

ESTUARY MANAGEMENT PROGRAM CASE STUDY

Rowland Reserve foreshore stabilisation

Pittwater Council has constructed an environmentally friendly seawall (Figure 1) to control erosion along a popular foreshore reserve with the assistance of \$145,000 from the Estuary Management Program.

Completed works have halted the loss of foreshore and increased valuable estuarine habitat, while improving public access and safety.



Figure 1: Part of the completed seawall with a bench of planted mangroves.

Project need

Erosion had led to a loss of foreshore and sediment impacting on seagrass beds

The northern edge of Rowland Reserve, located at Bayview in Pittwater, had a well known ongoing erosion and sedimentation problem. The Pittwater Estuary Processes Study (Lawson and Treloar, 2003) and Pittwater Estuary Management Study (WBM, 2006) had it earmarked as a high priority erosion site for rehabilitation. The eroded sediment was a potential threat to existing seagrass beds through smothering and increased turbidity. The continual erosion was also resulting in loss of foreshore area and public recreation space. Prior to the works, the northern edge consisted of a dangerous steep collapsing scarp with a 1.2m dune fence on the high side (Figure 2).

Over the years Rowland Reserve has changed dramatically from its natural state of intertidal flats, due to large scale dredging and reclamation which started around 1940 (Figure 3). The current reserve was formed somewhere between 1970 and 1974 through reclamation and since then the northern margin has been eroding at nearly 1m a year from wave action.



Figure 2: Erosion escarpment prior to rehabilitation works.

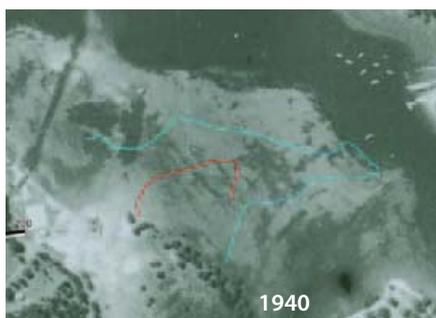


Figure 3: Historical aerial photos show the changes from intertidal flats in 1940 to the reclaimed reserve in 1974, and reserve alignment in 2005, after a recession of around 20m. The red line shows the position of 2005 erosion escarpment and the blue line shows the 2005 tidal flat dropover. (Photos: OEH)

Project steps

Understanding the erosion problem

A \$15,000 grant from the Estuary Management Program enabled council to study the scale and cause of erosion and prepare designs to manage the foreshore. Consultant Worley Parsons was engaged by council to:

- Develop a preliminary understanding of the physical coastal and estuarine processes driving sediment movement along the shoreline. This was largely based on photogrammetric analysis of historical aerial photography and comparisons between recent and historical hydro-surveys (supplied by OEH).
- Quantify rates of erosion and sediment movement volumes for past, current and future behaviour based on the photogrammetric analysis.
- Use the analysed data and information to develop a conceptual model of sediment movement (Figure 4), and assess the advantages and disadvantages of several feasible management options including beach nourishment, construction of groynes and foreshore revetment combinations.
- Outline the advantages and disadvantages of management options at a community meeting and facilitate consensus on the most suitable approach.

Anecdotal evidence had suggested that the recession at Rowland Reserve was mainly due to longshore drift and movement of sand east to form the spit. However, analysis of the photogrammetry and hydro-surveys revealed that the spit had not grown noticeably or had any perceivable shallowing of the surrounding channels.

The erosion was a result of the reclaimed land being out of equilibrium with the prevailing wind-wave climate, resulting in waves (up to 1m) undercutting the base of the bank, leading to collapse of the upper sandy soil from the steep lower mud profile (Figure 5). The erosion was expected to continue until the cross shore profile was in equilibrium with the prevailing wind-wave climate. Eventually this would have resulted in a foreshore with a very flat slope, similar to the original tidal flats prior to reclamation, as well as the loss of popular foreshore parkland.

