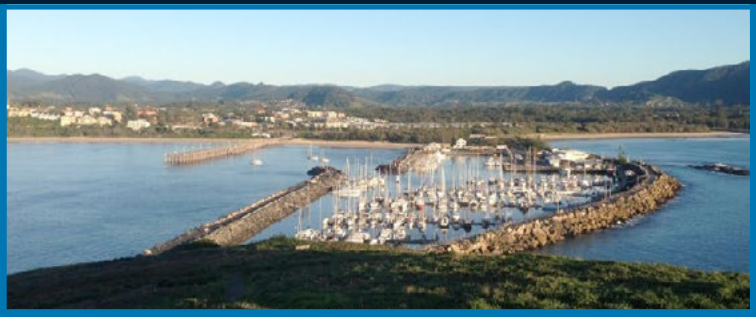
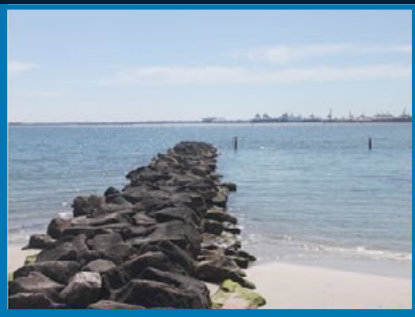
MARINE ESTATE MANAGEMENT AUTHORITY

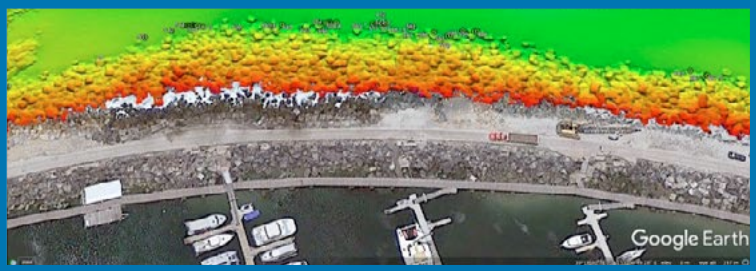
# An audit of trained river entrances, armoured harbours and groynes and their multi-use and eco-features in NSW

## Shellharbour to the Victorian border (Illustrated Volume III)









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The ten-year strategy was developed by the NSW Marine Estate Management Authority to coordinate the management of the marine estate.

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**Cover image**: Montage of multi-use and eco-engineering features used in NSW coastal infrastructure

**Cover photo sources**: Patrick Dwyer, Lea Mamo Google Earth, Ron Main and Adrian Toovey

# Why do an audit?

This is the first comprehensive audit of the 134 breakwater structures—large coastal structures that train river entrances, armour harbours and manage sand along the NSW coastline.

The audit is a first-pass assessment of these structures, their multi-use and eco-features, and their impacts on the environment. It has given us baseline information we need to better manage the structures. Multi-use features are built elements, such as a crest surface that provides access for pedestrians, and outcomes that enable uses and values additional to the structure's primary purpose. Eco-features are built elements or design outcomes that achieve an environmental benefit.

Completing an audit of these structures and features is important because estuary entrance modification—primarily caused by training river entrances and installing breakwaters—was identified as the second highest threat to the environmental assets in the NSW marine estate by the Threat and Risk Assessment undertaken by the Marine Estate Management Authority (MEMA) (Fletcher and Fisk 2017).

The community's access, use and enjoyment of nearshore and offshore marine environments is also important. This audit documents how some structures have features that improve access or add to social, cultural, economic and environmental values. The audit also identifies structures that could be suitable for adding multi-use and eco-features during maintenance or upgrade works to maximise delivery of social, cultural, economic and environmental values.

The audit was prepared as part of Initiative 2 in the Marine Estate Management Strategy (MEMS) (NSW Government 2018). The initiative focuses on delivering healthy coastal habitats with sustainable use and development. Together with a literature review (Mamo et al 2021) and the development of guidance notes (Dwyer and Dengate 2021), the audit fulfils the delivery of Action 2.1.2 outlined in the MEMS.

These resources are tools to assist in adopting a more integrated approach to maximise value and minimise unwanted impacts when undertaking future works to maintain and retrofit priority coastal infrastructure.

The complete audit includes an Audit Summary Report and three illustrated volumes:

- Volume I Breakwater Audit MEMA North Region
- Volume II Breakwater Audit MEMA Central Region
- Volume III Breakwater Audit MEMA South Region (this volume).

The three MEMA regions and the structures that were audited are mapped in Figure 1.

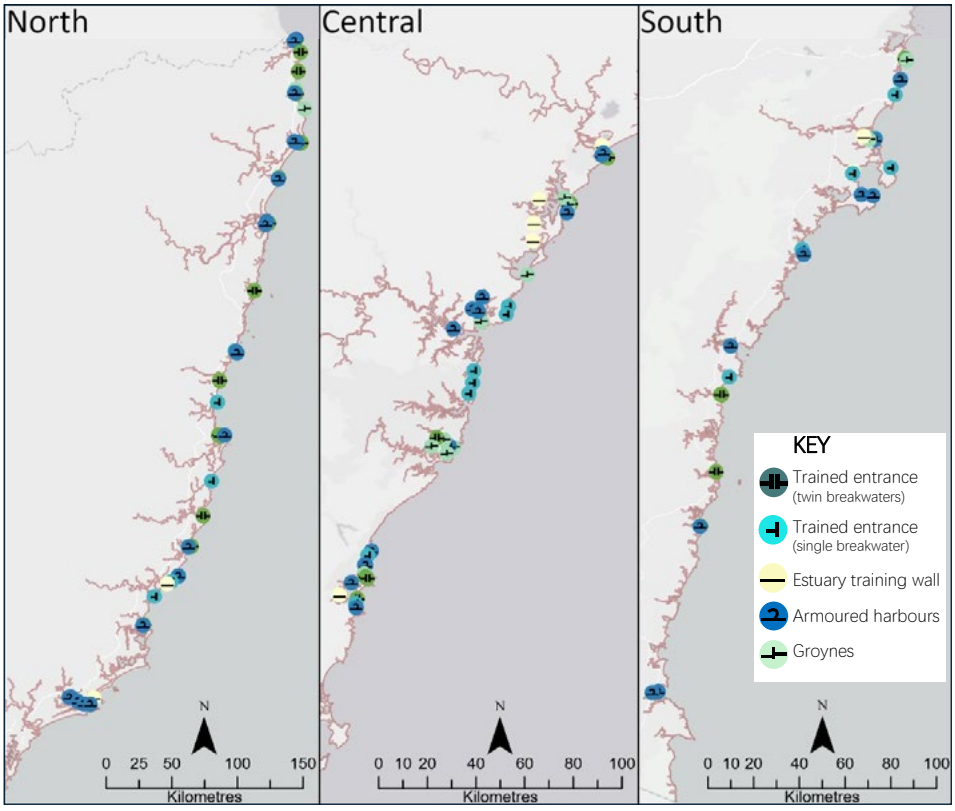
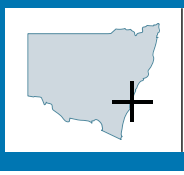



Figure 1: Marine Estate Management regions showing breakwater structures—trained river entrances, armoured harbours and groynes along the NSW coastline that were assessed in this audit.

*Maps prepared by Alex Wray-Barnes and Emma Wilkie*

# Table of Contents

# Shell Cove Breakwaters



-34.5884S
150.8588W

| | |
|---|---|
| **Responsible authority:** | Private developer |
| **Built:** | 2014–2022 |
| **Primary purpose when first built:** | Trained entrance for urban development |
| **Current uses:** | – Ocean access for boating<br>– Coastal walkway |

**Multi-use features:** – Walking pathway

**Eco-features:** Nil

The breakwater is very accessible. It is close to parking, amenities, greenspace and urban areas.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

- Maintain pedestrian walkway surface
- Rock placement for seating and fishing opportunities
- Rock placement for emergency safety stairs

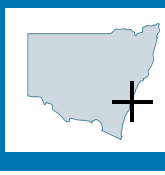
**Future eco-features**

- Increase submerged habitat complexity


The Shellharbour Wetlands before (2006) and after construction of entrance breakwaters (2009)
*Credit: Google Earth (2006) and nearmap (2019)*


The breakwater and large harbour entrance will be a key feature of the Shell Cove urban precinct *Credit: nearmap*

# Bass Point Pier Breakwater



-34.5935S
150.8847W

| | |
|---|---|
| **Responsible authority:** | Unknown |
| **Built:** | 1970s |
| **Primary purpose when first built:** | Gravel loading facility |
| **Current uses:** | – Loading facility for coastal shipping<br>– The loading facility has not been used to load gravel since July 2011 however the quarry owner is considering reintroducing shipping as a way to transport gravel. |

**Multi-use features:** – Scuba dive site

**Eco-features:** – Within 50 m of natural reef

The breakwater groyne supports a jetty and loading facility for coastal shipping.

