# Breakwater maintenance and upgrades: multi-use and eco-features

Guidance
for asset owners,
designers and project managers

NSW GOVERNMENT

www.marine.nsw.gov.au

## Disclaimer

These guidelines provide general advice that does not take into account the specific circumstances of existing or proposed breakwater structures. There could be other approaches that are better for the breakwater structure you are considering. Use these guidelines for ideas as you do your own investigations. We do not have any liability for how you use the guidelines or the resulting social, cultural, economic and environmental impacts.

*The following groups contributed to this publication:*
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*Cover image: Coffs Harbour, inner harbour*

## Aboriginal nations acknowledgment

The Department of Primary Industries acknowledges that it operates on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect to elders past, present and emerging. Aboriginal people have cared for Sea Country for thousands of years and through thoughtful and collaborative approaches to our work, we have an opportunity to work together to ensure a healthy sea country for now and into the future.

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# **Key focus areas** for better breakwaters

*Coffs Harbour, inner harbour*

## These guidelines are for asset owners, designers and project managers who are planning breakwater maintenance and upgrades.

They were developed in consultation with asset owners and managers, design and coastal engineers, hydrologists, biological scientists and government agency staff involved in environmental impact assessment.

The key focus areas identify multi-use and eco-features that can be incorporated into planning, design and construction of trained river entrances, armoured harbours and some sand trapping groynes.

We hope these guidelines will help make best practice become standard practice.

1. **Submerged habitat**
2. **Intertidal habitat**
3. **Terrestrial habitat**
4. **Aquatic recreation**
5. **Land-based recreation**
6. **Education and awareness**
7. **Rehabilitation and remediation**
8. **Aesthetics**
9. **Cultural values**
10. **Aboriginal cultural values**
11. **Land-use activation**

# A healthy coast and sea, managed for the greatest wellbeing of the community, now and into the future




# NSW Marine Estate Vision

Breakwaters and training walls control where and how our rivers meet the sea. In NSW, many breakwaters were built to improve shipping in the late 1800s and early 1900s. More works in the 1960s supported commercial fishing activities and a burgeoning recreational boating sector. They also protect infrastructure and sometimes create harbours.

These changes have also affected the environment as a result of the more direct connection between river and sea. It changes how tides move through estuaries, causing erosion and shoaling of shorelines, and changes to sand movement at the structure and sometimes many kilometres away. It can take more than 100 years for a trained estuary to adapt to its new state. These changes are a risk to the environmental, social, cultural and economic values derived from the marine estate.

Each breakwater and training wall is unique. The mix of uses and how eco-features are designed, installed and operate are also unique to each site. Sometimes the greatest difference can be between a waterway's northern and southern breakwaters.

All breakwaters have environmental impacts, but there are some great examples of where multi-use and environmentally friendly outcomes have already been achieved.

All breakwaters and training walls in NSW are on Aboriginal land. Many are close to sites of cultural heritage and value to Aboriginal people. In some cases, infrastructure and altered tidal movement has created erosion that has obstructed or covered these sites and may in the future disturb or uncover others.

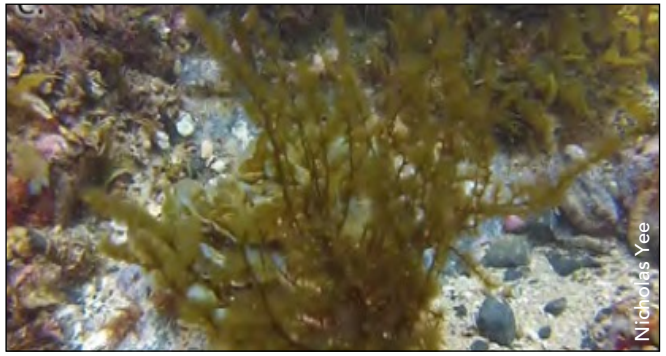
The Marine Estate Management Strategy recognises both the effects on environmental values and the importance for social, cultural and economic values. These guidelines aim to support these values.

*Coffs Harbour, inner harbour*

# 1 Submerged habitat

Mimic natural habitat features to improve complexity and diversity of submerged habitat while maintaining or enhancing engineering performance


*Rocks at the structure's toe create complex habitats, Coffs Harbour northern breakwater upgrade*




*Rock scree creates ideal habitat for micro-algae and was used at the Coffs Harbour northern breakwater upgrade*

## DESIGN

- Place armour—5 to 8 tonnes of rock can be an ideal size—to create crevices, overhangs and swim-throughs
- Install rock at the base of the structure to form a convoluted toe that maximises the habitat rich sand rock edge
- Place a scree layer of natural (endemic) rock at the toe of the structure to maximise habitat including for macro algae
- Install detached structures to create gullies or embayments
- Use materials that encourage settlement of desired marine species; for example, cast Hanbars using eco-friendly concrete mixes
- Use a concrete casting process for Hanbar units to enable:
  – varied colours and surface textures for habitat forming crevices and ridges
  – creation of lifting points using pipes (about 300 mm diameter)—these voids can become habitat spaces
- Use artificial reef units such as 'Reef balls' and seahorse hotels
- Affix complex habitat tiles to uniform structures to imitate natural rocky habitats
- Reuse local oyster shells (from the same estuary) to promote re-establishment of oyster reefs and the natural cementation of oysters and other shellfish and encrusting algae and invertebrates
- Wherever possible, use natural stabilisation methods, such as kelp or shellfish (i.e. oysters, mussels), or snag complexes (large woody debris and rootballs)

