

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

Queensland border to Stockton (Illustrated Volume I)



Published by NSW Department of Primary Industries
dpi.nsw.gov.au

Title: An audit of trained river entrances, armoured harbours and groynes and their multi-use and eco-features in NSW: Queensland border to Stockton (illustrated volume I)

First published December 2021

ISBN: 978-1-76058-511-2

PUB21/286

More information

Marine Estate Management Authority
www.marine.nsw.gov.au

Suggested citation

Dwyer PG and Dengate C (2021) *An audit of trained river entrances, armoured harbours and groynes and their multi-use and eco-features in NSW: Queensland border to Stockton (illustrated volume I)*. NSW Government

Acknowledgments



Department of
Primary Industries



This project was funded by the NSW Government under the Marine Estate Management Strategy.

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

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

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

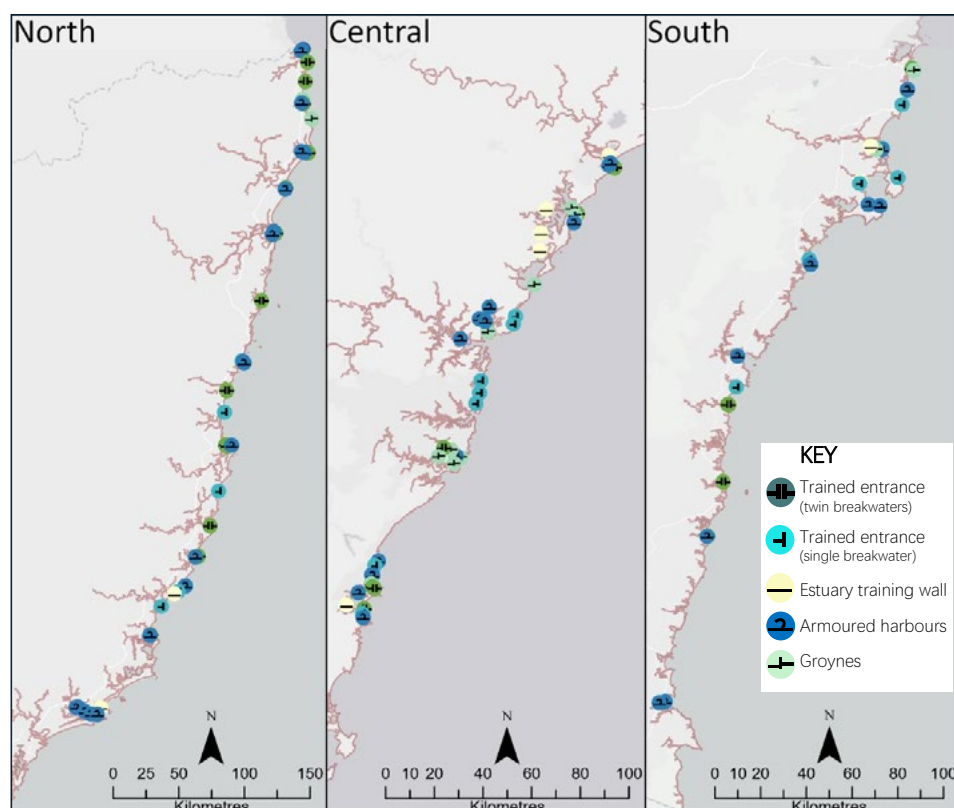


Figure 1: Marine Estate Management regions showing breakwater structures—trained river entrances, armoured harbours and groynes along the NSW coastline that were assessed in this audit.

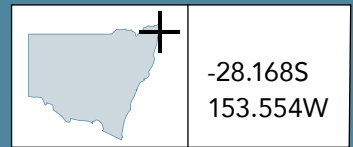
Maps prepared by Alex Wray-Barnes and Emma Wilkie

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Tweed River estuary-wide change



A submerged indurated sandstone bar was blasted and removed when the entrance was initially trained.

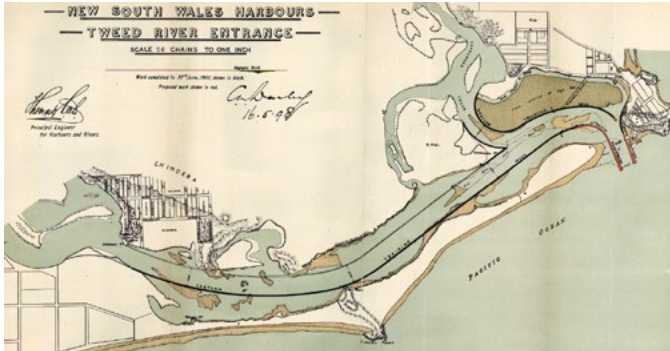


Chart showing progress on entrance training works at the Tweed River in 1902

Credit: NSW Public Works Department 1902 Annual Report



Tweed River estuary in 2017

Credit: Google earth



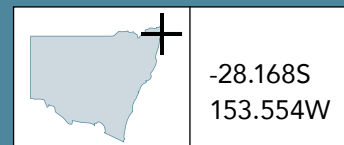
Changes in the shape of the Tweed River estuary due to the training walls from 1902 to 2017 are shown by merging the above two images

Right and below: Duranbah Beach looking south to the Tweed River from Point Danger

The red circle in the pictures shows the location of the end of the original Tweed River northern breakwater
1950s image credit: Ray Dwyer



Tweed River Breakwater (North)



Responsible authority: NSW State Government

Built: 1890 – 1902

Modified: Lengthened 380 m in the 1960s

Primary purpose when first built: Trained entrance for coastal shipping

Current uses:

- Ocean access for boating
- Popular coastal walkway
- Fishing spot
- Forms Duranbah surf beach
- Forms a popular estuarine wave-trap beach

Regulatory matters: – Tweed Sand Bypass

Multi-use features:

- Walking pathway
- Stabilises two beaches

Eco-features:

- Tweed Sand Bypass scheme to manage sand movement
- Within 50 m of natural reef

The breakwater is very accessible. It is adjacent to parking, amenities, greenspace and urban areas. An estuarine training wall network extends upstream for 3.4 km and incorporates the Jack Evans Boat Harbour precinct.

Duranbah beach is named after a cargo vessel that ran aground there in 1919. The beach was officially renamed to Flagstaff Beach in 1981 but the original name, Duranbah, was restored in 1993.

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

- Increase submerged habitat complexity
- Seahorse Hotel Trial (on estuarine training wall)



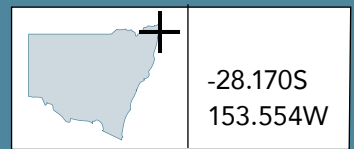
Northern Tweed River Breakwater: (1) the breakwater extension completed in the 1960s; (2) wave-trap beach; (3) original breakwater now part of estuarine training wall; (4) Jack Evans Boat Harbour; (5) Duranbah surf beach

Credit: Six Maps



Popular wave-trap beach just inside the Tweed River northern breakwater

Tweed River Breakwater (South)



Responsible Authority:	NSW State Government
Built:	1890 – 1902
Modified:	Lengthened 380 m in the 1960s
Primary purpose when first built:	Trained entrance for coastal shipping
Current uses:	<ul style="list-style-type: none"> – Ocean access for boating – Fishing spot – Forms a popular estuarine wave-trap beach
Regulatory matters:	– Tweed Sand Bypass

Multi-use features:	<ul style="list-style-type: none"> – Walking pathway – Stabilises an estuarine beach
Eco-features:	<ul style="list-style-type: none"> – Tweed Sand Bypass scheme to manage sand movement – Estuarine intertidal inlets
<p>The breakwater is accessed by an unsealed road.</p> <p>An estuarine training wall network extends upstream for 6.7 km. Inlets support seagrass, mangrove, saltmarsh and wader and migratory bird habitats originally evident in the 1902 chart.</p> <p>The Tweed Sand Bypass Scheme commenced pumping sand in May 2001 and has since inspired similar systems in Japan, Brazil, Portugal, South Korea and South Australia.</p>	

Recommendations for possible inclusion in future maintenance or upgrade works

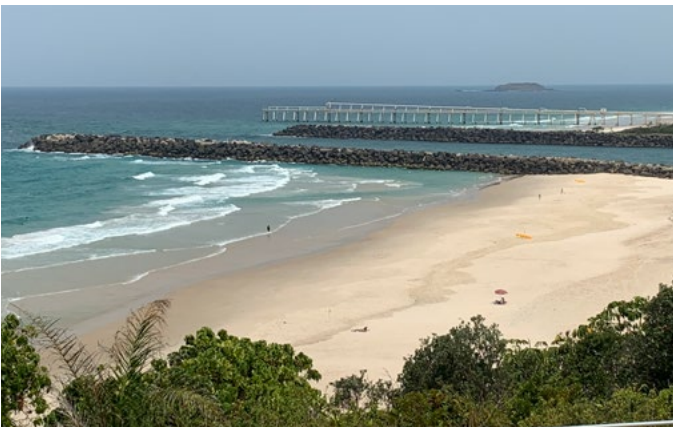
<p>Future multi-use features</p> <ul style="list-style-type: none"> – Maintain pedestrian walkway surface – Install CoastSnap photo point – Rock placement for seating and fishing opportunities – Rock placement for emergency safety stairs 	<p>Future eco-features</p> <ul style="list-style-type: none"> – Adjacent osprey tower – Increase submerged habitat complexity – Key fish habitat enhancement along training wall
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Southern Tweed River Breakwater: (1) the 1960s breakwater extension; (2) wave-trap beach; (3) original breakwater now part of estuarine training wall; (4) tidal gauge station and the water intake valve for the sand bypass scheme
 Credit: Six Maps

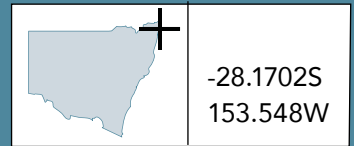


Painted bollards at the entrance to the breakwater



Tweed River breakwaters and the jetty associated with the Tweed Sand Bypass Scheme

Tweed River Jack Evans Boat Harbour



Responsible Authority: NSW State Government

Built: 1960s

Primary purpose when first built: Boat harbour for fishing vessels

Current uses:

- Passive recreation and primary contact water sports

Multi-use features: Nil

Eco-features: Nil

The Boat Harbour is mainly used for passive recreation. It is an important precinct with parking, amenities and greenspace.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

- Rock placement for emergency safety stairs

Future eco-features

- Increase submerged habitat complexity
- Seahorse hotel trial (on estuarine training wall)

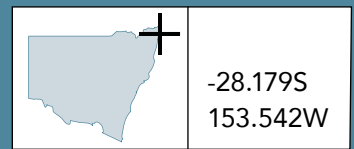


1961 aerial photo of the Jack Evans Boat Harbour formed by training walls at the entrance to the Tweed estuarine
Credit: NSW Public Works



Jack Evans Boat Harbour and urban development on the former Greenbank Island and reclaimed Tweed Back Channel
Credit: Google Earth

Tweed River Breakwater Marina



Responsible Authority: NSW State Government

Built: 1960s

Primary purpose when first built: Boat harbour for commercial fishing vessels

Current uses: – Boat harbour

Multi-use features: – Walking pathway

Eco-features: Nil

The marina is an important precinct for boating services with parking, amenities and greenspace.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

Nil

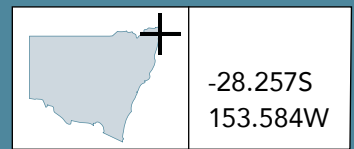
Future eco-features

– Maintain sewage pump-out facilities currently located at Foysters Jetty



The Tweed Trawler Boat Harbour and The Anchorage canal estate precinct, which was an intertidal area known as Greenbank Island *Credit: Google Earth*

Cudgen Creek Breakwater (North)



-28.257S
153.584W

Responsible Authority:	NSW State Government
Built:	1967
Primary purpose when first built:	Trained entrance for flood mitigation of Cudgen Creek coastal floodplain
Current uses:	<ul style="list-style-type: none">- Ocean access for boating- Popular coastal walkway- Fishing spot- Forms a popular estuarine wave-trap beach

Multi-use features: – Walking pathway
– Stabilises a wave-trap beach

Eco-features: Nil

The breakwater is accessible with adjacent parking, amenities, greenspace and urban areas. An estuarine training wall extends upstream for about 170 m. The bar is very shallow and dredging depths are limited by subsurface coffee rock.

Flood mitigation function is constrained by low ground levels on the coastal floodplain.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

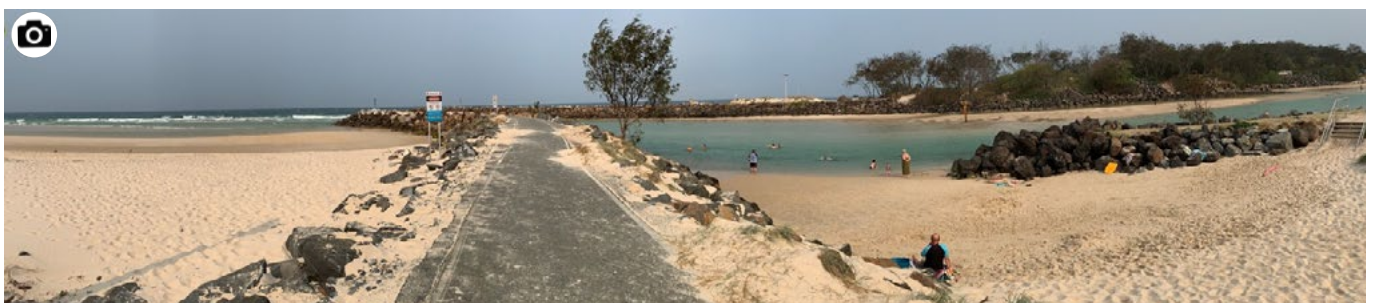
- Maintain pedestrian walkway surface
- Install CoastSnap photo point
- Rock placement for emergency safety stairs

Future eco-features

Nil

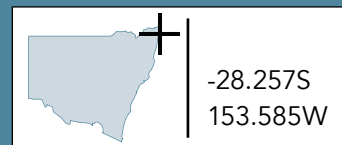


Cudgen Creek: (1) the northern breakwater; (2) wave-trap beach; (3) council boat ramp *Credit: Six Maps*



Popular wave-trap beach (left) just inside the Cudgen Creek northern breakwater

Cudgen Creek Breakwater (South)



Responsible Authority: NSW State Government

Built: 1967

Primary purpose when first built: Trained entrance for flood mitigation of Cudgen Creek coastal floodplain

Current uses:

- Ocean access for boating
- Coastal walkway
- Fishing spot

Multi-use features: - Walking pathway

Eco-features: - Within 50 m of natural reef

The breakwater is accessible with nearby parking. An estuarine training wall extends upstream for about 100 m. The bar is very shallow and dredging depths are limited by subsurface coffee rock.

Flood mitigation function is constrained by low ground levels on the coastal floodplain.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

- Install CoastSnap photo point
- Rock placement for emergency safety stairs

Future eco-features

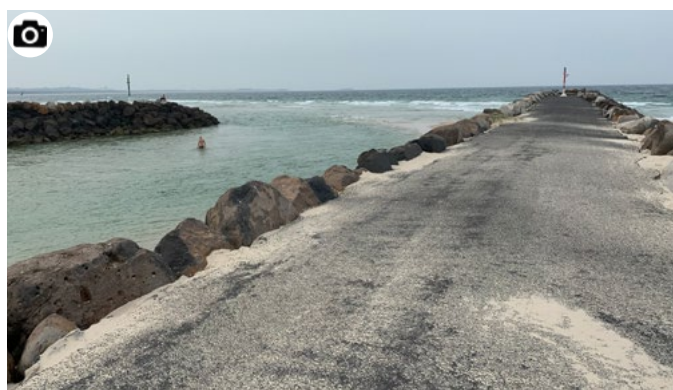
Nil



Cudgen Creek breakwater: (1) southern breakwater; (2) council boat ramp *Credit: nearmap*

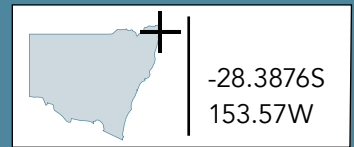


Sandy across part of the Cudgen Creek southern breakwater can restrict access for some people



Transport for NSW advise that 'caution and expert local knowledge is required' to navigate the bar

Mooball Creek Breakwater (North)



Responsible Authority:	NSW State Government
Built:	1968
Primary purpose when first built:	Trained entrance for flood mitigation of Mooball Creek coastal floodplain
Current uses:	The breakwater has partially collapsed. The WBM (2015) Flood Risk Study found: 'dredging the creek would have limited to negligible improvements on flood magnitude, extent and duration of inundation'

Multi-use features:	– Walking pathway
Eco-features:	– Within 50 m of natural reef

The breakwater is accessible from nearby parking and urban areas by a short unmarked sandy track. Mooball Creek estuary is popular for swimming and fishing, but the breakwater does not appear to enhance these activities. In contrast, nearby Cudgera Creek estuary does not have a trained entrance but is a very popular swimming site.