The first shipments of blue metal gravel from the Bass Point area were transported from a wooden jetty built in 1880. The wooden jetty was destroyed during a storm in 1957.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

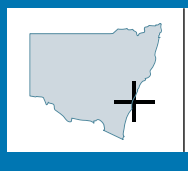
Nil

**Future eco-features**

Nil


The Bass Point groyne ship loading jetty *Credit: nearmap*

# Kiama Harbour historical change



-28.8745S
153.591W

Kiama Harbour in 1936 *Source: Adastra Collection*


Kiama Harbour in 2016 *Credit: Google Earth*

# Kiama Harbour Breakwaters

-34.671S
150.8588W

**Responsible authority:** NSW State Government

**Built:** 1861–76

**Primary purpose when first built:** Ocean harbour for coastal shipping

**Current uses:**
- Ocean access for boating
- Incorporated into a popular coastal walkway
- Fishing spot

**Regulatory matters:**
- *Heritage Act 1977*

**Multi-use features:**
- Walking pathway and heritage features

**Eco-features:**
- Within 50 m of natural reef

The harbour is a key precinct in the Kiama township. It is also located close to Blow Hole Point, a natural attraction that draws hundreds of thousands of tourists every year.

**Recommendations for possible inclusion in future maintenance or upgrade works**

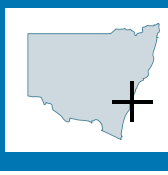
**Future multi-use features**
- Rock placement for seating and fishing opportunities

**Future eco-features**
Nil


Kiama Harbour *Credit: nearmap*

The walls of Robinsons Basin are a key heritage feature

# Werri Lagoon Entrance



-34.728S
150.8389W

| | |
|---|---|
| **Responsible authority:** | Kiama Council |
| **Built:** | 1930s invert 0.8 m AHD |
| **Modified:** | 1975 concrete race 0.9 m AHD |
| **Primary purpose when first built:** | Drainage and flood mitigation |
| **Current uses:** | – The structure has not been used for drainage of the Lagoon since 2000. |

**Multi-use features:** Nil

**Eco-features:** Nil

Werri Lagoon estuary is partially trained with a disused, deteriorating and often buried concrete race and pipeline structure on the northern side of the entrance. The estuary entrance is now managed in accordance with the Werri Lagoon Interim Entrance Management Policy. This involves occasionally using an excavator to create a breakout channel when water in the Lagoon has reached a trigger height of 1.65 m AHD (Kiama Council 2005).

**Recommendations: make the area safer by removing hazardous components (protruding metal pieces)**

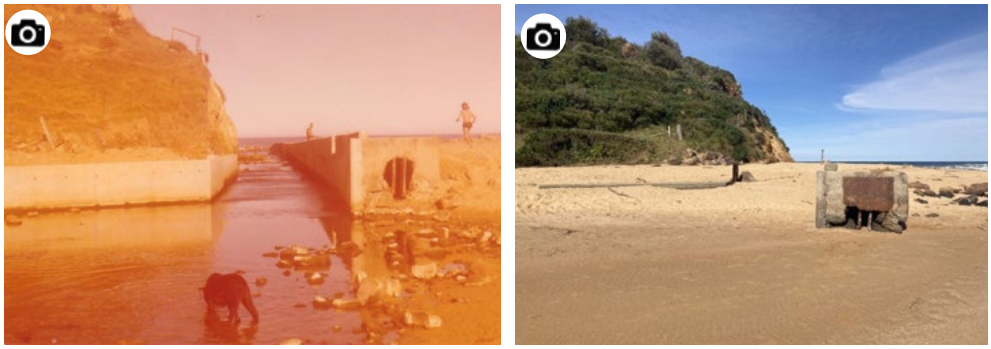
**Future multi-use features**

Nil

**Future eco-features**

Nil

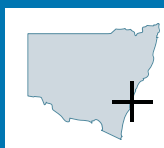
Entrance of Werri Lagoon, Gerringong with the concrete training pipe on the northern bank *Credit: Google Earth*



Part of the deteriorated and buried concrete race and pipeline at the entrance to Werri Lagoon in 1970s (LHS) and today. *Credit: Kiama Council and Byron Robinson*

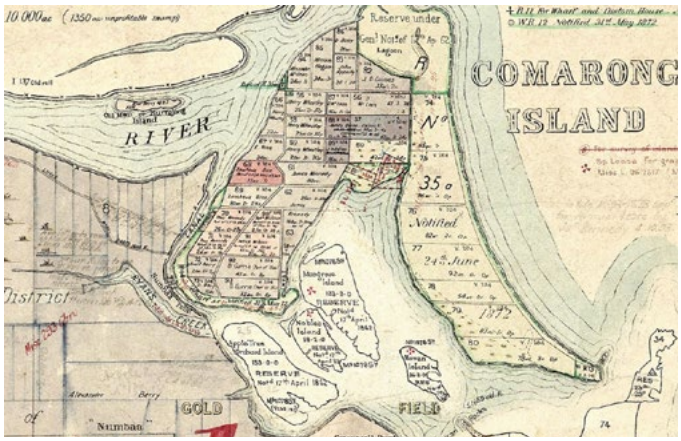
Lagoon inlet showing part of the deteriorated and buried concrete race and pipeline at the entrance to Werri Lagoon.

# Crookhaven River estuary-wide change

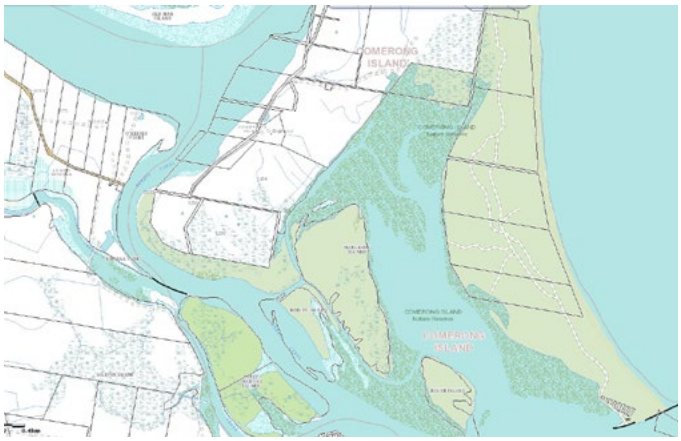


-28.8745S
153.591W

In June 1822, a team of three convicts took 12 days to dig a channel that was 191 m long by 5.5 m wide to link the Shoalhaven and Crookhaven Rivers. The reason was that the Crookhaven had a safer entrance. Since then, the channel has continued to widen and deepen. Berrys Canal is recognised as Australia's first constructed waterway transport canal.




