

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

Stockton to Shellharbour (Illustrated Volume II)



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

### Acknowledgments



Department of  
Primary Industries



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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.

[www.marine.nsw.gov.au](http://www.marine.nsw.gov.au)

**Cover photo sources:** Patrick Dwyer, Lea Mamo  
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# 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 (this volume)
- Volume III Breakwater Audit MEMA South Region.

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

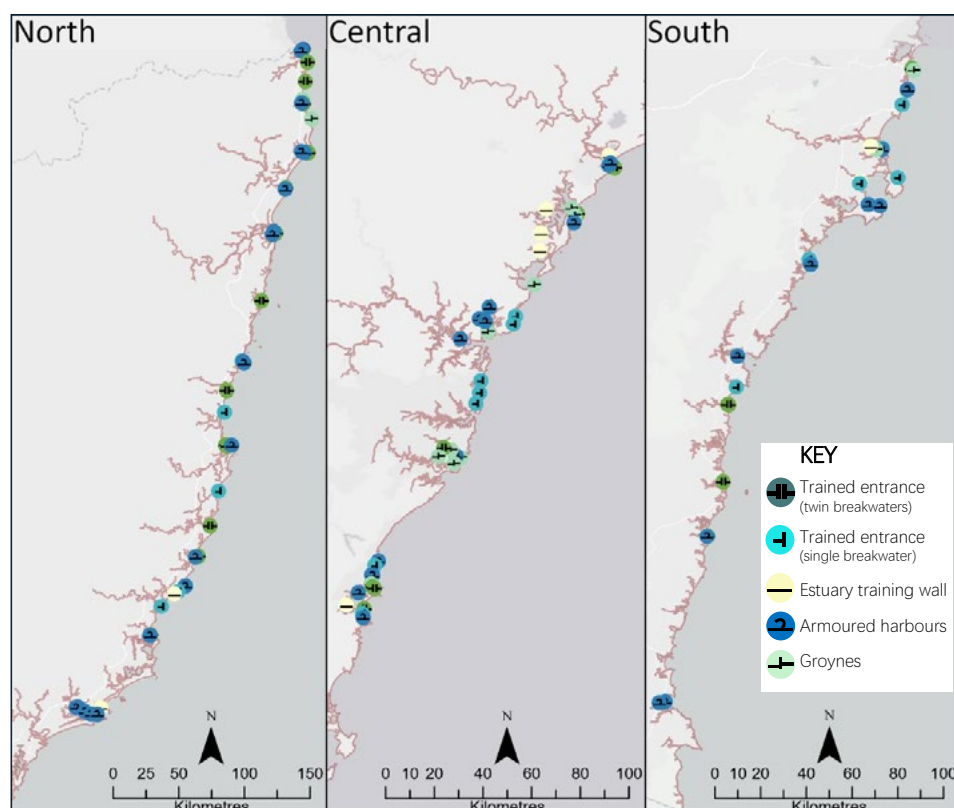


Figure 1: Marine Estate Management regions showing breakwater structures—trained river entrances, armoured harbours and groynes along the NSW coastline that were assessed in this audit.

Maps prepared by Alex Wray-Barnes and Emma Wilkie




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# Hunter River estuary-wide change

	-28.8745S 153.591W
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A submerged reef was blasted and removed as part of the works to create the entrance to the Port of Newcastle.

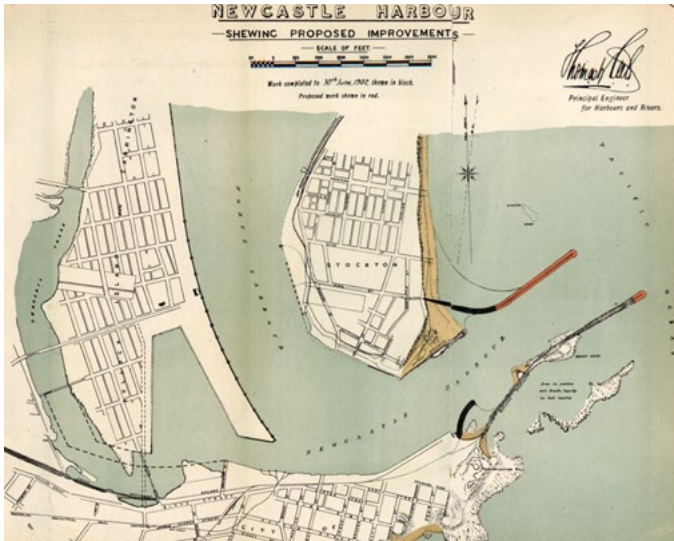


Chart updating progress on training the entrance of the Hunter River entrance at Newcastle in 1902

Source: NSW Public Works Department 1902 Annual Report



The Hunter River estuary in 2009

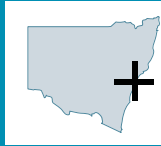
Credit: Google Earth



Changes in the shape of the Hunter River estuary and its trained entrance from 1902 to 2009 are shown by merging the above two images Credit: Google Earth



# Hunter River Breakwater (North)



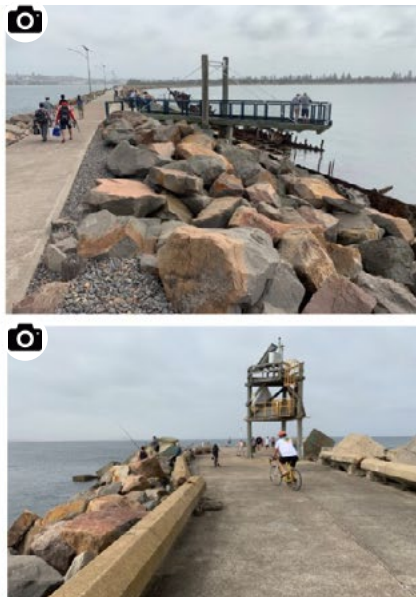
-32.9151S  
151.7951W

<b>Responsible authority:</b>	Newcastle Port Authority
<b>Built:</b>	1861–1872
<b>Modified:</b>	900 m extension in 1896–1912
<b>Primary purpose when first built:</b>	Trained entrance for coastal shipping
<b>Current uses:</b>	<ul style="list-style-type: none"> <li>– Ocean access for boating</li> <li>– Popular shipwreck walk</li> <li>– Heritage precinct</li> <li>– Fishing spot</li> <li>– Forms a popular estuarine wave-trap beach</li> </ul>
<b>Regulatory matters:</b>	– <i>Heritage Act 1977</i>

<b>Multi-use features:</b>	<ul style="list-style-type: none"> <li>– Shipwreck Walk pathway</li> <li>– Stabilises two beaches</li> </ul>
<b>Eco-features:</b>	Nil
<p>The breakwater is very accessible. It is close to parking, amenities, greenspace and urban areas. An estuarine training wall extends upstream by 4.18 km. It includes inlets that support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats.</p>	

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

<p><b>Future multi-use features</b></p> <ul style="list-style-type: none"> <li>– Maintain pedestrian walkway surface</li> <li>– Rock placement for seating and fishing opportunities</li> <li>– Rock placement for emergency safety stairs</li> </ul>	<p><b>Future eco-features</b></p> <ul style="list-style-type: none"> <li>– Increase submerged habitat complexity</li> <li>– Key fish habitat enhancement along training walls</li> </ul>
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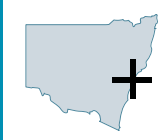
Aerial photo of the Hunter Northern breakwater showing (1) the breakwater and (2) heritage shipwrecks and water access  
Credit: nearmap



Safety stairs have been installed to assist divers accessing the shipwrecks adjacent to the Hunter River northern breakwater (detail from the top aerial image) Credit: nearmap



# Hunter River Breakwater (South)



–32.9169S  
151.801W

<b>Responsible authority:</b>	Newcastle Port Authority
<b>Built:</b>	1818–1846, 1896
<b>Primary purpose when first built:</b>	Trained entrance for coastal shipping
<b>Current uses:</b>	<ul style="list-style-type: none"> <li>– Ocean access for major shipping port</li> <li>– Popular coastal walkway</li> <li>– Fishing spot</li> <li>– Forms an estuarine wave-trap beach</li> </ul>
<b>Regulatory matters:</b>	– <i>Heritage Act 1977</i>

<b>Multi-use features:</b>	<ul style="list-style-type: none"> <li>– Walking pathway</li> <li>– Stabilises two beaches</li> <li>– Heritage value and information</li> </ul>
<b>Eco-features:</b>	Nil
<p>The breakwater is very accessible. It is close to parking, amenities, greenspace and urban areas. An estuarine training wall that extends upstream for 280 m has a walkway into the Newcastle central business district.</p>	

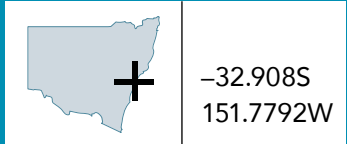
**Recommendations for possible inclusion in future maintenance or upgrade works**

<p><b>Future multi-use features</b></p> <ul style="list-style-type: none"> <li>– Maintain pedestrian walkway surface</li> <li>– Rock placement for emergency safety stairs</li> </ul>	<p><b>Future eco-features</b></p> <ul style="list-style-type: none"> <li>– Increase submerged habitat complexity</li> </ul>
---	---



The Hunter estuary southern breakwater showing seating opportunities and relief artwork used to explain the historical importance of the breakwater *Credit: Google Earth*

# Hunter River Hereford Street Harbour



**Responsible authority:** NSW Government

**Built:** 1890s

**Primary purpose when first built:** Coastal shipping trade

**Current uses:**

- Boat harbour
- Ocean access for boating
- Popular coastal walkway
- Fishing spot
- Heritage values

**Regulatory matters:** - Heritage Act 1977

**Multi-use features:** - Heritage

**Eco-features:** Nil

The breakwater is part of a heritage area known as The Ballast Grounds. Ballast is rock or other heavy material placed into the bilge of a ship to improve its stability. Up until the early 20th century ballast was adjusted by adding or removing ballast rock depending on the amount and weight of a ship's cargo. As ships were loaded with coal from the Port of Newcastle, their rock and rubble ballast was dumped at The Ballast Grounds. The Grounds and the breakwater contain rubble ballast from all over the world, including rubble from buildings destroyed in the 1906 San Francisco earthquake.

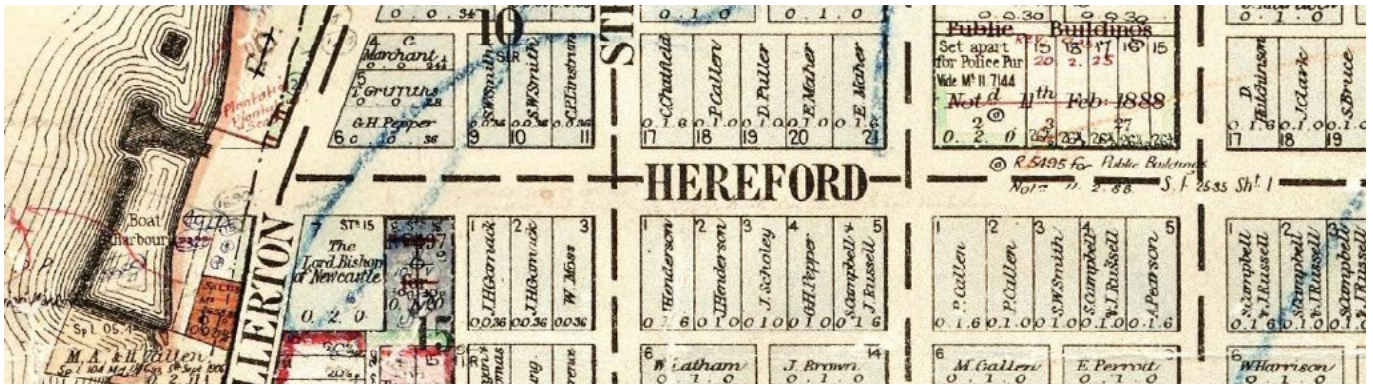
## Recommendations for possible inclusion in future maintenance or upgrade works

**Future multi-use features**

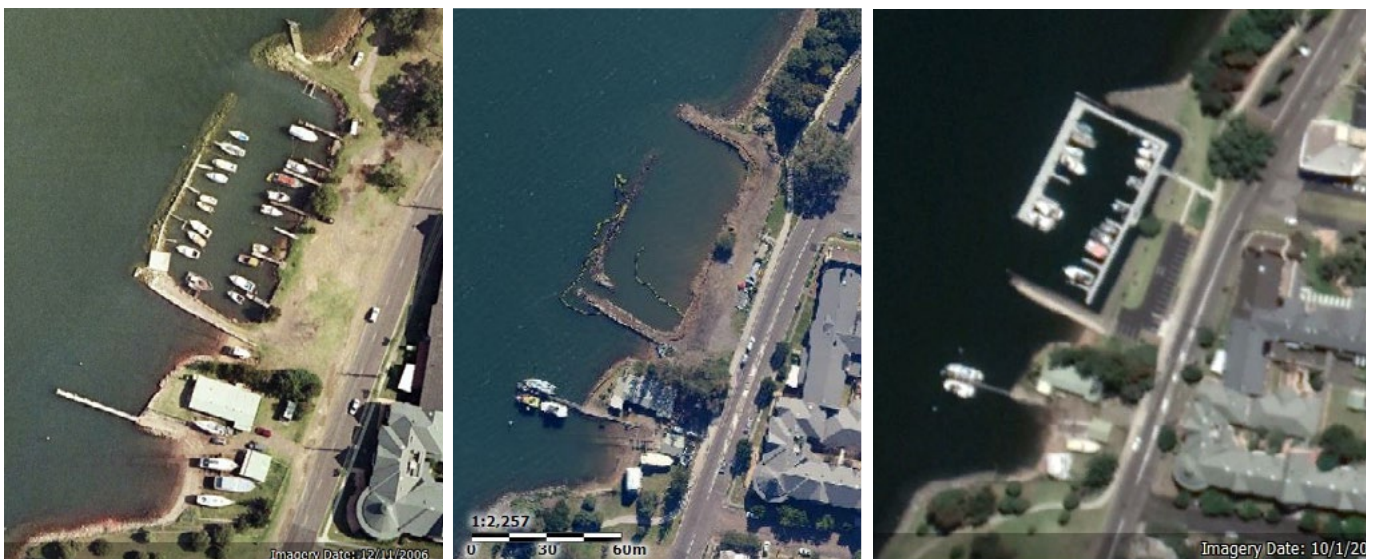
- Maintain pedestrian walkway surface

**Future eco-features**

Nil



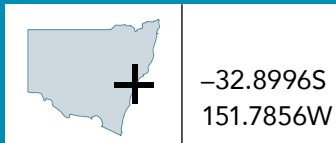
The Hereford Street boat harbour is shown on the 1915 parish map



Aerial photo of the Hereford Street Harbour in the Hunter estuary showing recent upgrade works that incorporated retaining heritage values and maximising boating values Credit: Six Maps



# Hunter River Griffith Avenue Harbour



-32.8996S  
151.7856W

**Responsible authority:** NSW Government

**Built:** 1890s

**Primary purpose when first built:** Coastal shipping trade

**Current uses:**

- Boat ramp
- Fishing spot

**Regulatory matters:** - Heritage Act 1977

**Multi-use features:** - Boat ramp

**Eco-features:** - Mangrove rock fillets

The estuarine harbour is very accessible. It is close to parking, amenities, greenspace and urban areas. Rock fillets incorporated into the training wall upstream of the harbour increase opportunities for mangrove recruitment.

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

**Future multi-use features**  
Nil

**Future eco-features**  
Nil



Mangroves had recruited into the inlet before 1954 and are still visible in this 1976 photo

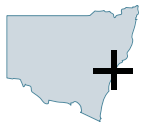


The mangroves were cleared from the inlet in about 1984, when the boat ramp was installed.

Recent upgrade works at the Griffith Avenue Harbour improved its value for recreational boating with (1) the installation of the jetty. Other works added environmental value to the site and involved installing (2) rock fillets as part of the training wall upstream. These sheltered areas provide ideal conditions for establishment of mangroves *Credit: Six Maps*



# Hunter River Kooragang Island Training Wall



-32.8730S  
151.7810W

<b>Responsible authority:</b>	Unknown
<b>Built:</b>	1960s
<b>Primary purpose when first built:</b>	Coastal shipping trade
<b>Current uses:</b>	– Estuary training
<b>Regulatory matters:</b>	– <i>Hunter Wetlands National Park</i>

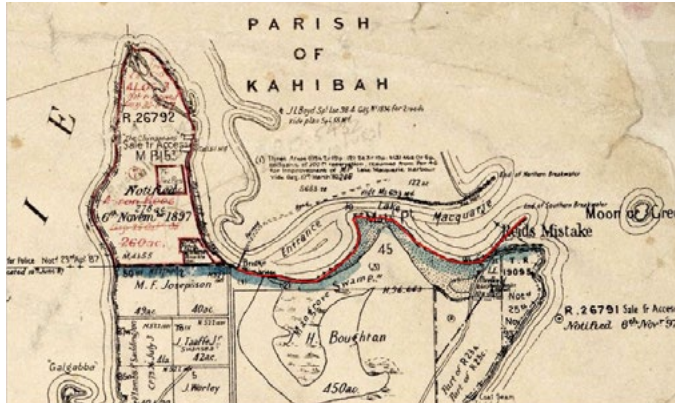
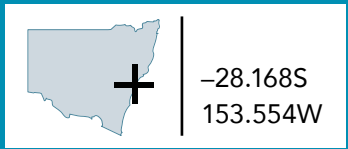
<b>Current multi-use features:</b>	Nil
<b>Eco-features:</b>	Nil
An estuarine training wall extends upstream by 1.9 km and includes inlets that support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats on the eastern foreshore of Kooragang Island.	