Recommendation: examine and assess primary purpose	
Future multi-use features	Future eco-features
Nil	Nil

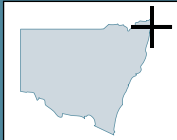


Mooball Creek Northern breakwater (1)



Mooball Creek, sometimes known as Pottsville Creek, northern breakwater

Mooball Creek Breakwater (South)



-28.388S
153.57W

Responsible Authority:	NSW State Government
Built:	1968
Primary purpose when first built:	Trained entrance for flood mitigation of Mooball Creek coastal floodplain
Current uses:	The breakwater has partially collapsed. The WBM (2015) Flood Risk Study found: 'dredging the creek would have limited to negligible improvements on flood magnitude, extent and duration of inundation'

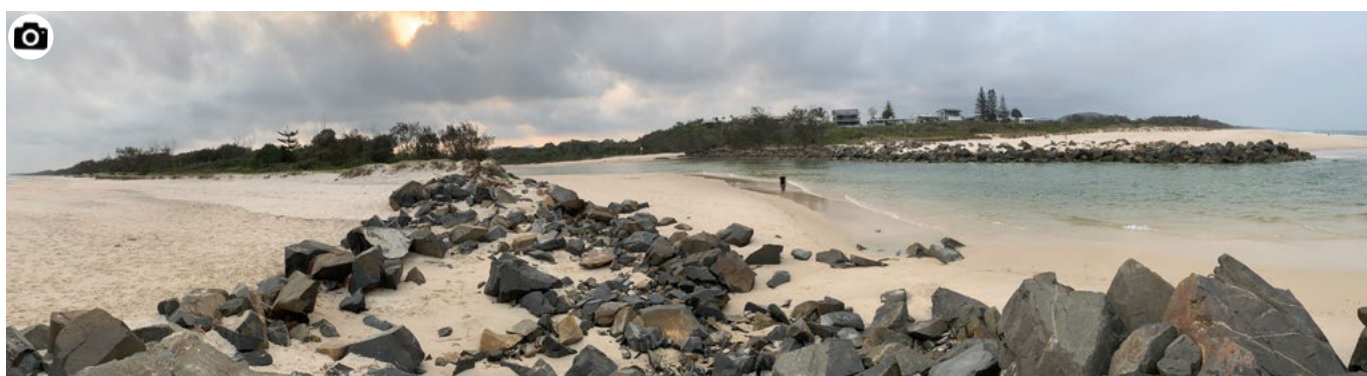
Multi-use features:	Nil
Eco-features:	Nil
The breakwater is accessible from nearby parking. An estuarine training wall extends upstream for 100 m.	
Mooball Creek estuary is popular for swimming and fishing, but the breakwater does not appear to enhance these activities. In contrast, the popular nearby Cudgera Creek estuary does not have a trained entrance but is a very popular swimming site.	

Recommendation: examine and assess primary purpose

Future multi-use features	Future eco-features
Nil	Nil

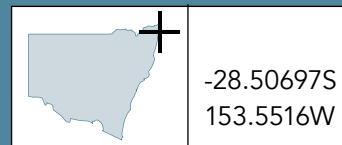


Mooball Creek, sometimes known as Pottsville Creek, southern breakwater *Credit: nearmap*



The collapsed Mooball Creek southern breakwater

New Brighton (Kendalls) Groyne



Responsible Authority: Byron Shire Council

Built: 1970s

Primary purpose when first built: Trap sand and minimise beach erosion at New Brighton

Current uses: – Trap sand and minimise beach erosion at New Brighton

Regulatory matters: – *Coastal Management Act 2016*

Multi-use features: Nil

Eco-features: Nil

The New Brighton beach groyne was built around 1975, when the village of Sheltering Palms, located to the south, was abandoned due to coastal erosion impacts from cyclone Pam in 1974.

The groyne is mostly buried. There is no opportunity for multiple use or environmental features.

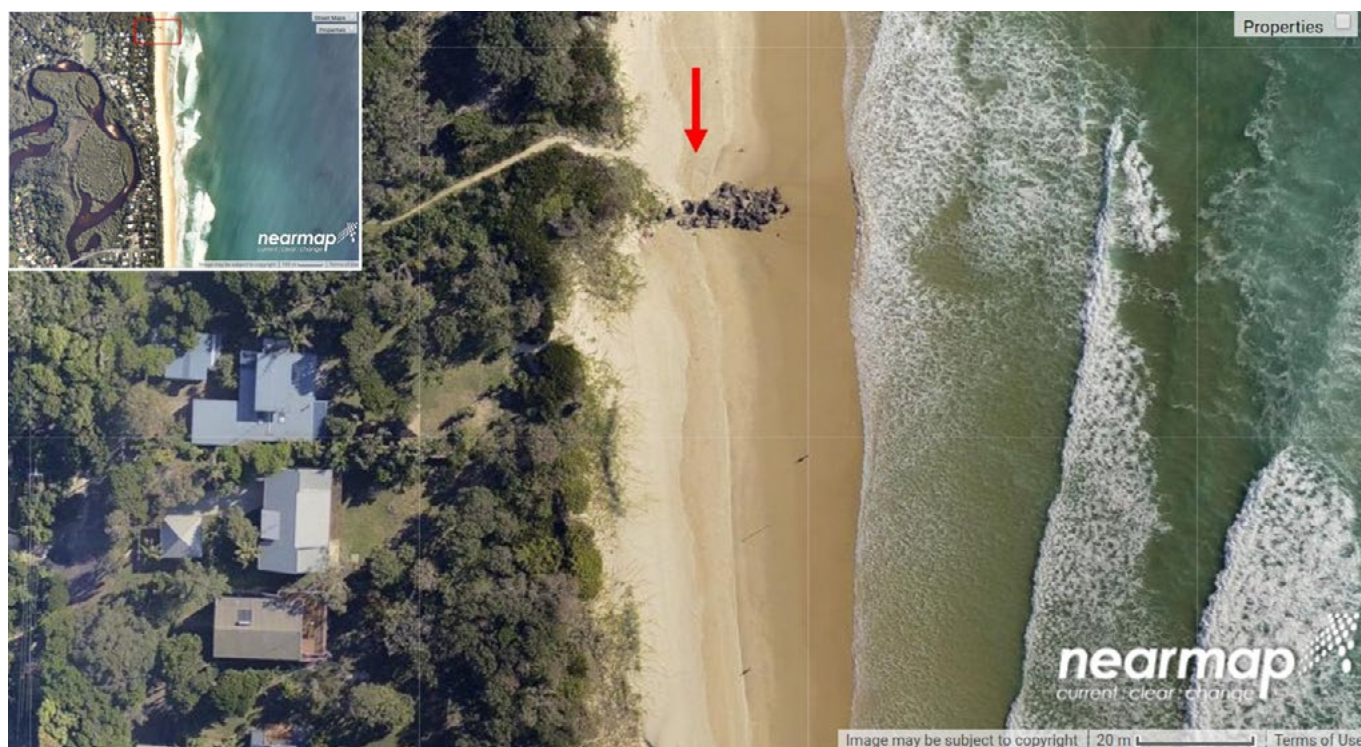
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

Nil

Future eco-features

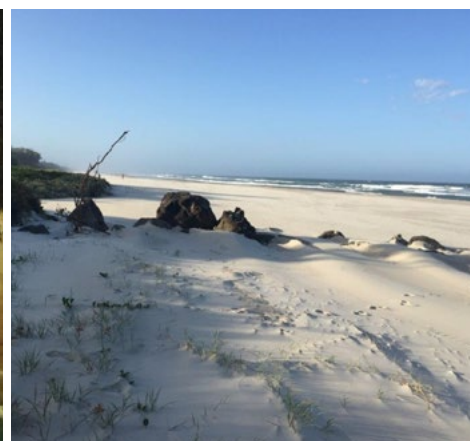
Nil



New Brighton Groyne: depending on the state of the beach, the structure is sometimes completely concealed by sand or a prominent feature *Credit: nearmap*

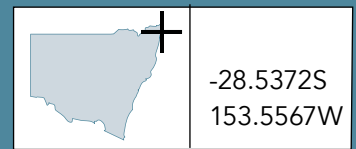


The New Brighton Groyne shown on the front cover of the 1979 Summary of Byron Bay – Hastings Point Erosion Study prepared by NSW Public Works



The partially buried groyne in 2020
Photo: Rebecca Philps

Brunswick River estuary-wide change



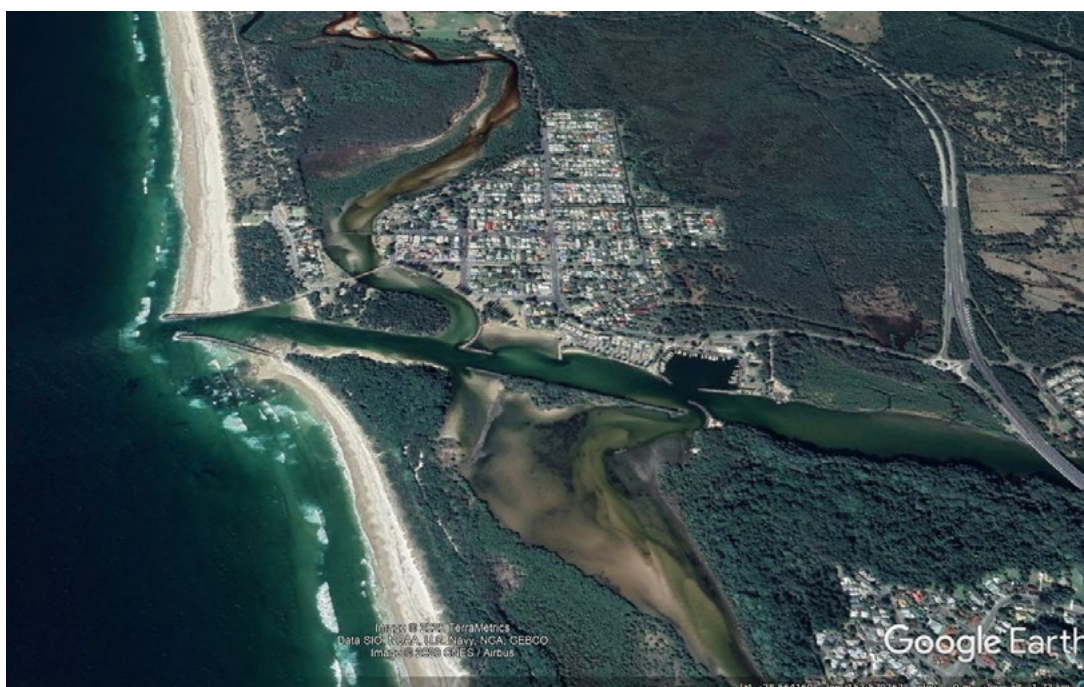
A submerged indurated sandstone bar was blasted and removed when the entrance was initially trained.



Aerial photo of the Brunswick River estuary looking south, April 1960, before the breakwaters were installed. The village of Sheltering Palms on the northern side of the Brunswick River was abandoned in 1975 due to coastal erosion.

Credit: NSW Public Works

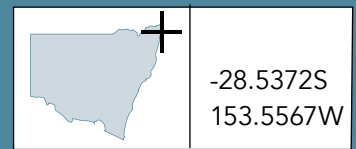
Prior to construction of the Brunswick River trained entrance breakwaters, erosion rates at Sheltering Palms were 0.5 m per year; rates increased to 2.6 m per year after construction (Gordon et al. 1978).



Brunswick River estuary looking south, showing its trained entrance. A carpark near the site of the abandoned village of Sheltering Palms provides access to the northern breakwater.

Credit: Google Earth

Brunswick River Breakwater (North)

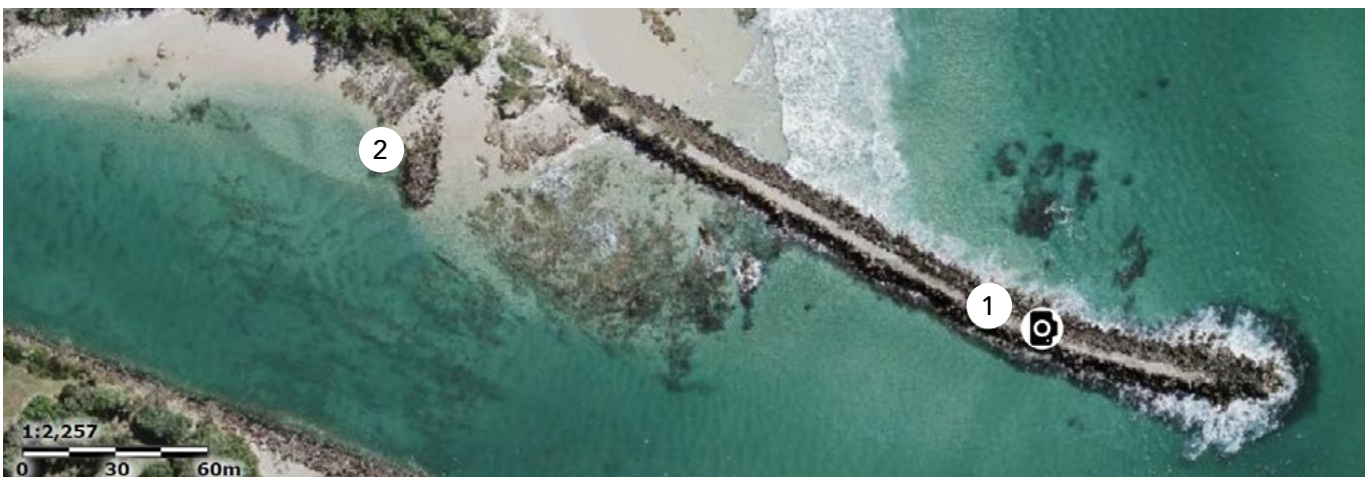


Responsible Authority:	NSW State Government
Built:	1960–62
Modified:	1968
Primary purpose when first built:	Trained entrance for boating: commercial fishing and tourism
Current uses:	<ul style="list-style-type: none"> – Ocean access for boating – Spur wall forms a popular estuarine beach
Regulatory matters:	<ul style="list-style-type: none"> – Cape Byron Marine Park – Brunswick Heads Nature Reserve

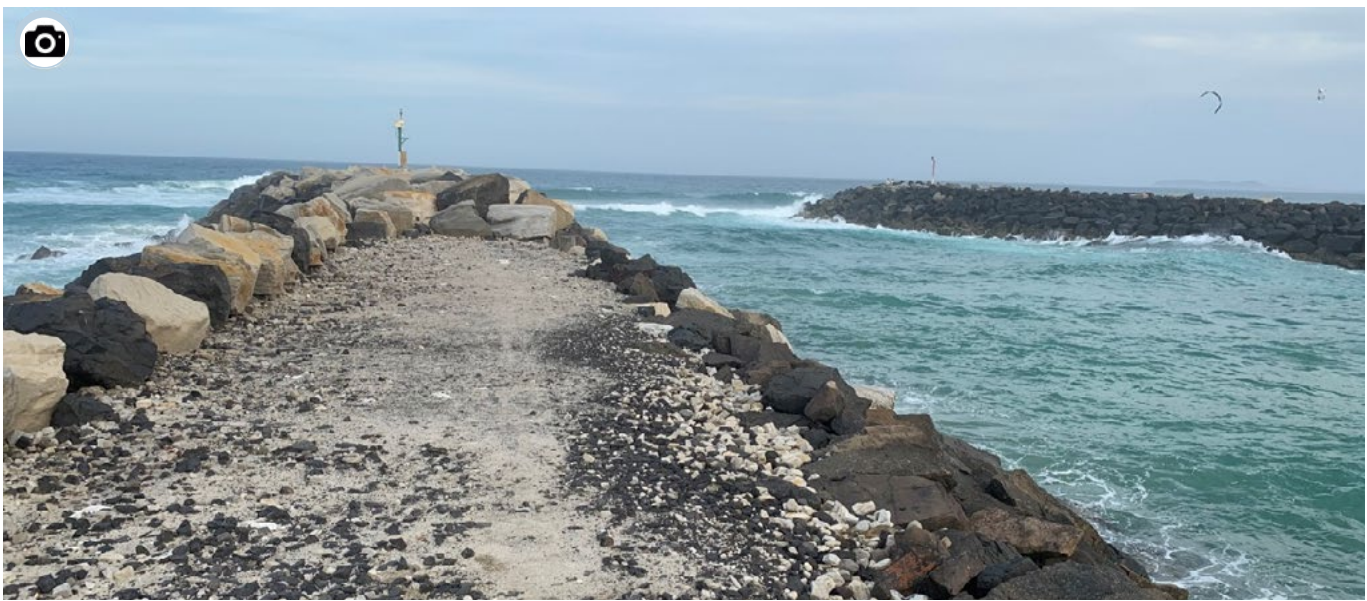
Multi-use features:	– Spur wall appears to stabilise sand on the northern estuarine beach
Eco-features:	<ul style="list-style-type: none"> – Within 50 m of natural reef – Estuarine intertidal inlets
<p>The breakwater is accessible from a 500-m track through the Brunswick Heads Nature Reserve from a small car park at the end of an unsealed track where the village of Sheltering Palms was located. An estuarine training wall network extends about 1 km upstream with inlets that support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats.</p>	

Recommendations for possible inclusion in future maintenance or upgrade works

<p>Future multi-use features</p> <ul style="list-style-type: none"> – Install CoastSnap photo point – Rock placement for emergency safety stairs 	<p>Future eco-features</p> <ul style="list-style-type: none"> – Maintain breakwater fauna refuge area – Key fish habitat enhancement along training wall
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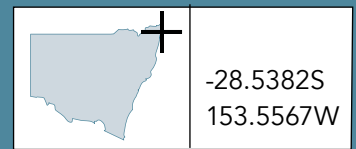


Brunswick River Breakwater: (1) the northern breakwater; (2) spur wall partly creating an estuarine beach *Credit: Six Maps*



The rough surface of the semi-remote breakwater has been left as large boulders at the head of the breakwater creating a fauna refuge area.