1894 Parish Map showing Berrys canal at about 100 m wide



Berrys Canal is now 200–300 m wide


The Shoalhaven – Crookhaven estuaries are artificially linked by Berrys Canal shown in red and: (1) Crookhaven breakwater; (2) Crookhaven Regional Boat ramp breakwater; (3) First Street training wall; (4) Greenwell Point; (5) Numbaa training wall *Credit: Google Earth*

# Crookhaven River Breakwater (North)

-34.9S
150.761W

| | |
|---|---|
| **Responsible authority:** | NSW State Government |
| **Built:** | 1910-12 |
| **Primary purpose when first built:** | Trained entrance for coastal shipping |
| **Current uses:** | – Ocean access for boating |
| **Regulatory matters:** | Comerong Island Nature Reserve |

| | |
|---|---|
| **Current multi-use features:** | Nil |
| **Eco-features:** | Nil |

The estuary end of the breakwater supports seagrass, mangrove, saltmarsh, and wader and migratory bird habitats. It also creates conditions ideal for nearby oyster aquaculture.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

– Rock placement for emergency safety stairs

**Future eco-features**

– Maintain breakwater fauna refuge area
– Adjacent osprey tower


The Crookhaven breakwater *Credit: Google Earth*


The estuary end of the breakwater supports important seagrass, mangrove, saltmarsh, and wader and migratory bird habitats
*Credit: nearmap*

# Crookhaven River Boat Ramp Breakwater

-34.9052S
150.76W

| | |
|---|---|
| **Responsible authority:** | NSW State Government |
| **Built:** | 1900s as a small pier |
| **Modified:** | Built as a breakwater in 1960s<br>Fishing access for people with disability upgrade in 2015 |
| **Primary purpose when first built:** | Fishing and tourism |
| **Current uses:** | – Ocean access for boating |
| **Multi-use features:** | – Walking pathway<br>– Fishing platform<br>– Breakwater for Crookhaven regional boat ramp |
| **Eco-features:** | Nil |

The breakwater shelters the boat ramp and armours a reclaimed area used as the boat ramp carpark.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

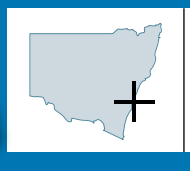
- Maintain pedestrian walkway surface
- Maintain fishing opportunity for people with disability

**Future eco-features**

- Increase submerged habitat complexity
- Key fish habitat enhancement along training walls


The Crookhaven regional boat ramp and breakwater
*Credit: nearmap*

# Crookhaven River First and Numbaa Training Walls



-34.9056
150.753W
-34.8912S
150.715W

**Responsible authority:** Unknown

**Built:** 1902-08

**Primary purpose when first built:** Training walls built to improve shipping and reduce erosion and widening of Berrys Canal

**Current uses:** – Training wall

**Regulatory matters** – *Heritage Act 1977* (Numbaa)

**Multi-use features:** Nil

**Eco-features:** – An estuarine intertidal inlet

In 1902–03, two sections of training wall were built. A 300-m long section was installed in the lower estuary adjacent to First Street, Orient Point. Another section was installed at Numbaa Point in Berrys Canal.

**Recommendation: examine and assess primary purpose**

**Future multi-use features**

Nil

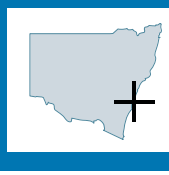
**Future eco-features**

– Key fish habitat enhancement along training wall


The remnant training wall adjacent to First Street, Orient Point that was installed in the early 1900s *Credit: Google Earth*


The training wall at Numbaa Point installed to address some of the erosion occurring in Berrys Canal in the early 1900s
*Credit: nearmap*

# Crookhaven River Greenwell Point Breakwater & Groynes



-34.9047S
150.7351W

| | |
|---|---|
| **Responsible authority:** | NSW State Government |
| **Built:** | 1979 breakwater |
| **Modified:** | Groyne field added 2006–08 |
| **Primary purpose when first built:** | Breakwater for fishing and tourism |
| **Current uses:** | – Bank management, estuarine intertidal inlet |
| **Regulatory matters:** | – *Heritage Act 1977* |

| | |
|---|---|
| **Multi-use features:** | – Reduce erosion and shelter the boat ramp |
| **Eco-features:** | – Estuarine intertidal inlet |

The groyne field was installed in the 2000s. The inlet, built in 1979, supports mangrove and habitat for waders and migratory birds.

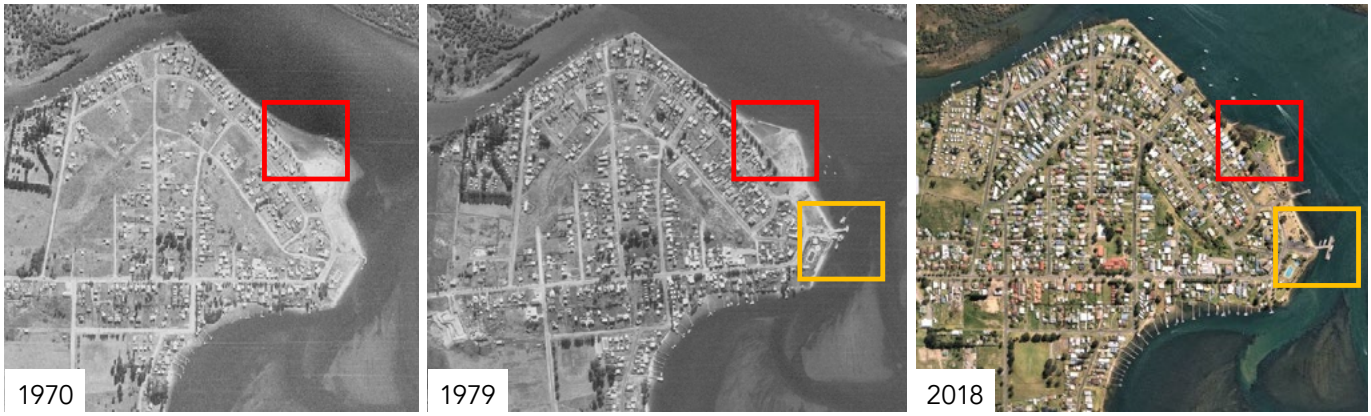
**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

Nil

**Future eco-features**

– Key fish habitat enhancement between groynes and within the inlet



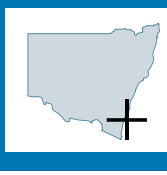

Aerial photos of showing progressive foreshore reclamation for parkland and installation of a fishing jetty and a breakwater that creates a shallow intertidal inlet where mangroves have established. *Source: NSW Public Works*

Part of the intertidal foreshore reclaimed for parkland and remaining intertidal vegetation *Credit: nearmap*

A government wharf at Greenwell Point was built in 1880. Upgrades to the Greenwell Point Wharf were completed in 1979 as part of the NSW Government's Fishing / Tourist Port Program. Approximately 160 m to the south are the historical remains of the original Greenwall Point Wharf constructed by convict labour in 1829.

*Source: NSW Public Works Department Annual Report 1979*

# Currarong Creek Breakwater



-35.0148S
150.8219W

| | |
|---|---|
| **Responsible authority:** | NSW State Government |
| **Built:** | 1940s to 50s |
| **Modified:** | Rebuilt in 1995 |
| **Primary purpose when first built:** | Entrance management |
| **Current uses:** | – Entrance management |
| **Regulatory matters** | – Jervis Bay Marine Park |

| | |
|---|---|
| **Multi-use features:** | Nil |
| **Eco-features:** | – Within 50 m of natural reef |

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

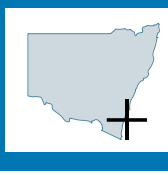
Nil

**Future eco-features**

Nil


The Currarong Creek breakwater *Credit: nearmap*

# Currambene Creek Breakwater



-35.0376S
150.672W

| | |
|---|---|
| **Responsible authority:** | NSW State Government |
| **Built:** | 1920s |
| **Modified:** | Rebuilt in 1995 |
| **Primary purpose when first built:** | Entrance management |
| **Current uses:** | – Entrance management |
| **Regulatory matters** | – Jervis Bay Marine Park |

**Multi-use features:** Nil

**Eco-features:** – Within 50 m of natural reef

The breakwater is very accessible. It is close to Voyager Park, amenities, greenspace and urban areas. The park, dedicated in 1972, commemorates the 82 lives lost in Australia's worst peacetime naval accident. Bank revetment at the nearby Woollamia boat ramp incorporates habitat features for estuary cod.