## CONSIDER

- Conduct pre-design diver inspections and liaise with DPI–Fisheries to confirm which existing and nearby habitat types are most desirable to emulate
- Design to meet marine park or other protected area zoning requirements
- Maximise habitat complexity in a submerged structural footprint that is as small as possible, especially in rock reef areas
- Seek opportunities to create specific habitat for locally-occurring threatened species (Black Cod, Nereia, Whites Seahorse)
- Include reusable materials such as ballast rock that are confirmed to be free from contaminants
- Engineering with alternative materials may require site specific solutions to avoid settlement, storm damage and projectile risks under design conditions
- Use tailored armour units, although this will require additional time and planning
- Use voids, crevices and swim-throughs because they can be ideal habitat, although dark (shaded) microhabitats can also favour colonisation of non-indigenous invertebrates in port and highly disturbed environments
- Avoid adverse effects on navigation and maintenance dredging

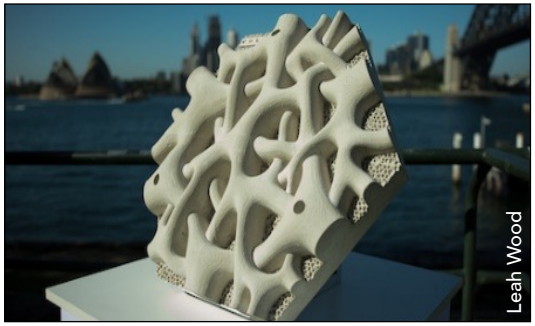

*Monitoring for the critically endangered marine alga*


*Oyster reef created in Port Stephens*

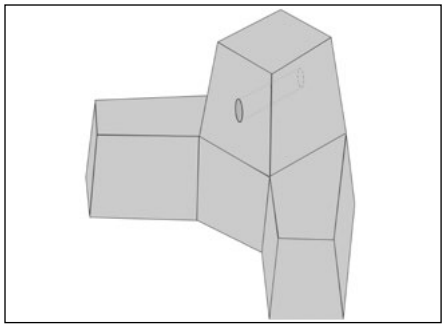

*Large woody debris and rootballs are natural stabilisers in sheltered conditions*


*Artificial reefs being installed at St Georges Basin in 2009*


*Reef balls in a small (30 unit) reef installed in St Georges Basin*




*Complex tiles imitate natural rocky habitats at the Sydney Institute of Marine Science World Harbour Project and Living Seawalls Initiative*



*Use pipes to create habitat spaces in concrete Hanbar units during casting*


*Whites Seahorse Hotel*

## MORE EXAMPLES

- The Australian guide to nature-based methods for reducing risk from coastal hazards
- Coffs Harbour northern breakwater upgrade 2016–18
- Fish Habitat Network, Fish Friendly Marine Infrastructure project
- Sydney Harbour seahorse hotels
- NSW Shellfish Reef Restoration Project Planning and Implementation Guidelines
- Offshore artificial reefs and estuarine artificial reefs managed by DPI – Fisheries
- Elliot Bay Seawall Project, Seattle Washington
- Portarlington shellfish reefs constructed in 2018, City of Greater Geelong, Victoria
- Wyndham Harbour shellfish friendly piers and marinas

# 2 Intertidal habitat

Mimic natural habitat features to improve complexity and diversity of intertidal habitat while maintaining or enhancing engineering performance

*The foreshore naturalisation project at Claydon Reserve uses natural stabilisation methods*

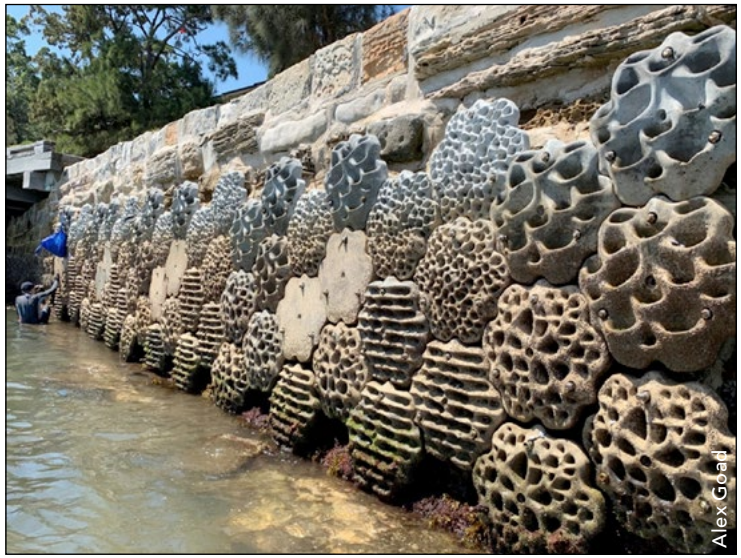
*Maximising surface area and foreshore habitat at Barangaroo Headland Park foreshore*

## DESIGN

- Maximise the range of habitats and surface area in the intertidal space
- Create intertidal shelves, benches and berms to create tidal pools
- Install structures that create gullies or embayments
- Engineer all materials types so that they are stable under design conditions and will avoid undermining or erosion
- Use designs and materials that encourage settlement of desired marine species as marine growth can strengthen materials and protect structures through wave attenuation
- Vary surface textures to create crevices and ridges
- Affix complex habitat tiles to uniform structures so they imitate natural rocky habitats
- In sheltered areas, use natural stabilisation methods, such as mangroves, saltmarsh, snag complexes (large woody debris and rootballs), and oyster reefs
- Use flatter rocks for fauna haul-out and resting sites