Brunswick River Breakwater (South)



Responsible Authority:	NSW State Government
Built:	1960–62
Primary purpose when first built:	Trained entrance for fishing and tourism
Current uses:	<ul style="list-style-type: none"> – Ocean access for boating – Popular coastal walkway – Fishing spot – Forms very popular estuarine wave-trap at Torakina Beach
Regulatory matters:	– Cape Byron Marine Park

Multi-use features:	<ul style="list-style-type: none"> – Walking pathway – Stabilises Torakina Beach
Eco-features:	– Estuarine intertidal inlets
<p>The breakwater is very accessible with nearby parking, amenities, greenspace and the central business district of Brunswick Heads. An estuarine training wall network extends upstream for 12 km. It includes the Boat Harbour precinct and inlets that support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats.</p>	

Recommendations for possible inclusion in future maintenance or upgrade works	
<p>Future multi-use features</p> <ul style="list-style-type: none"> – Maintain pedestrian walkway surface – Install CoastSnap photo point – Rock placement for seating and fishing opportunities – Rock placement for emergency safety stairs 	<p>Future eco-features</p> <ul style="list-style-type: none"> – Adjacent osprey tower – Increase submerged habitat complexity – Seahorse Hotel Trial (on the estuarine training wall) – Key fish habitat enhancement along training wall



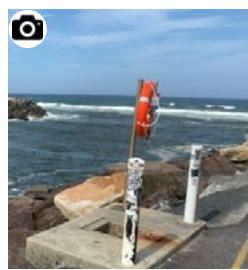
Brunswick River Breakwater: (1) the southern breakwater; (2) Torakina wave-trap beach; (3) part of the estuarine training wall
Credit: Six Maps



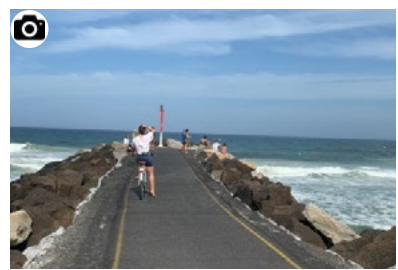
The popular Torakina wave-trap beach



Local breakwater art

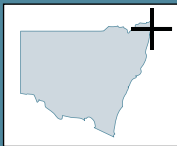


Angel Ring



A trafficable and smooth pavement finish is appreciated by walkers, bike riders and families with prams

Brunswick River Boat Harbour



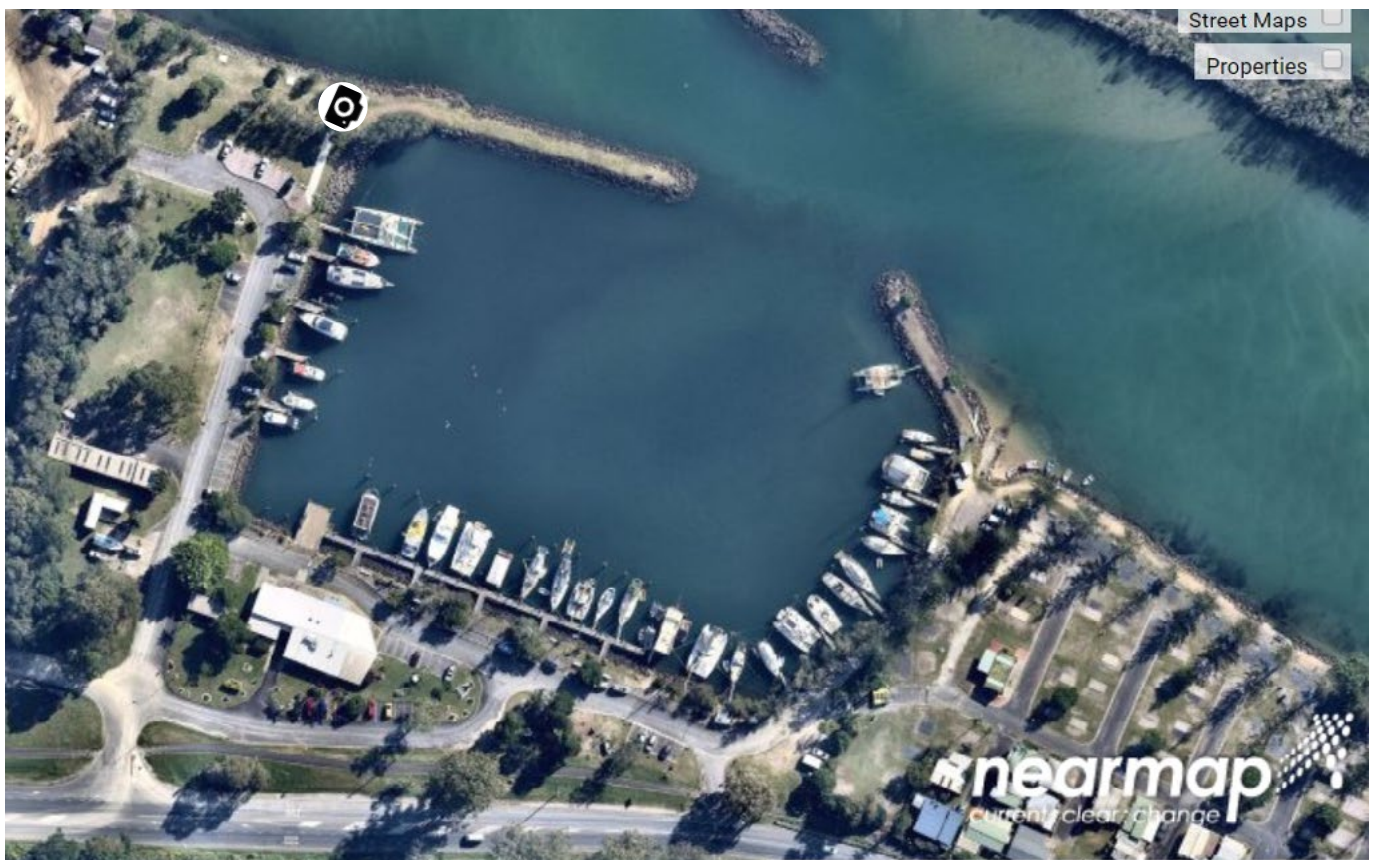
-28.5344S
153.5455W

Responsible Authority: NSW State Government
Built: 1960–62
Primary purpose when first built: Boat harbour for fishing and tourism
Current uses: – Boat harbour
Regulatory matters: – Cape Byron Marine Park

Multi-use features: – Walking pathway
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 Nil	Future eco-features – Sewage pump-out facilities are required
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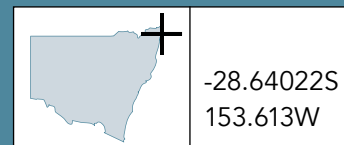


Brunswick Heads boat harbour breakwaters Credit: nearmap



The Brunswick Heads boat harbour provides berths for recreational and commercial fishing vessels.

Byron Main Beach Groynes



Responsible authority: Byron Shire Council

Built: 1962

Modified: Upgraded in 1975

Primary purpose when first built: Rock armour and three spur groynes for swimming pool carpark and Byron Main Beach

Current uses:

- Popular gathering spot
- Main Beach car park

Regulatory matters:

- Cape Byron Marine Park
- *Coastal Management Act 2016*

Multi-use features: Nil

Eco-features: Nil

The groyne field is very accessible. It is close to parking, amenities, greenspace and the central business district of Byron Bay.

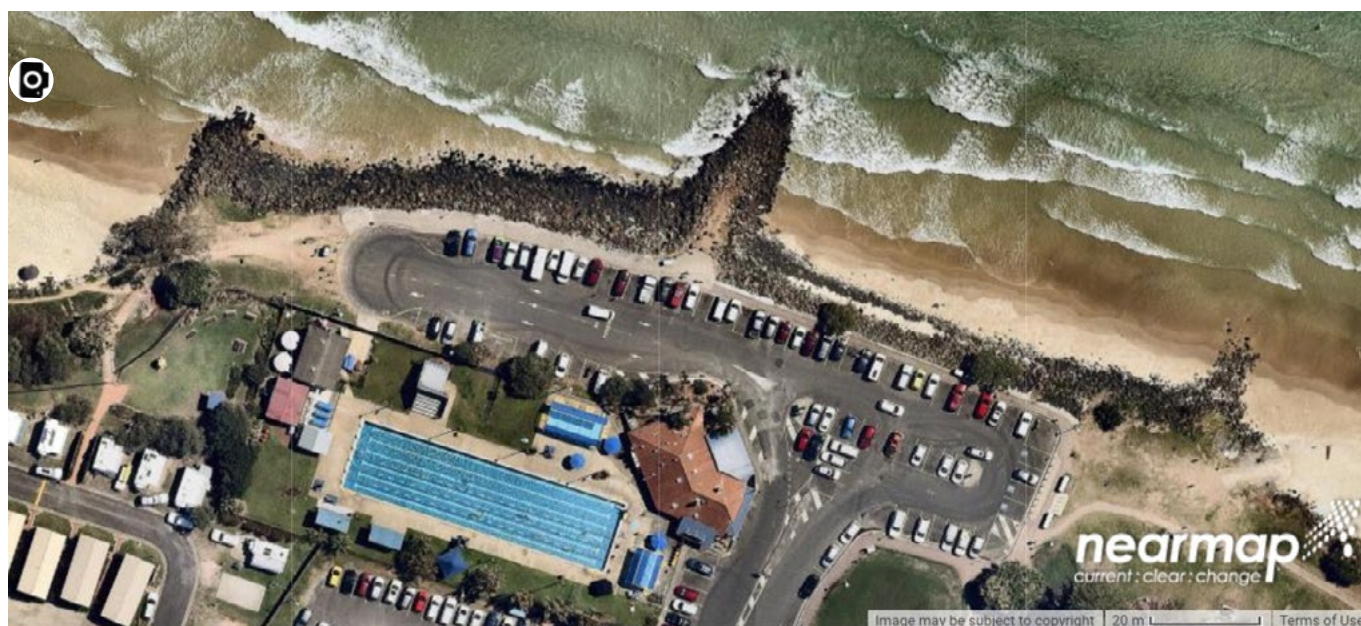
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

- Install CoastSnap photo point
- Rock placement for seating opportunities
- Rock placement for emergency safety stairs

Future eco-features

Nil

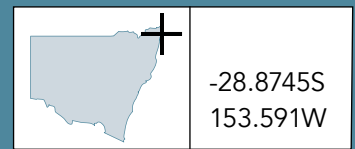


The Byron Main Beach armoured groyne field Credit: nearmap

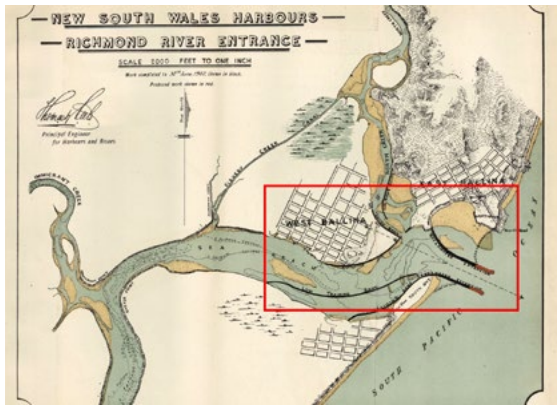


The groyne field is a popular gathering spot very near the Byron Bay central business district

Richmond River estuary-wide change



A submerged indurated sandstone bar was blasted and removed when the entrance was initially trained.



1902 chart showing progress on entrance training works at the Richmond River. The area outlined in the red square is shown right and below in a current aerial image

The Richmond River estuary in 2020

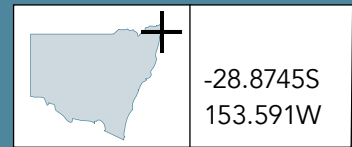
Credit: nearmap

Source: NSW Public Works Department 1902 Annual Report



Changes in the shape of the Richmond River estuary due to the training walls are shown by merging the above two images, detailing: (1) northern breakwater; (2) southern breakwater; (3) Lighthouse Beach; (4) Shaws Bay urban development; (5) Shaws Bay sea lido; (6) Martin Street Boat Harbour; (7) Ballina Boat Harbour (approximately 300 m upstream).

Richmond River Breakwater (North)



-28.8745S
153.591W

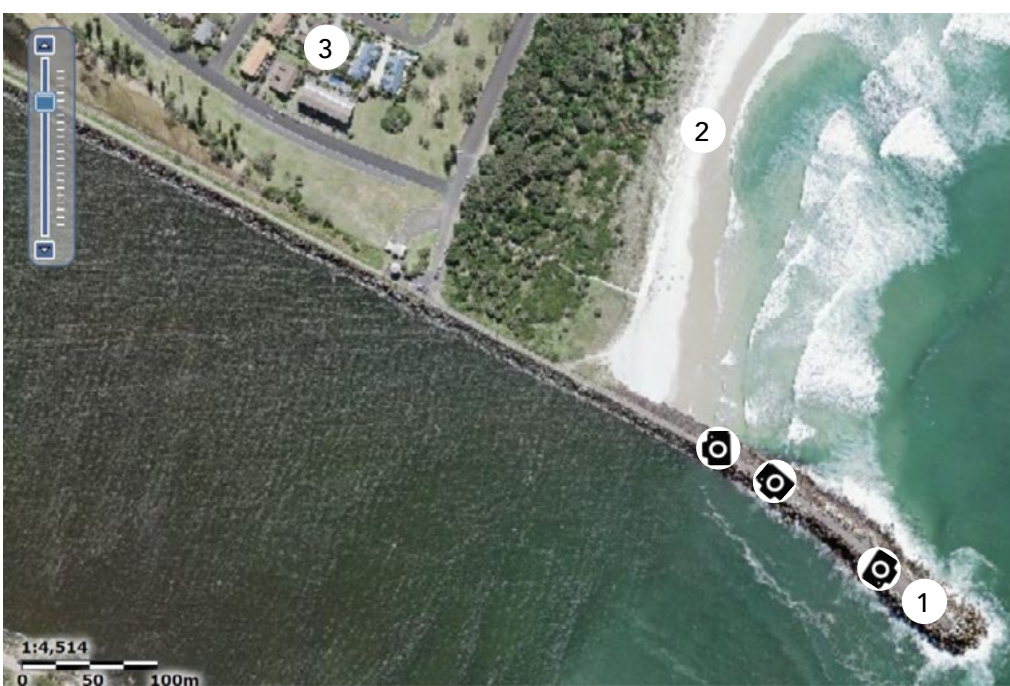
Responsible authority:	NSW State Government
Built:	1889–1910
Modified:	Lengthened in the 1960s
Primary purpose when first built:	Trained entrance for coastal shipping
Current uses:	<ul style="list-style-type: none"> – Integral for Shaws Bay urban precinct (25 ha) and popular Shaws Bay sea lido – Forms Lighthouse surf beach – Ocean access for boating – Popular coastal walkway – Fishing spot

Multi-use features:	<ul style="list-style-type: none"> – Protects an urban precinct – Stabilises Lighthouse Surf Beach and the Shaws Bay sea lido – Training wall provides a popular pathway
Eco-features:	<ul style="list-style-type: none"> – Estuarine intertidal inlets

The breakwater is very accessible. It is close to parking, amenities, greenspace and a popular walkway to Ballina central business district. An estuarine training wall network extends upstream for about 3.9 km. It includes the Shaws Bay precinct, which supports seagrass, mangrove and saltmarsh and receives tidal flushing through voids in the training wall.