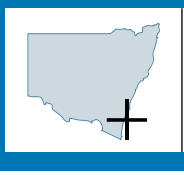
**Recommendations for possible inclusion in future maintenance or upgrade works**

| Future multi-use features | Future eco-features |
|---|---|
| Nil | Nil |

In 1961, the trained entrance of Currambene Creek incorporated an estuarine swimming enclosure that was later infilled to create parkland. *Source: Crown Lands*


The Currambene Creek breakwater and the Huskisson Ocean Pool built in 1965.
*Credit: Google Earth*

# Currambene Creek Training Wall, Myola



-35.0294S
150.6733W

| | |
|---|---|
| **Responsible authority:** | Unknown |
| **Built:** | 1980s |
| **Primary purpose when first built:** | Entrance management, for protection of Callala sand spit |
| **Current uses:** | – Estuary training wall |
| **Regulatory matters** | – Jervis Bay Marine Park |

**Multi-use features:** Nil

**Eco-features:** – Estuarine intertidal inlet

The training wall is remote but used by holiday makers and recreational fishers

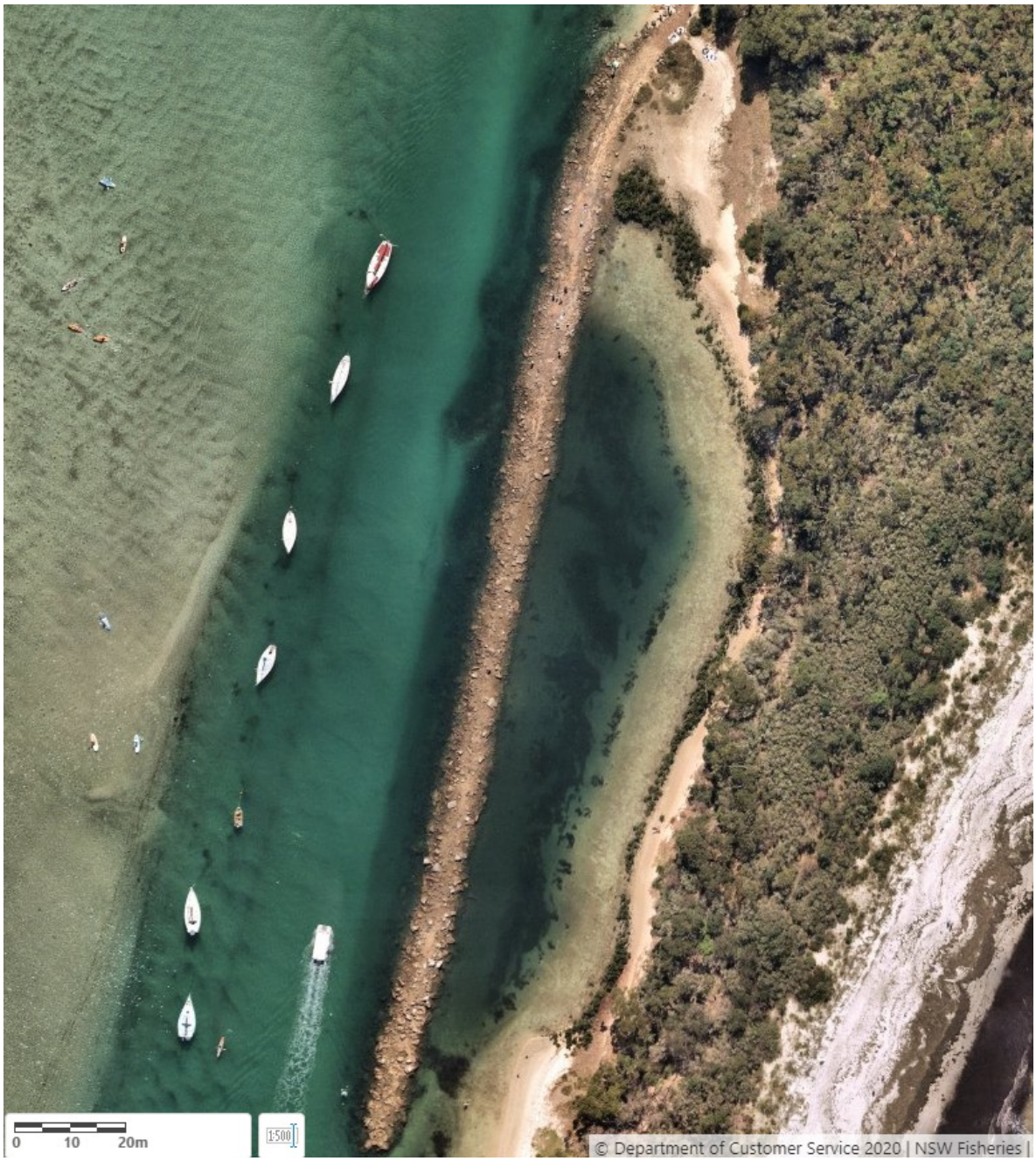
**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

– Rock placement for seating and fishing opportunities
– Rock placement for emergency safety stairs

**Future eco-features**

– Key fish habitat enhancement along training wall




The Currambene Creek, Myola estuarine training wall *Credit: nearmap*

# Jervis Bay
# Captains Point Breakwater

-35.1211S
150.706W

| | |
|---|---|
| **Responsible authority:** | Commonwealth Government |
| **Built:** | 1915 |
| **Primary purpose when first built:** | Trained entrance for coastal shipping |
| **Current uses:** | – Ocean access for vessels from HMAS Creswell Naval College |
| **Regulatory matters:** | – HMAS Creswell Naval College<br>– Jervis Bay Marine Park<br>– Commonwealth waters of Booderee National Park |
| **Multi-use features:** | – Design incorporates a swimming enclosure |
| **Eco-features:** | – Within 50 m of natural reef |

Captains Point breakwater was built when the jurisdiction of the Jervis Bay Territory was ceded from NSW to the Commonwealth. A major sea port with a rail link to Canberra was envisaged. Today, public access to the HMAS Creswell Defence Base is managed by the Department of Defence.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

Nil

**Future eco-features**

Nil


The Captains Point breakwater at HMAS Creswell Naval College. *Credit: nearmap*

# Jervis Bay
# Murrays Beach Breakwater

-35.1256S
150.7516W

| | |
|---|---|
| **Responsible authority:** | Commonwealth Government |
| **Built:** | 1982 |
| **Primary purpose when first built:** | Breakwater and jetty intended for a natural science research and study centre (never built) |
| **Current uses:** | – Ocean access for Boating |
| **Regulatory matters** | – Jervis Bay Marine Park<br>– Commonwealth waters of Booderee National Park |
| **Multi-use features:** | – Walking pathway and attached pontoons |
| **Eco-features:** | – Within 50 m of natural reef |

The breakwater is accessible. It is close to parking, amenities and greenspace areas.

Construction of the breakwater was endorsed by the Commonwealth House of Representatives standing committee report on development pressures on Jervis Bay. This committee recommended abandoning plans commenced in 1969 for a nuclear power reactor, instead proposing: 'managing to safeguard the environment and retain the natural landscape and atmosphere' (Commonwealth of Australia 1975).

Another legacy from the 1969 nuclear reactor investigations is a row of 11 bare circular areas within *Posidonia* seagrass. The row of circles, with approximately 20 metre diameters, is located 225 metres to the south west of the breakwater and continues south west for approximately 850 metres. This strange feature, still evident in aerial photos more than 50 years later, is apparently due to the impact of seismic surveys.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

- Maintain pedestrian walkway surface
- Rock placement for seating and fishing opportunities
- Rock placement for emergency safety stairs

**Future eco-features**

- Increase submerged habitat complexity


The Murrays Beach boat ramp breakwater in Jervis Bay *Credit: nearmap*

# Blackwater Creek Entrance

–33.347S
151.504W

| | |
|---|---|
| **Responsible authority:** | Shoalhaven City Council |
| **Built:** | 1994 |
| **Primary purpose when first built:** | Partially trained entrance and estuary management |
| **Current uses:** | – Entrance and sand management |

| | |
|---|---|
| **Multi-use features:** | Nil |
| **Eco-features:** | Nil |

Blackwater Creek estuary is partially trained with geotextile sandbags on the northern bank that are designed to be buried most of the time.