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



Aerial photo showing the estuary and Kooragang Island in 1958 (left) prior to the expansion of the Island for port facilities, installation of the training wall and construction of the Stockton Bridge (right). *Credit: Crown Lands and Six Maps*

# Lake Macquarie estuary-wide change



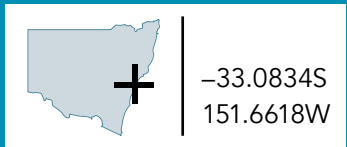
The foreshore around the entrance has retreated since 1914. The parish map (left) and the red line of the 2018 aerial photograph (right) show the original shoreline. Credit: Six Maps



Changes to the entrance and lake foreshore from 1914 to 2018 are shown by merging the above two images



# Lake Macquarie Breakwater (North)

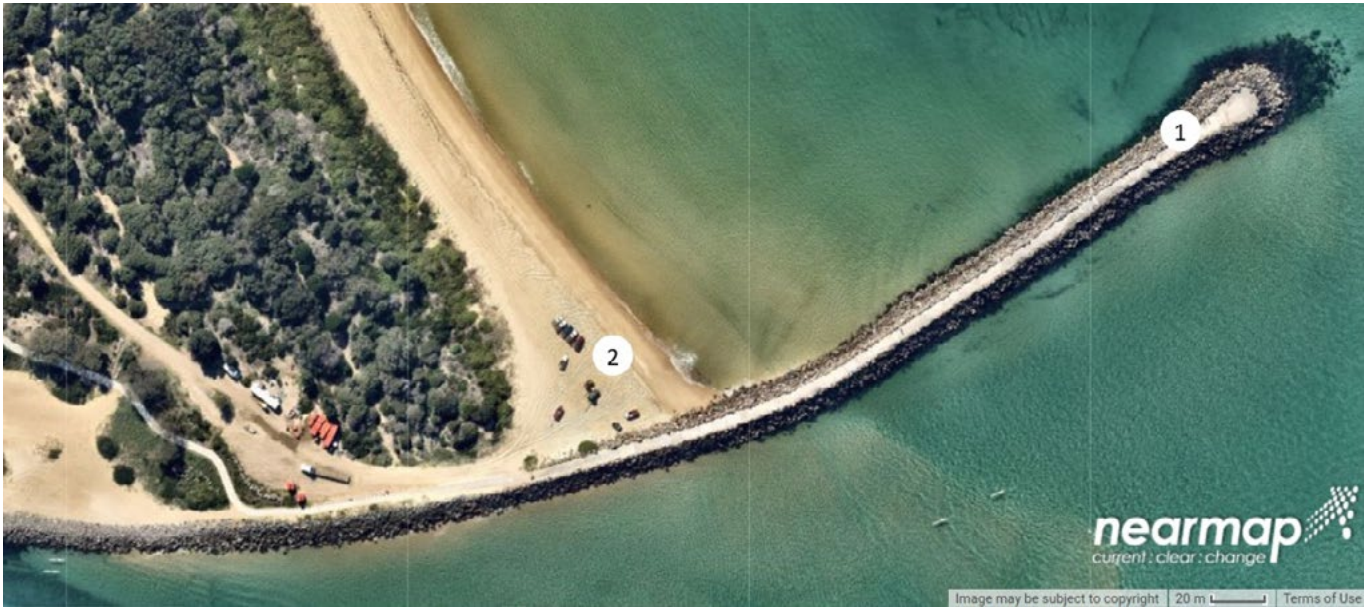


<b>Responsible authority:</b>	NSW State Government
<b>Built:</b>	1880–1887
<b>Modified:</b>	Lengthened 380 m in the 1960s
<b>Primary purpose when first built:</b>	Trained entrance for coastal shipping
<b>Current uses:</b>	<ul style="list-style-type: none"> <li>– Ocean access for boating</li> <li>– Popular coastal walkway</li> <li>– Fishing spot</li> </ul>

<b>Multi-use features:</b>	<ul style="list-style-type: none"> <li>– Walking pathway</li> <li>– CoastSnap photo point</li> </ul>
<b>Eco-features:</b>	Nil
<p>The breakwater is very accessible. It is close to parking, amenities, greenspace and urban areas. An estuarine training wall extends upstream for 1.6 km and includes several small inlets. One inlet, known as Grannys Pool, provides a popular sheltered swimming area. Another has a ramp and provides boating access. Other areas support seagrass, mangrove and saltmarsh habitats.</p>	

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

<p><b>Future multi-use features</b></p> <ul style="list-style-type: none"> <li>– Maintain pedestrian walkway surface</li> <li>– Rock placement for seating and fishing opportunities</li> <li>– Rock placement for emergency safety stairs</li> </ul>	<p><b>Future eco-features</b></p> <ul style="list-style-type: none"> <li>– Increase submerged habitat complexity</li> <li>– Key fish habitat enhancement along training walls</li> </ul>
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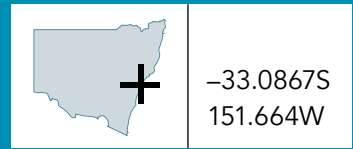
Aerial photo of the Lake Macquarie Northern breakwater showing (1) the northern breakwater; (2) commercial fishers haul mullet from the beach *Credit: NearMap*



Lake Macquarie northern training wall: (3) Grannys Pool; (4 and 6) intertidal inlet with seagrass, mangroves and saltmarsh; (5) inlet with boat ramp *Credit: Six Maps*



# Lake Macquarie Breakwater (South)



<b>Responsible authority:</b>	NSW State Government
<b>Built:</b>	1877–1887
<b>Primary purpose when first built:</b>	Trained entrance for coastal shipping
<b>Current uses:</b>	<ul style="list-style-type: none"> <li>– Ocean access for boating</li> <li>– Fishing spot (Lucys Groyne)</li> </ul>

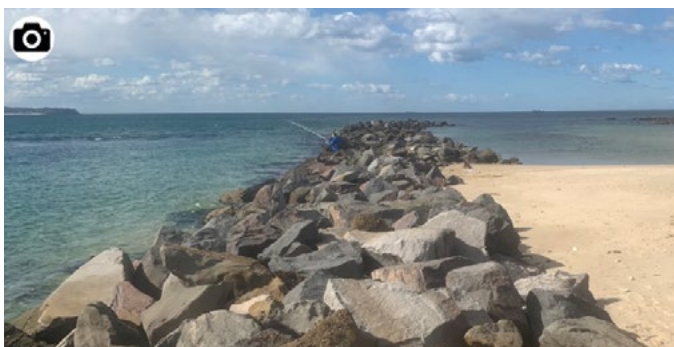
<b>Multi-use features:</b>	Nil
<b>Eco-features:</b>	<ul style="list-style-type: none"> <li>– Within 50 m of natural reef</li> </ul> <p>Lucys Groyne is part of a scheme to manage sand movement</p>
<p>The breakwater is accessible. It is close to parking, amenities and greenspace. The breakwater has a rubble surface crest. An estuarine training wall extends 480 m to Lucys Groyne. Further upstream, numerous works have been installed to arrest the retreat of Salts Bay, where seagrass, mangrove, saltmarsh, and wader and migratory bird habitats have been lost.</p>	

**Recommendation: examine and assess primary purpose**

<b>Future multi-use features</b>	<b>Future eco-features</b>
– Rock placement for emergency safety stairs	– Maintain breakwater fauna refuge area



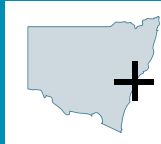
Aerial photo of (1) the Lake Macquarie southern breakwater (2) Lucys Groyne and (3) remnant erosion protection works  
 Credit: nearmap



The rubble crest surface of the southern breakwater and the concrete surface of Lucys Groyne



# Lake Macquarie Salts Bay Groynes



-33.091S  
151.654W

**Responsible authority:** Unknown

**Built:** 1980s and 1990s

**Primary purpose when first built:** Sand management

**Current uses:** – Sand management

**Multi-use features:** – Walking pathway on Lucys Groyne

**Eco-features:** – Sand management

A network of groynes has been established to limit erosion and maintain seagrass, mangrove, saltmarsh, and wader and migratory bird habitats.

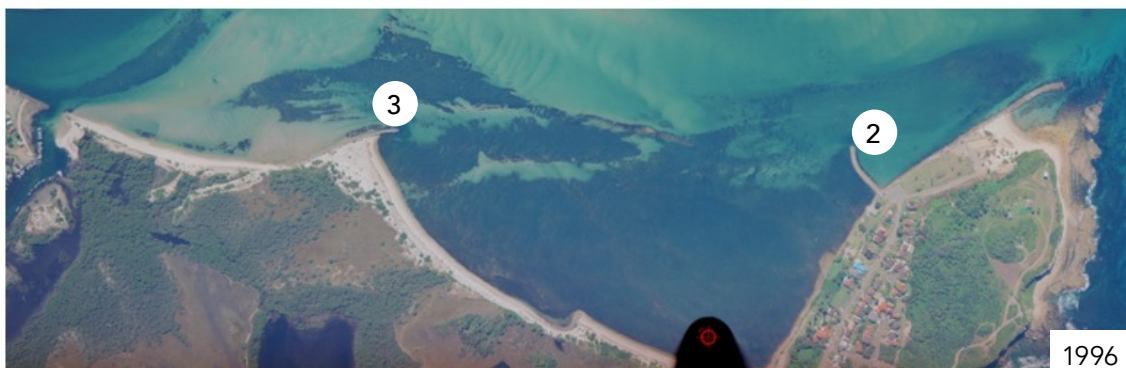
## Recommendations for possible inclusion in future maintenance or upgrade works

### Future multi-use features

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

### Future eco-features

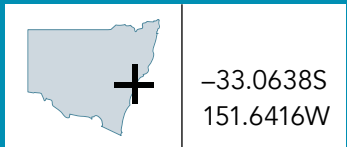
Nil



Aerial photo of Salts Bay: (1) Remnant erosion protection works; (2) Lucys Groyne; (3) Mats Groyne; (4) Salts Bay Groynes *Credit: Crown Lands*



# Lake Macquarie Swan Bay Groynes



<b>Responsible authority:</b>	Unknown	<b>Multi-use features:</b>	Nil
<b>Built:</b>	1990s	<b>Eco-features:</b>	Nil
<b>Primary purpose when first built:</b>	Sand management	In 2016, the Pelican Marina building - a function centre on the lake foreshore – partially collapsed. The building has been demolished. To prevent further erosion of the foreshore, stabilisation and erosion control works have been installed at the site.	
<b>Current uses:</b>	– Sand management		

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



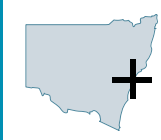
Aerial photo images of Swan Bay in 1976; in 1996 a large channel that formed in response to commercial dredging; and, after the channel was narrowed by installing two groynes Credit: Crown Lands



Detail of Swan Bay entrance in 2013 after groynes were used to narrow the entrance to the Bay (left) and control erosion downstream near Pelican Inlet (right) Credit: Six Maps



# Lake Macquarie Myuna Bay Training Wall



–33.0689S  
151.5478W

<b>Responsible authority:</b>	Unknown
<b>Built:</b>	1977
<b>Primary purpose when first built:</b>	Power plant cooling water canal outlet infrastructure
<b>Current uses:</b>	– Power plant infrastructure, pedestrian walkway

<b>Multi-use features:</b>	– Adjacent pedestrian walkway
<b>Eco-features:</b>	Nil
The breakwater was built during the late 1970s as part of the outlet (1) for the Eraring Power Station water cooling system. The power station draws through an intake (2) that passes under Dora Creek.	

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
– Currently nil, but linked to future management of the power station	Nil




The Eraring Power Station coolant water is returned into Myuna Bay within Lake Macquarie via a constructed outlet (1) armoured with a breakwater. The location of the outlet is shown in 1976 (left) before it was constructed and in 2018 (right)  
Credit: Crown Lands and Google Earth



The breakwater at the Eraring Power Station cooling water outlet  
Credit: Six Maps



# Lake Macquarie Manning Point Training Wall

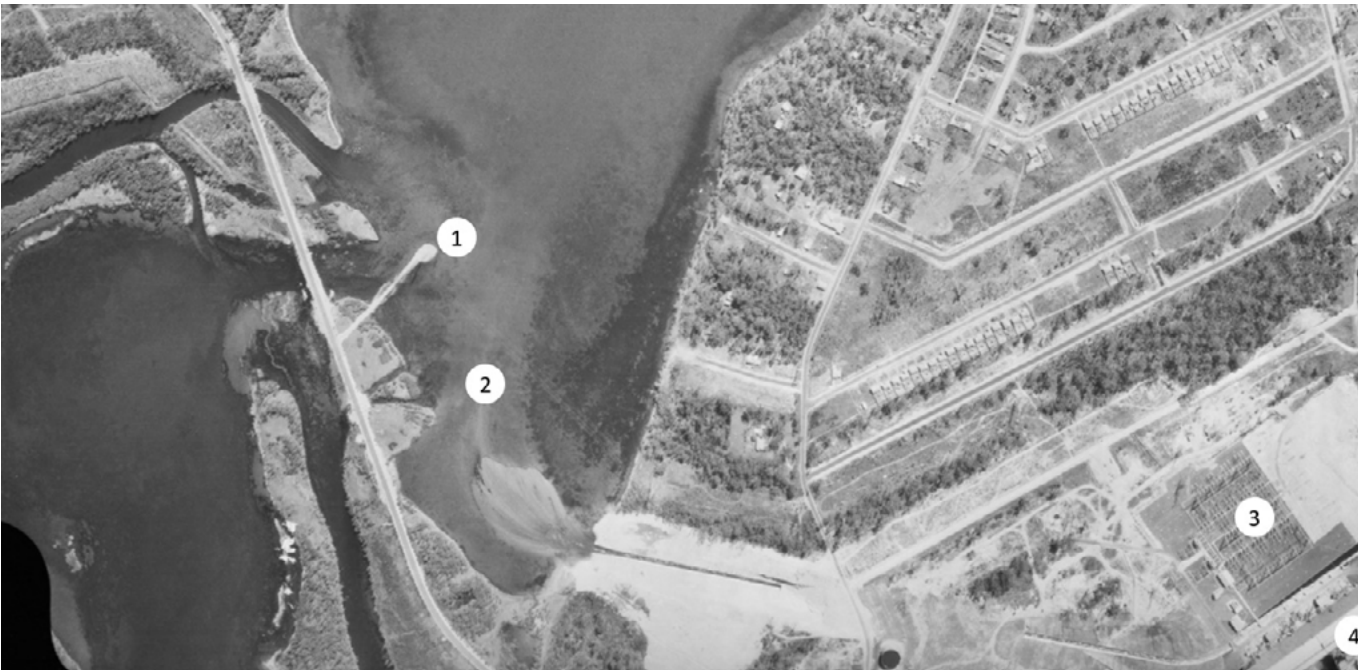


–33.1560S  
151.5283W

<b>Responsible authority:</b>	Unknown
<b>Built:</b>	1960s
<b>Primary purpose when first built:</b>	Installation of powerlines from Vales Point Power Plant
<b>Current uses:</b>	– Powerlines from Vales Point Power Plant

<b>Multi-use features:</b>	Nil
<b>Eco-features:</b>	Nil
The breakwater was built during the early 1960s as part of infrastructure for the Vales Point Power Plant.	