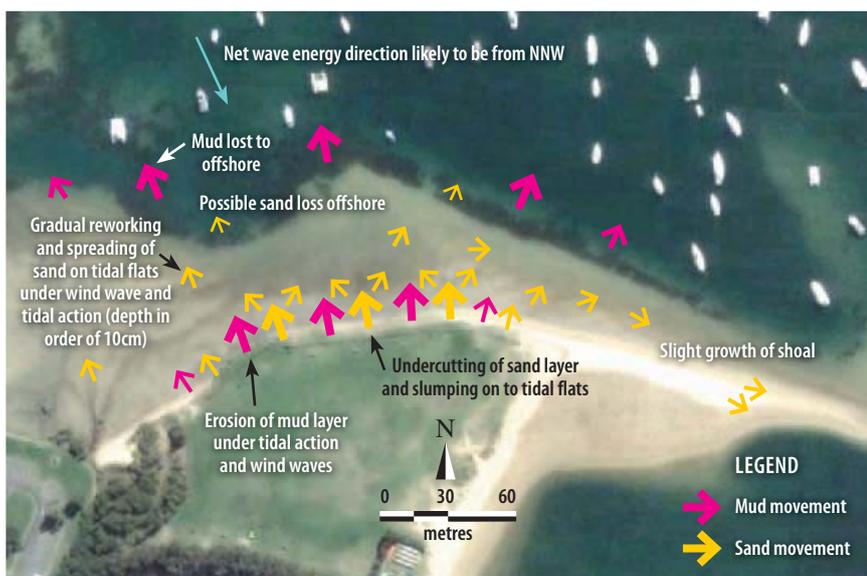


Figure 4: Conceptual model of sediment transport processes at Rowland Reserve (Worley Parsons, 2008).



Figure 5: Erosion escarpment showing collapse of upper sandy soil.

“ Analysis of photogrammetry and hydro-surveys found that the erosion of Rowland Reserve was a result of the reclaimed land being out of equilibrium with the prevailing wind-wave climate. ”

Danny Wiecek, Senior Natural Resource Officer, Office of Environment and Heritage.

Designing and building an environmentally friendly seawall to control the erosion

The final design favoured by council and the community (Figure 6) entailed a constructed benched rock seawall (revetment) with mangroves and saltmarsh in separate bays at the western end, a designated beach area for foreshore access, and a conventional rock seawall at the eastern end. This provides a range of environmental and recreational opportunities and helped to keep costs down. The seawall was backed by plantings of native riparian species to maximise environmental outcomes. This project has balanced the need to expand surrounding vegetation communities with minimising the impacts on views. This was achieved by having mangroves at the western point only, where they already existed. Low-lying riparian species were also planted along the whole foreshore for unobstructed views. This follows recommended design principles outlined in the *Environmentally Friendly Seawall Guidelines* (DECC and SMCMA, 2009).