Recommendations for possible inclusion in future maintenance or upgrade works

<p>Future multi-use features</p> <ul style="list-style-type: none"> – Maintain pedestrian walkway surface – Rock placement for seating and fishing opportunities – Rock placement for emergency safety stairs 	<p>Future eco-features</p> <ul style="list-style-type: none"> – Increase submerged habitat complexity – Key fish habitat enhancement along training wall
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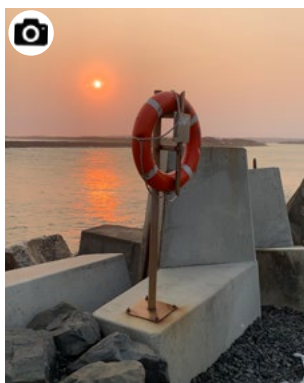
Aerial photo showing:
(1) northern breakwater;
(2) Lighthouse Beach;
(3) Shaws Bay urban development



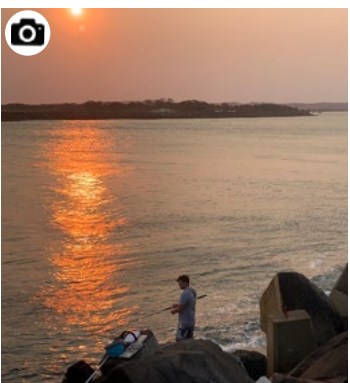
Shaws Bay urban area



A raised walkway crest on North Wall maintains the spectacular view

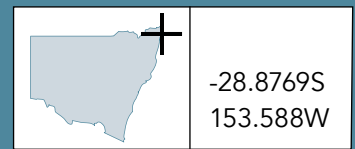


Angel Ring



Sunset fishing

Richmond River Breakwater (South)



-28.8769S
153.588W

Responsible Authority:	NSW State Government
Built:	1889–1910
Modified:	Lengthened in the 1960s
Primary purpose when first built:	Trained entrance for coastal shipping
Current uses:	<ul style="list-style-type: none"> – Ocean access for boating – Fishing spot
Regulatory matters:	<ul style="list-style-type: none"> – Ballina Nature Reserve

- Multi-use features:** – Walking pathway (rough surface)
- Eco-features:** – Estuarine intertidal inlets

The breakwater is accessible from a nearby carpark at the end of a 1.5-km unsealed road. An estuarine training wall network extends upstream by 4.4 km. It includes Mobbs Bay and other inlets that are formed by half-tide training walls. These support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

- Install CoastSnap photo point
- Rock placement for emergency safety stairs

Future eco-features

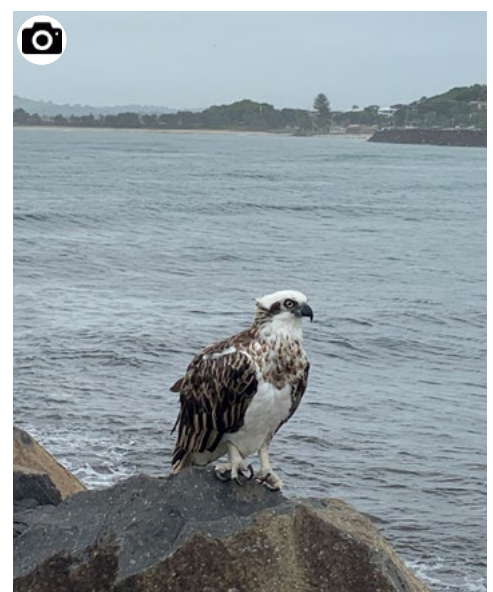
- Adjacent osprey tower
- Increase submerged habitat complexity
- Key fish habitat enhancement along training wall



Aerial photo showing: (1) southern breakwater; (2) a half-tide training wall; (3) saltmarsh community reliant on tidal flushing through the breakwater *Credit: nearmap*

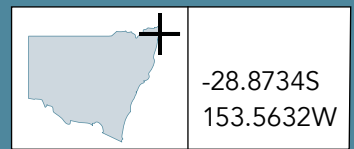


Saltmarsh plant community reliant on tidal flows flushing through the breakwater



Osprey sitting on the Richmond River southern breakwater

Richmond River Martin Street Boat Harbour



Responsible Authority:	NSW State Government	Multi-use features:	Nil
Built:	1900s	Eco-features:	Nil
Primary purpose when first built:	Boat harbour		
Current uses:	- Boat harbour		

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

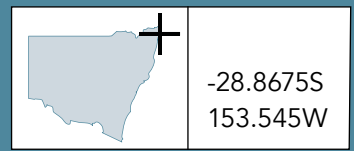


The Martin Street Boat Harbour was formed as part of the Richmond River estuary training walls. Credit: nearmap



The Martin Street Boat Harbour is close to the Ballina central business district

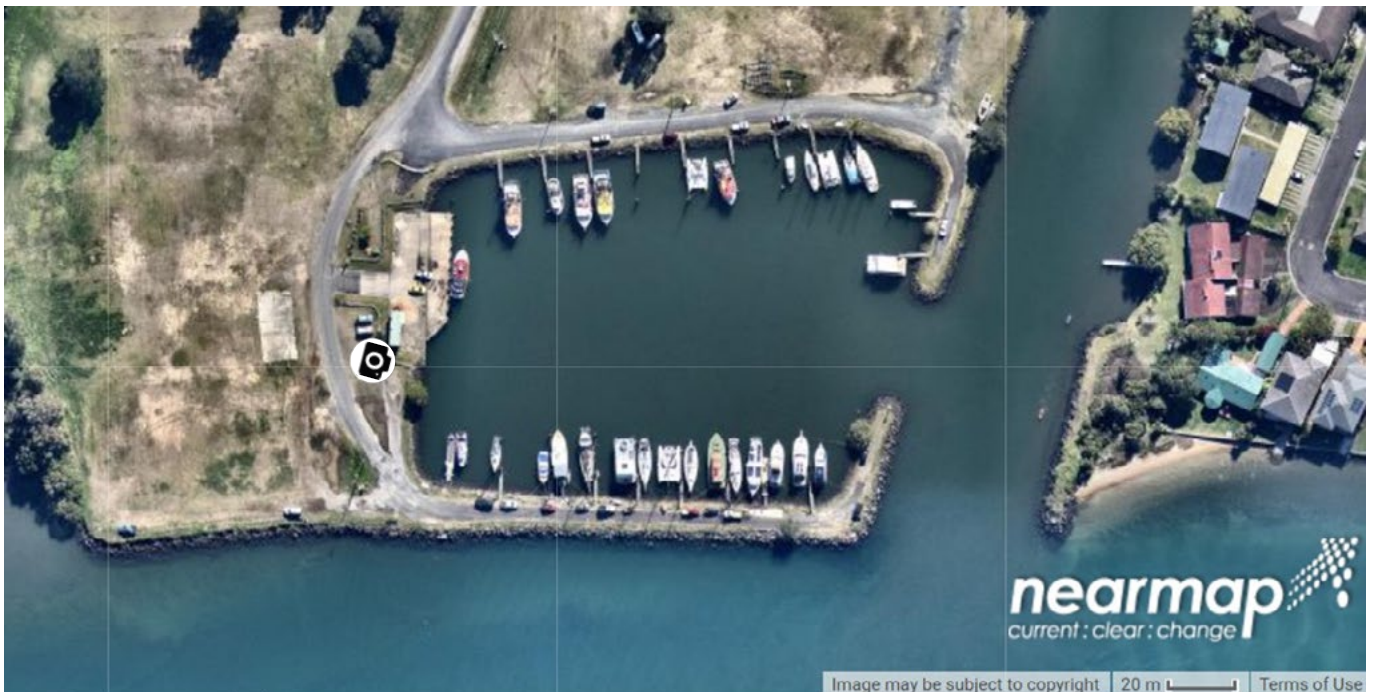
Richmond River Ballina Boat Harbour



Responsible Authority:	NSW State Government	Multi-use features:	Nil
Built:	1960s	Eco-features:	Nil
Primary purpose when first built:	Boat harbour for fishing and tourism		
Current uses:	– Boat harbour		

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features	Future eco-features
– Maintain pedestrian walkway surface	– Sewage pump-out facilities are required

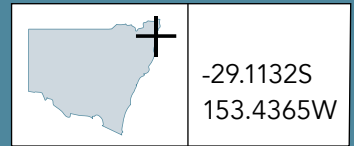


The Richmond River Ballina Boat Harbour breakwaters *Credit: nearmap*



The Ballina Boat Harbour also provides berths for recreational vessels.

Evans River estuary-wide change



A submerged indurated sandstone bar was blasted and removed when the entrance was initially trained.



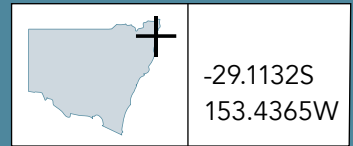
Evans River estuary entrance in September 1960 before the trained entrance was installed *Credit: NSW Public Works*



During 1895 a team of 60 - 70 men widened by 250 feet a narrow point on the Evans River known as the Iron Gates to a depth of 3 feet below low water for a length of 750 feet to increase discharge of floodwaters through via the Evans River.

Evans River estuary and its trained entrance *Credit: NSW Public Works*

Evans River Breakwater (North)



Responsible Authority:	NSW State Government
Built:	1963
Primary purpose when first built:	Trained entrance for fishing and tourism
Current uses:	<ul style="list-style-type: none"> - Ocean access for boating - Popular coastal walkway - Fishing spot - Forms rocky estuarine wave-trap beach

Multi-use features:	- Walking pathway
Eco-features:	<ul style="list-style-type: none"> - Within 50 m of natural reef - Forms a rocky intertidal area used by wader birds
<p>The breakwater is very accessible. It is close to parking, amenities, greenspace and the central business district of Evans Head. Several private memorials are attached to rocks on the wall. The breakwater joins a short estuarine training wall that creates a rocky intertidal area used by birds.</p>	

Recommendations for possible inclusion in future maintenance or upgrade works

<p>Future multi-use features</p> <ul style="list-style-type: none"> - Maintain pedestrian walkway surface - Install CoastSnap photo point - Rock placement for emergency safety stairs 	<p>Future eco-features</p> <ul style="list-style-type: none"> - Increase submerged habitat complexity - Retain rocky wave-trap beach as a habitat refuge
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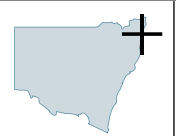
Smooth walking pathway and an angel ring

Evans River Breakwater: (1) the Northern breakwater; (2) wave-trap beach with part of the rocky shelf that was blasted to deepen the entrance *Credit: Six Maps*



Private memorials to loved ones have been installed on the breakwater

Evans River Breakwater (South)



-29.1132S
153.4375W

Responsible Authority:	NSW State Government
Built:	1963
Primary purpose when first built:	Trained entrance for boats used for fishing and tourism
Current uses:	<ul style="list-style-type: none"> - Ocean access for boating - Popular coastal walkway - Fishing spot - Forms Shark Bay surf beach

Multi-use features:	<ul style="list-style-type: none"> - Walking pathway - Stabilises Shark Bay beach
Eco-features:	<ul style="list-style-type: none"> - Within 50 m of natural reef
<p>The breakwater is very accessible with nearby parking, amenities, greenspace and nearby urban areas.</p>	

Recommendations for possible inclusion in future maintenance or upgrade works

<p>Future multi-use features</p> <ul style="list-style-type: none"> - Maintain pedestrian walkway surface - Rock placement for emergency safety stairs 	<p>Future eco-features</p> <ul style="list-style-type: none"> - Increase submerged habitat complexity
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Evans River Breakwater with: (1) southern breakwater; (2) Shark Bay, a surf beach that was created when the breakwater was built. Credit: Six Maps

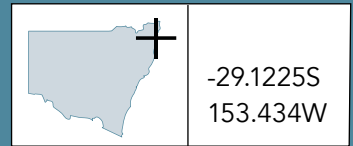


Fishing line collection bin attached to a warning sign at the entrance to the Evans River southern breakwater



Tarred surface of the breakwater

Evans River Boat Harbour



Responsible Authority:	NSW State Government	Multi-use features:	Nil
Built:	1963	Eco-features:	Nil
Primary purpose when first built:	Boat harbour for fishing and tourism		
Current uses:	– Boat harbour		

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features	Future eco-features
– Maintain pedestrian walkway surface	– Sewage pump-out facilities are required

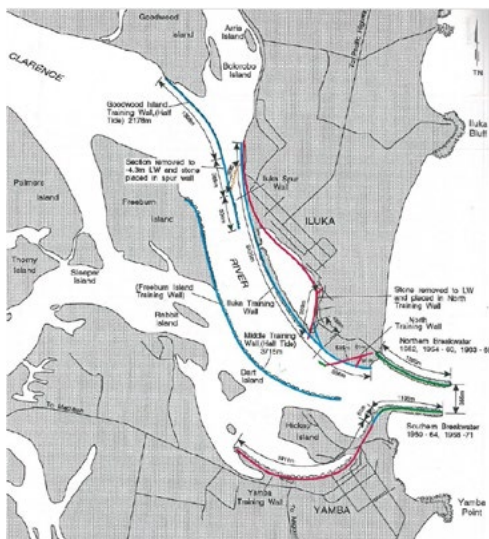
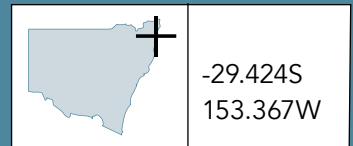


Evans Head boat harbour Credit: Six Maps



The Evans River Boat Harbour provides berths for commercial fishing and recreational vessels.

Clarence River estuary-wide change



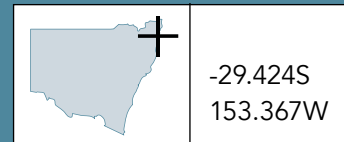
The image above was created using a chart from the NSW Public Works Department 1902 Annual Report, showing progress on entrance training works at the Clarence River and a recent Google Earth image.

The map (left) is an extract taken from a nomination submitted to Engineers Australia (Mashiah, 2012) to recognise the significance of the engineering heritage of the Port of Clarence. The nomination was successful, and a plaque and an interpretative sign were installed in 2012.

Breakwater construction phases:

- Red 1862–1889 Moriarty Scheme
- Blue 1893–1903 Coode Scheme
- Green 1950–1971 Clarence Harbour Act 1950

Clarence River Breakwater (North)



Responsible authority:	NSW State Government
Built:	1874–1903
Modified:	Lengthened 1280 m in the 1960s
Primary purpose when first built:	Trained entrance for coastal shipping
Current uses:	<ul style="list-style-type: none"> – Ocean access for coastal shipping and boating – Fishing spot – Forms an estuarine wave-trap beach used by mullet fishers
Regulatory matters:	<ul style="list-style-type: none"> – Native Title (determined) – <i>Heritage Act 1977</i>

- Multi-use features:**
- Partial walking pathway
 - Stabilises a wave-trap beach used by mullet haulers
 - Shipwreck heritage HMAS Waree
- Eco-features:**
- Fauna refuge in the eastern most 250 m of the breakwater
 - Estuarine intertidal inlets

The breakwater is accessible with nearby parking. An estuarine training wall network extends upstream for 6.4 km and includes the Iluka Bay Boat Harbour precinct. Other inlets support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats.