## CONSIDER

- Liaise with local stakeholders and review historical data to identify intertidal habitats most desirable to emulate
- Remember that intertidal features will be visible, more accessible and experience greater wave attack than submerged or terrestrial features
- Consider the potential for intertidal features to collect or trap litter, flotsam, wrack, and other debris that can be unsightly, attract pests and need ongoing maintenance
- Design to minimise potential conflicts between wildlife and recreational users (and their pets)
- Start planning for incorporating eco-works early in the process because this reduces cost penalties, especially if you can stay within a standard construction footprint
- Confirm that reused materials such as ballast rock are free from contaminants before you (re)use them
- Avoid adverse impacts on navigation and maintenance activities




*Habitat tiles imitate natural rocky habitats*


*The foreshore naturalisation project at Carrs Park creates tidal pools*


*The benefits of stabilisation from mangrove fillets can be seen for decades*

## MORE EXAMPLES

- Apple Tree Bay Cowan Creek, Hawkesbury River Bobbin Head
- Coffs Harbour northern breakwater upgrade 2016–18, Coffs Harbour
- Foreshore naturalisation projects at Kogarah Bay Creek and Georges River Council
- 'Living Seawalls' (Sydney Institute of Marine Science) sites at Milsons Point and Sawmillers Reserve, Blues Point, Clontarf, Fairlight Pool and Rushcutters Bay
- St Kilda Pier penguin friendly redevelopment 2020–23
- Wyndam Harbour shellfish friendly piers and marinas


*Seals use flat rocks as a haul-out site*

# 3 Terrestrial habitat

Mimic natural habitat features to improve complexity and diversity of terrestrial habitat while maintaining or enhancing engineering performance

*Lighting that is solar powered and shielded*


*Osprey towers can be installed to increase nesting opportunities for this threatened species*

## DESIGN

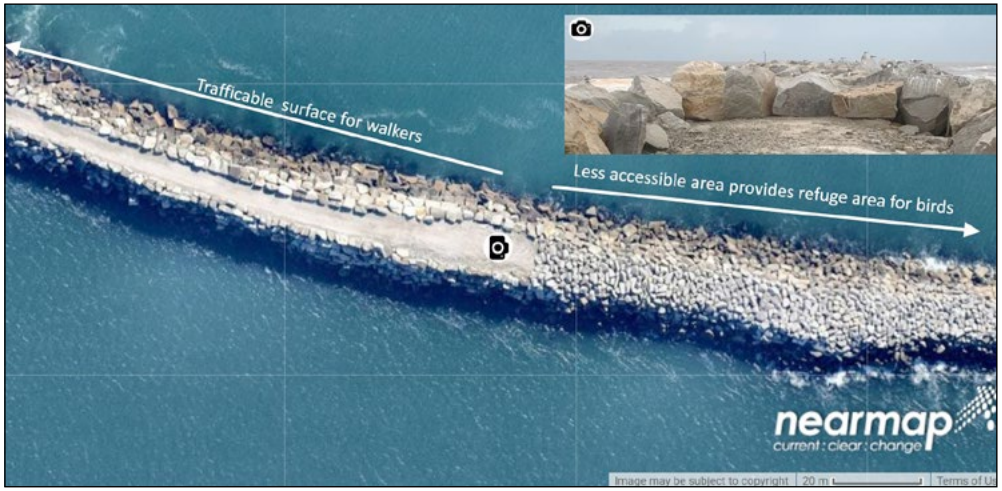
- Separate fauna features from pedestrian areas
- Install accompanying predator barriers if necessary
- Include rookery crevices for birds and osprey towers
- Minimise artificial lighting, but if necessary, use shielding to reduce light pollution
- Use light poles with a strong T-piece above the light fixture with dedicated nesting and separate roosting features tailored for target species—birds will nest and roost on light poles, so you need to adapt
- Bury hard engineering structures with natural materials
- Create pocket planting sites and improve soil properties for endemic coastal plant species
- Prioritise endemic plant species and threatened ecological communities in your planning

## CONSIDER

- Liaise with local stakeholders and review historic data to confirm which existing and surrounding habitat types are most desirable to mimic
- Consider risks of attracting snakes and pest species
- Minimise the threat of natural hazards and nuisances associated with encouraging wildlife near public infrastructure
- Accept that light poles, navigation aids and signs will be used by birds
- Recognise that adaptive approaches are able to accommodate future changes to coastal environments
- Maintain sightlines for Surf Life Saving Clubs, Marine Rescue and other emergency services
- Provide access for trucks and cranes for future maintenance

*Pocket planting sites for endemic coastal species at Barangaroo Headland Park*

*Shielded lighting along the Forster Breakwater using a design that minimises perching opportunities*




*Breakwater design separates birds and other fauna from pedestrians*

*An osprey on the southern breakwater of the Richmond River*

## MORE EXAMPLES

- Shoalhaven City Council communication tower in Ulladulla fitted with a webcam to observe nesting ospreys
- Fishermans Beach, Northern Beaches Council
- Local government native plant species guides
- National Light Pollution Guidelines for Wildlife including marine turtles, seabirds and migratory shorebirds
- Nature-based coastal defence - Port Phillip and Westernport