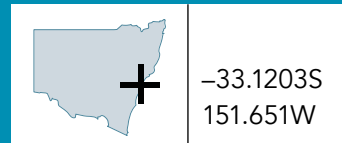
Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



Manning Point breakwaters, installed as part of the powerline infrastructure for the Vales Point power station in 1965 (above) and 2017 showing (1) the original breakwater; (2) second breakwater also built in the 1960s; (3) electricity substation and (4) Vales Point Power Plant *Credit: Crown Lands and Google Earth*



# Caves Beach Mawsons Breakwater

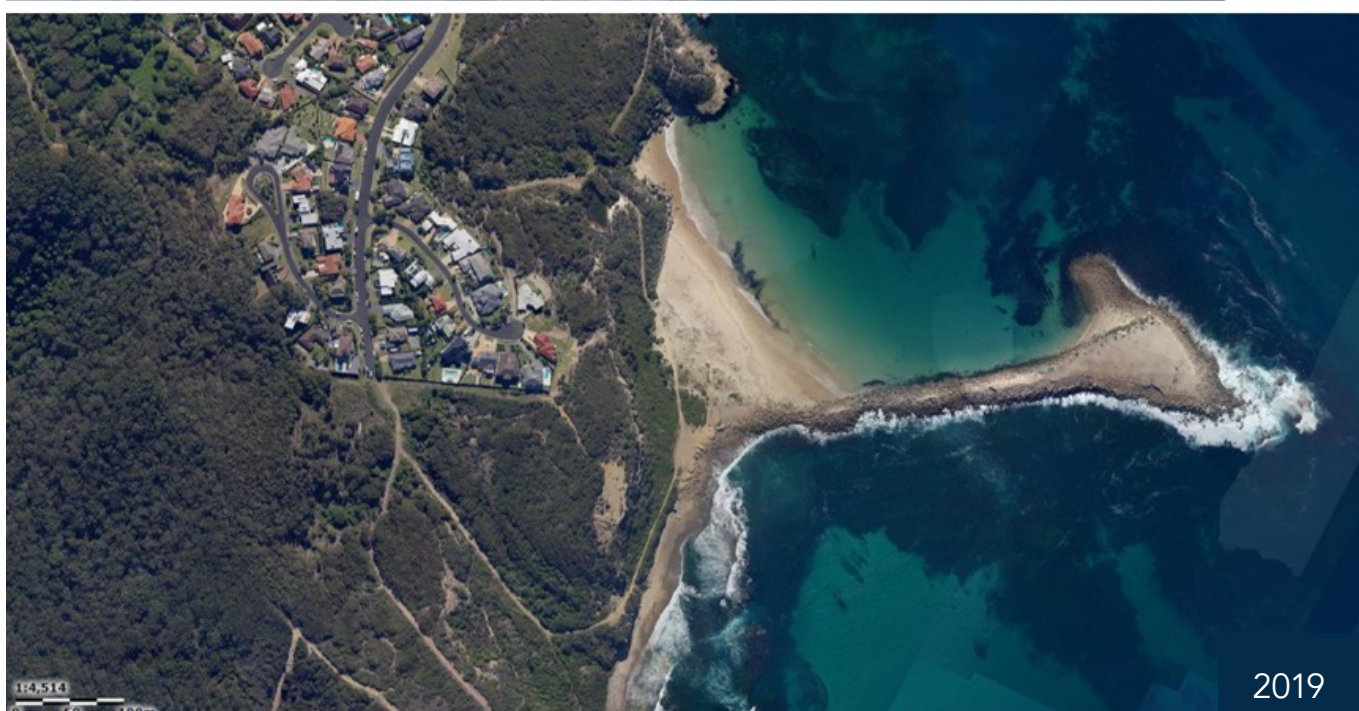


<b>Responsible authority:</b>	Unknown	<b>Multi-use features:</b>	Nil
<b>Built:</b>	1968	<b>Eco-features:</b>	- Within 50 m of natural reef
<b>Primary purpose when first built:</b>	Installed as the first stage of a harbour that was not finished	The breakwater was built using overburden from a nearby mine site. The structure is abandoned and is deteriorating.	
<b>Current uses:</b>	Nil		

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



1965

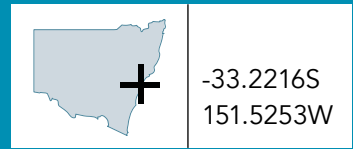


2019

Aerial photo of Mawsons breakwater Credit: Crown Lands and Six Maps



# Budgewoi Lake San Remo Training Wall



<b>Responsible authority:</b>	Unknown
<b>Built:</b>	1965
<b>Modified:</b>	2020 boat ramp installed
<b>Primary purpose when first built:</b>	Power plant cooling water canal outlet infrastructure
<b>Current uses:</b>	<ul style="list-style-type: none"> <li>- Power plant infrastructure,</li> <li>- Adjacent boat ramp</li> <li>- Pedestrian walkway</li> </ul>

<b>Multi-use features:</b>	- Boat ramp
<b>Eco-features:</b>	Nil
<p>The breakwater was built during the 1965 as part of the outlet system for release of cooling water into Budgewoi Lake. The coolant water, drawn from Lake Munmorah was initially used in the now decommissioned Munmorah Power Station. Today, the Colongra gas fired power station uses the same cooling water canals. It was completed in 2009 and is currently owned by Snowy Hydro.</p>	

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
<ul style="list-style-type: none"> <li>- Maintain and improve pedestrian walkway surface</li> <li>- Rock placement for seating and fishing opportunities</li> </ul>	Nil



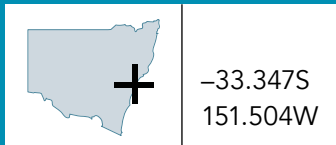
The San Remo breakwater at Budgewoi Lake directs water releases from the Colongra gas-fired power station into Budgewoi Lake. The images show the breakwater in 1965 (left) and 2017 (right) *Credit: Crown Lands and Google Earth*



Water from Lake Munmorah is drawn into an intake (1), used at the power station (2) and released into Budgewoi Lake (3)



# The Entrance Groyne

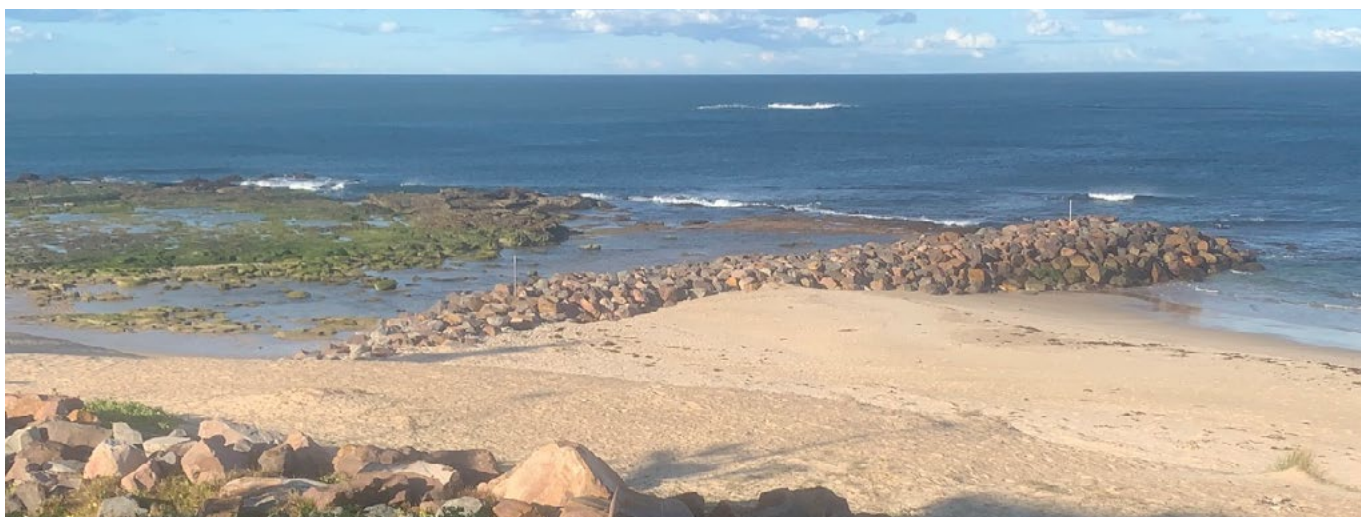


<b>Responsible authority:</b>	NSW State Government	<b>Multi-use features:</b>	Nil
<b>Built:</b>	2017	<b>Eco-features:</b>	- Within 50 m of natural reef
<b>Primary purpose when first built:</b>	Sand management for maintenance of sand on Roberts Beach	The groyne is accessible. It is close to parking, amenities, greenspace and urban areas.	
<b>Current uses:</b>	- Estuary management		

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



The Entrance showing: (1) a groyne on Roberts Beach south of the rock outcrop and (2) The Entrance channel, where Tuggerah Lake meets the sea *Credit: nearmap*



The Tuggerah Lakes groyne at the northern end of Roberts Beach



# Avoca Lagoon Entrance



-33.4643S  
151.4344W

**Responsible authority:** Central Coast Council  
**Built:** Unknown  
**Primary purpose when first built:** Partially trained entrance for estuary management  
**Current uses:** – Sand management

**Multi-use features:** Nil  
**Eco-features:** Nil  
The local council manages the entrance to reduce flooding of properties in the catchment by mechanically opening the entrance once water levels in the lagoon reach 2.1 m AHD.

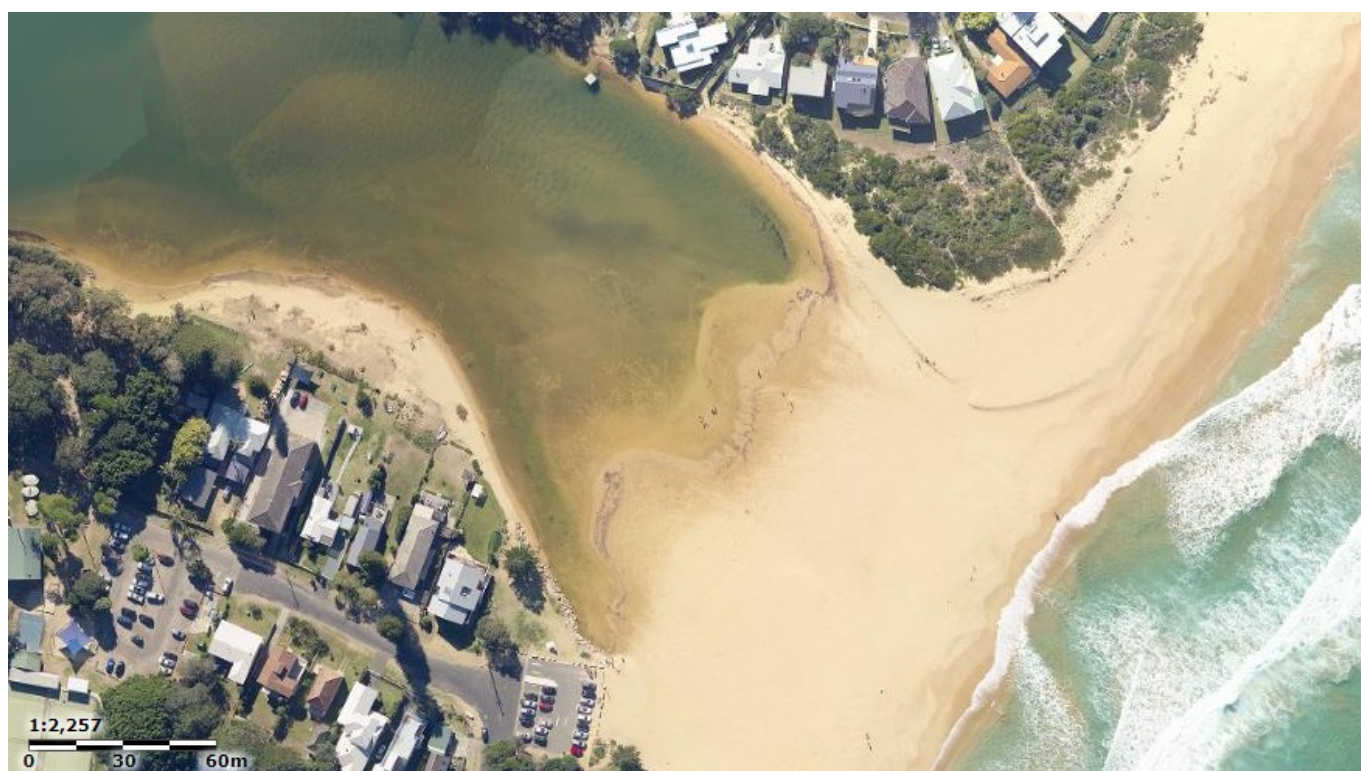
## Recommendations for possible inclusion in future maintenance or upgrade works

### Future multi-use features

Nil

### Future eco-features

Nil



The entrance at Avoca Lagoon

*Credit: Six Maps*

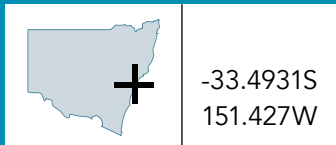


The rocks on the southern bank of the entrance channel were installed to limit the channel undermining the car park area

*Credit: Six Maps*



# Cockrone Lagoon Entrance



**Responsible authority:** Central Coast Council  
**Built:** Unknown  
**Primary purpose when first built:** Partially trained entrance for estuary management  
**Current uses:** – Sand management

**Multi-use features:** Nil  
**Eco-features:** Nil  
The local council manages the entrance to reduce flooding of properties in the catchment by mechanically opening the entrance once water levels in the lagoon reach 2.53 m AHD. The rocks on the southern bank protect a public foreshore reserve and walkway.

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

### Future multi-use features

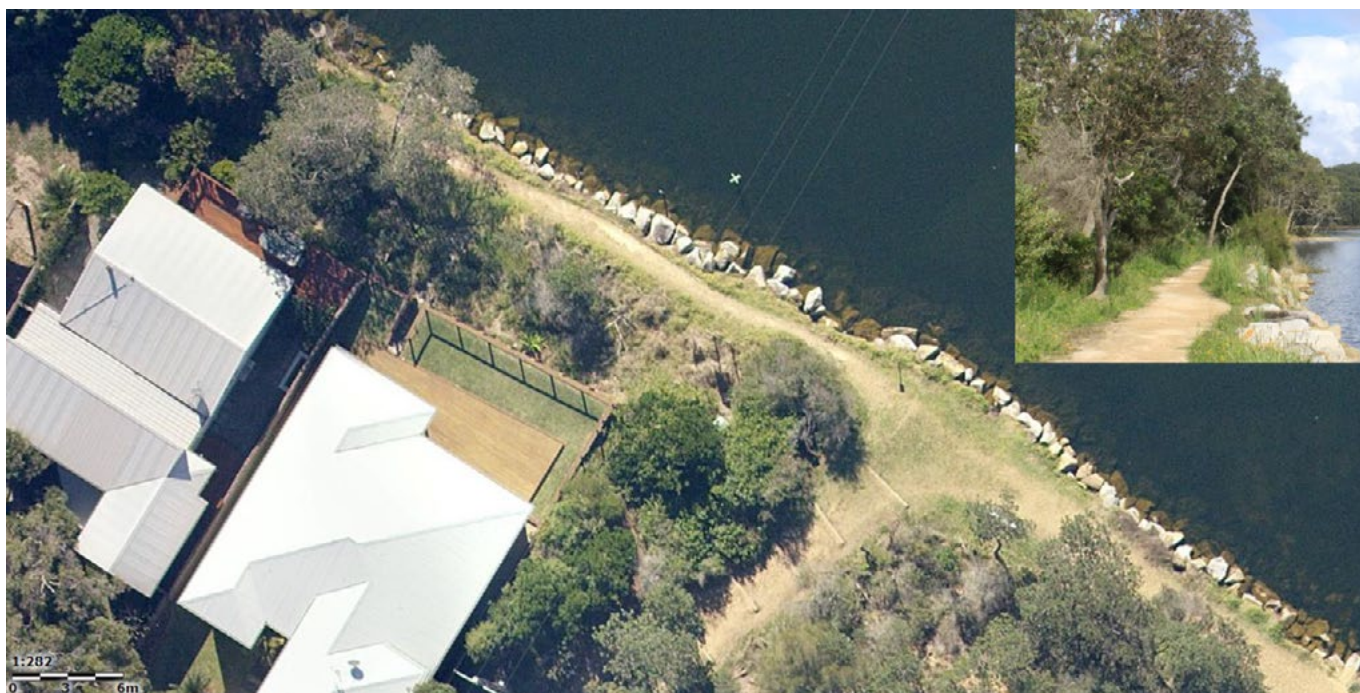
Nil

### Future eco-features

Nil



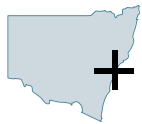
The entrance of Cockrone Lagoon *Credit: nearmap*



Cockrone Lagoon foreshore walkway on the southern bank near the entrance of Cockrone Lagoon *Credit: Six Maps*



# Broken Bay Ettalong Point Groynes



-33.520S  
151.3330W

<b>Responsible authority:</b>	NSW State Government
<b>Built:</b>	1970
<b>Updated:</b>	1990s
<b>Primary purpose when first built:</b>	Sand management
<b>Current uses:</b>	– Sand management

<b>Multi-use features:</b>	Nil
<b>Eco-features:</b>	Nil
<p>In 1972, five groynes were built to manage sand losses after outlet headworks for a drain, installed in 1965 to drain the Lemon Grove Swamp (now the netball courts), interrupted movement of sand. The site has since been armoured along the foreshore and received beach nourishment.</p>	

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



Aerial photo of the Ettalong Point groyne field in 1978 (left) and showing the Ettalong Point groyne field now (right)  
Credit: Crown Lands, Six Maps



# Brisbane Waters Gosford Breakwater



-33.4322S  
151.338W

**Responsible authority:** NSW State Government  
**Built:** 1880s  
**Modified:** Breakwater extension added in the 1950s  
**Primary purpose when first built:** Estuarine harbour for coastal shipping  
**Current uses:**

- Heritage
- Estuarine harbour
- Fishing spot

**Multi-use features:**

- Heritage
- Walking pathway

**Eco-features:** Nil

The breakwater is located on the site of the original Gosford Wharf. Gosford breakwater is accessible. It is close to parking, amenities and a walking pathway.