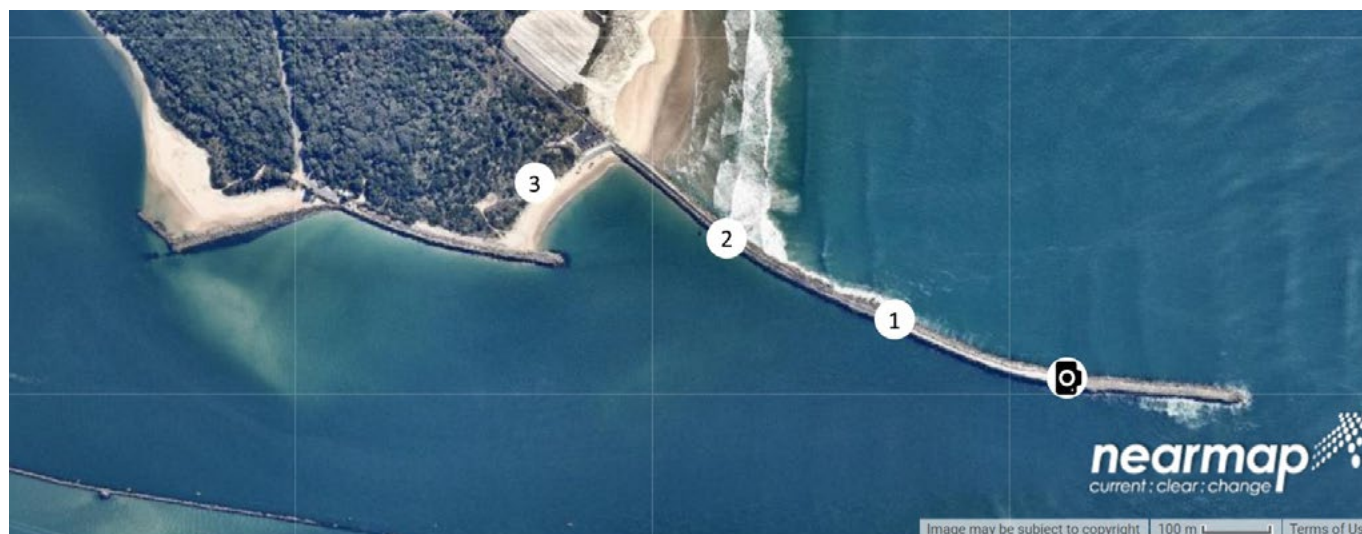
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

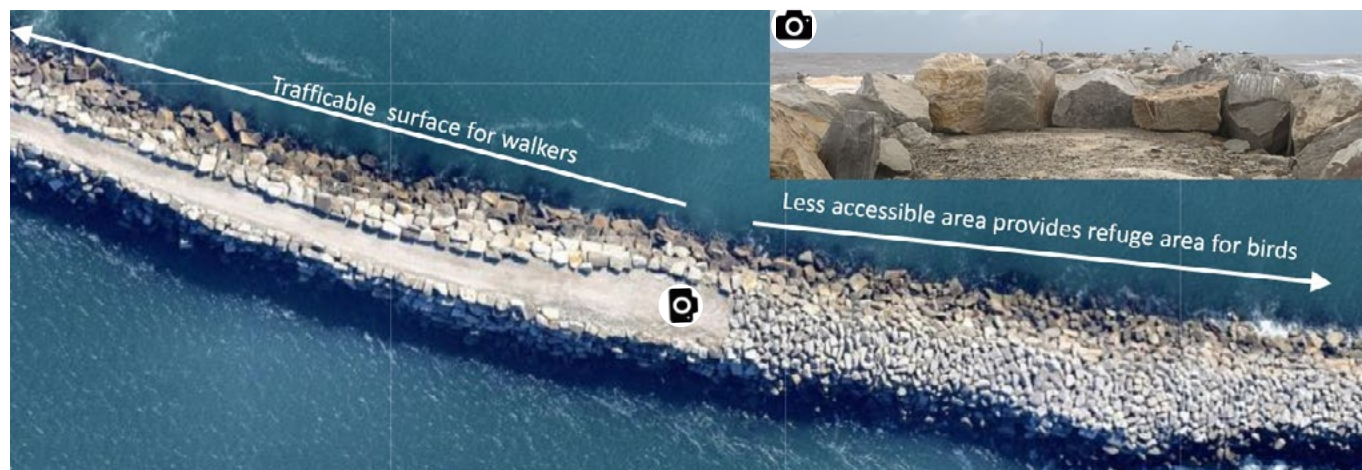
- Maintain existing pedestrian walkway surface
- Rock placement for emergency safety stairs
- Time works to avoid the mullet haul season in autumn

Future eco-features

- Maintain breakwater fauna refuge area
- Adjacent osprey tower
- Increase submerged habitat complexity
- Key fish habitat enhancement along training wall

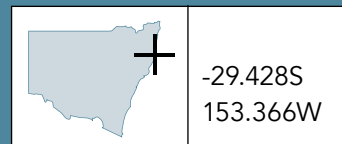


Clarence Northern breakwater, showing the (1) northern breakwater; (2) Shipwreck HMAS Waree; (3) mullet haul beach
Credit: nearmap



The last 250 metres of the breakwater is inaccessible, and this creates a refuge for breakwater fauna
Credit: nearmap

Clarence River Breakwater (South)



Responsible Authority: NSW State Government

Built: 1862–1903

Modified: Lengthened by 1.1 km in 1960s

Primary purpose when first built: Trained entrance for coastal shipping

Current uses:

- Ocean access for coastal shipping and boating
- Fishing spot
- Forms Turners surf beach

Regulatory matters: – Native Title (determined)

Multi-use features:

- Walking pathway
- Angel Ring
- Stabilises Turners beach

Eco-features:

- Estuarine intertidal inlets

The breakwater is accessible. It is close to parking, amenities and greenspace. An estuarine training wall extends upstream by about 5.5 km and includes the Yamba Harbour precinct. Other inlets support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

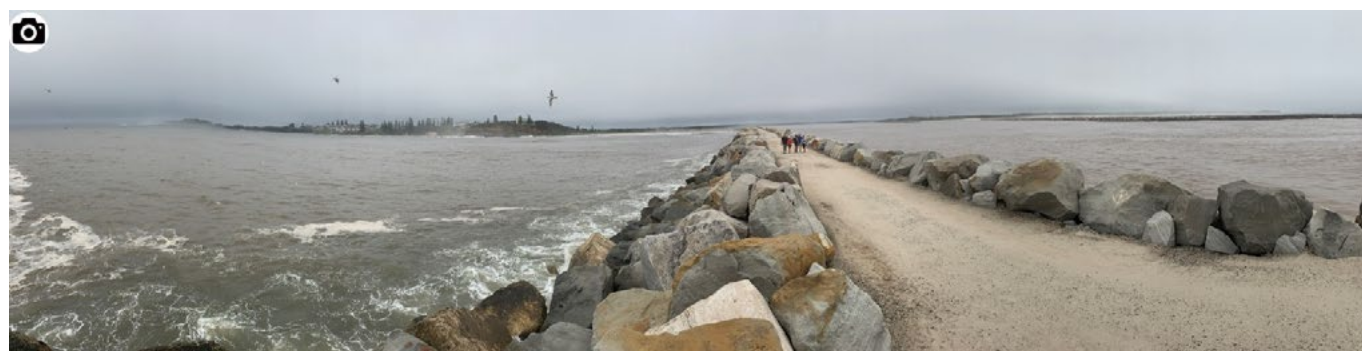
- Maintain pedestrian walkway surface
- Rock placement for seating and fishing opportunities
- Rock placement for emergency safety stairs

Future eco-features

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

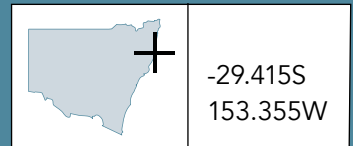


Clarence River Breakwater: (1) the southern breakwater; (2) Turners Beach; (3) interpretative signage acknowledging the engineering heritage of the Port of Clarence breakwater infrastructure *Credit: Six Maps*



The view back to land from the end of the Clarence River southern breakwater provides a unique perspective as sea birds arc and dive for fish. The first two-thirds of the breakwater has a smooth, tar-finished trafficable surface and the last third is a coarser gravel.

Clarence River Iluka Boat Harbour



Responsible Authority: NSW State Government

Built: 1970s

Primary purpose when first built: Boat harbour for fishing and tourism

Current uses: – Boat harbour

Regulatory matters: – Native Title (determined)

Multi-use features: – Walking pathway

Eco-features: – Adjacent marine vegetation

The boat harbour precinct and adjacent marine vegetation are both within the training wall network at Iluka Bay.

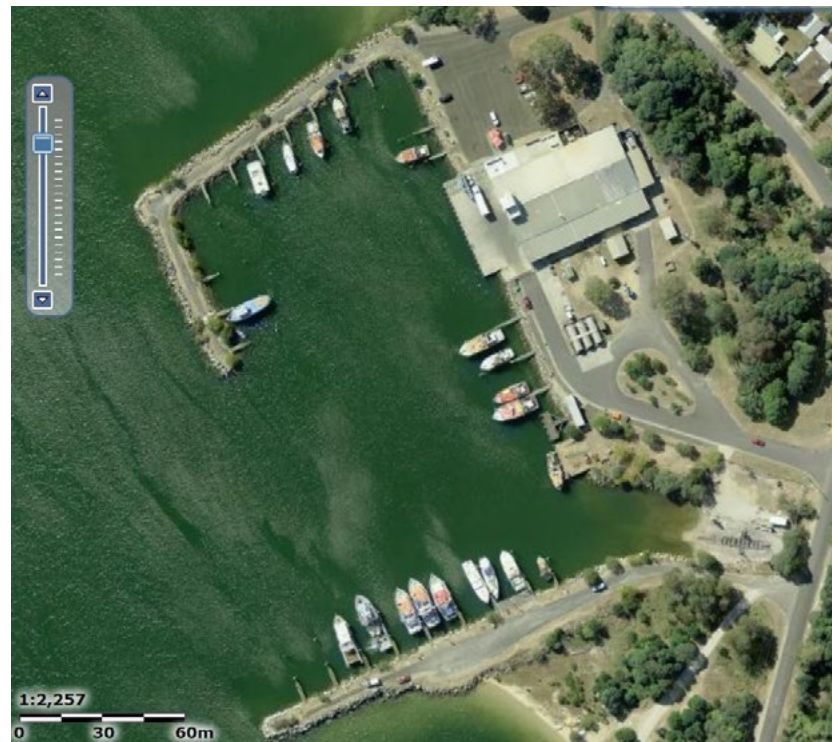
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

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

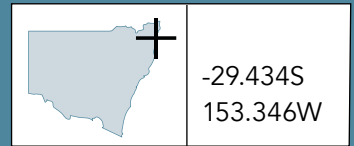
Future eco-features

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



Iluka Boat Harbour within Iluka Bay *Credit: Six Maps*

Clarence River Yamba Boat Harbour



Responsible Authority:	NSW State Government
Built:	1900
Modified	Harbour facilities added 1990s
Primary purpose when first built:	Boat harbour
Current uses:	– Boat harbour for fishing and tourism
Regulatory matters:	– Native Title (determined)

- Multi-use features:** – Walking pathway
- Eco-features:** – Adjacent intertidal inlet creates mangrove habitat

The breakwater is very accessible and critical for access around the harbour. There are nearby parking, amenities, greenspace and urban areas.

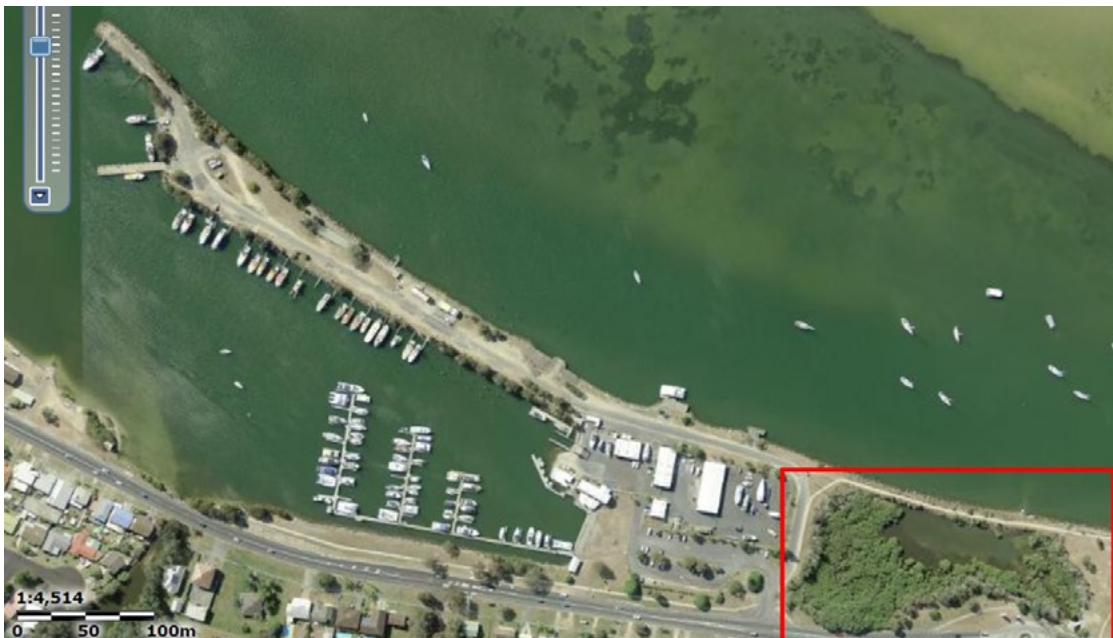
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

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

Future eco-features

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

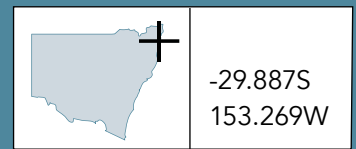


Yamba Boat Harbour
Credit: Six Maps



Estuarine intertidal inlet in the training wall sustains an area of mangrove adjacent to the Yamba Boat Harbour
Credit: Six Maps

Wooli River Breakwater (North)



Responsible Authority: NSW State Government

Built: 1973

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

Current uses:

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

Regulatory matters:

- Native Title (determined)
- Solitary Islands Marine Park

Multi-use features:

- Walking pathway

Eco-features:

- Estuarine intertidal inlet and the breakwater rubble surface supports areas of oyster reef

The breakwater is accessible. It is close to parking and green space.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

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

Future eco-features

- Key fish habitat enhancement along training wall



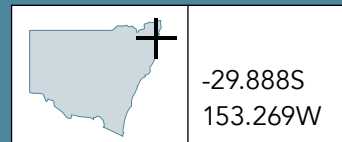
Aerial photo of the Wooli estuary showing (1) northern breakwater; (2) southern breakwater; (3) wave-trap beach



Wooli breakwater rubble has been colonised by oysters to create a valuable oyster reef habitat

Credit: Charlie Jenkins

Wooli River Breakwater (South)



Responsible Authority: NSW State Government

Built: 1973

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

Current uses:

- Ocean access for boating
- Forms an estuarine wave-trap beach

Regulatory matters: - Solitary Islands Marine Park

Multi-use features: - Creates a wave-trap beach

Eco-features: - Fauna refuge

The breakwater is not accessible.