# 4 Aquatic recreation

Improve recreational amenity and opportunity of maritime infrastructure while maintaining or enhancing engineering performance


*Side view of the rock safety stairs that create an informal access point on the Hastings River Port Macquaire Breakwater*

## DESIGN

- Allow for informal and formal water access
- Use large flat surfaced rocks at strategic points along the breakwater to create 'stairways' from the intertidal edge up the breakwater to its crest for 'emergency safety stairs' and access opportunities
- Co-locate Angel Rings with 'emergency safety stairs'
- Provide access points for divers and snorkellers and passive crafts (kayaks, stand-up paddlers and foil boards)
- Place rocks so they create large rock baths and swimming beaches
- Use submerged habitat features to maximise features of interest for divers and snorkellers
- Include underwater dive trails in your planning
- Design breakwater length, orientation and height to maintain or improve existing surf condition
- Place sand bypass structures so they create or maintain beaches and favourable surf conditions
- Breakwater configurations that create wave-trap beaches provide recreational facilities. Some wave-trap beaches or groyne fields may be suitable for netted swimming enclosures
- Use copper-free 'seahorse friendly material' if netting swimming areas

## CONSIDER

- Recognise the potential for conflicts between recreational users
- Liaise with local stakeholders to identity the most desirable activities
- Document the safety in design (SiD) risks associated with encouraging public access to hazardous areas
- Minimise potential impacts to sensitive marine environments
- Consider negative impacts to windsurfers and kiteboarders associated with wind sheltering impacts


*The Gold Coast Waterways Authority installed 'emergency safety stairs' at the Southport Seaway in South East Queensland.*


*Sea lido pool at Nambucca Heads*


*A swimming enclosure net spans two groynes at Silver Beach, Botany Bay*

## MORE EXAMPLES

- Diver access stairs Stockton Breakwater
- Gordons Bay underwater nature trail, Randwick City Council
- Sea lido pools at Urunga, Nambucca Heads and Ballina
- Shaws Bay and Lighthouse Beach at Ballina created by northern breakwater
- Grannys Pool at Blacksmiths Beach
- Tweed River Entrance Sand Bypass System considers surf quality in management regime
- Training wall designs that create wave-trap beaches within Tweed, Cudgen, Brunswick, Clarence, Camden Haven and Hunter Estuaries
- Wave-trap beaches with swimming enclosure nets at Wallis Lake, Lake Illawarra, Wagonga Inlet and Bermagui
- Lake Illawarra breakwater design modifications to minimise impacts to windsurfers and kiteboarders
- Emergency safety stairs installed at four sites on the Gold Coast in south east Queensland
- SCUBA access and egress at Ogden Point, Vancouver Island Canada

# 5 Land-based recreation

## Improve recreational amenity of maritime infrastructure while maintaining or enhancing engineering performance

*Accessible walkways with raised crests allow a wide variety of uses and maximise views at the northern breakwater of the Richmond River at Ballina*

*Main armour outer layer encourages multiple uses on the southern breakwater of the Hastings River at Port Macquarie*

### DESIGN

- Install walkway surfaces on breakwater crests to improve public access for all (bicycles, prams and wheelchairs)
- Maximise views for walkers by using elevated crest surface or raised lookout platforms
- Improve fishing opportunities; for example, by including fishing platforms and cleaning tables or using eco-friendly designs to enhance fish habitat
- Main armour outer layer or Hanbars positioned and modified for multiple uses; for example, fishing, seating and viewing areas
- Create viewing areas for wildlife watching of whales, penguins, muttonbirds and other marine species
- Engineer structures and platforms so they are stable under design conditions
- Include public performance arenas in your designs
- Provide tactile paving to mitigate potential hazards
- Infill voids adjacent to walkways to mitigate hazards to the public
- Monitor user numbers with trip counters and other means

### CONSIDER

- Liaise with local stakeholders to identify the range of activities
- Be aware of potential conflicts between recreational users
- Recognise and design to minimise potential impacts to sensitive marine environments
- Separate maintenance activities from environmental and recreational uses
- Consider the natural hazards and nuisances associated with encouraging wildlife in close proximity to public infrastructure
- Incorporate safety in design (SiD) risks associated with encouraging public access to foreshore areas
- Consider or manipulate 'desire lines' (paths the majority of people will naturally follow because they are the shortest, easiest or most interesting route) with strategic placement of stencil artwork or other features
- Create a sense of arrival through the above features
- Empty bins along the breakwater using a shared responsibility agreement with local surf clubs, fishing clubs, environmental or other groups


*Accessible paths and ramps at Urunga Sea Lido*


*Wheelchair accessible fishing opportunities at the Crookhaven Regional Boat Ramp breakwater*

*The northern training wall of the Manning River at Harrington provides a walkway that is well used by pedestrians and cyclists*

*Pedestrian pathway around the stepped intertidal foreshore at Bangaroo Headland, Sydney*

*A smooth crest surface maximises accessibility and recreational opportunities*

## MORE EXAMPLES

- Coffs Harbour Northern Breakwater access way and associated ramps
- Port Macquarie Town Green Fishing Platforms
- South West Rocks Accessible Fishing Platform, Back Creek
- Stepped foreshore of Barrangaroo Headland reserve provides places for public to sit and interact with the Sydney Harbour environment
- St Kilda, Melbourne 'set aside' no access part of the breakwater for wildlife
- Southport Seaway water taxi facilities
- Wheelchair accessible surface with raised crests to maximise views at Ballina, Camden Haven, Wallis Lake and Lake Macquarie
- Wildlife photography opportunities can be maximised on long and remote breakwaters when part of the breakwater has a very rough rock rubble finish that is rarely accessed; for example, Clarence River north