**Recommendations for possible inclusion in future maintenance or upgrade works**

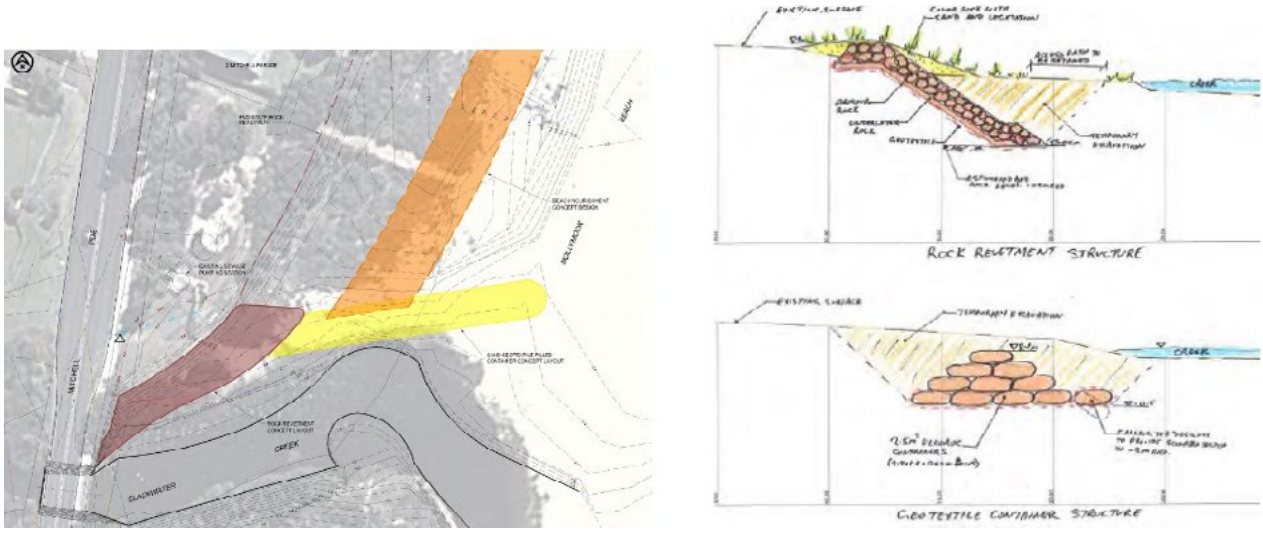
**Future multi-use features**

Nil

**Future eco-features**

Nil

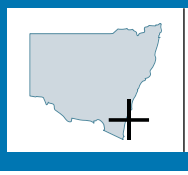

Nearmap image showing of Blackwater Creek, Mollymook, where the entrance is trained by buried geotextile sandbags.




Plan from Mollymook Beach Management Action Plan showing the location of the buried geotextile sandbag training wall on the northern side of Blackwater Creek, Mollymook. The red area is where rock has been placed, the yellow area where geotextile bags filled with sand have been installed, and the orange area is where sand nourishment is undertaken. Cross sections of the geotextile sandbags are shown on the right.

*Source: Shoalhaven Council (2019)*

# Ulladulla Harbour historical change

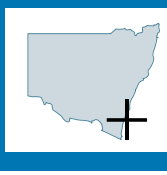


-28.8745S
153.591W

Aerial photo from November 1937 of Ulladulla Harbour showing the now heritage-listed ocean breakwater commenced in 1863 and upgraded in 1882 *Source: Adastra Aerial Photo Collection*


The Ulladulla Harbour: (1) heritage-listed inner harbour wall; (2) Gondwana fossil sites; (3) northern breakwater; (4) southern outer breakwater *Credit: Google Earth*

# Ulladulla Harbour Breakwater (North)



-35.355S
150.4777W

| | |
|---|---|
| **Responsible authority:** | NSW State Government |
| **Built:** | 1964 |
| **Primary purpose when first built:** | Ocean harbour for coastal shipping |
| **Current uses:** | – Ocean access for boating<br>– Fishing spot |
| **Regulatory matters** | – *Heritage Act 1977* |

**Multi-use features:** – Walking pathway

**Eco-features:** – Within 50 m of natural reef

The breakwater is very accessible. It is close to parking, amenities, greenspace and urban areas.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

- Maintain pedestrian walkway surface
- Rock placement for seating and fishing opportunities

**Future eco-features**

Nil


The Ulladulla Harbour northern breakwater *Credit: Six Maps*

# Ulladulla Harbour Breakwater (South)

-35.3565S
150.479W

| | |
|---|---|
| **Responsible authority:** | NSW State Government |
| **Built:** | 1863–1882 |
| **Modified:** | Outer harbour wall built 1964 |
| **Primary purpose when first built:** | Ocean harbour for coastal shipping |
| **Current uses:** | – Ocean access for boating<br>– Fishing spot |
| **Regulatory matters** | – *Heritage Act 1977* |

**Multi-use features:** – Walking pathway

**Eco-features:** – Within 50 m of natural reef

The breakwater is very accessible. It is close to parking, amenities, greenspace and urban areas. Fossils up to 270 million years old can be seen in the rock platforms adjacent to the harbour's northern and southern breakwaters. These rock platforms form part of the guided Gondwana Coastal Fossil Walk.

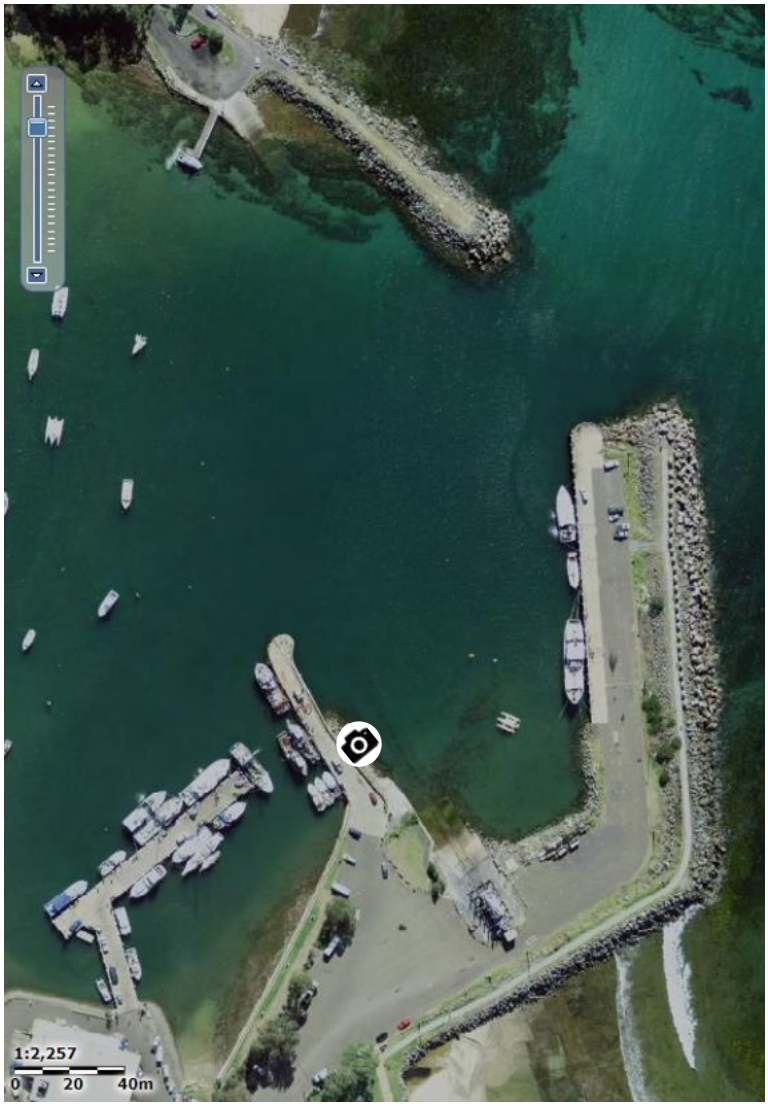
**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

– Maintain pedestrian walkway surface

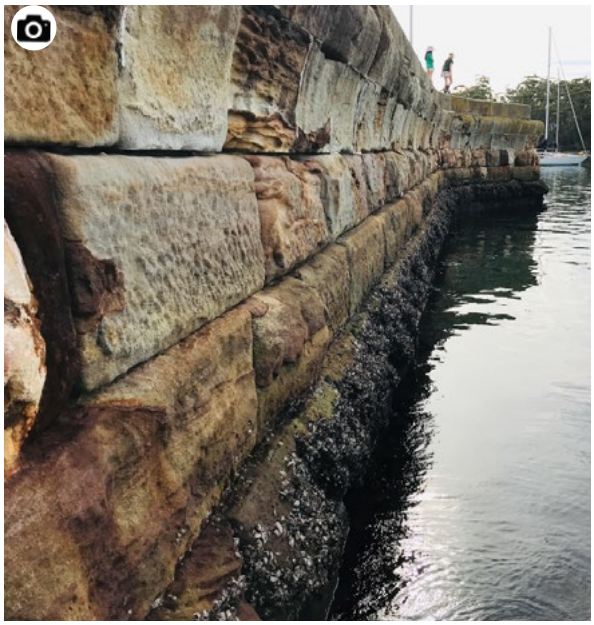
**Future eco-features**

– Sewage pump out facilities are required




The heritage-listed inner breakwater and the outer harbour walls constructed in the 1960s

*Credit: Six Maps*



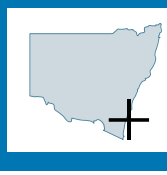
The heritage stone pier on the southern side of Ulladulla Harbour is encrusted in oysters, which provide a natural filtering of the Harbour's waters

*Credit: Jillian Keating*

The heritage stone pier (now known as the inner harbour wall) was built on the edge of a natural reef in 1865 and replaced a wooden jetty that provided little protection for coastal shipping.