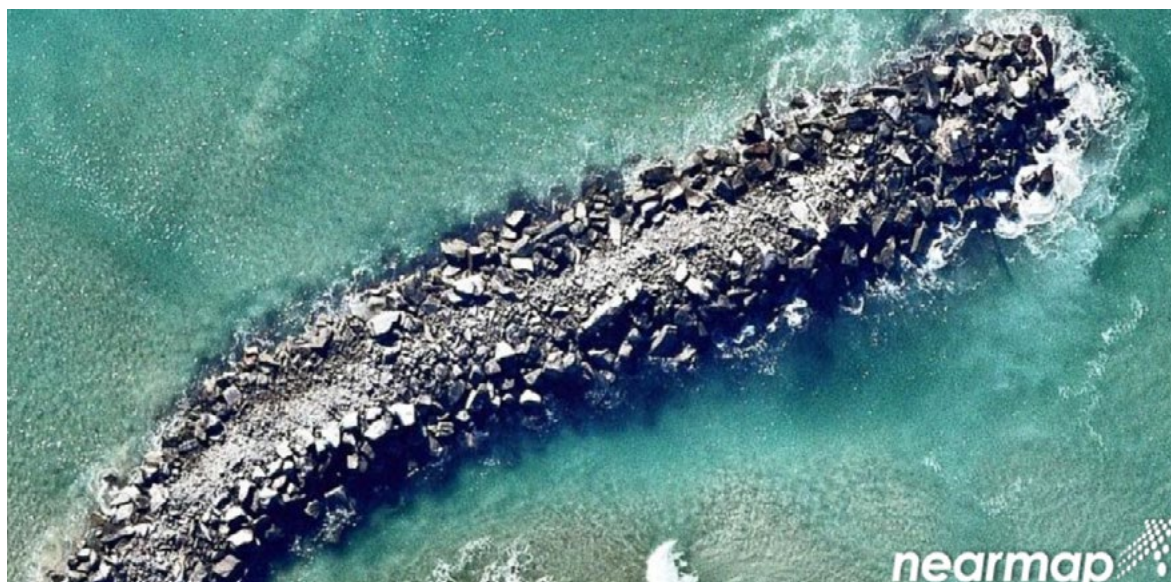
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

Nil

Future eco-features

- Key fish habitat enhancement along training wall

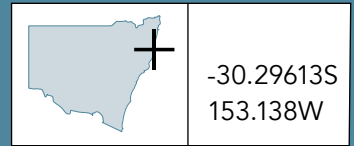


The Wooli River southern breakwater does not have a smooth surface for walking *Credit: nearmap*



The trained entrance of the Wooli River estuary showing (1) the southern breakwater, the wave-trap beach and the lack of access to the southern breakwater *Credit: nearmap*

Coffs Creek Training Wall



Responsible Authority:	Coffs Harbour City Council
Built:	1977
Modified:	Upgraded in 1987
Primary purpose when first built:	Trained entrance for sand management
Current uses:	– Sand management
Regulatory matters:	– Coastal Management Act 2016 – Solitary Islands Marine Park

Multi-use features:	Nil
Eco-features:	Nil
The training wall is 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	Future eco-features
Nil	Nil

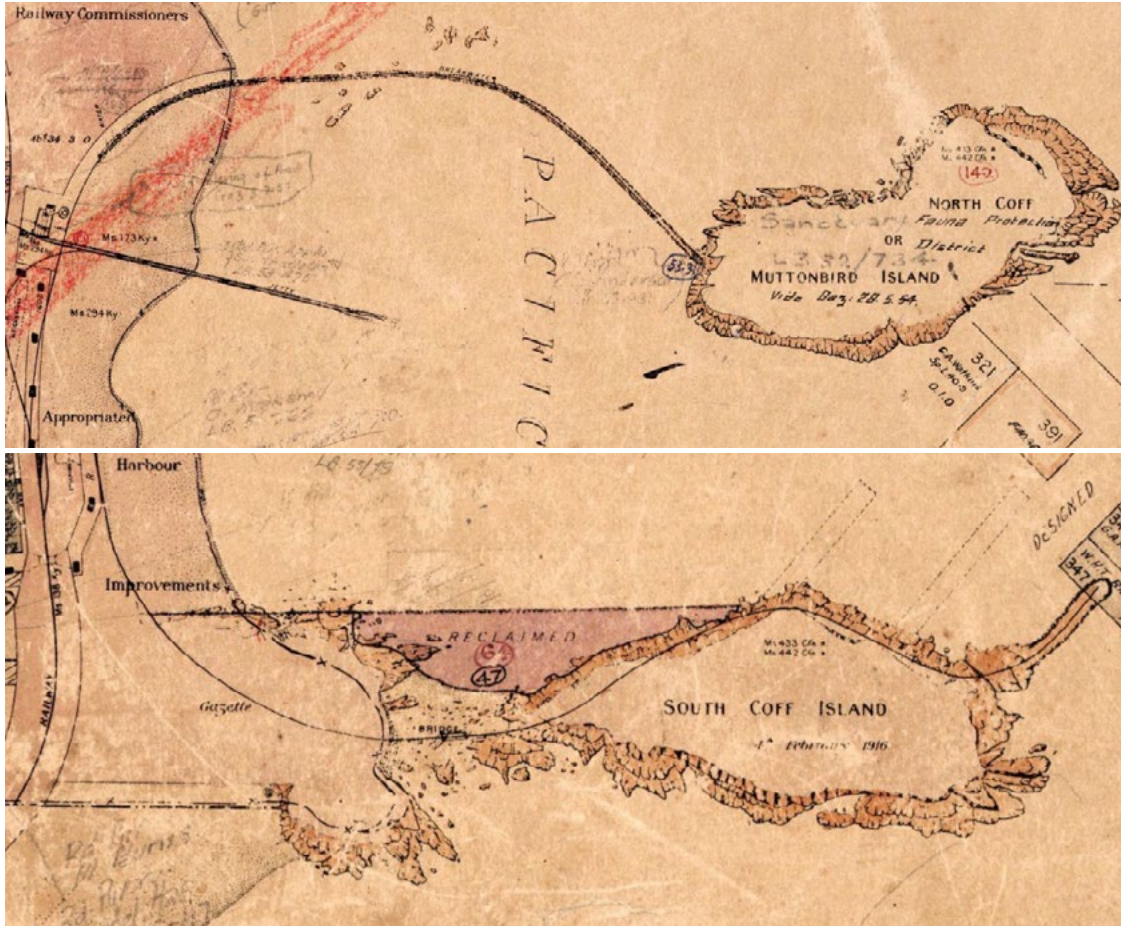
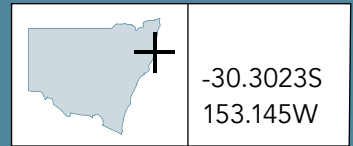


The training wall at the Coffs Creek breakwater in 2016 (1). Credit: nearmap



Shifting sands in Coffs Creek sometimes bury the northern training wall and expose it at other times.

Coffs Harbour historical change

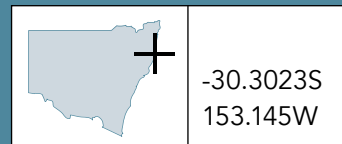


Extracts from the 1931 Coffs Harbour Parish Map show the northern breakwater linking the mainland to Muttonbird (North Coffs) Island (top image). The lower image shows initial work on the eastern breakwater and the reclamation and retaining wall that links South Coffs Island to the mainland and creates Gallows Beach.



Coffs Harbour: (1) eastern breakwater; (2) northern breakwater; (3) inner breakwaters (east and west); (4) Coffs Harbour Jetty; (5) The Causeway, a reclaimed area joining the former South Coffs Island to the mainland and creates, (6) the 150 m long, southeast facing, Gallows Beach. Credit: Six Maps

Coffs Harbour Breakwater (North)



Responsible authority:	NSW State Government
Built:	1915–1924
Modified:	Upgraded in 2016–18
Primary purpose when first built:	Harbour for coastal shipping
Current uses:	<ul style="list-style-type: none"> – Harbour with ocean access – Access to Muttonbird Island National Park – Popular coastal walkway – Fishing spot
Regulatory matters:	<ul style="list-style-type: none"> – <i>Heritage Act 1977</i> – Solitary Island Marine Park – Critically endangered seaweed <i>Nereia lophocladia</i>

- Multi-use features:**
- Walking pathway
 - Rock placement for seating and fishing opportunities
 - Advisory information about breakwater eco-features
- Eco-features:**
- Within 50 m of natural reef
 - Convoluted toe and scree, maximising submerged structural complexity

The breakwater is very accessible and is central to the Coffs Harbour 'jetty' precinct with nearby parking, restaurants, amenities, marina services.

A snorkelling trail is being considered adjacent to the northern wall and western end of Muttonbird Island.

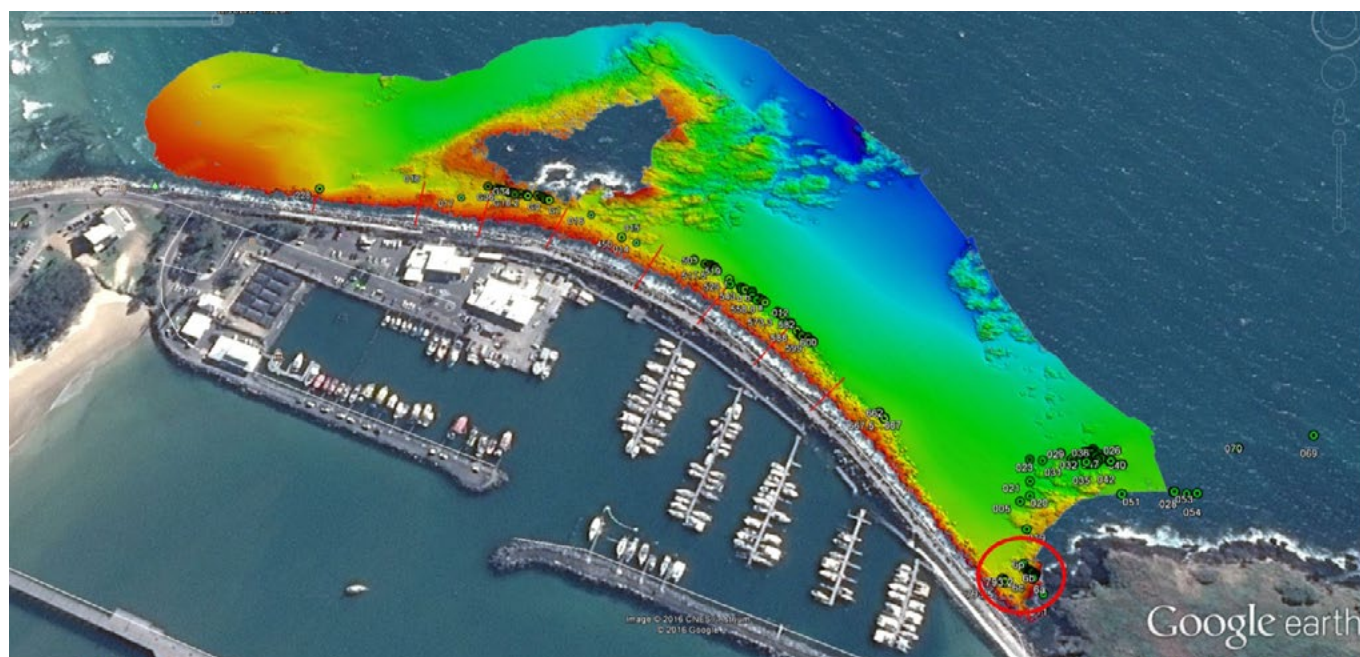
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

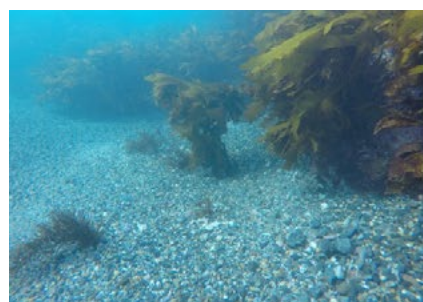
- Maintain existing pedestrian walkway surface
- Rock placement for emergency safety stairs

Future eco-features

- Maintain submerged habitat complexity
- Ongoing monitoring of populations of *Nereia lophocladia*, a critically endangered seaweed and the habitats it uses



Google Earth image of the Coffs northern breakwater with LiDAR overlay showing the bathymetry of the nearby reef, and, circled in red, the site where *Nereia lophocladia* was first found. Credit: Google Earth and Crown Lands



Convoluted toe and scree installed with northern breakwater upgrade;

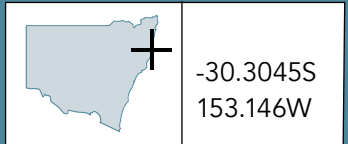


underwater dive survey;



Plans for seating, trafficable surface and maintaining views

Coffs Harbour Breakwater (Inner)



Responsible Authority: NSW State Government

Built: 1970s

Primary purpose when first built: Harbour for coastal shipping

Current uses: – Harbour with ocean access

Multi-use features: – Walking pathway

Eco-features: Nil

The breakwaters are very accessible and central to the Coffs Harbour 'jetty' precinct with nearby parking, restaurants, amenities, and marina services.

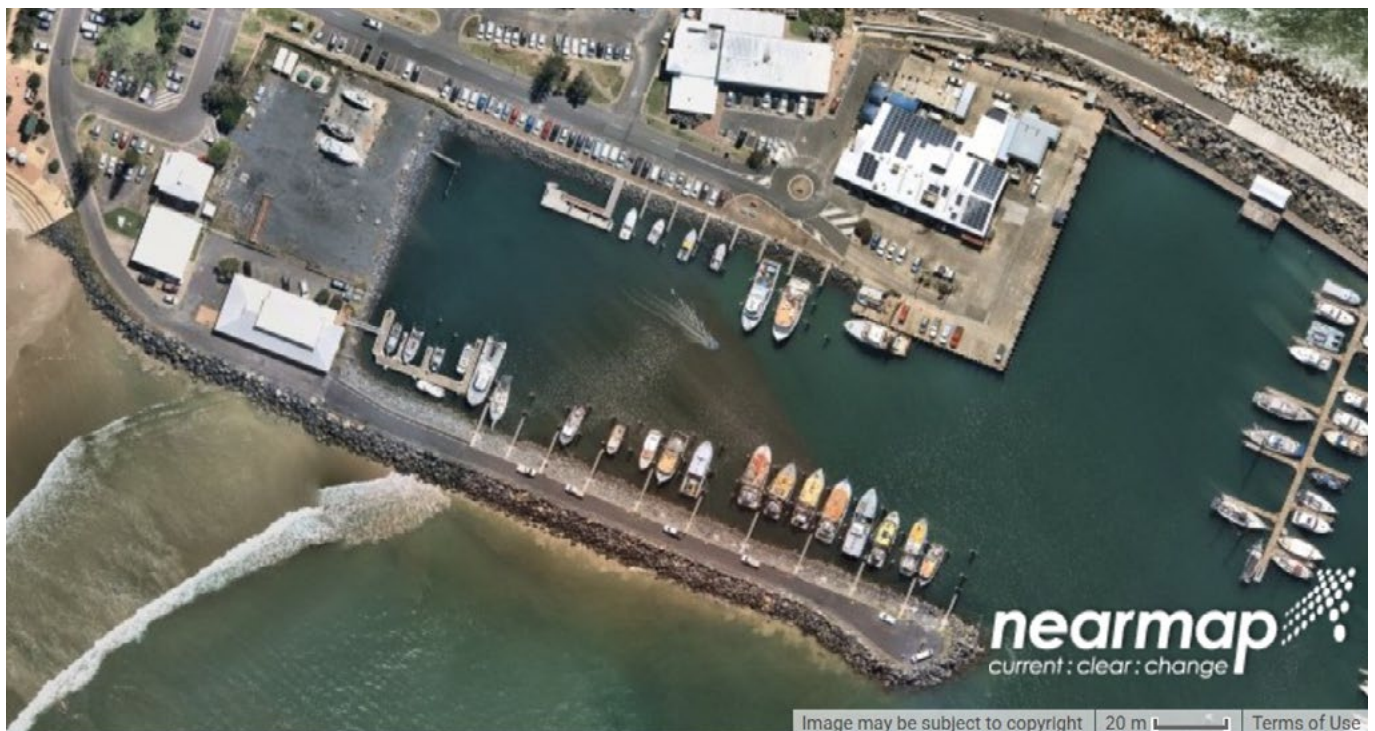
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