# 6 Education and awareness

Greater awareness of how to safely use breakwaters and deeper understanding of benefits and impacts from breakwaters


*A CoastSnap point on the northern breakwater of Lake Macquarie at Blacksmiths provides a community information and a citizen science photo point*

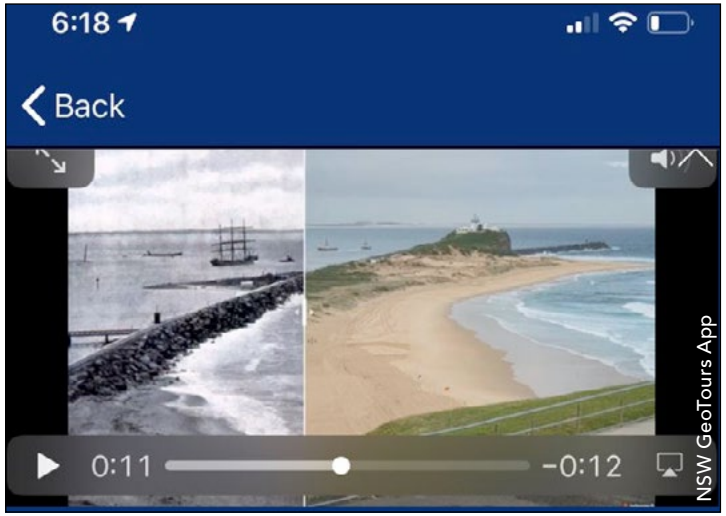

*Muttonbird Island signs, Coffs Harbour*

## DESIGN

- Place signs in appropriate areas
- Be selective in use of signs—too many signs can dilute critical messages and reduce amenity
- Use weather and vandal resistant materials
- Engineer signs so they cannot become a projectile during major overtopping events
- Use signs to provide an opportunity to redirect new users to more appropriate nearby access facilities
- Use Variable Message Signs (VMS) at breakwater access points (these are the signs used at roadworks and infrastructure works)
- Install Community photo and citizen science points such as CoastSnap
- Use coastal cameras, citizen science photo points and strategically placed art and features to assist in monitoring breakwater condition after storm events
- Provide QR codes and other artefacts to provide augmented reality features showing a historical perspective, environmental change or conditions during major overtopping events
- Where possible, use sculptural signs such as path stencils and reliefs because it can be more robust and aesthetically pleasing
- Increase public awareness of marine life, and eco-friendly design

## CONSIDER

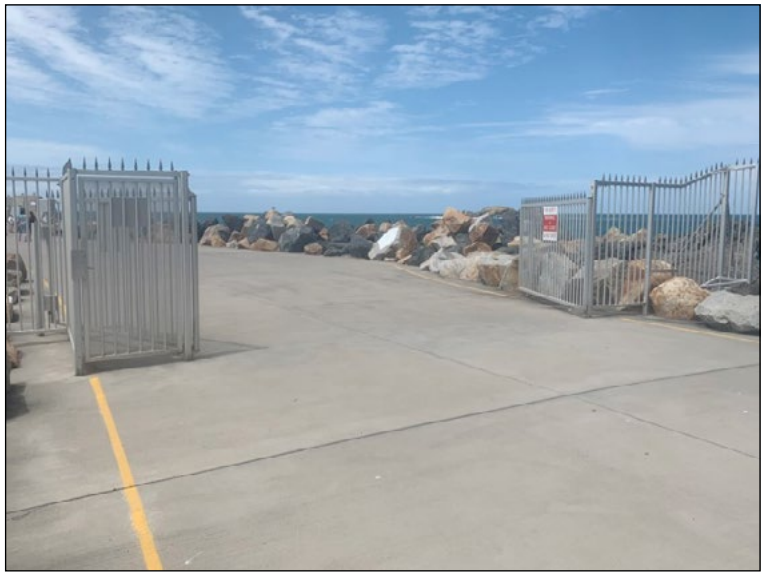
- Publish coastal hazards and high seas breakwater closure plans
- Promote environmental and cultural heritage places of interest
- Advertise upcoming infrastructure works
- Provide hotline details for emergency services, pollution, fisheries, customs
- Advertise fisheries closures
- Provide crisis support contacts where cliffs are present




*Newcastle Coastal GeoTrail uses QR codes to show a before and after view using augmented reality features*

*Appropriately located signs*

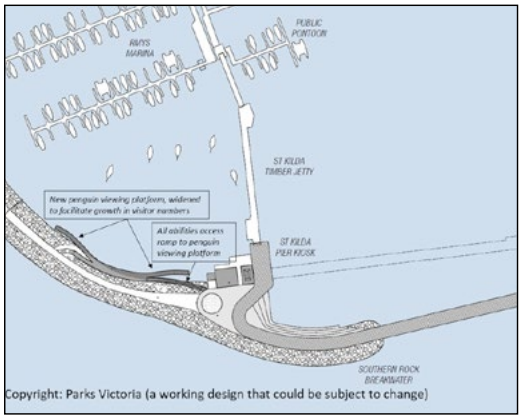

*North Sydney Council sculptural signs at Sawmillers Reserve Living Seawall, McMahons Point increase public awareness of marine life*



*Overtopping hazard warning signs and barrier fencing to manage entry to breakwaters in dangerous conditions*