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

### Future multi-use features

- Maintain pedestrian walkway surface

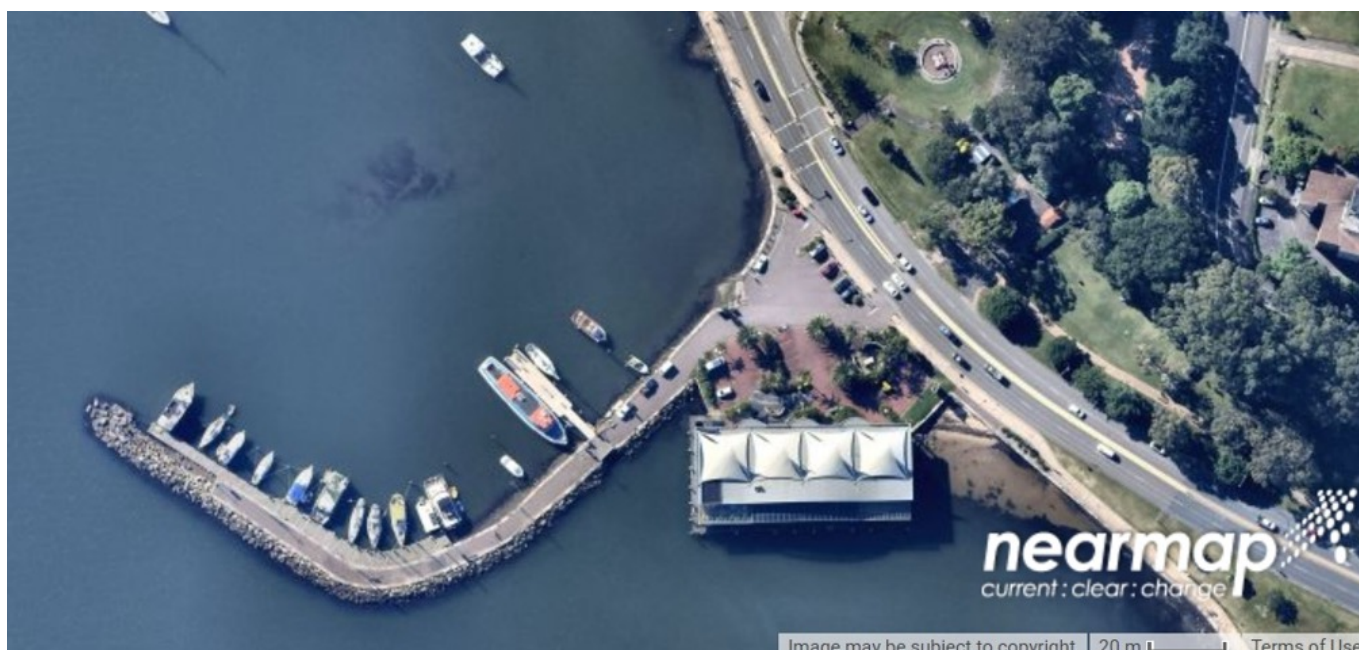
### Future eco-features

Nil



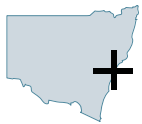
Aerial photo of the Gosford Boat Harbour and waterfront in 1953

Source: *Gostalgia*, local history from Gosford Library



Aerial photo of Gosford Harbour 2019 Credit: nearmap

# Brisbane Waters Woy Woy Railway Wharf Breakwater



-33.48242S  
151.3233W

<b>Responsible authority:</b>	Unknown
<b>Built:</b>	1890s
<b>Primary purpose when first built:</b>	Wharf for coastal shipping
<b>Current uses:</b>	- Heritage

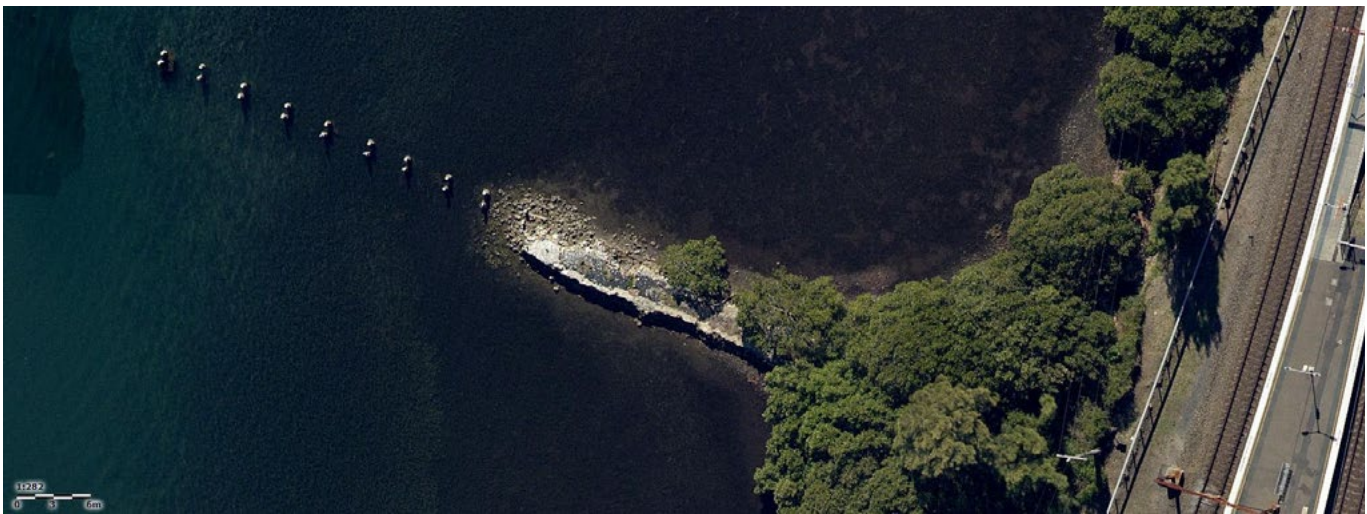
<b>Multi-use features:</b>	- Heritage
<b>Eco-features:</b>	Nil
The breakwater is generally inaccessible due to the railway tracks and establishment of mangroves.	

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

<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



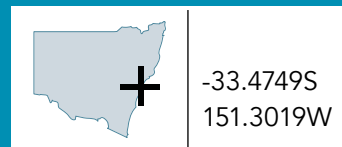
Historical image of the Woy Woy Railway Jetty 1899 *Credit: Central Coast Council*



Aerial photo of the Woy Woy public jetty located opposite the railway platform *Credit: Six Maps*



# Brisbane Waters Woy Woy Bay Breakwater



**Responsible authority:** Unknown  
**Built:** 1880s or 1920s  
**Primary purpose when first built:** Rock jetty to land boats  
**Current uses:** Nil

**Multi-use features:** Nil  
**Eco-features:** Nil  
The rock jetty may have been first built by RJ Scott, the nearby landholder, to obtain supplies. Records suggest it was upgraded or repaired in the 1920s to improve access to a walking path to the nearby lookout, Spion Kop, which has spectacular view of Woy Woy and beyond.

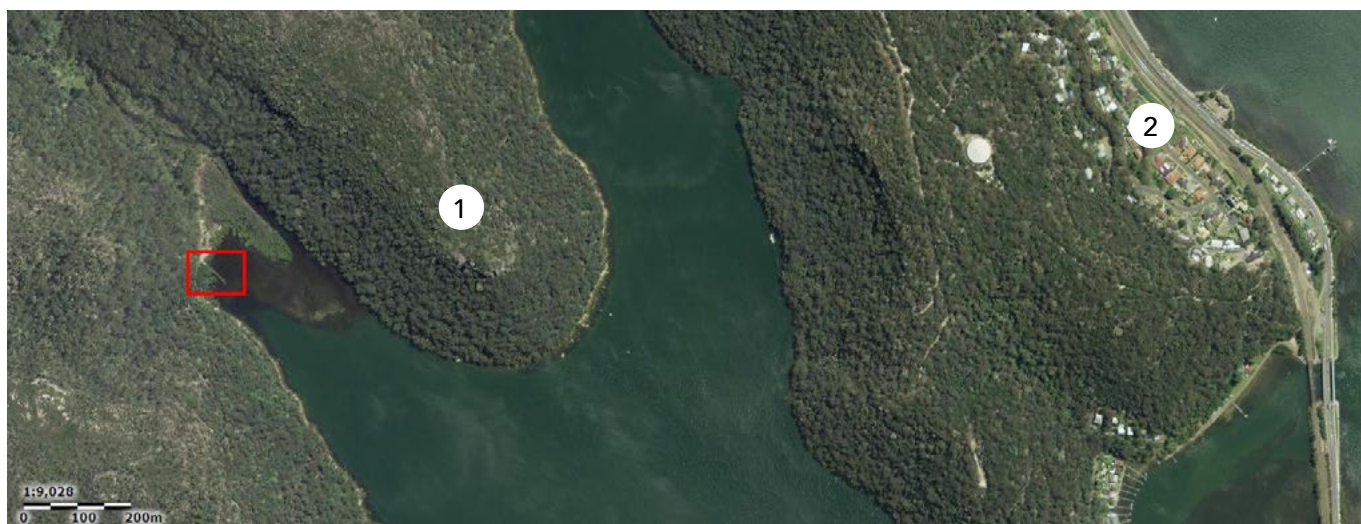
## Recommendations for possible inclusion in future maintenance or upgrade works

### Future multi-use features

- Maintain pedestrian walkway surface
- Heritage

### Future eco-features

Nil



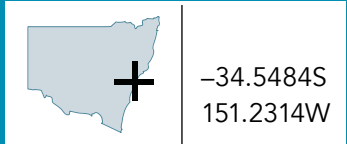
Woy Woy Bay showing the location of the rock jetty (red box); (1) Spion Kop Lookout (meaning Spy or Lookout Hill in Afrikaans) shares the name of a significant battle in the Boer War, and (2) the suburb of Koolewong. *Credit: Six Maps*



Detail from the photo above of the rock jetty at the head of Woy Woy Bay *Credit: Six Maps*



# Hawkesbury River Parsley Bay Harbour



**Responsible authority:** Unknown  
**Built:** 1965-66  
**Primary purpose when first built:** Boat harbour  
**Current uses:** – Boat harbour and boat wharf

**Multi-use features:** – Wharf  
**Eco-features:** Nil

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

### Future multi-use features

Nil

### Future eco-features

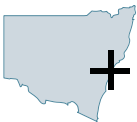
Nil



Parsley Bay Breakwater at Brooklyn, Hawkesbury River showing (1) the location of the breakwater in 2018 (above) and in 1961, prior to the breakwater being installed circa 1965 (below). Part of the bay has also been reclaimed for the carpark and foreshore facilities *Credit: Crown Lands and Google Earth*



# Narrabeen Lagoon Entrance



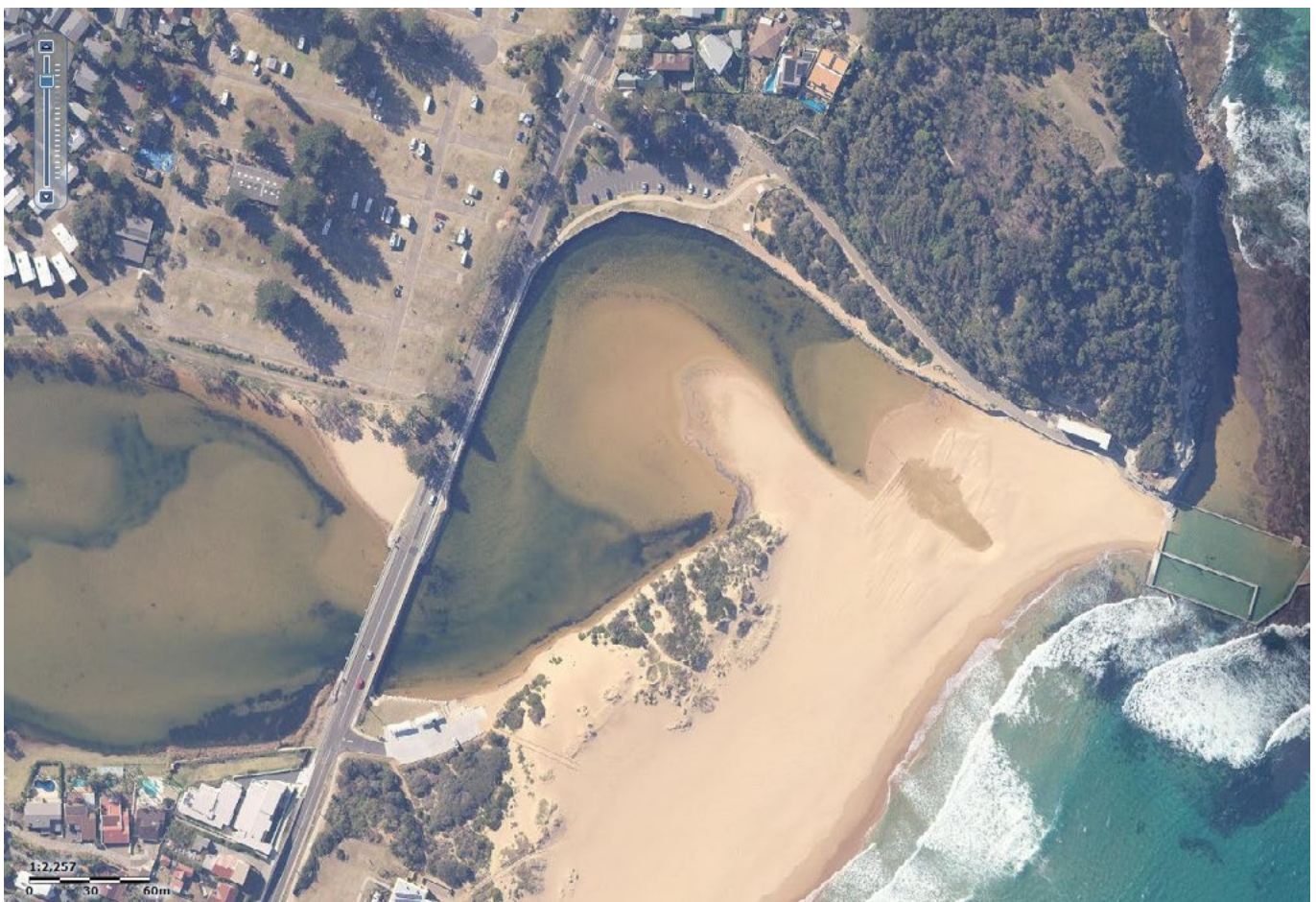
-33.17023S  
151.307W

<b>Responsible authority:</b>	Northern Beaches Council
<b>Built:</b>	1950s
<b>Primary purpose when first built:</b>	Partially trained entrance for entrance management
<b>Current uses:</b>	- Pedestrian access

<b>Multi-use features:</b>	- Walking pathway
<b>Eco-features:</b>	- Within 50 m of natural reef


The partially trained entrance provides access to the beach, surf club and ocean swimming pool facilities. The local council manages the entrance to reduce flooding of properties in the catchment by mechanically opening the entrance once water levels in the lagoon reach 1.4 m AHD.

<b>Recommendations for possible inclusion in future maintenance or upgrade works</b>	
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



The Narrabeen Lagoon entrance  
Credit: Six Maps

# Dee Why Lagoon Entrance



-33.7466S  
151.3024W

<b>Responsible authority:</b>	Northern Beaches Council
<b>Built:</b>	1979 northern side
<b>Primary purpose when first built:</b>	Partially trained entrance for estuary management
<b>Current uses:</b>	- Estuary management

<b>Multi-use features:</b>	Nil
<b>Eco-features:</b>	Nil
Dee Why Lagoon is perched above sea level. The local council manages the entrance to reduce flooding of properties in the catchment by mechanically opening the entrance once water levels in the lagoon reach 2.2 m AHD.	


<b>Recommendations for possible inclusion in future maintenance or upgrade works</b>	
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



Rock work at the entrance to Dee Why Lagoon *Credit: Six Maps*



# Manly Lagoon Entrance



–33.7858S  
151.2884W

<b>Responsible authority:</b>	Northern Beaches Council	<b>Multi-use features:</b>	– Walking pathway and pool
<b>Built:</b>	1940s	<b>Eco-features:</b>	– Within 50 m of natural reef
<b>Modified:</b>	Low flow pipes extended in 1999	The entrance incorporates a concrete race with two 1.8-m diameter low-flow pipes positioned 0.71 m below mean sea level. The local council mechanically open the entrance across the beach when lagoon water levels reach 1.4 m AHD. A rock bar 0.2 m AHD high located under the bridge behind the beach influences lagoon water levels.	
<b>Primary purpose when first built:</b>	Partially trained entrance for estuary management		
<b>Current uses:</b>	– Entrance management		

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



The Manly Lagoon estuary entrance was modified in the 1940s to incorporate a race and pipe outlet network. Source: nearmap and Crown Lands

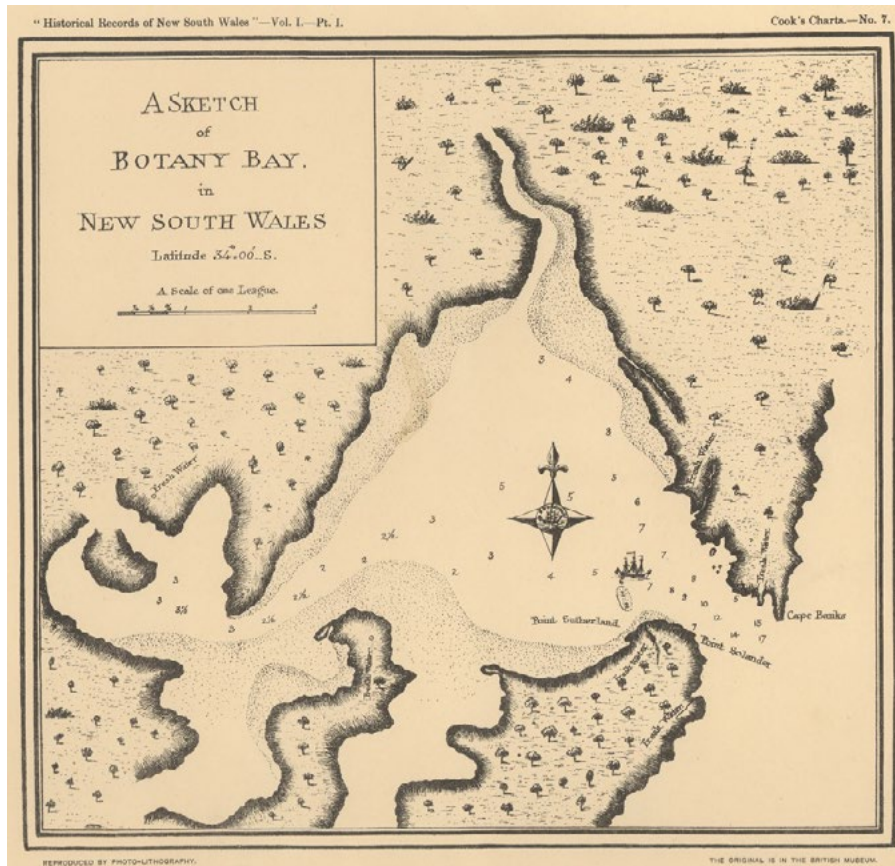


# Botany Bay estuary-wide change



-33.9847S  
151.2306W

Botany Bay is one of Australia's most impacted estuaries with large reclamations, dredging and substantial foreshore development. The southern part of the Bay includes the Towra Point Nature Reserve Ramsar site listed in 1984.



