintain the integrity and transparency of the assessment process, Council insisted all management options should be properly considered and assessed on their merits.

The assessment showed that planned retreat was not justified at Marks Point and Belmont South, although the LAP does allow the planned retreat of local wetlands. However, having communities engage in a structured assessment process that may support an option for retreat, with its implied social dislocation and loss of property value, remains a significant obstacle to future collaborations.

Beyond 0.9 metres

The elephant in the room during the adaptation planning process was that sea-level rise is projected to continue for several hundred years, even with a low emissions scenario, well beyond the 0.9 metres accommodated in the adaptation plan. However, the uncertainties about climate change and sea-level rise projections increase with time, and the usefulness of planning for far-distant possibilities decreases accordingly. The asset and functional life of the developments covered by local government planning rarely extend beyond 100 years, except perhaps for some water and sewerage infrastructure.

The relative certainty provided to residents by the Marks Point and Belmont South LAP, by planning for up to a 0.9 metres increase in sea levels, provides the community the security and time to plan beyond 0.9 metres as the projections become more certain, and adaptation options become more sophisticated.

Critically, none of the adaptation options proposed in the LAP are likely to limit or prevent the community from choosing different options or strategies in future.

Conclusion – adapting to adaptation planning

Whether the Marks Point and Belmont South Local Adaptation Plan is an appropriate response to the wicked problem of rising sea levels will not become clear for many years. However, reflecting on the experience of developing the LAP may provide some useful guidance for those that follow. From the experience of the Marks Point and Belmont South LAP, good adaptation planning requires:

- close collaboration with those affected
- good planning frameworks and decision-making frameworks
- consistent political support
- good science, hazard and risk information – although this is not sufficient on its own
- flexibility and patience
- new knowledge and new planning and financial frameworks but, until LAPs are developed, it is hard to identify and argue for these.

References

Giles, G., T. Boyle, and H. Stevens, 2015: Planning to Adapt: The Marks Point and Belmont South Local Adaptation Plan. Coastal Conference 2015. Accessed 15 June 2017. [Available online at <http://www.coastalconference.com/2015/papers2015/Greg%20Giles%20Full%20Paper.pdf>].

Lake Macquarie City Council, 2013: Planning for Future Flood Risks, Newsletter 1, Lake Macquarie City Council, Speers Point, NSW. Accessed (accessed 15 June 2017). [Available online at <http://haveyoursaylakemac.com.au/future-flood-planning/documents/1215/download>].

Lake Macquarie City Council, 2015: Planning for Future Flood Risks: Mark Point and Belmont South Local Adaptation Plan – Final Draft. Lake Macquarie City Council, Speers Point, NSW. Accessed 15 June 2017. [Available online at <http://haveyoursaylakemac.com.au/future-flood-planning>].

Further reading

Lake Macquarie City Council's website: Marks Point and Belmont South Local Adaptation Plan: <http://haveyoursaylakemac.com.au/future-flood-planning> (accessed 15 June 2017).

Other supporting studies and engagement materials: <http://haveyoursaylakemac.com.au/future-flood-planning/documents> (accessed 15 June 2017).

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