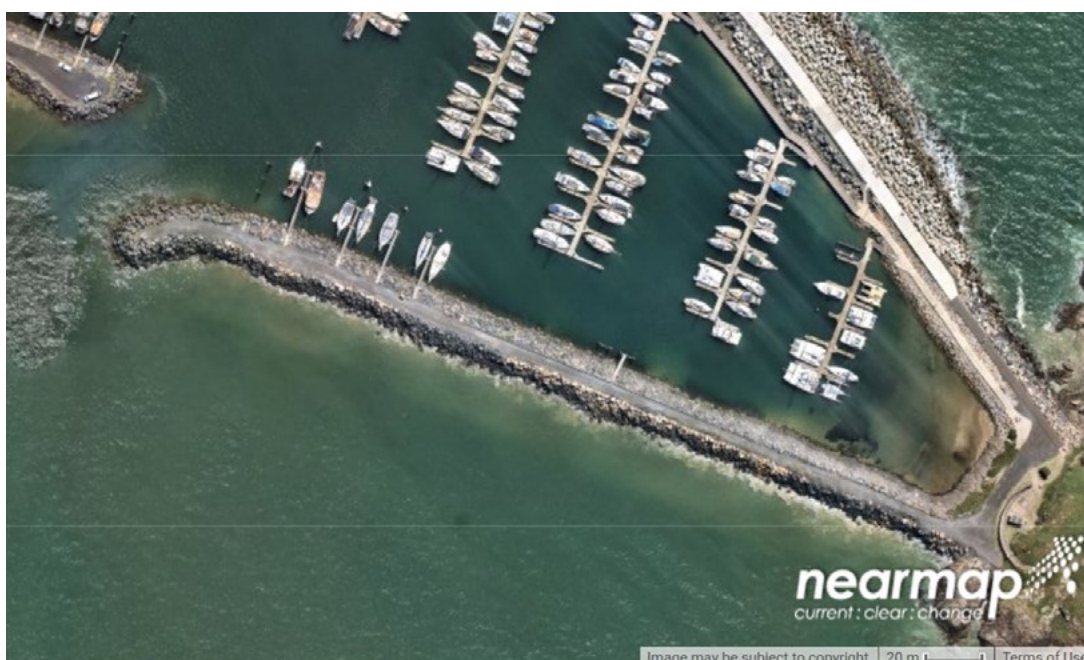
– Maintain pedestrian walkway surface

Future eco-features

– Increase submerged habitat complexity



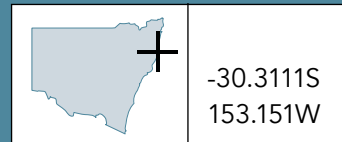
South-western part of the Coffs Harbour inner breakwater Credit: nearmap



South-eastern part of the Coffs Harbour inner breakwater

Credit: nearmap

Coffs Harbour Breakwater (Eastern)



Responsible Authority: NSW State Government

Built: 1917–1946

Primary purpose when first built: Harbour for coastal shipping

Current uses:

- Harbour
- Popular coastal walkway
- Fishing spot

Regulatory matters: – *Heritage Act 1977*

Multi-use features: – Walking pathway

Eco-features: – Within 50 m of natural reef

The breakwater is accessible and part of the Coffs Harbour 'jetty' precinct with nearby parking, restaurants, amenities, marina services.

The causeway, a reclaimed area that connects the former South Coffs Island, also forms Gallows Beach.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

- Install CoastSnap photo point at Gallows Beach
- Improve opportunities to enjoy the view
- Maintain the pedestrian walkway surface
- Rock placement for seating and fishing opportunities
- Rock placement for emergency safety stairs

Future eco-features

- Increase submerged habitat complexity
- Improved sand management



Aerial photo of the Coffs eastern breakwater Credit: nearmap

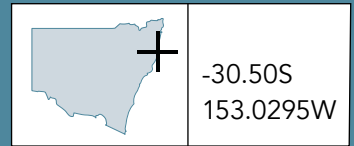


Concrete Hanbar units with attached lifting hooks on the eastern breakwater limit opportunities to enjoy the view to the south east over Korffs Islet

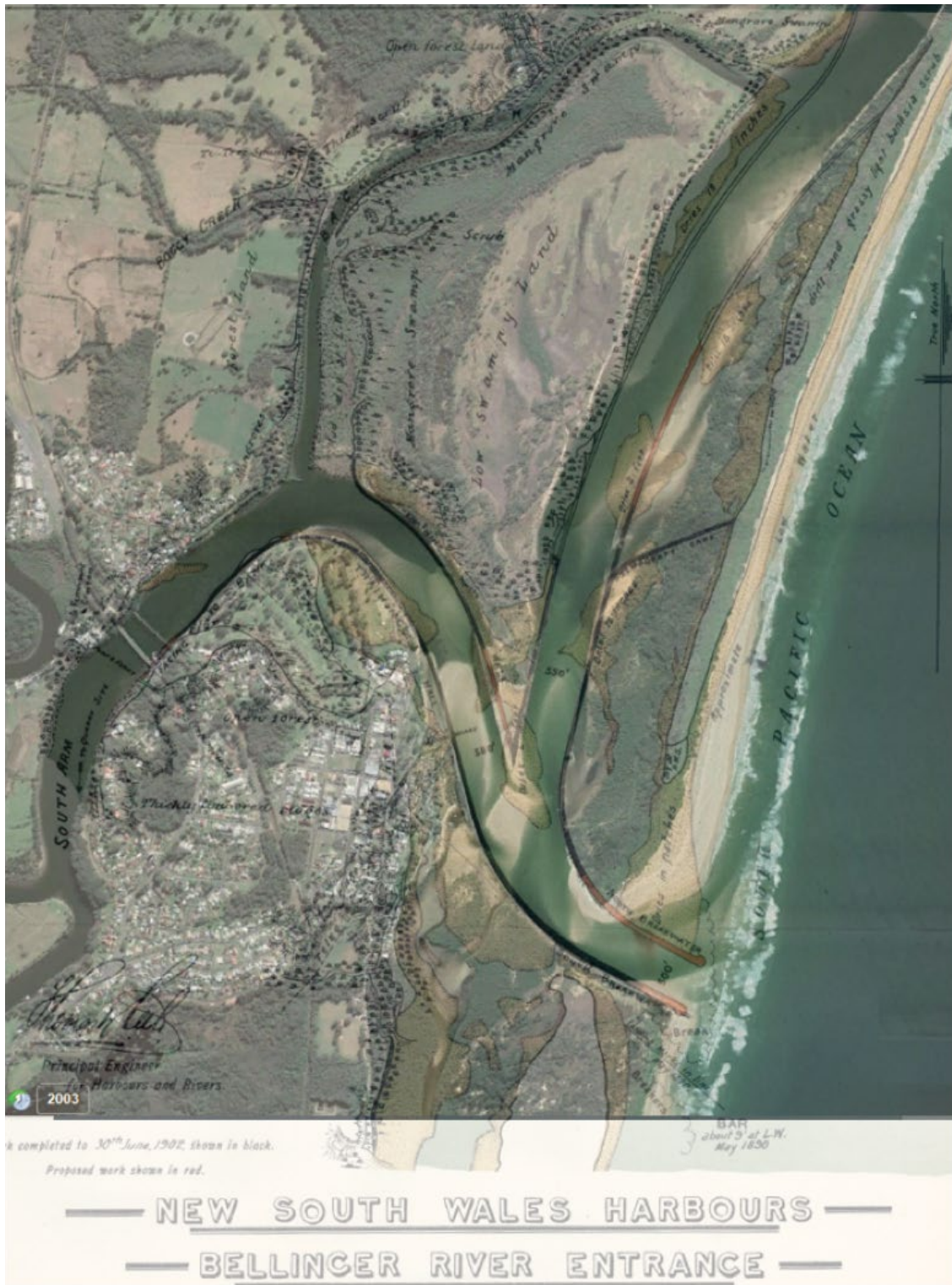


The Coffs Harbour eastern breakwater

Bellinger-Kalang River estuary-wide change



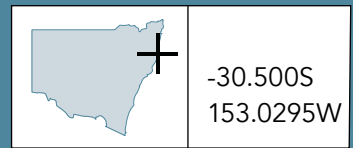
A submerged indurated sandstone bar was blasted and removed when the entrance was initially trained.



Changes in the Bellinger-Kalang River estuary entrance are shown by this overlay of a Google Earth image from 2003 with a chart from the NSW Public Works Department 1902 Annual Report

Credit: Google Earth; NSW Public Works Department 1902 Annual Report

Bellinger-Kalang River Breakwater (North)



-30.500S
153.0295W

Responsible Authority:	NSW State Government	Multi-use features:	Nil
Built:	1900–1906	Eco-features:	– Estuarine intertidal inlets
Primary purpose when first built:	Trained entrance for coastal shipping	The breakwater is generally inaccessible. An estuarine training wall network extends upstream for 1.3 km. Inlets support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats.	
Current uses:	– Ocean access for boating		

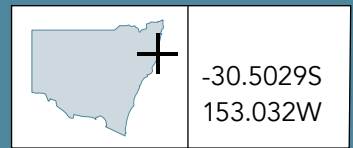
Recommendations for possible inclusion in future maintenance or upgrade works	
Future multi-use features	Future eco-features
Nil	<ul style="list-style-type: none"> – Adjacent osprey tower – Increase submerged habitat complexity – Key fish habitat enhancement along training walls



The Bellinger and Kalang Rivers estuary entrance showing (1) northern breakwater; (2) Bellinger River training wall; (3) southern breakwater; (4) Urunga pedestrian boardwalk; (5) Urunga sea lido; (6) Urunga Lagoon

Credit: Google Earth

Bellinger-Kalang River Breakwater (South)



-30.5029S
153.032W

Responsible Authority: NSW State Government

Built: 1892–1906

Primary purpose when first built: Trained entrance for coastal shipping

Current uses:

- Ocean access for boating
- Adjacent to popular coastal boardwalk
- Popular swimming sea lido

Multi-use features:

- Creates a popular sea lido
- Adjacent beach access boardwalk pathway and mangrove boardwalk

Eco-features:

- Estuarine intertidal inlets

The breakwater is very accessible. It is close to parking, amenities, greenspace and the Urunga central business district. An estuarine training wall network extends upstream for 1.9 km and includes inlets that support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats.

A plank footway was built soon after the breakwater was constructed to provide access to a light at the end of the breakwater. The boardwalk was improved by local volunteers in 1922 and the local council upgraded the structure in 1940 and again in 2010.

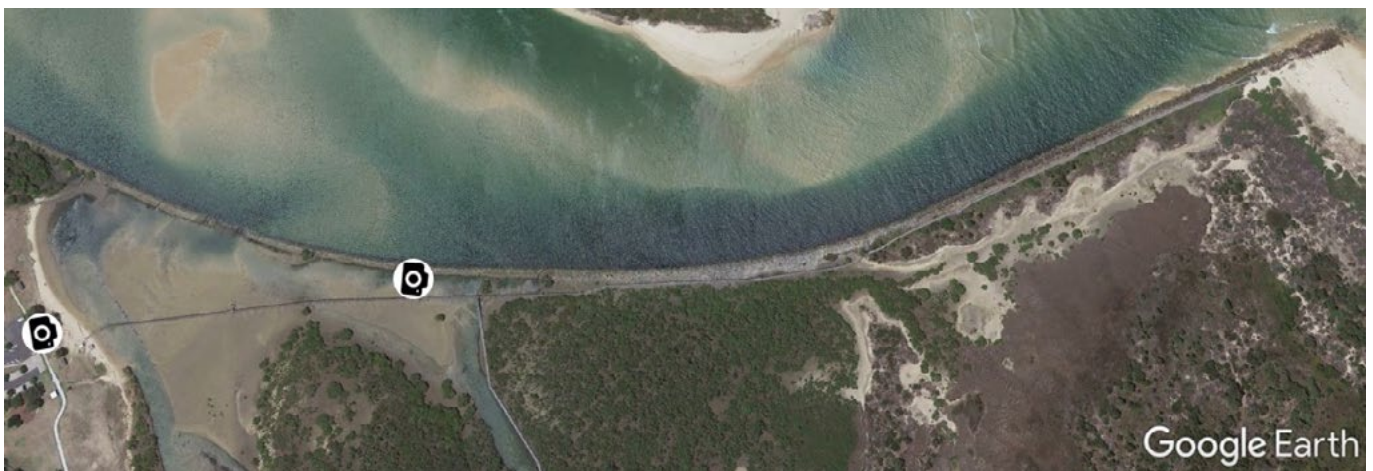
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

- Breakwater design creates Urunga Sea Lido
- All abilities access to the sea lido
- Maintain breakwater fauna refuge area
- Maintain adjacent pedestrian boardwalk

Future eco-features

- Adjacent osprey tower
- Increase submerged habitat complexity
- Key fish habitat enhancement along training walls



The Bellinger River southern breakwater *Credit: Google Earth*



All abilities access to the Urunga Sea Lido



The popular 960 m long Urunga boardwalk is accessible for all ability along its entire length. It also has places for people to climb down and explore the intertidal zone.

Nambucca River estuary-wide change

A submerged indurated sandstone bar was blasted and removed when the entrance was initially trained.



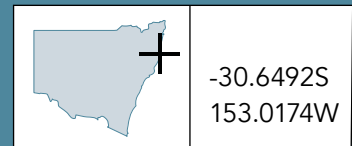
A chart shows progress on entrance training works at the Nambucca River in 1902
Source: NSW Public Works Department 1902 Annual Report

The Nambucca River estuary entrance in 2020
Credit: Six Maps



Changes in the shape of the Nambucca River estuary due to the training walls are shown by merging the above two images

Nambucca River Breakwater (North)



-30.6492S
153.0174W

Responsible Authority: NSW State Government

Built: 1890–1903

Primary purpose when first built: Trained entrance for coastal shipping

Current uses:

- Ocean access for boating
- Popular coastal walkway
- Fishing spot
- Forms Wellington surf beach
- Popular Tourist attraction

Regulatory matters: – *Heritage Act 1977*

Multi-use features:

- Walking pathway
- Stabilises Wellington Beach, a caravan park and sea lido
- Shipwreck memorial and well-known painted rocks

Eco-features:

- Estuarine intertidal inlets

The breakwater is very accessible. It is close to parking, amenities, greenspace and a walkway link to the Nambucca Heads urban area. An estuarine training wall extends upstream for 2.5 km and includes a break for access into The Glen and Inner Harbour area in Freshwater Creek. Other inlets support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

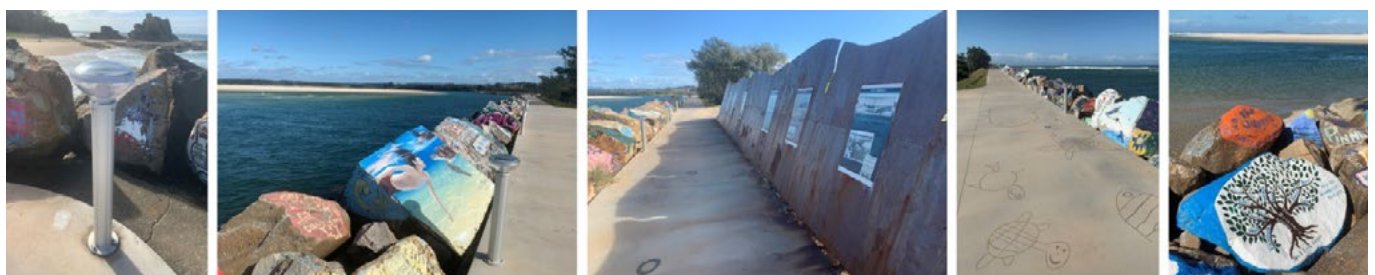
- Maintain pedestrian walkway surface
- Accommodate community artwork on breakwater rocks
- Maintain shipwreck display
- Rock placement for emergency safety stairs

Future eco-features

- Adjacent osprey tower
- Increase submerged habitat complexity
- Key fish habitat enhancement along training walls