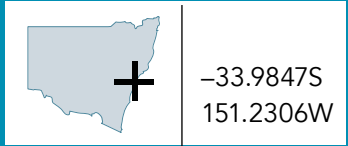
Sketch of Botany Bay published 1893 in NSW Government from the proceedings of His Majesty's Bark Endeavour on a voyage around the world by Lieutenant James Cook.



Aerial photo of Botany Bay 2020 Credit: Six Maps



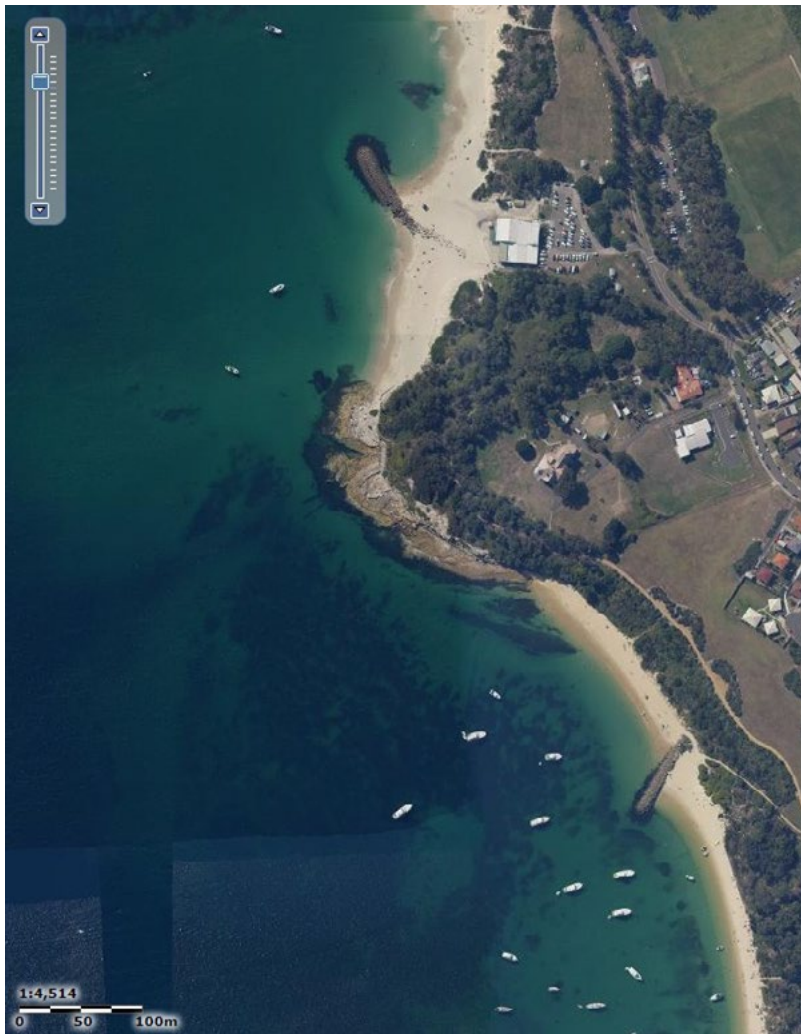
# Botany Bay Frenchmans and Yarra Bay Groynes



<b>Responsible authority:</b>	Unknown
<b>Built:</b>	1970s
<b>Primary purpose when first built:</b>	Sand management
<b>Current uses:</b>	– Sand management

<b>Multi-use features:</b>	Nil
<b>Eco-features:</b>	Nil
The groynes are very accessible. They are close to parking, amenities, greenspace and urban areas.	

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



Frenchmans Bay and Yarra Bay groynes were built and upgraded to manage sand and reduce erosion from waves refraction into the beach from the Molineux Point

Credit: Six Maps



Frenchmans Bay groyne

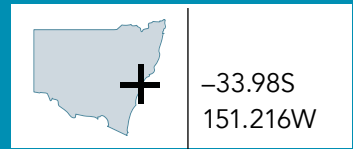
Credit: nearmap



Yarra Bay groyne

Credit: nearmap

# Botany Bay Molineux Point Breakwater



<b>Responsible authority:</b>	Ports NSW
<b>Built:</b>	1977–78
<b>Primary purpose when first built:</b>	Estuary harbour for shipping and port facilities
<b>Current uses:</b>	– Port facilities for shipping

<b>Multi-use features:</b>	– Road and walkway path – Integral to port development
<b>Eco-features:</b>	Nil
The breakwater is not accessible. Fishing is prohibited. A road follows along the length of the breakwater to access some of the Port Botany facilities. Estuary harbour for shipping and port facilities.	

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
– The breakwater and port facilities create a road and parkland at Molineux Point Reserve	Nil



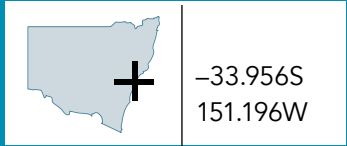
Botany Bay before and after commencement of the Molineux Point breakwater and the Port Botany reclamation works  
Credit: Crown Lands



Aerial photo of Port Botany and the Molineux Point breakwater  
Credit: NSW Ports



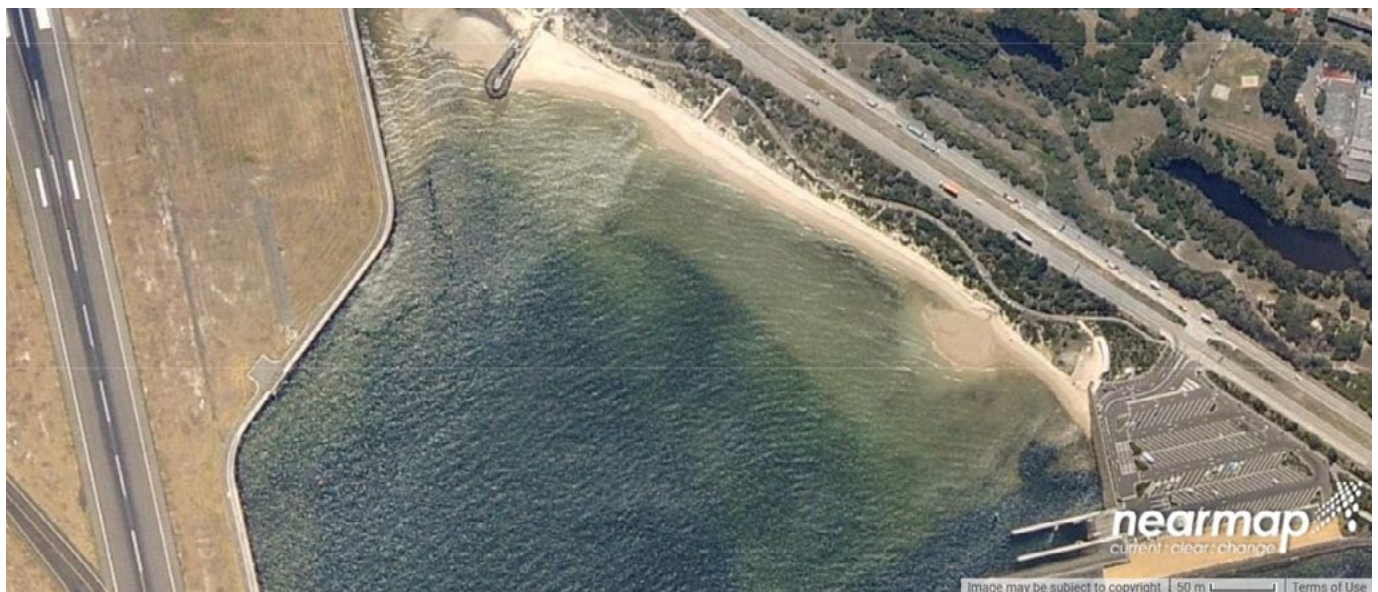
# Botany Bay Foreshore Beach Groynes



<b>Responsible authority:</b>	Ports NSW
<b>Built:</b>	2016s
<b>Primary purpose when first built:</b>	Sand management
<b>Current uses:</b>	– Sand management

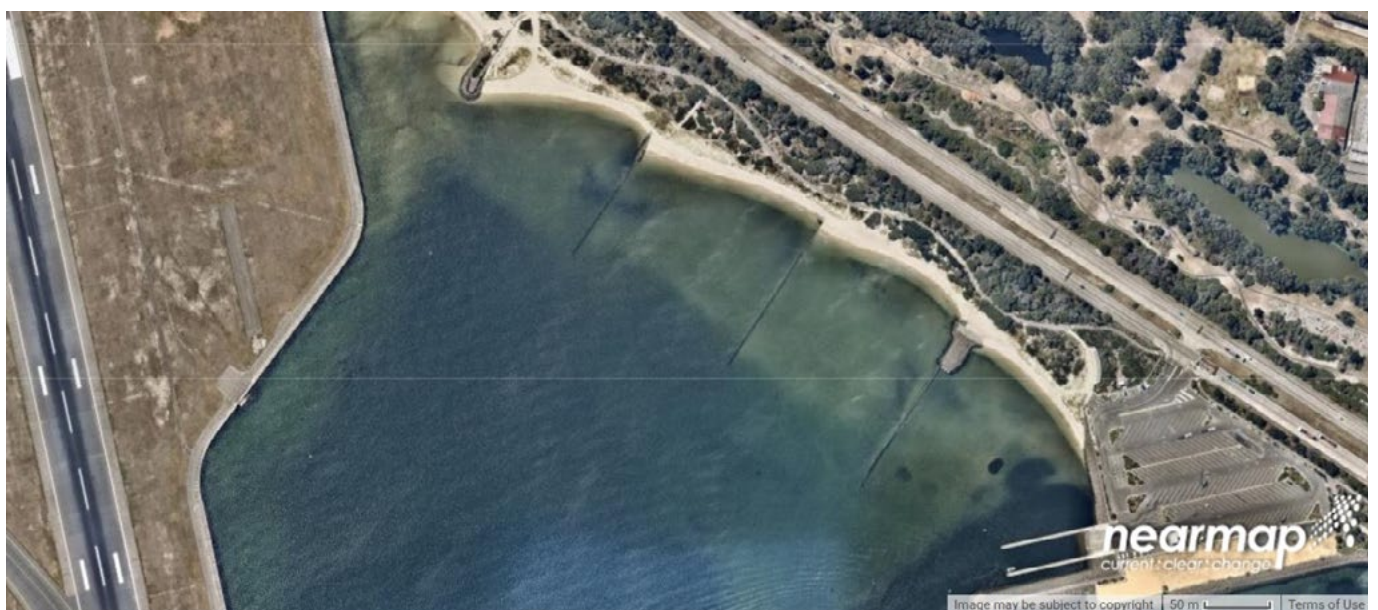
<b>Multi-use features:</b>	– Incorporates existing stormwater outlet structures
<b>Eco-features:</b>	Nil
The groynes include rock and fibre reinforced sheet piling. Two of the groynes incorporate and extend existing stormwater outlets.	

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



Aerial photo of Foreshore Beach area with one groyne before installation of another three groynes in 2016

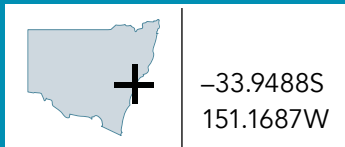
Credit: nearmap



The foreshore Beach after installation of partial rock armour groynes at Chelmsford Avenue and Livingstone Avenue. The Livingstone Avenue structure includes 42 m of rock groyne that incorporates the stormwater outlets and sheet piling that extends another 106 m into the Bay. The third groyne in between these structures has a 13-m long rock section followed by 126 m of sheet pile. Credit: nearmap



# Cooks River Breakwater (North)

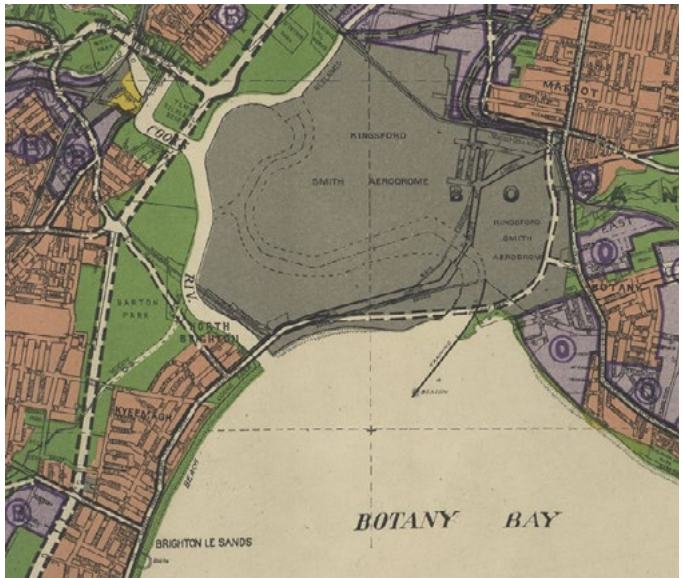


<b>Responsible authority:</b>	Unknown
<b>Built:</b>	1950s
<b>Primary purpose when first built:</b>	Trained entrance due to reclamation works
<b>Current uses:</b>	<ul style="list-style-type: none"> <li>– Ocean access for boating</li> <li>– Fishing spot</li> </ul>

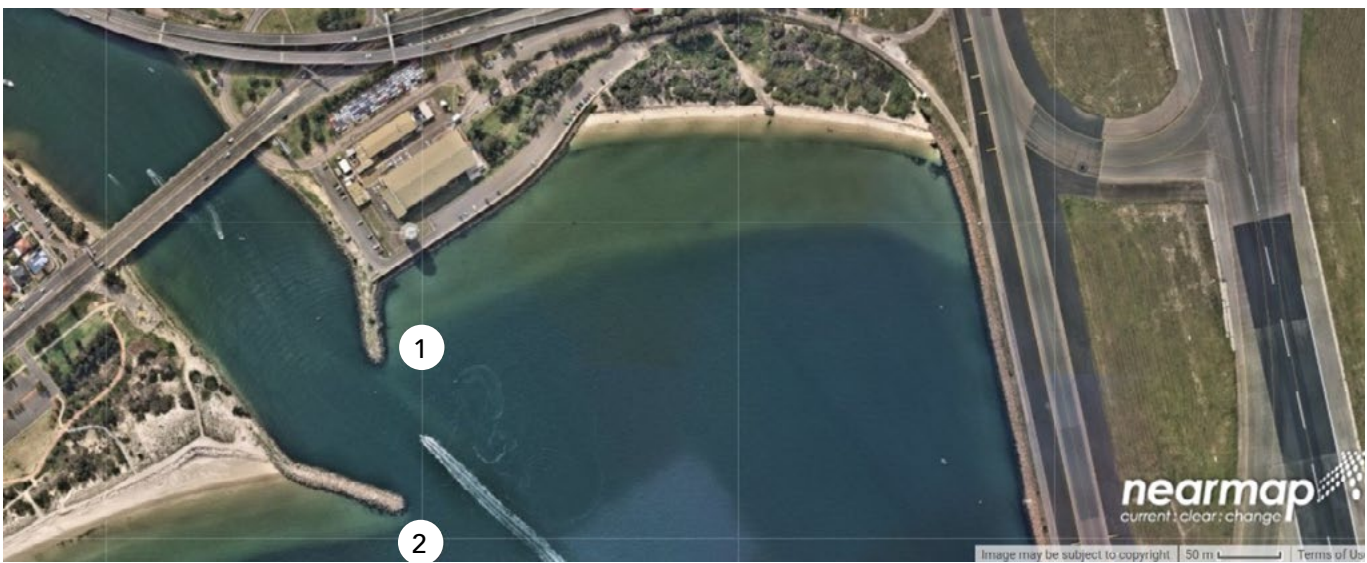
<b>Multi-use features:</b>	– Protects reclaimed land used by the airport
<b>Eco-features:</b>	Nil
The breakwater is very accessible. It is close to parking, amenities, greenspace and urban areas.	