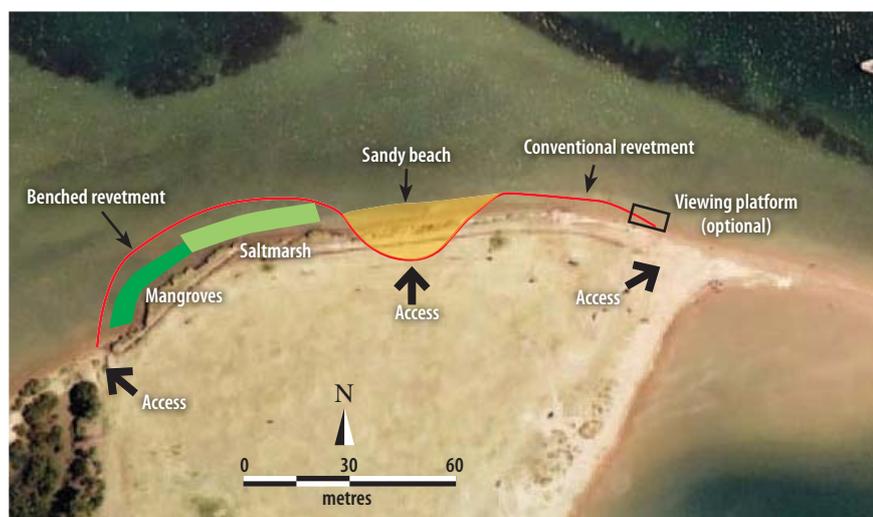


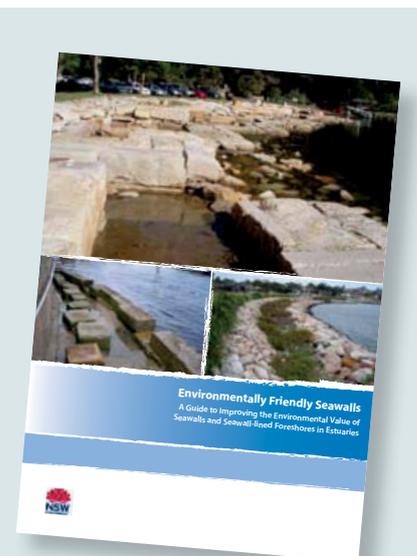
Figure 6: Preferred design implemented by council. (Photo: Worley Parsons, 2008)

Successes and lessons learnt

The seawall has successfully controlled the erosion and community feedback has been very positive. The transplanted mangrove seedlings have established well with crabs making the area home. This success is attributable to cutting large clumps of dirt around the locally sourced seedlings to ensure the roots remained largely undisturbed; only transplanting young seedlings of around 20-40cm in height; and having adequate wave protection from the front rock revetment. These factors are all critical to successful mangrove transplanting (Stewart and Fairfull, 2008).

This contrasts with council's efforts over a decade ago when the batter of the bank was regraded and stabilised with jute matting, followed by mulch and plantings on the top of the bank and a trial of mangrove seedlings planted in front of the bank. The mangrove seedlings all died from a lack of protection from wave impact, which is particularly important during the mangrove establishment phase. Regrading the bank and planting it out also proved unsuccessful, due to the force of waves on the bank being too great for this form of erosion control.

The saltmarsh plantings have been slower to establish, with some species having high mortality rates. Other saltmarsh construction sites have reported similar slow establishment, due to factors such as the quality of the soil and lack of organic matter (Paul and Farran, 2009). Manual addition of organic matter into the



Visit environment.nsw.gov.au/estuaries/index.htm for a copy of OEH's *Environmentally Friendly Seawalls Guide* to help improve the environmental value of seawalls and seawall-lined foreshores in estuaries.

“ The environmentally friendly seawall has stopped erosion, increased important habitats and provided public access to this valued community resource.

A special mention goes to council's staff who constructed this project. These skills have been utilised at subsequent projects. ”

Chris Hunt ,
Director Urban and
Environmental Assets,
Pittwater Council

sediments at these sites has led to vastly enhanced saltmarsh establishment (Paul and Farran, 2009). Council has constructed similar saltmarsh projects adjacent to Rowland Reserve that have taken up to five years for good establishment. This has relied on natural soil improvement through the decomposition of wrack, washed over the area over time, which is council's preferred approach for this saltmarsh project.

The beach, created in the middle of the revetments to enable public access, has undergone some minor erosion from overland flow and may need some nourishment or beach scraping over time.



Figure 7: Use of geotextile fabric behind the boulders and sediment control barriers during construction.



Figure 8: Bench of saltmarsh within seawall (top); Riparian vegetation behind the seawall to maximise habitat diversity (middle); Beach for foreshore access showing boulders used to create a small offshore reef (bottom).

Project design specifics

- Conservative 1m design wave height for the conventional revetment style seawall and offshore bunds and 0.8 m design wave height for the rock revetment at the front of the mangrove and saltmarsh benches.
- Around 2500 tonnes of sandstone boulders used, predominantly sourced from local excavation sites. Boulders were underlain with geotextile fabric to control loss of fine material (Figure 7).
- Around 4500 plant species from a range of endemic species planted, including saltmarsh grown from local provenance seeds and mangrove seedlings sourced from an adjacent established mangrove community (Figure 8).
- Rock mulch was used in the terrestrial planting area above the revetment to minimise any potential damage from overtopping.
- Two bench heights accommodated different tidal inundation requirements for saltmarsh and mangroves. These heights were obtained by surveying surrounding heights of established saltmarsh and mangrove communities.
- Seawall and benches designed to accommodate sea level rise by allowing for increases in their height over time.
- A design beach slope of 1 Vertical: 12 Horizontal was used to minimise cut and disturbance of potential acid sulphate soils.
- Modifications to the original design included a fence to exclude public and dog access to the revetment, several large boulders placed midway in front of the beach as a small offshore reef to dissipate wave energy and reduce any potential minor beach erosion (Figure 8), as well as treatment of potential acid sulphate soils followed by burial behind the seawall.