## MORE EXAMPLES

- Ballina breakwater heritage trail
- DPI – Fisheries fish size and bag limit signs
- Heritage relief images on Hunter estuary southern breakwater
- Nambucca estuary shipwreck feature and stencil artwork
- Port Kembla Breakwater public access status webpage (www.nswports.com.au/public-access-news)
- Whale watching counts




*Plans for the St Kilda Pier upgrade incorporate penguin viewing and education*

# 7 Rehabilitation and remediation

## Rehabilitation and remediation of coastal processes to maximise environmental, social, cultural and economic values


*The Barangaroo site as a container terminal prior to the construction of the Headland Park Foreshore*


*Once completed, the Barangaroo Headland Park foreshore has a reduced footprint that includes convoluted and battered edges to provide habitat opportunities and lessen the environmental impact*

### DESIGN

- Ask whether the structure is required and, if so, could it be reduced in size
- Reuse, remove or manage the senescence of stranded or redundant infrastructure
- Modify existing structures to re-establish sediment and water movements
- Reduce the design footprint to minimise direct impacts on natural habitats
- Undertake habitat offsets for direct or indirect impacts caused by works or associate legacy; for example, address marina contaminated sediments through removal, isolation or stabilisation (you can also beneficially reuse stabilised sediments in breakwater upgrade works)
- Apply the mitigation hierarchy at all stages of project components
- Incorporate the additional 'value' from the structure's multi-use and eco-features, especially if it has a fundamental role in protecting public and private infrastructure

### CONSIDER

- Consider the primary purpose, other uses of the structure, and, how the direct and indirect impacts of the structure can be avoided or minimised
- Liaise with local stakeholders to help identity priority areas and issues
- Confirm that reused materials, such as marina sediments, are free from contaminants before you reuse them
- Seek funding applications for removing, handling and stabilising contaminated sediments—this high-cost exercise can be eligible for funding

*The habitat rich complex edges of the recreated Barangaroo foreshore are contrasted by the straight concrete edge (left) of an adjacent part of the Sydney Harbour foreshore*


*The Southerly Street groyne in Port Phillip Bay before and after it was shortened to reinstate sand movement in the Bay*

## MORE EXAMPLES

- Coffs Harbour slipway remediation
- Tweed Sand Bypass program to reinstate long-shore drift
- Investigations into the removal of the 3.5 km long offshore breakwater at East San Pedro Bay USA
- Port Nelson Calwell Slipway, New Zealand


*The redundant Mawsons breakwater, built in 1968 for a failed sea port south of Caves Beach, has been abandoned and is gradually being washed away*

# 8 Aesthetics

## Improving and maintaining aesthetic qualities for existing breakwaters

*Ballina Northern Breakwater raised viewing platform*

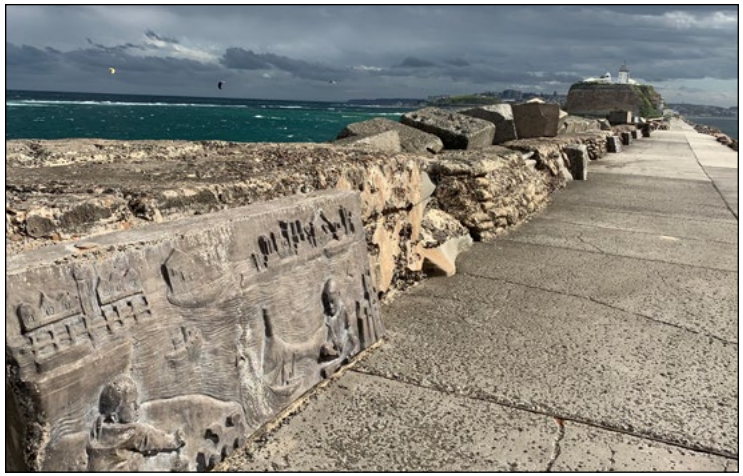
*Public art on the breakwater at Nambucca Heads*

### DESIGN

- Raise crest walkway surface to maintain pedestrian views
- Install raised viewing platforms
- Keep crest containment heights to be less than 1 metre on average because this will preserve wave approach sightlines, which is an important safety feature and improves aesthetics
- Use swept finishes to minimise reflection and glare
- Avoid turreted designs that obstruct views
- Use pipe-formed holes for Hanbar lifting points and future habitat hollows in preference to metal lifting hooks
- Improve aesthetics on existing structures aesthetics by cutting off lifting hooks and patching cutaways
- Reduce the brightness of concrete surfaces (and colour of concrete) to provide both ecological and aesthetic benefits

### CONSIDER

- Manage community expectations—personal opinions about appearance will vary throughout the community and can be difficult to satisfy
- Use commissioned sculptural, relief or stencil art and signs where possible as it can be more robust and aesthetically pleasing
- Be aware that public art on breakwater armour units has been divisive among community members in the past but has been largely considered an asset and tourist attraction
- Use eco-friendly designs—such as habitat panels with complex surfaces—to improve aesthetics as well as ecological performance



*Newcastle breakwater, Hunter River historical relief artwork*

*High concrete armour units and turrets impede views*

*Commissioned stencil artwork on the fully accessible walkway compliments public art on the breakwater rocks*

*High concrete armour units obscure the view for most of the length of the eastern breakwater at Coffs Harbour*

*Lifting hooks should be removed (Coffs Harbour northern breakwater)*

# 9 Cultural values

Identify and celebrate the historical heritage, cultural and social values of existing breakwaters