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

<b>Future multi-use features</b>	<b>Future eco-features</b>
<ul style="list-style-type: none"> <li>– Upgrade crest surface to a pedestrian walkway surface</li> <li>– Rock placement for seating and fishing opportunities</li> <li>– Rock placement for emergency safety stairs</li> </ul>	Nil



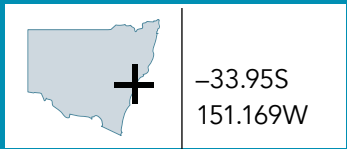
An aerial photo (left) and map (right), both from 1951, show airport reclamation works resulting in the diversion and training of the Cooks River entrance into Botany Bay  
 Credit: Crown Lands



The new entrance of the Cooks River with (1) northern and (2) southern training walls  
 Credit: nearmap



# Cooks River Breakwater (South)



-33.95S  
151.169W

**Responsible authority:** Unknown  
**Built:** 1950s  
**Primary purpose when first built:** Trained entrance due to reclamation works  
**Current uses:**

- Ocean access for boating
- Fishing spot
- Used to watch planes land

**Multi-use features:** - Protects reclaimed land used by airport and for urban development

**Eco-features:** Nil

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

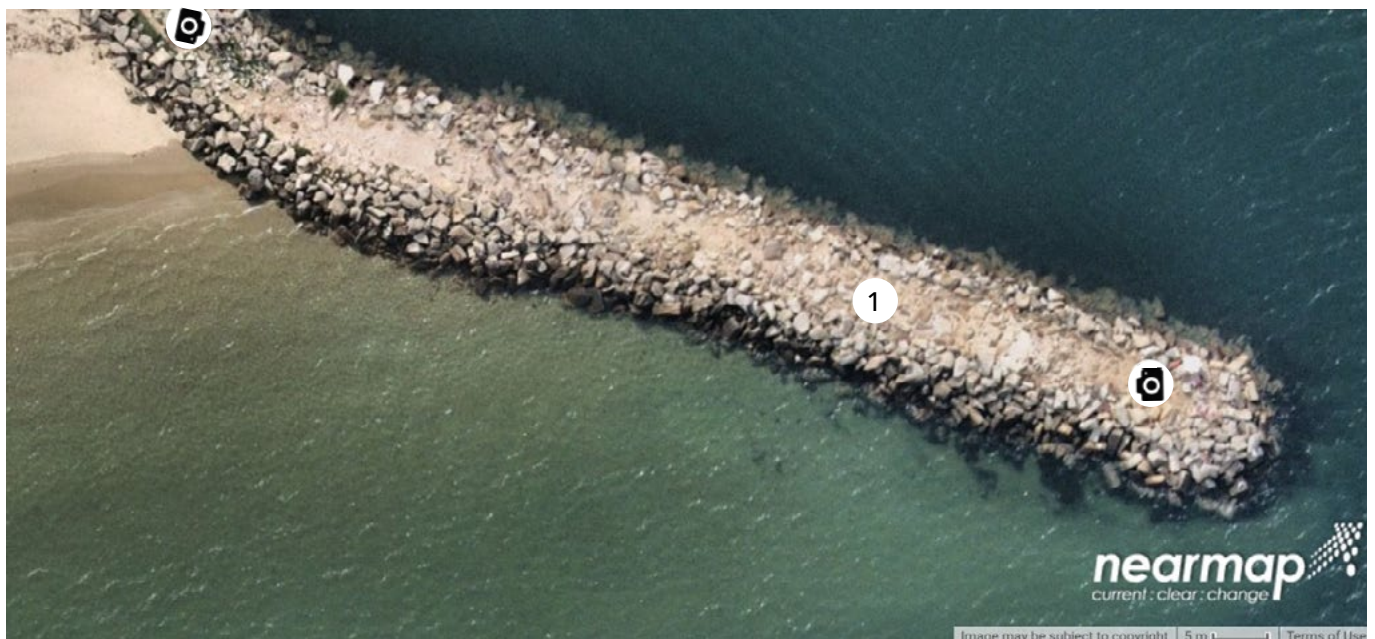
## Recommendations for possible inclusion in future maintenance or upgrade works

### Future multi-use features

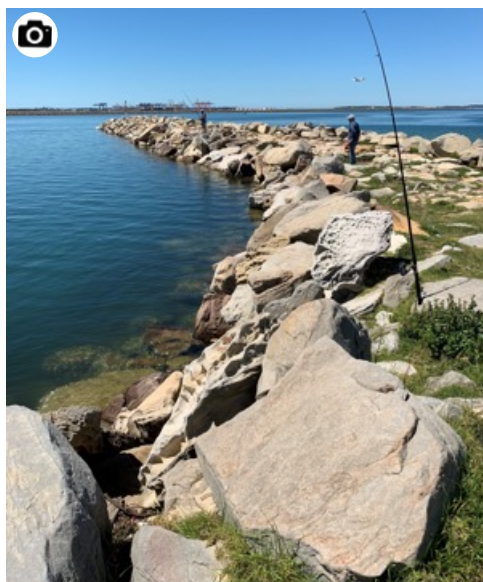
- Upgrade crest surface to a pedestrian walkway surface
- Rock placement for seating and fishing opportunities
- Rock placement for emergency safety stairs

### Future eco-features

Nil

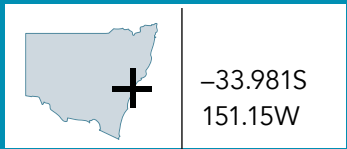


The southern training wall of the artificial entrance of the Cooks River into Botany Bay *Credit: nearmap*



Fishing and plane spotting are popular activities on the southern wall, but the rubble surface is a hazard.

# Botany Bay Lady Robinsons Beach Groynes



<b>Responsible authority:</b>	Bayside Council
<b>Built:</b>	1997 (six groynes constructed)
<b>Modified:</b>	Five additional groynes 2005
<b>Primary purpose when first built:</b>	Groynes for sand management
<b>Current uses:</b>	<ul style="list-style-type: none"> <li>- Sand management</li> <li>- Fishing spot</li> </ul>

<b>Multi-use features:</b>	Nil
<b>Eco-features:</b>	Nil
The groyne field is accessible. It is close to parking, amenities, greenspace and urban areas.	

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



The groyne field on Lady Robinsons Beach, Botany Bay *Credit: nearmap*



# Botany Bay Silver Beach Groynes



-34.0074S  
151.207W

**Responsible authority:** Sutherland Shire Council  
**Built:** 1969–70 (8 eastern groynes)  
**Modified:** Additional groynes added in 1980 and in 1992  
**Primary purpose when first built:** Groynes for sand management  
**Current uses:**

- Sand management
- Fishing spot

**Multi-use features:** – Two groynes in the field are used to support a net creating a swimming enclosure.

**Eco-features:** Nil

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

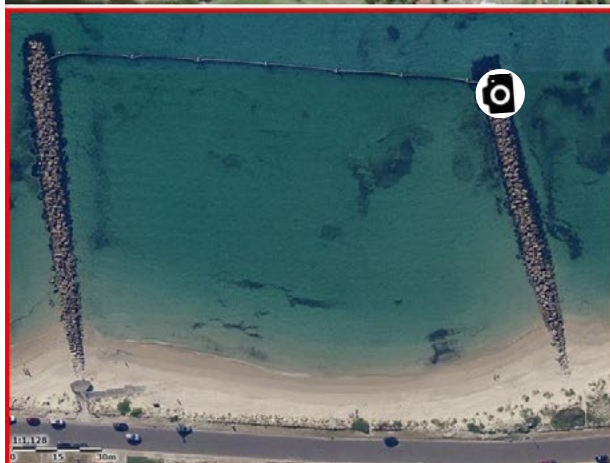
## Recommendations for possible inclusion in future maintenance or upgrade works

### Future multi-use features

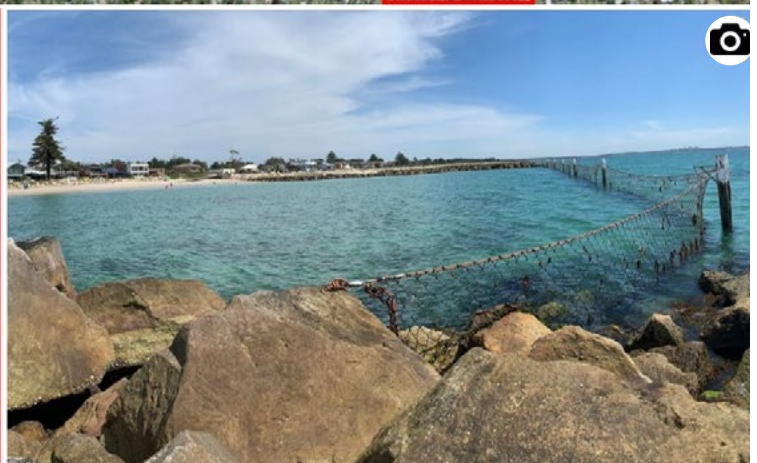
Nil

### Future eco-features

Nil



Credit aerial images: Six Maps




Credit: Adrian Toovey



The Silver Beach groyne field has two groynes with a net spanned across to create a popular swimming enclosure. The net is bolted on to the rocks *Credit: Adrian Toovey*



# Bellambi Point Breakwater



-34.368S  
150.929W

<b>Responsible authority:</b>	NSW State Government	<b>Multi-use features:</b>	Nil
<b>Built:</b>	1979	<b>Eco-features:</b>	- Within 50 m of natural reef
<b>Primary purpose when first built:</b>	Breakwater for fishing and tourism	The breakwater is very accessible. It is close to parking, amenities, greenspace and urban areas.	
<b>Current uses:</b>	- Ocean access for boating		

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
- Rock placement for seating and fishing opportunities	Nil



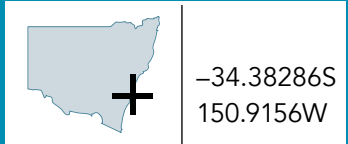
The Bellambi Point breakwater, boat launching ramp and carpark *Credit: nearmap*



Bellambi Point ocean breakwater protecting a boat ramp *Source: NSW Public Works Department Annual Report 1980*



# Towradgi Creek Entrance



**Responsible authority:** Wollongong City Council  
**Built:** 1990s  
**Primary purpose when first built:** Entrance and estuary management  
**Current uses:** – Sand management

**Multi-use features:** Nil  
**Eco-features:** Nil  
The entrance is partially trained by gabions. The entrance 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

Nil

### Future eco-features


Nil



The Towradgi estuary entrance in 1961 and in 2020 source: Crown Lands (1961); Six Maps



# Wollongong Harbour historical change



-28.8745S  
153.591W

A submerged rock shelf was blasted and removed to deepen the harbour when it was constructed.



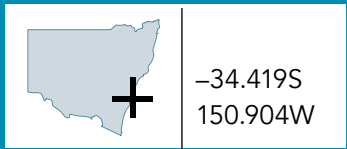
Wollongong Harbour 1936 *Source: Adastra Aerial Photo Collection*



Wollongong Harbour in 2017 *Credit: Google Earth*



# Wollongong Harbour (North)



-34.419S  
150.904W

<b>Responsible authority:</b>	NSW State Government
<b>Built:</b>	1978
<b>Primary purpose when first built:</b>	Ocean harbour for coastal shipping
<b>Current uses:</b>	<ul style="list-style-type: none"> <li>- Ocean access for boating</li> <li>- Adjacent to a popular coastal walkway</li> </ul>

<b>Multi-use features:</b>	Nil
<b>Eco-features:</b>	<ul style="list-style-type: none"> <li>- Within 50 m of natural reef</li> </ul> <p>The breakwater is very accessible. It is close to parking, amenities, greenspace and urban areas. While the breakwater was being constructed, rock in the harbour was blasted to improve the depth.</p>

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

<p><b>Future multi-use features</b></p> <ul style="list-style-type: none"> <li>- Improve opportunities to enjoy the view</li> <li>- Upgrade crest surface to a pedestrian walkway surface</li> <li>- Rock placement for seating and fishing opportunities</li> <li>- Rock placement for emergency safety stairs</li> </ul>	<p><b>Future eco-features</b></p> <p>Nil</p>
--	--




The northern breakwater at Wollongong Harbour  
Credit: Six Maps



While the breakwater is located next to Wollongong’s famous ‘Blue Mile Walk’, the rubble surface of the breakwater (left) reduces the number of people walking out onto the breakwater. The height of the crown rock (centre picture) obscures opportunities to enjoy the view for those who do walk out onto the breakwater. The value of the existing structure could be improved by making the structure accessible to all, improving amenity and adding other multi-use features.

# Wollongong Harbour (East)

 -34.4199S  
150.90772W

**Responsible authority:** NSW State Government

**Built:** 1837-44

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

**Current uses:**

- Ocean access for boating
- Popular coastal walkway
- Fishing spot

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

**Multi-use features:**

- Walking pathway
- Heritage features

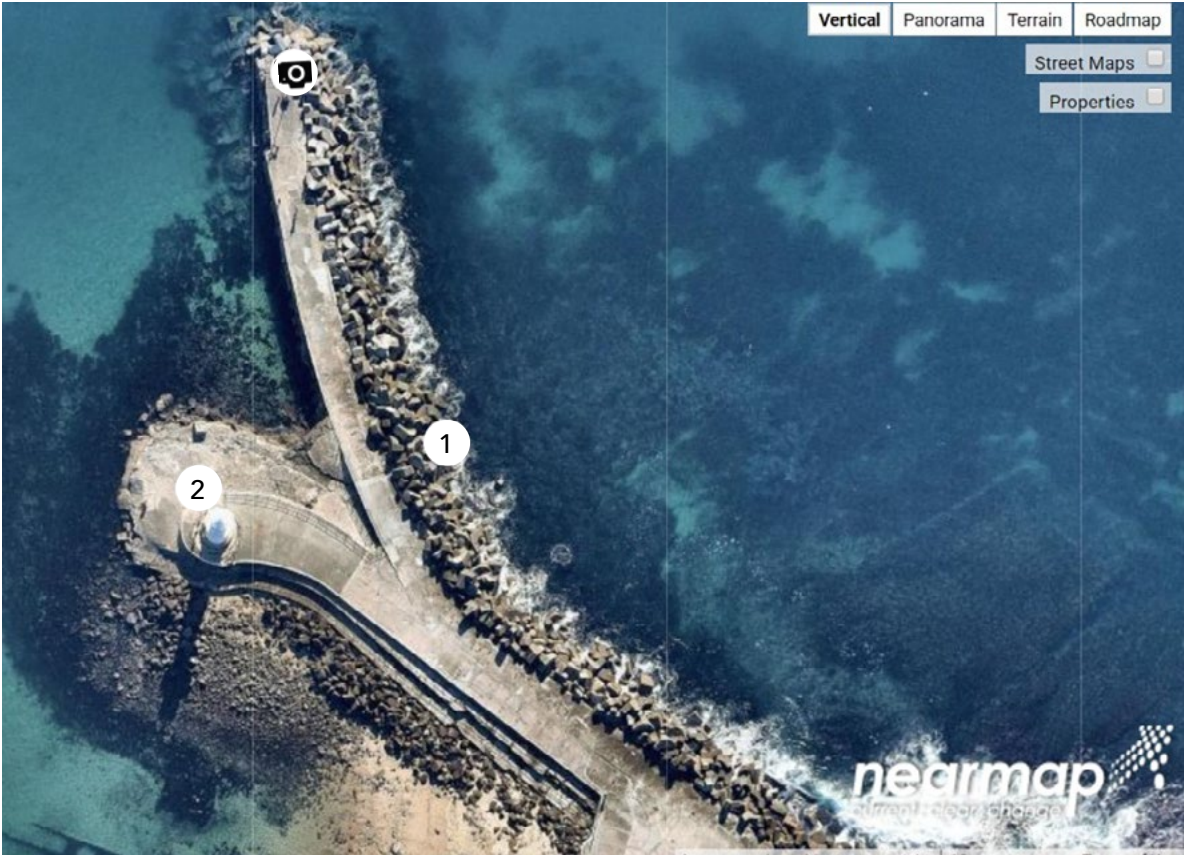
**Eco-features:**

- Within 50 m of natural reef

Wollongong Harbour is an iconic precinct in the city. It is very accessible and is close to parking, amenities, greenspace and urban areas.

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

<b>Future multi-use features</b>	<b>Future eco-features</b>
- Maintain pedestrian walkway surface	Nil



The Wollongong Harbour eastern breakwater: (1) the eastern wall; (2) the heritage wall and lighthouse  
Credit: nearmap



Fishing from the eastern breakwater back into Wollongong Harbour



# Port Kembla estuary-wide change



Aerial photo from 1951 (left) and 1990 (right) showing changes and the reclamation of Tom Thumb Lagoon with the construction of the coal loading wharf and other infrastructure in the inner Port Kembla Harbour area. The Tom Thumb Lagoon was described by George Bass and Matthew Flinders following a 1796 expedition undertaken in the 2.5 m open vessel called Tom Thumb II. *Credit: Crown Lands*

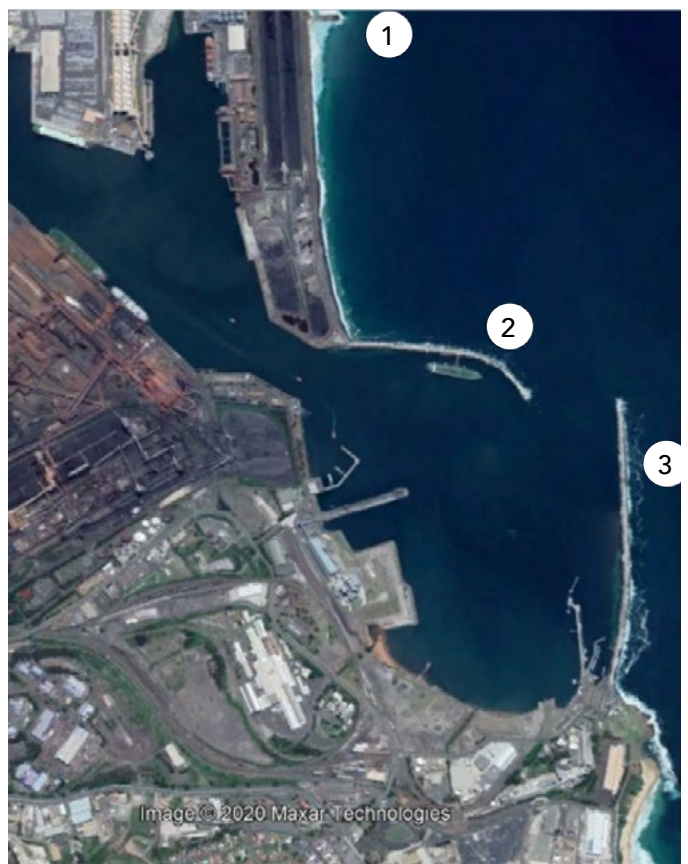
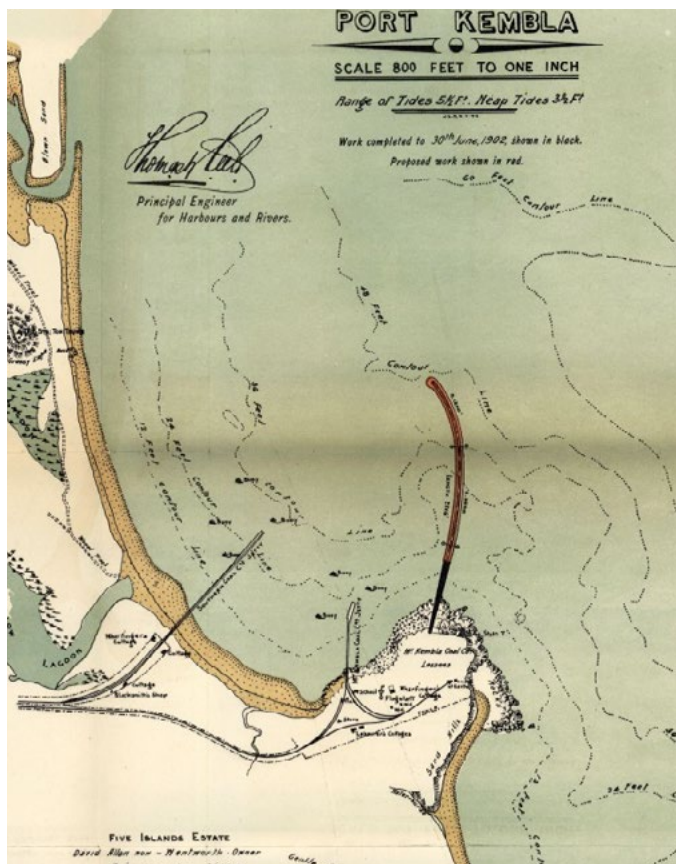


Chart showing the constructed and proposed breakwater works at the Port Kembla Outer Harbour area in 1902 (left) and 2008 (right) for: (1) the MM groyne on South Wollongong Beach; (2) northern breakwater; (3) eastern breakwater  
Source: Public Works Department Annual Report 1902; Google Earth



# Port Kembla (MM) Groyne



-34.541S  
150.901W

**Responsible authority:** NSW State Government  
**Built:** 1978  
**Primary purpose when first built:** Ocean harbour for coastal shipping  
**Current uses:**

- Ocean access for boating
- Adjacent to a popular coastal walkway

**Multi-use features:** Nil  
**Eco-features:** - Within 50 m of natural reef  
The breakwater is very accessible. It is close to parking, amenities, greenspace and urban areas. While the breakwater was being constructed, rock in the harbour was blasted to improve the depth.