Ulladulla Harbour has hosted the annual Blessing of the Fleet since 1971, which was first performed at the Ulladulla Harbour in 1956. The event celebrates the Italian heritage of many of the commercial fishers who use the harbour and continues a centuries old tradition from Sicily. It is now an important social and cultural event that attracts many visitors.

# Clyde River estuary-wide change



-28.8745S
153.591W

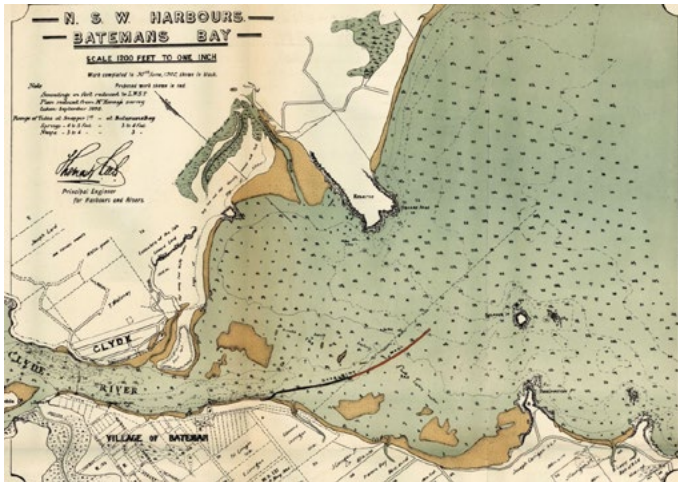
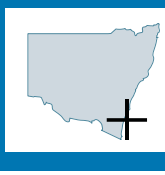



Chart showing progress on installing the southern training wall in 1902.
*Credit: NSW Public Works Department Annual Report 1902*

Current-day accretion and reclamation landward of the breakwater and erosion around Surfside on the northern part of the Bay opposite the breakwater.
*Credit: Six Maps*


Changes to the estuary since the breakwater was installed are shown by merging the two images above.

# Clyde River Harbour Breakwater South



-35.7159S
150.1922W

| | |
|---|---|
| **Responsible authority:** | NSW State Government |
| **Built:** | 1899–1905 |
| **Modified:** | Harbour added in 1978–80 |
| **Primary purpose when first built:** | Trained entrance for coastal shipping |
| **Current uses:** | – Integral for 35 ha of housing, holiday park, sports fields and marina harbour<br>– Provides a coastal walkway<br>– Fishing spot |
| **Regulatory matters:** | – Batemans Marine Park |
| **Multi-use features:** | – Protects an urban precinct behind Corrigans Beach, Hanging Rock Boat Harbour and ramp and a harbour marina |
| **Eco-features:** | Nil |

Parts of the breakwater and training wall are accessible. They are close to parking, amenities, greenspace and urban areas. The estuarine training wall extends upstream for 1.2 km and includes inlets that support seagrass, saltmarsh, and wader and migratory bird habitats.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

– Maintain pedestrian walkway surface
– Install CoastSnap photo point
– Rock placement for seating and fishing opportunities
– Rock placement for emergency safety stairs

**Future eco-features**

– Enhance key fish habitat by improving flushing along parts of the training wall, especially where a stormwater outlet discharges into a backwater

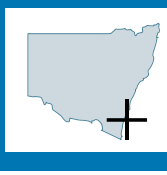

Batemans Bay: (1) Corrigans Beach; (2) Hanging Rock Boat Harbour; (3) Inlet with key fish habitats.

Hanging Rock boat harbour and ramp

Inlet with key fish habitats that could be improved


Progressive time series of aerial photos of the Clyde River estuary at Batemans Bay (left to right: 1964, 1977 and 2016). A break was made in the training wall to create the marina in 1978 and, later, another break created Hanging Rock boat harbour and the ramp at the eastern end

# Tomaga River Breakwater



-35.8377S
150.1868W

| | |
|---|---|
| **Responsible authority:** | Unknown |
| **Built:** | 1850-59 |
| **Primary purpose when first built:** | Rock ballast from shipping used to partially train the estuary entrance |
| **Current uses:** | – Heritage values |
| **Regulatory matters:** | – *Heritage Act 1977* |

**Multi-use features:** – Heritage item of local significance

**Eco-features:** – Within 50 m of natural reef

The State Heritage Inventory listing for the site explains that the material in the ballast dump breakwater comes from a variety of locations including South America. The structure includes rails used to carry the ballast and extend the breakwater along the point.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

– Document and recognise heritage values

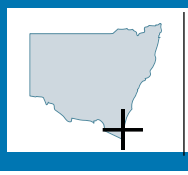
**Future eco-features**

Nil


The Tomaga River, Mossy Point rock ballast heritage breakwater *Credit: nearmap*

Entrance of the Tomaga River *Source: Broulee Bay Folklore, Myth and Legends website. Photo: Richard Fisher*

# Moruya River estuary-wide change

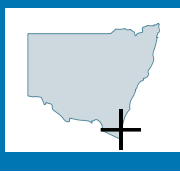


-28.8745S
153.591W


Aerial photo from November 1937 showing the trained entrance of Moruya River showing (1) the Metrological Station and (2) the end of original southern training wall (also in the aerial photo below) *Source: Adastra Aerial Photo Collection*


The Moruya River and its trained entrance: (1) the Meteorological Station; (2) end of the original southern training wall; (3) Shelly Beach; (4) abandoned southern breakwater; (5) northern breakwater. *Source: Google Earth*

# Moruya River Breakwater (North)



-35.905S
150.154W

**Responsible authority:** NSW State Government

**Built:** 1897–1903

**Primary purpose when first built:** Trained entrance for coastal shipping, especially for high quality granite for many prominent government buildings in Sydney during the late 1800s and for the Sydney Harbour Bridge pylons during the 1920–30s

**Current uses:**
– Ocean access for boating
– Popular coastal walkway
– Fishing spot

**Regulatory matters:** – Batemans Marine Park

**Multi-use features:** – Walking pathway

**Eco-features:** – An estuarine intertidal inlet

The breakwater is accessible. It is close to parking and greenspace. An estuarine training wall extends upstream for 120 m. An inlet supports seagrass, saltmarsh, and wader and migratory bird habitats.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

– Maintain pedestrian walkway surface
– Install CoastSnap photo point
– Rock placement for emergency safety stairs

**Future eco-features**

– Adjacent osprey tower
– Increase submerged habitat complexity
– Key fish habitat enhancement along training wall


The Moruya River trained entrance in 1957 and 2017. *Credit: Six Maps, Crown Lands*

# Moruya River Breakwater (South)

-35.9065S
150.152W

| | |
|---|---|
| **Responsible authority:** | NSW State Government |
| **Built:** | 1876–1903 |
| **Modified:** | Lengthened 1923–25 |
| **Primary purpose when first built:** | Trained entrance for coastal shipping especially for high quality granite for many prominent government buildings in Sydney during the late 1800s and for the Sydney Harbour Bridge pylons during the 1920–30s |
| **Current uses:** | – Ocean access for boating<br>– Forms Moruya Heads surf beach |
| **Regulatory matters:** | – Batemans Marine Park |