*Stockton Shipwreck Walk and Adolphe shipwreck*


*Ballina breakwater heritage trail and Maritime Museum*

## DESIGN

- Use signs that recognise cultural heritage and aesthetic values
- Document values in plans of management for specific areas
- Display or incorporate infrastructure that is of heritage value
- During upgrade works, try to temporarily move, store and then reposition private restore memorial plaques

## CONSIDER

- Be aware that people in the community will have different opinions that can be difficult to satisfy
- Check heritage registers and development controls because many NSW breakwaters have listed local or state heritage value—these are often maintained by local government
- Invite stakeholders to identify notable events that need to be managed during construction phase activities
- Foster regional tourism with an app and QR code NSW Coast Breakwater Tourist Trail to focus on fishing, whale and bird watching, heritage, art trails and other nature or culture based activities associated with breakwaters

*A heritage wall dating from the earliest days of Wollongong Harbour*

*Public art creates a sense of character and place at Brunswick Heads*

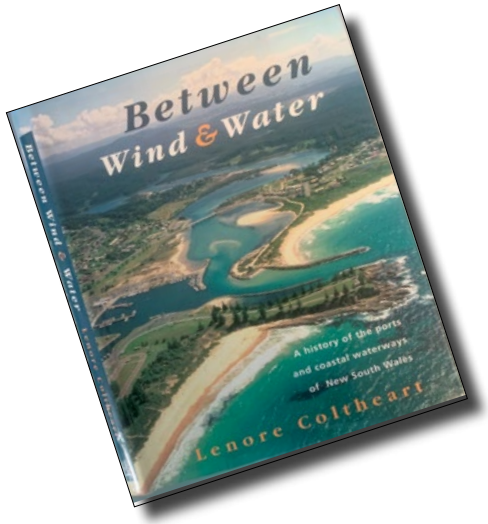
*Personal memorial plaques on many breakwaters*



*Examples of commissioned art incorporated into coastal walkways that could be used on breakwaters*

## MORE EXAMPLES

- Engineering heritage listing of Hunter and Clarence breakwaters and harbour works
- Interpretive information at Coffs Harbour
- Maps of shipwrecks and other NSW maritime heritage sites
- NSW Crown Lands policy on memorial plaques
- Painted rock walls at Nambucca and Port Macquarie
- Brunswick Nature Sculpture Walk, an event held every three years around the breakwater, wave-trap beach and park




*The history of ports and coastal waterways in NSW has been documented and published.*

# 10 Aboriginal Cultural Values

## Protecting the Aboriginal cultural values of the marine estate


*Sea Country Rangers managing weeds and other impacts on Country to sustain culture, land and sea.*

### DESIGN

- Understand that all of the large coastal infrastructure in NSW is on Aboriginal Sea Country
- Ensure project timelines allow for early and ongoing respectful engagement with Aboriginal communities
- Recognise that Aboriginal people have been custodians of natural resources and Sea Country for tens of thousands of years
- Recognise that connection to Sea Country is important to the overall health and wellbeing of Aboriginal people, their cultural practices and traditions, which continue to be exercised to the present day
- Fulfill legislative obligations relating to the Native Title Act 1993 (including consideration of 'future acts') and the Aboriginal Land Right Act 1983

### CONSIDER

- Avoid structures that threaten links to Country, such as those that cause environmental degradation, restrict access or increase competition between user groups. These can result in a loss of culture for Aboriginal people because of the relationship between culture, nature, land and water
- Include infrastructure and educational materials that communicate the cultural heritage values of a given area
- Promote Aboriginal cultural values, including Sea Country stories and significant underwater cultural sites
- Be aware that there may be a range of different opinions from various Aboriginal groups
- Identify or establish opportunities to involve Sea Country and related land-based Aboriginal ranger programs where ongoing management programs are required



*Sea Country Rangers from the Kempsey Local Aboriginal Land Council own and manage land at South West Rocks adjacent to the Macleay River southern breakwater. They manage weeds and other impacts On Country to sustain culture and land*


*Public art creates a sense of character and place at the entry to the southern breakwater of the Tweed River at Fingal Head where the Aboriginal People maintain connection to Country*

## MORE EXAMPLES

- For Aboriginal people, culture, nature, land and water are linked. Where these links to Country are threatened, due to environmental degradation, restricted access or competition between user group

# 11 Land-use activation

## Activating land uses in the vicinity of maritime infrastructure



*Shaws Bay urban area, Ballina, enjoys the protection provided by breakwaters*

### DESIGN

- Consider existing and potential future uses as breakwaters often create a focal point of activity:
  - many breakwaters have created areas that became heavily developed and are now reliant on the structure
  - many breakwaters create a sheltered port environment that can be used by cruise berths, marinas, slipways, water police, customs and others
- Consider the context—foreshore areas are generally popular with the public and create demand for cafes, restaurants and retail developments
- Provide adequate transport linkages to facilitate movement of goods and people in and out of port areas

### CONSIDER

- Minimise the potential impacts on sensitive marine environments caused by adjacent development
- Require strategic master planning to ensure a holistic approach to management of high value areas
- Recognise that there is an increased 'value' and critical use of the breakwater feature due to the private, public and natural infrastructure it protects


*A breakwater provide a sheltered environment at Port Botany*



*Batemans Bay (Catalina Village and nearby resort) was developed as a result of the breakwater*


## MORE EXAMPLES

- Eden breakwater and multipurpose jetty
- Iluka, Yamba and Clarence River
- Jack Evans Boat Harbour and the urban area developed on the former Greenbank Island Tweed
- Port Macquarie town green and caravan park
- Wollongong and Ulladulla Boat Harbours

# Best-practice tips

**1. Consider the primary purpose of the structure**

Is the structure still needed and doing what it was designed to do? Are there secondary benefits, such as those described in these guidelines? Could you retrofit other 'secondary benefit' structures during maintenance works without constraining the primary purpose or increasing the environmental impact?