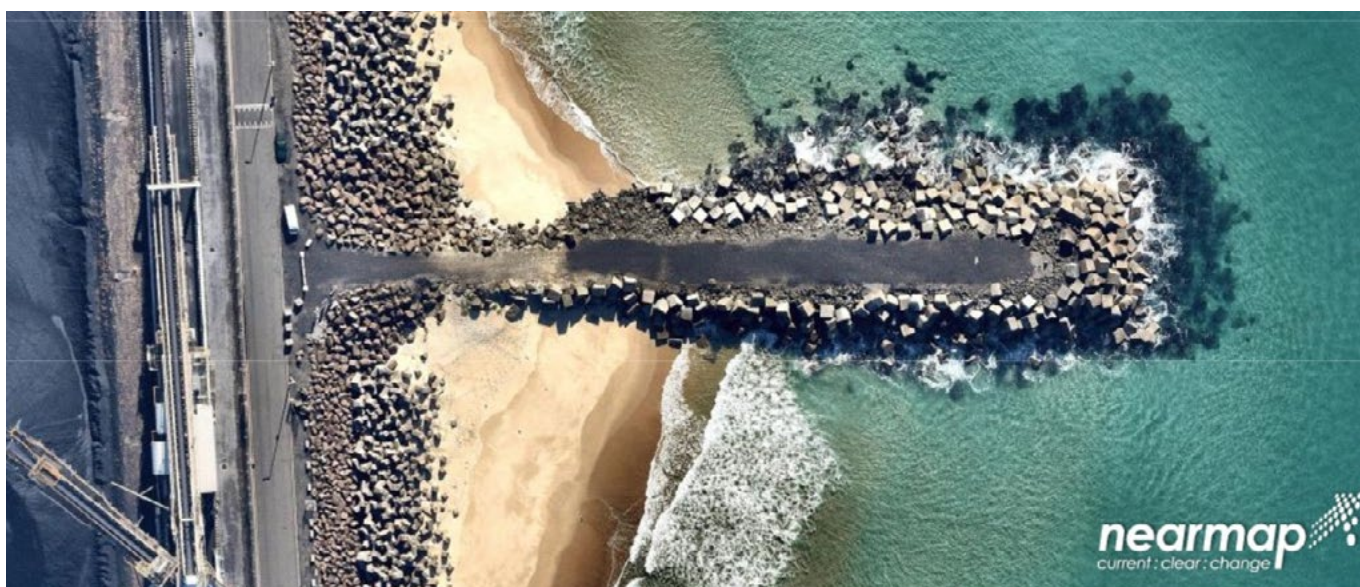
## Recommendations for possible inclusion in future maintenance or upgrade works

### Future multi-use features

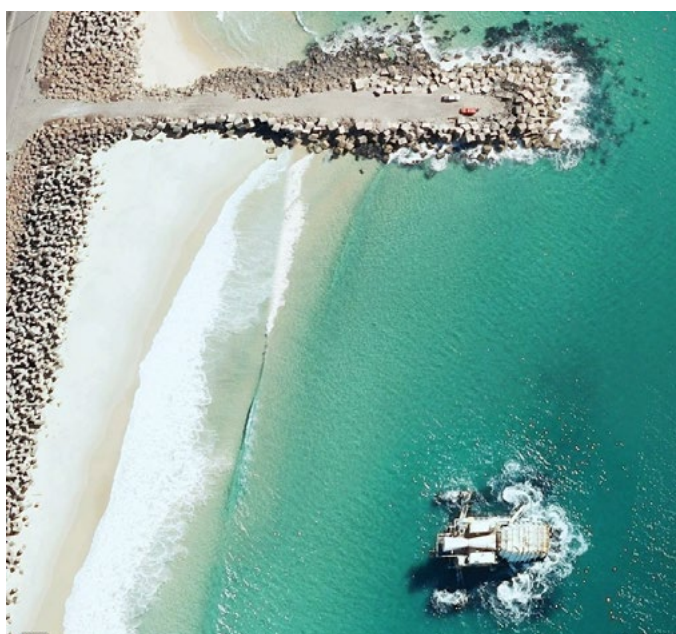
- Improve opportunities to enjoy the view
- Upgrade crest surface to a pedestrian walkway surface
- Rock placement for seating and fishing opportunities
- Rock placement for emergency safety stairs

### Future eco-features

Nil



The MM (Metal Manufactures) groyne installed when Port Kembla was expanded to include the coal loading facilities  
*Credit: nearmap*



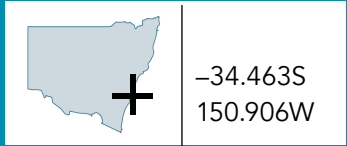
Approximately 1.2 million cubic metres of material dredged from Port Kembla was placed in the swash zone of South Wollongong Beach in the 1970s.

In 2006, an experimental wave energy generator known as the MK1 was installed. The generator worked for a short period only, and in 2017, the rusted and wave-impacted structure that had not operated for seven years was removed. The Google Earth image (left) shows the structure in 2008 when it was still functioning.

*Credit: Google Earth*



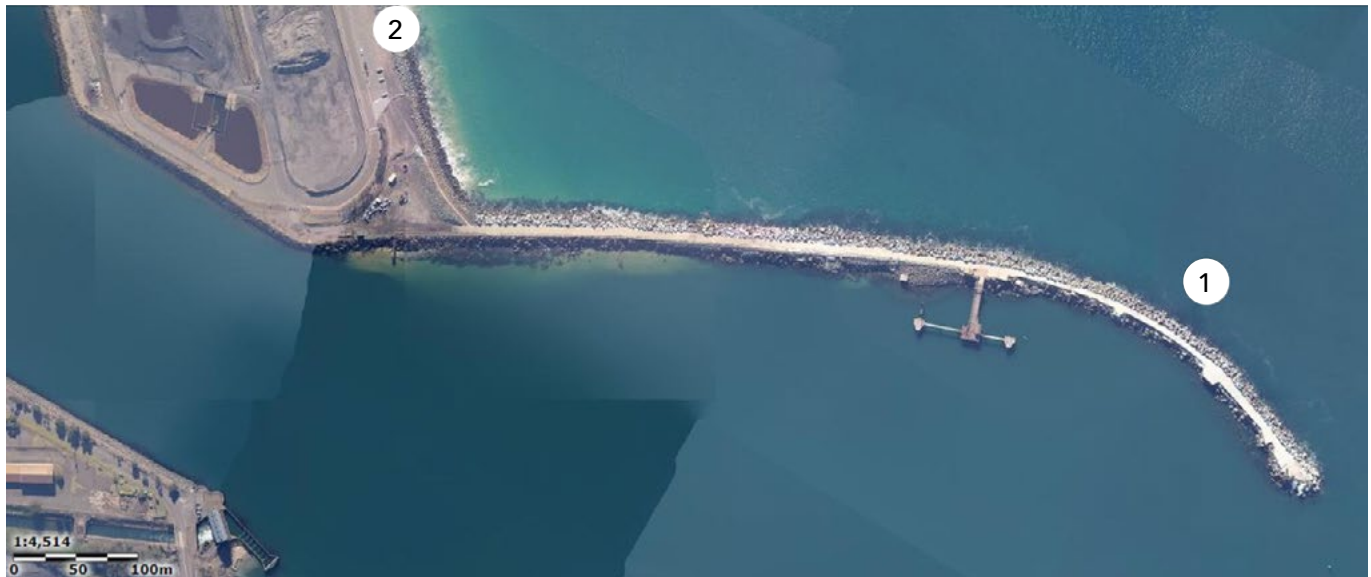
# Port Kembla Breakwater (North)



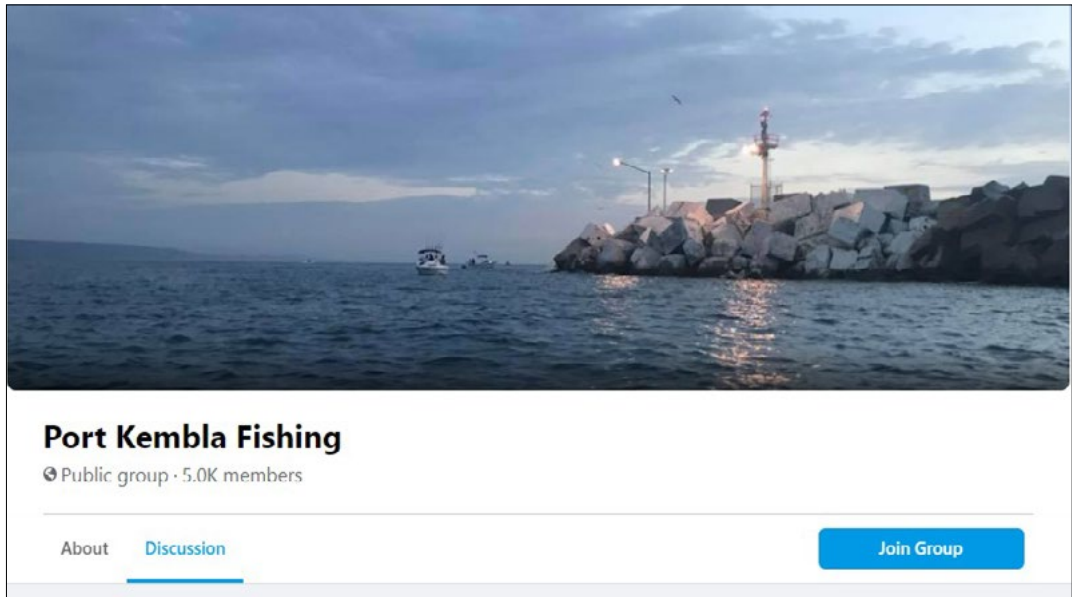
<b>Responsible authority:</b>	NSW Ports
<b>Built:</b>	1909–1925
<b>Primary purpose when first built:</b>	Trained entrance for coastal shipping
<b>Current uses:</b>	<ul style="list-style-type: none"> <li>– Ocean access for shipping</li> <li>– Coastal walkway</li> <li>– Fishing spot</li> </ul>

<b>Multi-use features:</b>	<ul style="list-style-type: none"> <li>– Walking pathway</li> <li>– Protects reclaimed land for port facilities</li> </ul>
<b>Eco-features:</b>	Nil
The breakwater is very accessible and is close to parking. The waters of Inner Port Kembla Harbour the former Tom Thumb Lagoon are closed to all forms of fishing.	

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
<ul style="list-style-type: none"> <li>– Maintain and improve pedestrian walkway surface</li> <li>– Rock placement for seating and fishing opportunities</li> <li>– Rock placement for emergency safety stairs</li> </ul>	Nil



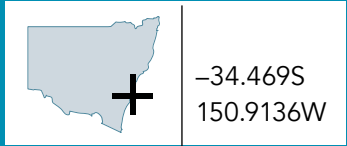
The northern Port Kembla breakwater: (1) the breakwater; (2) Rock armoured South Wollongong Beach south of the MM Groyne Credit: Six Maps



Port Kembla is a popular fishing location. A Facebook page dedicated to fishing in the Port has 5,000 members



# Port Kembla Breakwater (Eastern)

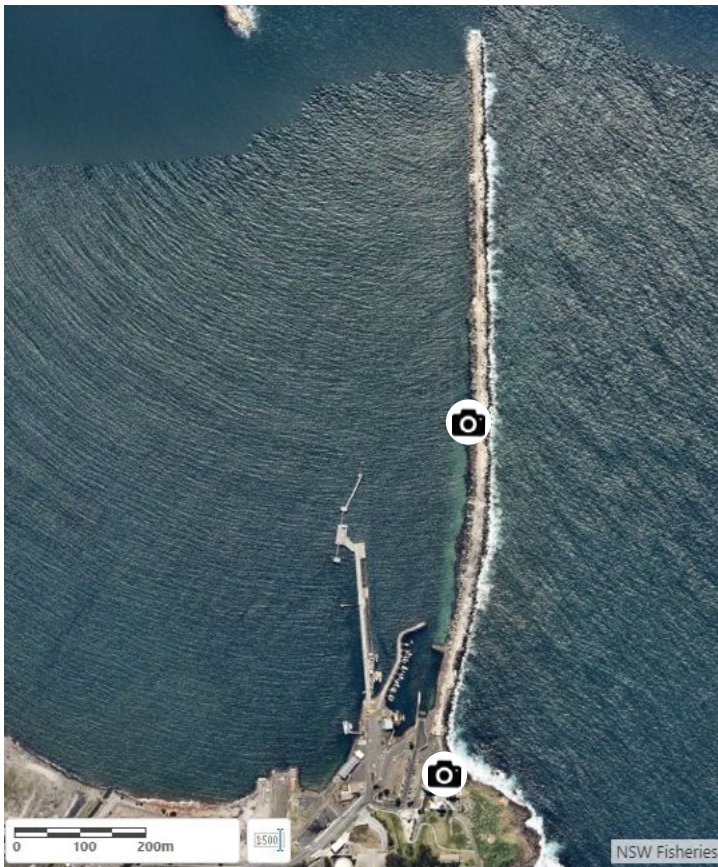


<b>Responsible authority:</b>	NSW Ports
<b>Built:</b>	1901–1962
<b>Primary purpose when first built:</b>	Trained entrance for coastal shipping
<b>Current uses:</b>	<ul style="list-style-type: none"> <li>– Ocean access for shipping</li> <li>– Coastal walkway</li> <li>– Fishing spot</li> </ul>

<b>Multi-use features:</b>	<ul style="list-style-type: none"> <li>– Walking pathway</li> <li>– Nearby Breakwater Battery Museum</li> <li>– Aboriginal cultural trail connecting a midden and other important sites</li> <li>– Self-guided heritage trail</li> </ul>
<b>Eco-features:</b>	<ul style="list-style-type: none"> <li>– Within 50 m of natural reef</li> </ul>

The breakwater is accessible. It is close to parking and amenities, including the Breakwater Battery Museum.