**Multi-use features:** – Stabilises Moruya Heads ocean beach

**Eco-features:** – Estuarine intertidal inlets

The breakwater is remote. An estuarine training wall extends 1.5 km upstream with inlets that support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats. The upstream end of the training wall is close to parking, amenities, greenspace and an urban area.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

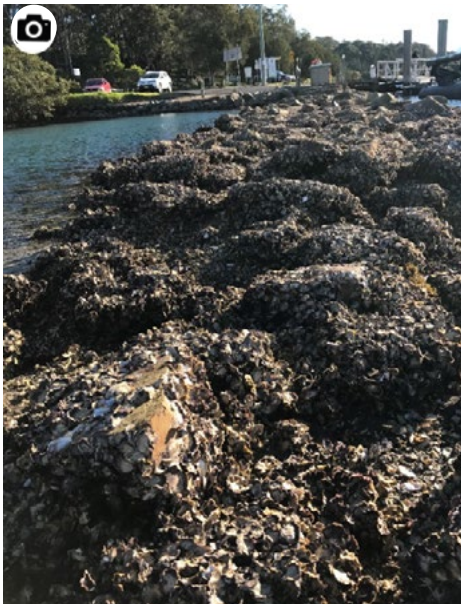
Nil

**Future eco-features**

– Maintain breakwater fauna refuge area
– Increase submerged habitat complexity
– Key fish habitat enhancement along training walls

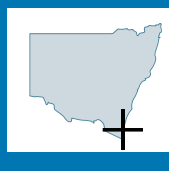

*left*: A 1917 Parish Map over a contemporary aerial photo shows the accretion of sand forming 320 m of ocean front sand beach south of the current southern breakwater

The Moruya River southern breakwater and training wall
*Credit: Six Maps*



Oyster encrusted training walls
*Credit: Jillian Keating*

# Moruya River Breakwater (abandoned)



-35.908S
150.156W

| | |
|---|---|
| **Responsible authority:** | Unknown |
| **Built:** | 1861–1862 |
| **Modified:** | Structure failed and collapsed |
| **Primary purpose when first built:** | Trained entrance for coastal shipping |
| **Current uses:** | – Artificial Reef |
| **Regulatory matters:** | – Batemans Marine Park<br>– *Heritage Act 1977* |

| | |
|---|---|
| **Multi-use features:** | – 140 metres of ocean beach |
| **Eco-features:** | – Artificial reef<br>– Within 50 m of natural reef<br>140 metres of ocean beach |

The abandoned breakwater was the first step in developing the current estuary entrance condition, which is located further north than the natural entrance.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

– Document and recognise heritage values

**Future eco-features**

Nil

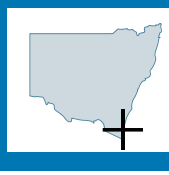
**Historical notes from the state heritage listing:**

*"According to the Log Book and Diary kept by Captain John Ross, first Maritime Pilot at Moruya Heads in 1860, work commenced on the Southern Breakwater in September 1861 when a "draft of men and horses occupied a site on the Head and started a quarry on Middle Head". Mr Baron, Superintendent of Harbour Improvements surveyed and laid out a line for the Breakwater. Ross and his men assisted by putting down some posts. Only 2 months after work had commenced on the Breakwater (November 1861) a fierce southerly storm washed away a great part of the new work. Again in December, the contractor's road was "broken by the sea and part of the dyke washed away, resulting in a wagon going over the end".*

*"With the completion of the Breakwater (no date recorded) it was found to have the effect of scouring a channel through the bar which improved navigation for a time. The Breakwater only achieved limited success and by 1867 construction had commenced on the present training walls using granite from a quarry on the southern side of the river near the "Anchorage" and from the north of the river. Part of the Old Breakwater can still be found near Shelly Beach, noticeable because of its smooth rounded boulders as compared with the jagged appearance of the natural rock formations in the area".*
(NSW EES 2020).

The Moruya River southern breakwater and submerged remnants of the original, heritage listed, southern breakwater.
*Credit: Six Maps*

# Wagonga River estuary-wide change

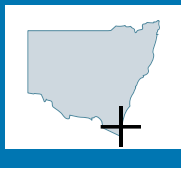


-28.8745S
153.591W

Aerial photo from November 1937 showing the trained entrance in the Wagonga River estuary. Further works, including construction of the breakwaters occurred in 1977–78 *Source: Adastra Aerial Photo Collection*


The Wagonga River estuary and its breakwater and trained entrance showing: (1) entrance breakwaters; (2) wave-trap beach; (3) estuary training walls; (4) heritage lock built in 1939 to pen Eastern Australian Salmon. *Credit: Google Earth*

# Wagonga Inlet Breakwater (North)



-36.2094S
150.1341W

| | |
|---|---|
| **Responsible authority:** | NSW State Government |
| **Built:** | 1922 training wall |
| **Modified:** | Breakwater added in 1976–78 |
| **Primary purpose when first built:** | Trained entrance for coastal shipping especially |
| **Current uses:** | – Ocean access for boating<br>– Popular coastal walkway<br>– Fishing spot<br>– Forms popular estuarine wave-trap beach with an enclosed swimming area |
| **Regulatory matters:** | – Batemans Marine Park<br>– *Heritage Act 1977* |

**Multi-use features:**
– Walking pathway
– Stabilises estuarine beach

**Eco-features:**
– Estuarine intertidal inlets

The breakwater is very accessible. It is close to parking, amenities and greenspace. An estuarine training wall extends upstream for 1.1 km. Inlets support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats. The wave trap beach, known as Bar Beach, is a popular swimming and snorkelling spot.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

– Maintain pedestrian walkway surface
– Install CoastSnap photo point
– Rock placement for emergency safety stairs

**Future eco-features**

– Adjacent osprey tower
– Increase submerged habitat complexity
– Key fish habitat enhancement along training walls
– Sewage pump-out facilities are required

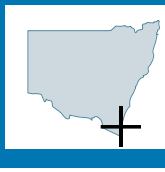

The breakwater and training wall network in the Wagonga Inlet at Narooma. *Credit: Six Maps*



Swimming enclosure on the wave-trap beach adjacent to Apex Park *Credit: neamap*

The site of an opening installed into the northern training wall in 1939 and fitted with a lifting gate and winch to use the backwater area created by the training wall as a holding pen for Eastern Australian Salmon for Australia's first fish cannery (Coltheart 1997).

# Wagonga Inlet Breakwater (South)



-36.2103S
150.1343W

| | |
|---|---|
| **Responsible authority:** | NSW State Government |
| **Built:** | 1922 training wall |
| **Modified:** | Breakwater added in 1976–78 |
| **Primary purpose when first built:** | Trained entrance for coastal shipping |
| **Current uses:** | – Ocean access for boating<br>– Popular coastal walkway<br>– Fishing spot |
| **Regulatory matters:** | – Batemans Marine Park<br>– *Heritage Act 1977* |

**Multi-use features:** – Walking pathway

**Eco-features:** – Estuarine intertidal inlets

The breakwater is very accessible. It is close to parking, amenities and greenspace. An estuarine training wall extends upstream for 1.2 km. Inlets support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats. Nearby a hole in the rockface was originally used to moor ships to the headland with large chains. The hole is now known as Australia Rock and is a popular natural tourist attraction.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

– Maintain pedestrian walkway surface
– Rock placement for emergency safety stairs
– Consider use of crown rock to maximise physical buffers between humans and seals

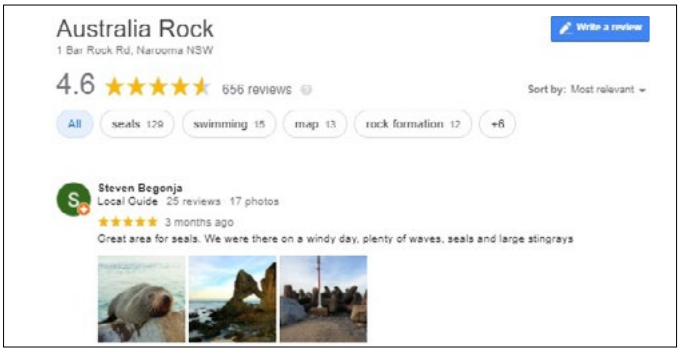
**Future eco-features**

– Increase submerged habitat complexity
– Key fish habitat enhancement along training walls
– Sewage pump-out facilities are required