**2. Investigate existing direct and indirect environmental impacts of the structure**

How could impacts be reduced? Consider primary and secondary benefits against environmental impact, climate change risk and infrastructure condition.

**3. Begin planning early**

Proposal development is usually an iterative process. Integrate the mitigation hierarchy into project planning and understand the environmental constraints and opportunities as early as possible to minimise redesign.

**4. Recognise that monitoring requirements should be tailored to suit each project**

Where a project is considered high risk or there is a high degree of uncertainty, then you might need to collect more data to make an evidence-based decision. This can involve extensive monitoring.

**5. Work with other stakeholders**

Engage with local stakeholders, regulators, scientists, designers and contractors to identify win-win solutions such as the provision of fishing waste bins by government and regular waste removal service contracted to volunteer community groups.

**6. Consider and address sustainable development goals and climate change risks**

Incorporate multiple use and ecological value features into the planned works. This can add to the social, cultural and economic value of the structure and justify future maintenance or upgrade costs. Consider climate change risks over the design life of the structure with a particular focus on future adaptability.

**7. Consider, assign and document safety in design (SiD) risks**

Breakwaters can improve access to waterways and are focal points for commercial and recreational users. Designs now need to consider and achieve safety elements for these uses, so the Safety in Design considerations can be complex.

**8. Use structured citizen science programs to identify, inform, monitor and evaluate projects**

Photo points allow citizen scientists to contribute to cumulative records of the use of breakwater eco-features such as seal haul areas or first-pass checks for shifts in armour rock after large storms. Good examples of this approach include the CoastSnap program and similar breakwater focused photo points.

Photo points allow citizen scientists to contribute to cumulative records of the use of breakwater eco features such as seal haul areas or first-pass checks for shifts in armour rock after large storms. Good examples of this approach include the CoastSnap program and similar breakwater focused photo points.

# More reading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# Take a virtual tour with Google Earth

**TIPS:**

> Set the latitude and longitude to 'Decimal Degrees' in Tools > Options to reach the exact locations.

> Use the 'timeslider' feature to find before and after images of the sites.

## Aquatic recreation tour

| SITE | LOCATION |
|---|---|
| Coral Greenhouse, John Brewer Reef, Townsville, Museum of Underwater Art | -18.614, 147.069 |
| Gold Coast emergency safety stairs | -27.937, 153.4256<br>-27.939, 153.4223 |
| Tweed South wave trap beach | -28.1711, 153.552 |
| Ballina stairs | -28.8669, 153.5725 |
| Shaws Bay Sea Lido | -28.867, 153.583 |
| Nambucca Sea Lido | -30.648, 153.014 |
| Urunga Sea Lido | -30.4976, 153.024 |
| Tuncurry wave trap and swimming enclosure | -32.1742, 152.507 |
| Grannys Pool Blacksmiths | -33.0837, 151.6563 |
| Gordons Bay underwater trail | -33.91598, 151.2651 |
| Silver Beach groynes swimming enclosure, Botany Bay | -34.0075, 151.208 |
| Narooma wave trap beach and swimming enclosure | -36.2099, 150.132 |
| Bermagui Bruce Steer ocean swimming enclosure | -36.424, 150.0734 |

## Remediation tour

| SITE | LOCATION |
|---|---|
| Tweed Sand Bypass Scheme | -28.1722, 153.5568 |
| Iluka breakwater habitat refuge boundary | -29.4251, 153.37 |
| Coffs Harbour northern breakwater submerged features | -30.3023, 153.145 |
| Mawsons breakwater, Caves Beach redundant structure | -33.1203, 151.651 |
| Apple Tree Bay Cowan Creek intertidal | -33.6522, 151.1556 |
| Sawmillers Reserve intertidal | -33.8469, 151.2024 |
| Barangaroo Headland intertidal | -33.8555, 151.201 |
| Carss Park intertidal | -33.988, 151.122 |
| Claydon Reserve, Kogarah Bay intertidal | -33.9843, 151.1312 |
| St Kilda breakwater penguin viewing | -37.8648, 144.965 |
| Southerly Street Sandringham, Port Philip Bay groyne | -37.9569, 145.0063 |
| Port Nelson Calwell slipway, New Zealand | -41.26, 173.28 |

## Land activation tour

| SITE | LOCATION |
|---|---|
| Molineux Point breakwater, Botany Bay, Port Botany | -33.98, 151.216 |
| Batemans Bay | -35.7159, 150.1922 |

## Heritage tour

| SITE | LOCATION |
|---|---|
| Iluka breakwater, shipwreck HMAS Waree (1946) | -29.42312, 153.36438 |
| Laggers Point breakwater | -30.8754, 153.0672 |
| Stockton breakwater, shipwreck Adolphe (1904) | -32.9138, 151.797 |

*Coffs Harbour, inner harbour*

NSW GOVERNMENT

www.marine.nsw.gov.au