QUICK FACTS

Project overview	Design and construct an environmentally friendly seawall to control erosion, provide marine and terrestrial habitat and improve foreshore access
Council and location	Pittwater Council, Rowland Reserve at Bayview, Pittwater, Sydney's northern beaches
Cost and time	Total project cost for design and construction \$435,000 Construction completed over eight months in 2009
Funding and technical support	Design – \$15,000 and technical support from the Estuary Management Program Construction – \$130,000 and technical support from the Estuary Management Program – \$100,000 from the NSW Environmental Trust
Key project facts and outcomes	180m of foreshore remediated, of which 140m is seawalls 4500 native plants established, including saltmarsh and mangroves
Project Partners	Construction by Pittwater Council staff NSW Department of Primary Industries (Fisheries) Hawkesbury-Nepean Catchment Management Authority NSW Environmental Trust

Planning and approvals

- No development consent is required for bank erosion stabilisation works under the *State Environmental Planning Policy (Infrastructure) 2007* by public authorities, therefore works were considered under Part 5 of the *Environmental Planning and Assessment Act 1979* through a review of environmental factors.
- A permit was required for reclamation under the *Fisheries Management Act 1994* from Department of Primary Industries (Fisheries), as the seawall was built seaward of the erosion scarp in the intertidal zone.
- A permit was required for dredging under the *Fisheries Management Act 1994* from Department of Primary Industries (Fisheries), as sand was sourced from the adjacent spit to create the beach in-between the revetments.
- A permit was required for harm to marine vegetation under the *Fisheries Management Act 1994* from Department of Primary Industries (Fisheries), due to transplanting of mangrove seedlings sourced from adjacent mangrove stand.
- A permit was required under the *Threatened Species Conservation Act 1995*, from the Office of Environment and Heritage for the collecting of saltmarsh seed for propagation.
- Land Owners Consent under the *Crown Lands Act 1989* was required by Department of Primary Industries (Catchments and Lands), as part of the land on which the works occurred is Crown land.

Find out more

Phone the Office of Environment and Heritage on 131 555 or Pittwater Council on (02) 9970 1111 about the project.

Visit environment.nsw.gov.au/coasts/estuarygrants.htm for information on technical and funding assistance available under the Estuary Management Program.

References

- DECC and SMCMA (2009). *Environmentally friendly seawalls: A guide to improving the environmental value of seawalls and seawall-lined foreshores in estuaries*, Department of Environment and Climate Change, Sydney. Visit environment.nsw.gov.au/estuaries/index.htm for a copy.
- Lawson and Treloar (2003). *Pittwater Estuary Processes Study*, Report J1942/R1945, for Pittwater Council.
- Paul, S. and Farran, M. (2009). *Experimental and field regeneration of coastal saltmarsh within Sydney Olympic Park*, *Wetlands (Australia)* 25(2).
- Stewart, M. and Fairfull, S. (2008). *Mangroves*. Primefact 746, NSW Department of Primary Industries: http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0020/236234/mangroves.pdf (accessed 31 August 2012).
- WBM (2006). *Pittwater Estuary Management Study*, Draft Report, May, for Pittwater Council.
- Worley Parsons (2008). *Rowland Reserve, Bayview, proposed foreshore stabilisation, review of environmental factors*, Issue 3 October, for Pittwater Council.

Photos: unless otherwise stated, photos are from Daniel Wiecek (OEH)

OFFICE OF ENVIRONMENT AND HERITAGE 59 Goulburn Street, Sydney NSW 2000.

PO Box A290, Sydney South NSW 1232. **Phone** +61 2 9995 5000 (switchboard) **Fax** +61 2 9995 5999 **TTY** +61 2 9211 4723

Email info@environment.nsw.gov.au **Website** environment.nsw.gov.au October 2012 OEH 2012/0799 ISBN 978 1 74293 848 6