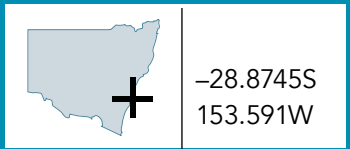
Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
<ul style="list-style-type: none"> <li>– Maintain and improve pedestrian walkway surface</li> <li>– Improve opportunities to enjoy the view</li> <li>– Rock placement for seating and fishing opportunities</li> <li>– Rock placement for emergency safety stairs</li> </ul>	Nil



The Port Kembla eastern breakwater  
Credit: nearmap



# Lake Illawarra estuary-wide change



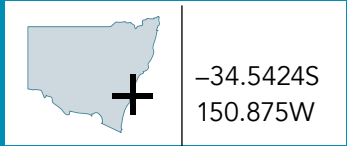
Lake Illawarra in 1936 Source: Adastra Aerial Photo Collection



Lake Illawarra in 2017 Credit: Google Earth



# Lake Illawarra Breakwater (North)



**Responsible authority:** NSW State Government

**Built:** 2000-7

**Primary purpose when first built:** Trained for entrance and estuary management

**Current uses:**

- Ocean access for boating
- Fishing spot

**Multi-use features:** Nil

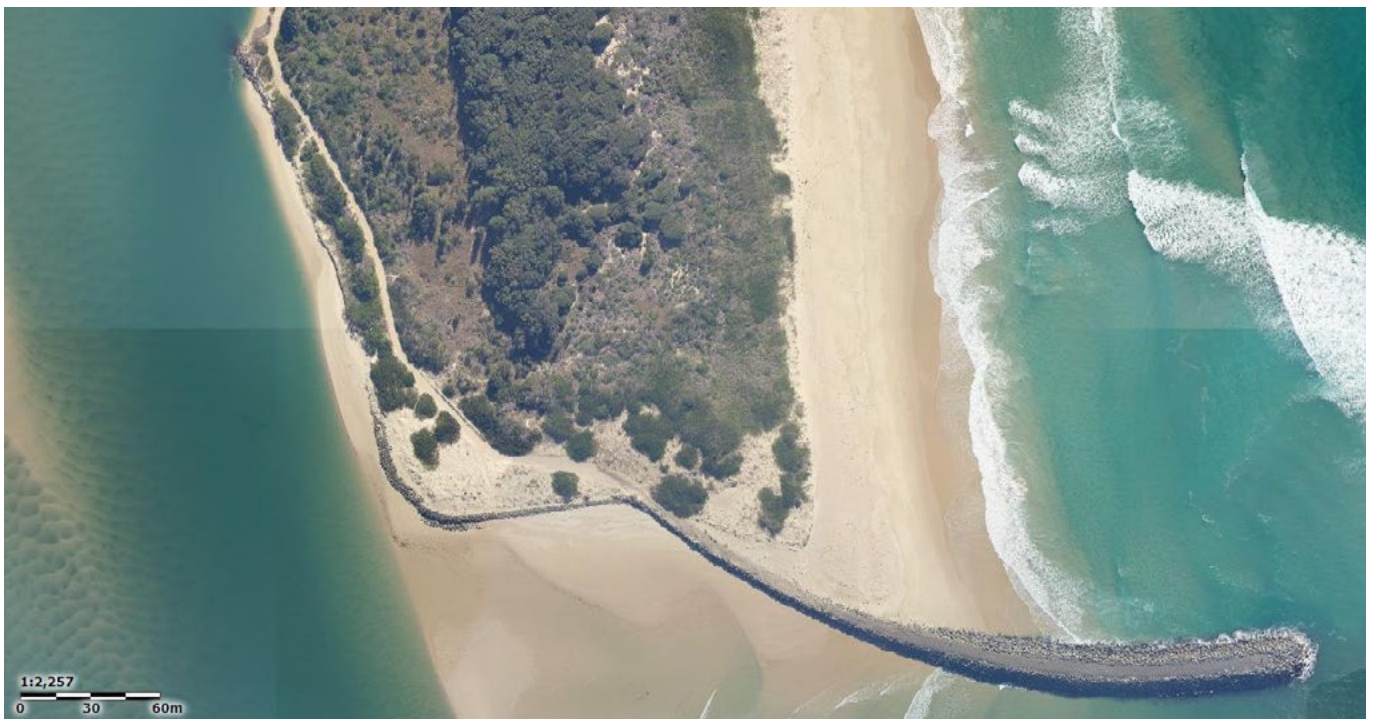
**Eco-features:** Nil

The changed tidal flows have caused erosion around parts of the lake, including the northern banks. Some key fish habitats have been lost, and some built infrastructure has needed to be strengthened, relocated or removed.

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

**Future multi-use features:** Nil

**Future eco-features:** Nil



The Lake Illawarra northern breakwater  
Credit: nearmap



Sept 2011



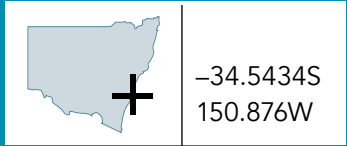
July 2020

Following training of the entrance at Lake Illawarra, tidal flows in the lake increased. This caused a loss of seagrass and erosion in some areas, which then required the installation of groyne and armoring of the foreshore. The two images show before (2011) and after (2020)

Credit: nearmap



# Lake Illawarra Breakwater (South)



**Responsible authority:** NSW State Government

**Built:** 2001

**Primary purpose when first built:** Trained for entrance and estuary management

**Current uses:**

- Ocean access for boating
- Fishing spot

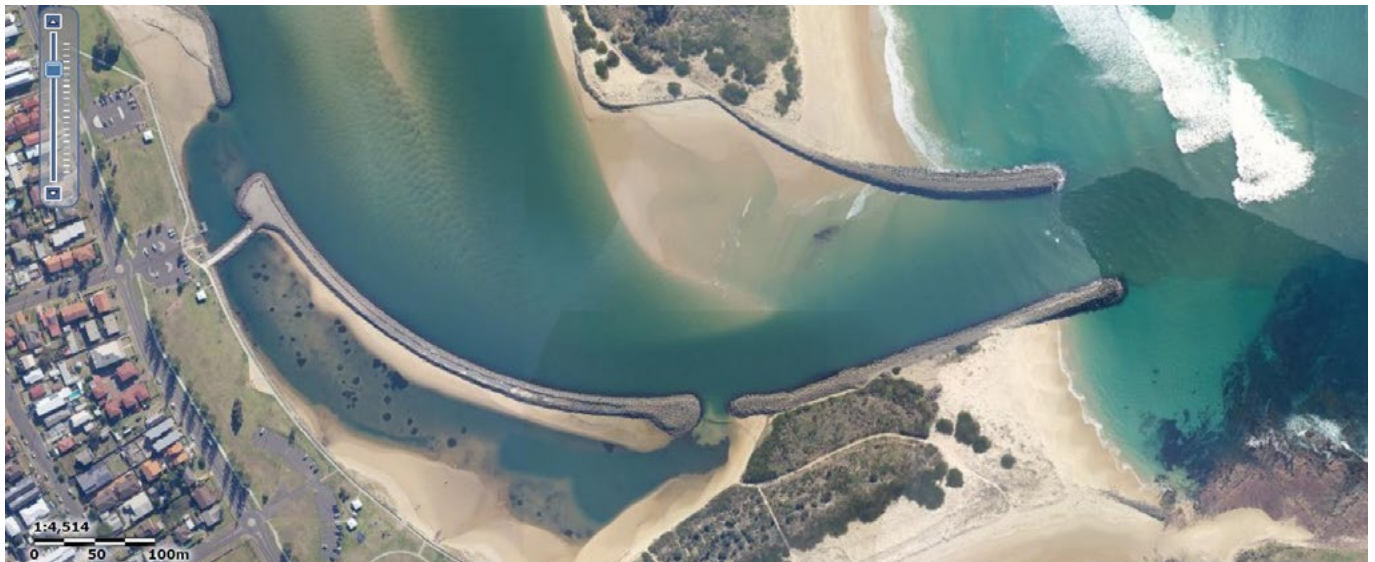
**Multi-use features:** – Training wall creates a swimming enclosure

**Eco-features:** Nil

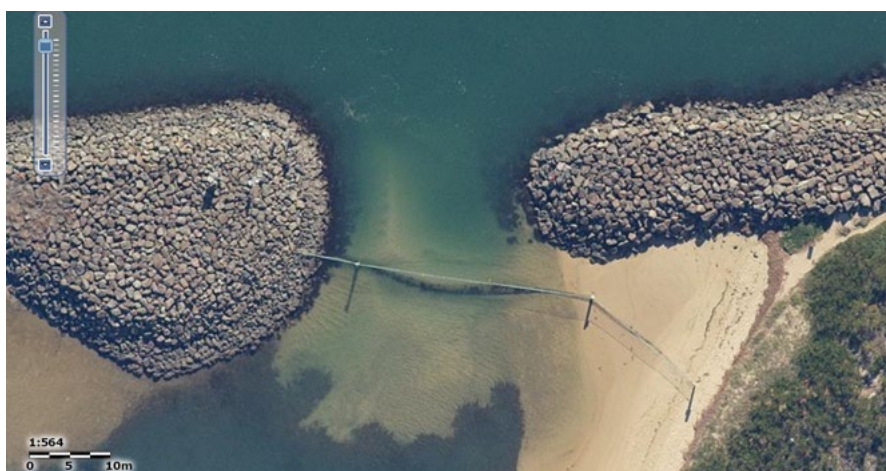
The trained entrance and breakwater include a partially buried rock wall connection to Windang Island. The training wall extends upstream for 430 m and creates an enclosed swimming area that support seagrass, saltmarsh, and wader and migratory bird habitats.

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

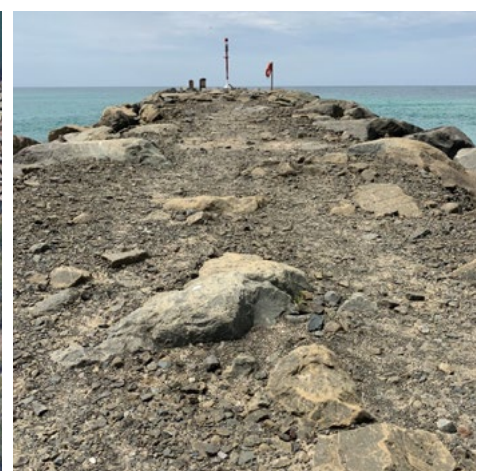
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



The entrance works at Lake Illawarra including the partially buried wall connecting Windang Island *Credit: Six Maps*

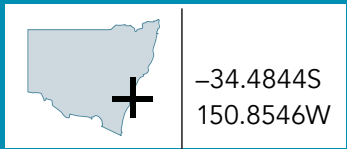


The breakwater and training walls include a swimming enclosure area *Credit: Six Maps*



The rubble crest surface of the southern breakwater limits accessibility for some people

# Lake Illawarra Berkeley Harbour



<b>Responsible authority:</b>	Unknown
<b>Built:</b>	1950s
<b>Modified:</b>	1970s dredging and reclamation for berthing areas
<b>Primary purpose when first built:</b>	Boat harbour
<b>Current uses:</b>	– Boat harbour and boat ramp

<b>Multi-use features:</b>	Nil
<b>Eco-features:</b>	Nil
During the 1950s, redundant 900–1200 mm high concrete tetra-hedrons positioned around Berkeley during WWII as tank traps were repurposed and used to shelter fishing vessels in Berkeley Harbour. Some tank trap tetra-hedrons were preserved at the Port Kembla Breakwater Battery Museum.	

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



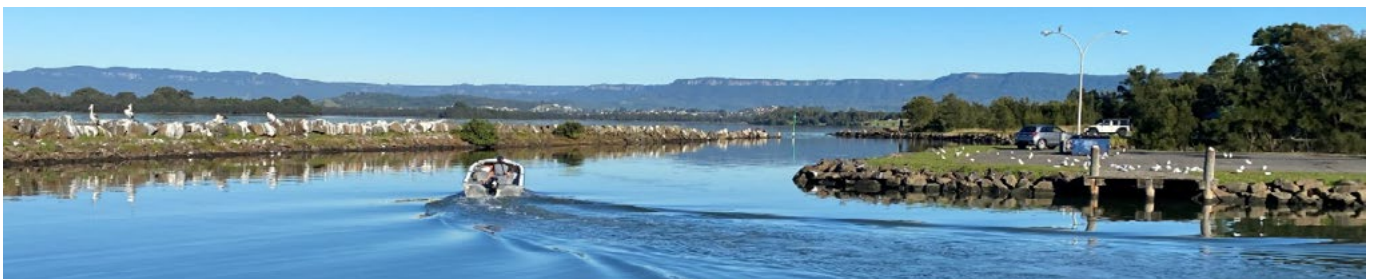
Berkeley Harbour began as a sheltered area behind a small offshore breakwater built from repurposed WWII tank traps  
 Credit: Crown Lands



An area adjacent to Berkeley Harbour was reclaimed and then manipulated to improve water quality from Budjung Creek  
 Credit: Six Maps



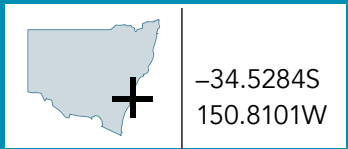
Repurposed tank trap tetra-hedrons used to form the original breakwater are still evident in the structure  
 Credit: Carla Ganassin



The partially detached breakwater provides a habitat refuge for several birds.  
 Credit: Carla Ganassin



# Lake Illawarra Yallah Bay Training Wall



<b>Responsible authority:</b>	Unknown
<b>Built:</b>	1950s
<b>Modified:</b>	2009 incorporate a boat ramp 2011 a pedestrian surface
<b>Primary purpose when first built:</b>	Power plant cooling water canal outlet infrastructure
<b>Current uses:</b>	– Power plant infrastructure, boat ramp and pedestrian walkway

<b>Multi-use features:</b>	– Boat ramp and walkway
<b>Eco-features:</b>	Nil
The breakwater was built during the 1950s as part of the outlet system for release of cooling water drawn from Lake Illawarra and used in the Tallawarra coal fired power station. The plant was refurbished and began operating as an Energy Australia gas power station in 2006.	

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

<b>Future multi-use features</b>	<b>Future eco-features</b>
<ul style="list-style-type: none"> <li>– Maintain and improve pedestrian walkway surface</li> <li>– Rock placement for seating and fishing opportunities</li> </ul>	Nil



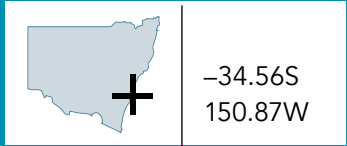
Tallawarra power plant and the Yallah Bay Breakwater showing: (1) the power plant water coolant inlet and (2) the outlet of the cooling water returning into Lake Illawarra in 1963 (left) and 2016 (right) *Credit: Crown Lands and Google Earth*



The discharging cooling water is channelled by the breakwater (LHS) which incorporates a boat ramp and a smooth crest surface that provides opportunities for all to walk along the breakwater *Credit: Crown Lands and Google Earth*



# Barrack Point (Elliot Lake) Breakwater



**Responsible authority:** NSW State Government

**Built:** 1966-68

**Modified:** Lengthened in 2006-08

**Primary purpose when first built:** Sand management and partial entrance training

**Current uses:** – Sand and estuary management

**Multi-use features:** Nil

**Eco-features:** Nil

The structure was originally built as a groyne for sand management on Warilla Beach. It also acts as an entrance training structure and was lengthened between 2006 to 2008.

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

**Future multi-use features**

- Maintain and improve the pedestrian walkway surface
- Install CoastSnap photo point

**Future eco-features**

Nil



1963



2006

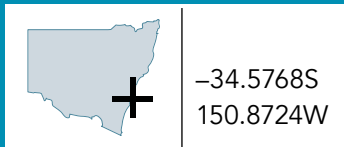
The Barrack Point training wall was installed in 1968 *Credit: Crown Lands*



The Barrack Point training wall was extended in 2006-08 *Credit: Six map*



# Shell Harbour Breakwaters



<b>Responsible authority:</b>	NSW State Government
<b>Built:</b>	1830s
<b>Modified:</b>	1882 southern wall
<b>Primary purpose when first built:</b>	Ocean harbour for coastal shipping
<b>Current uses:</b>	<ul style="list-style-type: none"> <li>– Ocean access for boating</li> <li>– Fishing spot</li> </ul>
<b>Regulatory matters:</b>	– <i>Heritage Act 1977</i>

<b>Multi-use features:</b>	– Heritage
<b>Eco-features:</b>	– Within 50 m of natural reef
<p>The breakwater is described in its heritage listing as ‘a rare item of Victorian masonry works remaining in a fairly intact state’. Arrival of rail during the 1880s reduced the need for and importance of the harbour.</p> <p>Caroline Chisholm assisted settlers to the township of Shellharbour in 1843 and a nearby park is named after her.</p>	

Recommendations for possible inclusion in future maintenance or upgrade works	
<b>Future multi-use features</b>	<b>Future eco-features</b>
Nil	Nil



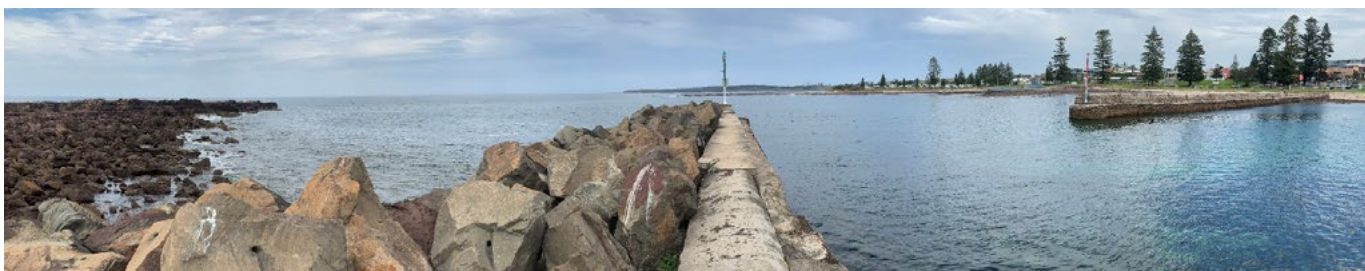
Shell Harbour 1936 Credit: Adastra Photo Collection



Shell Harbour in 2008 Credit: Google Earth



Shell Harbour southern breakwater



Shell Harbour northern breakwater armoured on its eastern side with rock

# References

Adastra Airways (1937) Adastra collection of aerial photographs and negatives (flown and compiled by Adastra Airways for clients). Adastra Airways Pty Ltd, Mascot, NSW.

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Dwyer PG and Dengate C (2021) *Multi-use and eco-features for breakwater maintenance and upgrade works: guidance notes for asset owners, designers and project managers*. NSW Government.

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