The breakwater and training wall network and (1) the location of Australia Rock at Wagonga Inlet, Narooma. *Credit: Six Maps*

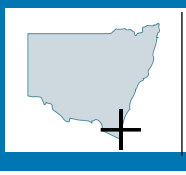
Dense aggrigations of oysters have settled in the training walls and associated backwater areas
*Credit: Jillian Keating*

Seal resting on the Narooma breakwater
*Source: Narooma News*




Google Review showing the southern breakwater as a popular place for visitors to watch seals resting on the breakwater. The southern breakwater is also located next to a rock formation that has become known as Australia Rock

# Bermagui River estuary-wide change



-28.8745S
153.591W

Aerial photo from November 1937 showing the natural condition of the entrance to the Bermagui River prior to the installation of breakwaters, training wall and estuary harbour infrastructure

*Source: Adastra Aerial Photo Collection*


The Bermagui River estuary and its trained entrance: (1) northern breakwater; (2) southern breakwater; (3) northern wave-trap beach; (4) southern wave-trap beach; (5) Bermagui Harbour *Credit: Google Earth*

# Bermagui River Breakwater (North)

-36.422S
150.0726W

**Responsible authority:** NSW State Government

**Built:** 1958–59

**Primary purpose when first built:** Trained entrance for boating for fishing and tourism

**Current uses:**
- Ocean access for boating
- Popular coastal walkway
- Fishing spot
- Forms an estuarine wave-trap beach

**Multi-use features:**
- Walking pathway
- Wave-trap beach

**Eco-features:** Nil

The breakwater is very accessible. It is close to parking, amenities, greenspace and urban areas. An estuarine training wall extends upstream for 270 m. Inlets support saltmarsh, and wader and migratory bird habitats.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**
- Maintain pedestrian walkway surface
- Install CoastSnap photo point
- Rock placement for emergency safety stairs

**Future eco-features**
- Increase submerged habitat complexity
- Key fish habitat enhancement along training walls


The Bermagui River northern breakwater: (1) northern breakwater; (2) northern wave-trap beach; (3) an area where tidal flows through the training wall create an intertidal that could be enhanced for a small area of fish or bird forage habitat *Credit: Six Maps*

# Bermagui River Breakwater (South)

-36.423S
150.0735W

| | |
|---|---|
| **Responsible authority:** | NSW State Government |
| **Built:** | 1958–59 |
| **Primary purpose when first built:** | Trained entrance for fishing and tourism |
| **Current uses:** | – Ocean access for boating<br>– Popular coastal walkway<br>– Fishing spot<br>– Forms popular estuarine wave-trap beach and enclosed ocean swimming pool |
| **Multi-use features:** | – Walking pathway<br>– Wave-trap beach and enclosed Bruce Steer Ocean Swimming Pool |
| **Eco-features:** | – Within 50 m of natural reef |

The breakwater is very accessible. It is close to parking, amenities, greenspace and urban areas. An estuarine training wall that extends 1.2 km upstream incorporates the Bermagui Boat Harbour.

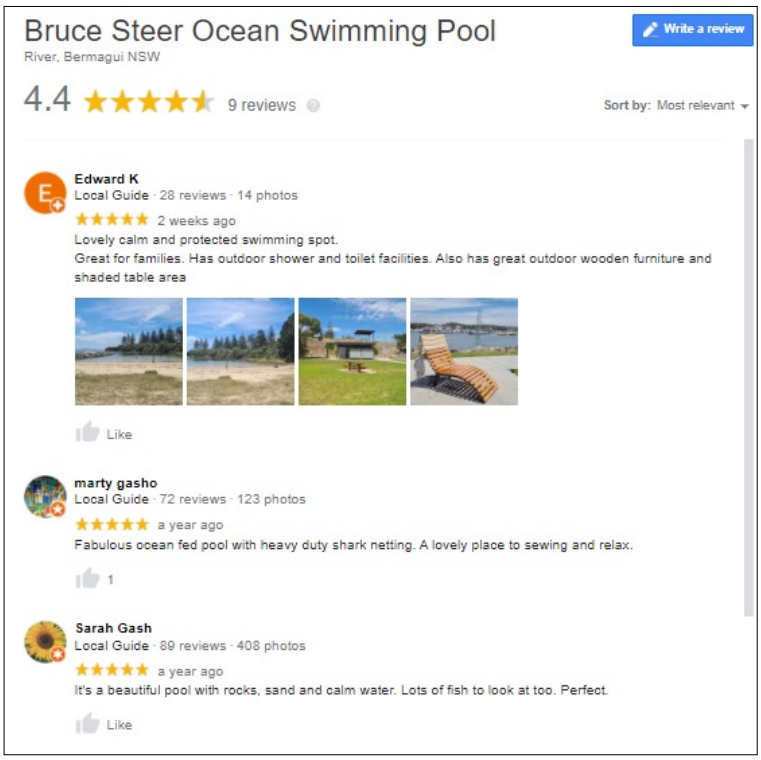
**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

– Maintain pedestrian walkway surface
– Rock placement for emergency safety stairs

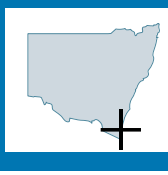
**Future eco-features**

Nil


*left*: The Bermagui southern breakwater: (1) southern breakwater; (2) the sandy area of Bermagui's popular Bruce Steer enclosed ocean swimming pool *Credit: Six Maps*

# Bermagui Harbour



-36.4246S
150.0716W

| | |
|---|---|
| **Responsible authority:** | NSW State Government |
| **Built:** | 1958–1959 |
| **Primary purpose when first built:** | Boat harbour for fishing and tourism |
| **Current uses:** | – Boat harbour and ocean access for boating |

| | |
|---|---|
| **Multi-use features:** | – Walking pathway<br>– Wave-trap beach |
| **Eco-features:** | Nil |

The boat harbour is an important precinct with parking, amenities and greenspace.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

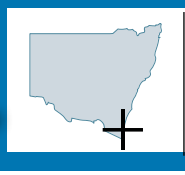
– Maintain pedestrian walkway surface

**Future eco-features**

– Sewage pump-out facilities are required


The Bermagui Boat Harbour *Credit: Six Maps*

# Twofold Bay Eden Shipping Terminal Breakwater



-37.0747S
149.907W

| | |
|---|---|
| **Responsible authority:** | NSW State Government |
| **Built:** | 1965 |
| **Modified:** | Extended in 1985–87 |
| **Primary purpose when first built:** | Armoured harbour for fishing and tourism |
| **Current uses:** | – Harbour and ocean access for boating |

**Multi-use features:** Nil

**Eco-features:** Nil

The breakwater is a key piece of infrastructure that enables cruise ships to berth at the Port of Eden.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

– Upgrade crest surface to a pedestrian walkway surface
– Rock placement for emergency safety stairs

**Future eco-features**

– Sewage pump-out facilities are required


The Snug Cove, Eden breakwater
*Credit: Six Maps*

# Twofold Bay
# Quarantine Bay Breakwater

-37.0785S
149.884W

| | |
|---|---|
| **Responsible authority:** | Bega Valley Shire Council |
| **Built:** | Initially the site of an older wharf structure, the present breakwater structure was built and expanded in 1978–79 |
| **Primary purpose when first built:** | – Breakwater for fishing and tourism |
| **Current uses:** | – Ocean access for boating |

**Multi-use features:** Nil

**Eco-features:** – Within 50 m of natural reef

The breakwater shelters the adjacent boat ramp and moored vessels in Quarantine Bay.

**Recommendations for possible inclusion in future maintenance or upgrade works**

**Future multi-use features**

– Upgrade crest surface to a pedestrian walkway surface
– Rock placement for emergency safety stairs

**Future eco-features**

Nil


The Quarantine Bay breakwater
*Credit: Six Maps*

Loading timber sleepers on the 'Bellinger' at Quarantine Bay, Eden, circa 1930s
*Source: CE Wellings, National Library of Australia (nla.obj-148655807*

Quarantine Bay, Eden: breakwater & launching ramp, 1979
*Source: NSW Public Works State Library Government Printing Office 37507*


Quarantine Bay, Eden: breakwater and launching ramp, 1979
*Source: NSW Public Works State Library Government Printing Office 287225*

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