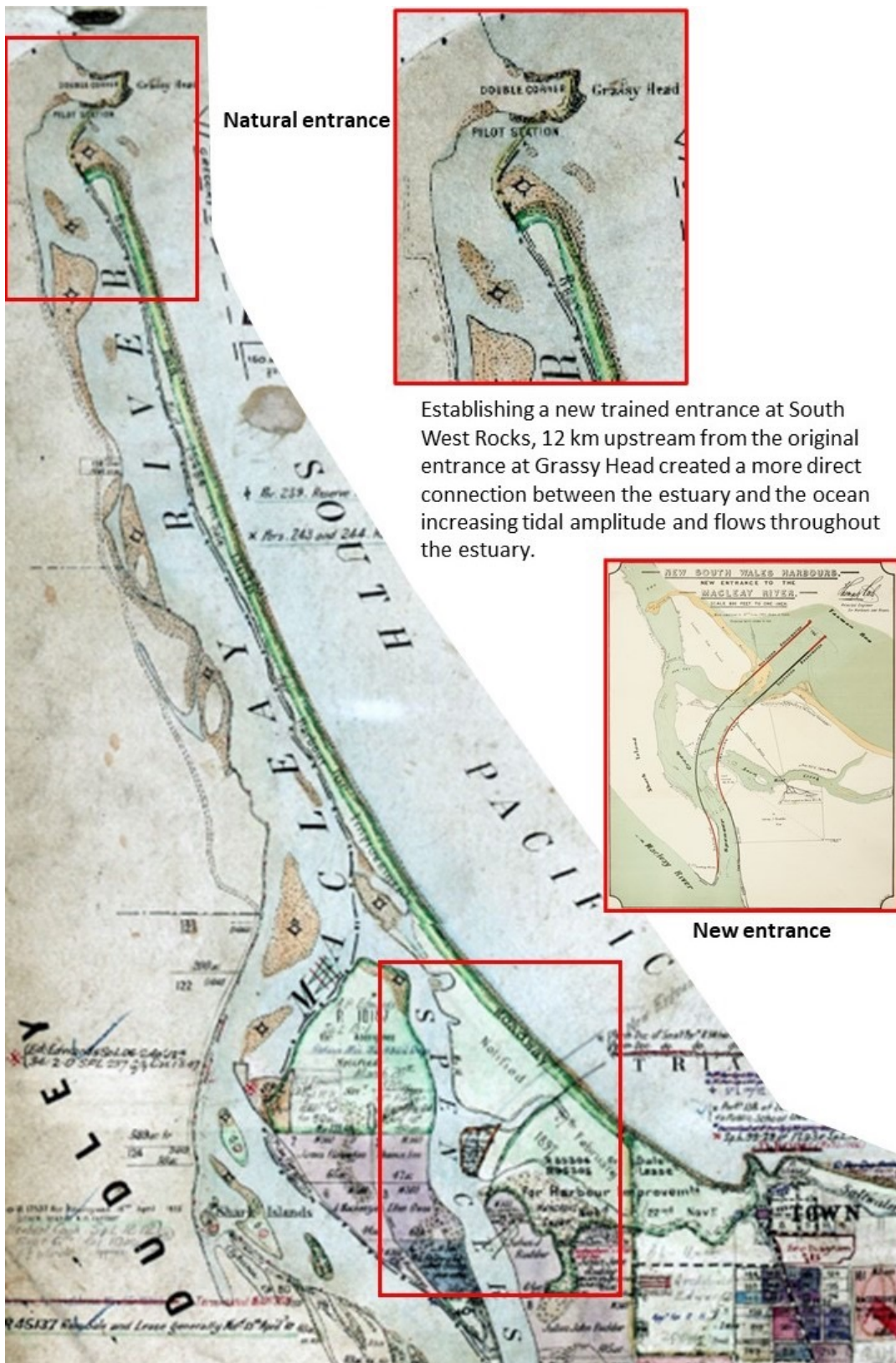
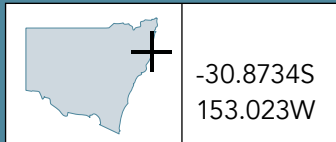


The Nambucca Northern breakwater: (1) northern breakwater; (2) sea lido; (3) caravan park reliant on the training wall; (4) the Glen, Inner Harbour and Freshwater Creek *Credit: Six Maps*



Shielded lighting; public art; ship wreck memorial; a pathway accessible to all; community art

Macleay River estuary-wide change

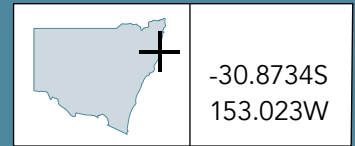


Establishing a new trained entrance at South West Rocks, 12 km upstream from the original entrance at Grassy Head created a more direct connection between the estuary and the ocean increasing tidal amplitude and flows throughout the estuary.

A parish map from early 1900 shows the natural entrance of the Macleay River at Grassy Head (within the red square at the top of the map). The location of the trained entrance near South West Rocks has been annotated on the parish map (within the red square at the bottom of the map). The chart on the right shows the plans for the entrance works. The new entrance 'shortened' the estuary by about 12 km. Tides with greater amplitude now penetrate further into the Macleay estuary due to the compounding effects of the trained entrance and the 'shorter' estuary.

Credit: Crown Lands parish map, NSW Public Works Department 1902 Annual Report (right)

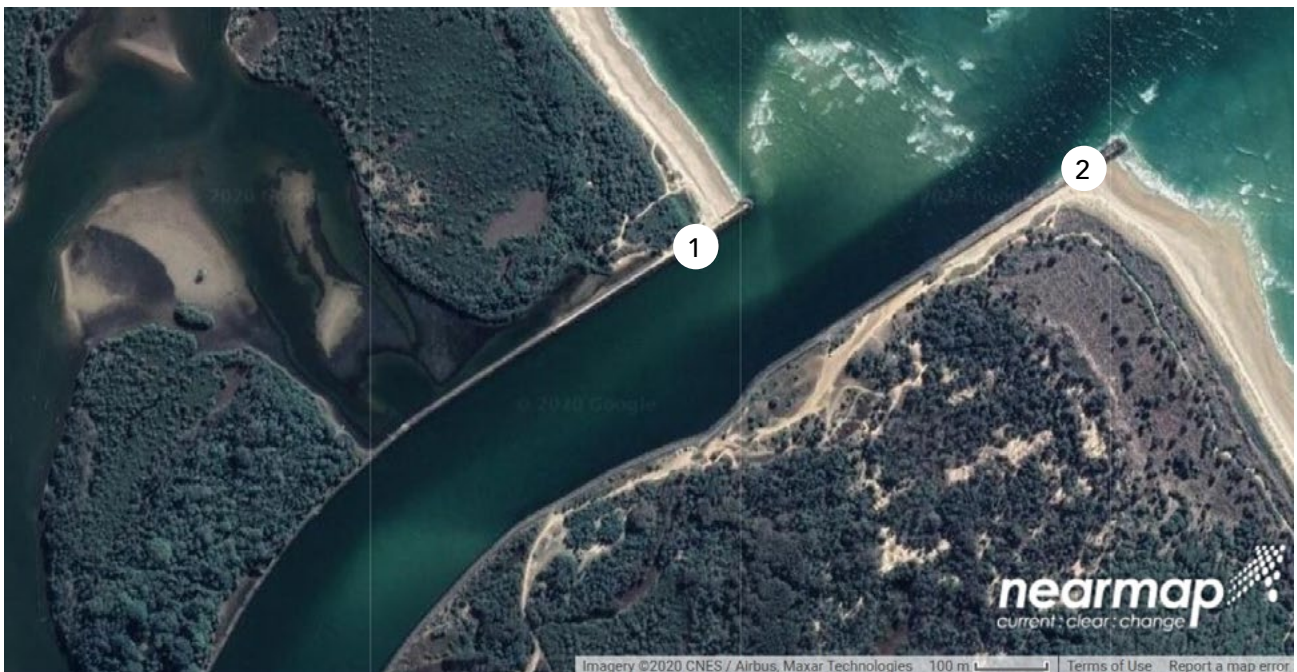
Macleay River Breakwater (North)



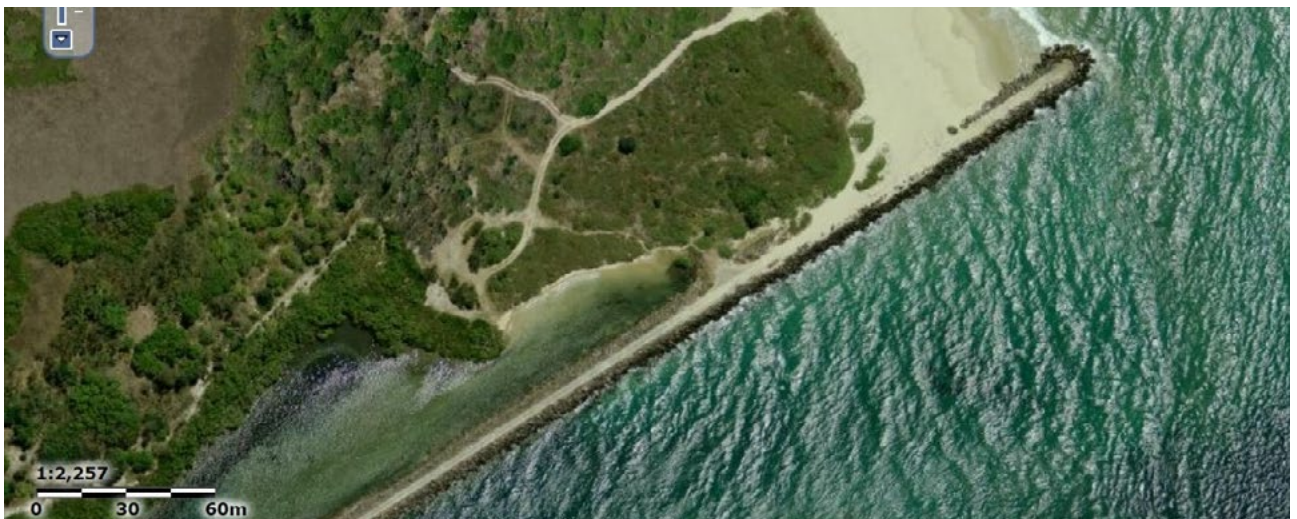
-30.8734S
153.023W

Responsible Authority:	NSW State Government	Multi-use features:	Nil
Built:	1896–1906	Eco-features:	– Estuarine intertidal inlets
Primary purpose when first built:	Trained entrance for coastal shipping	The breakwater is inaccessible. It requires access along the beach from Grassy Head to the north.	
Current uses:	– Ocean access for boating	An estuarine training wall extends upstream for 2.3 km and includes inlets that support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats.	

Recommendations for possible inclusion in future maintenance or upgrade works	
Future multi-use features	Future eco-features
– Rock placement for emergency safety stairs	– Adjacent osprey tower
	– Increase submerged habitat complexity
	– Key fish habitat enhancement along training walls

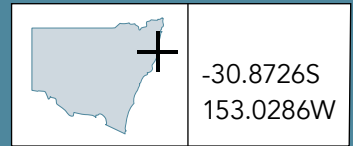


The Macleay River estuary trained entrance with the (1) northern and (2) southern breakwaters *Credit: nearmap*



The Macleay River northern breakwater and a backwater area it creates *Credit: Six Maps*

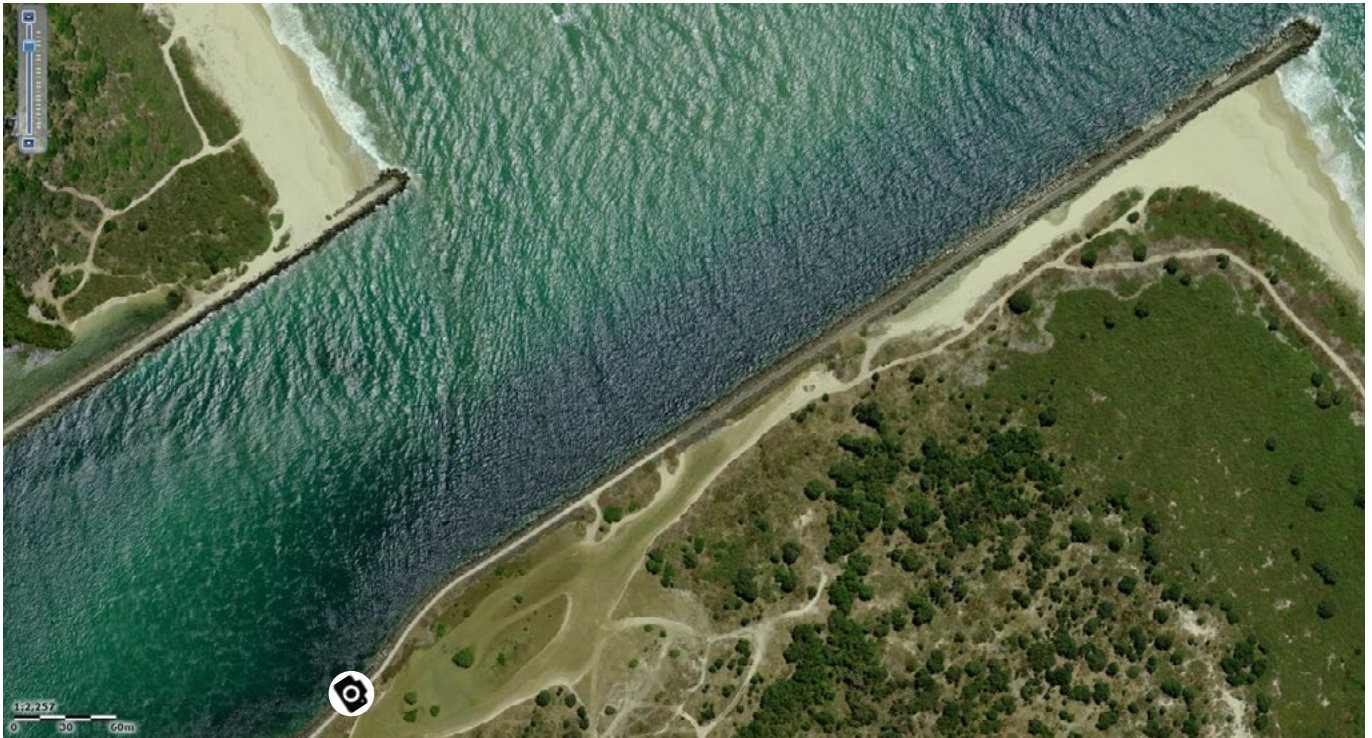
Macleay River Breakwater (South)



Responsible Authority:	NSW State Government	Multi-use features:	– Walking pathway
Built:	1896–1906	Eco-features:	– Estuarine intertidal inlets
Primary purpose when first built:	Trained entrance for coastal shipping		
Current uses:	<ul style="list-style-type: none">– Ocean access for boating– Popular coastal walkway– Fishing spot		The breakwater is accessible. It is close to parking, amenities, greenspace and urban areas. An estuarine training wall extends upstream for 2 km and includes inlets that support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features <ul style="list-style-type: none">– Maintain pedestrian walkway surface– Rock placement for seating and fishing opportunities– Rock placement for emergency safety stairs	Future eco-features <ul style="list-style-type: none">– Adjacent osprey tower– Increase submerged habitat complexity– Key fish habitat enhancement along training walls– Sewage pump out facilities are required
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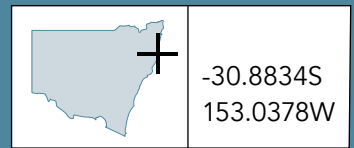


The Macleay southern breakwater *Credit: Six Maps*



Macleay southern breakwater with saltmarsh and mangrove habitats landward of the structure reliant on flows through the wall

South West Rocks Creek Breakwater (North)



Responsible Authority: NSW State Government

Built: 1979–82

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

Current uses: – Ocean access for boating

Regulatory matters: – Commercial dredging operation

Multi-use features: Nil

Eco-features: Nil

The breakwater is accessed from a bridge across the creek. A submerged rocky bar was blasted and removed when the entrance was initially trained.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

– Rock placement for emergency safety stairs

Future eco-features

Nil

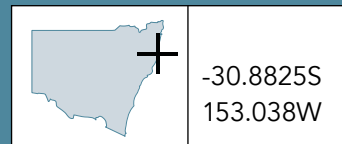


South West Rocks Creek in 2019 with (1) northern breakwater; (2) southern breakwater and commercial drag-line dredging operation work area; (3) fishing pontoon with access for people with disability
 Credit: Google Earth



South West Rocks Creek northern breakwater
 Credit: Six Maps

South West Rocks Creek Breakwater (South)



Responsible Authority:	NSW State Government
Built:	1979–82
Primary purpose when first built:	Trained entrance for fishing and tourism
Current uses:	<ul style="list-style-type: none"> – Ocean access for boating – Training wall is attached to a popular coastal walkway, which features a fishing platform for people with disability
Regulatory matters:	– Commercial dredging operation

Multi-use features: – Estuarine training wall is attached to a walking pathway and nearby fishing platform for people with disability

Eco-features: – Within 50 m of natural reef

The breakwater is accessible. It is close to parking, amenities and greenspace. It is attached to a short estuarine training wall and a walkway that crosses the creek and features a fishing platform for people with disability.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

- Maintain pedestrian walkway and access for people with disability
- Rock placement for emergency safety stairs

Future eco-features

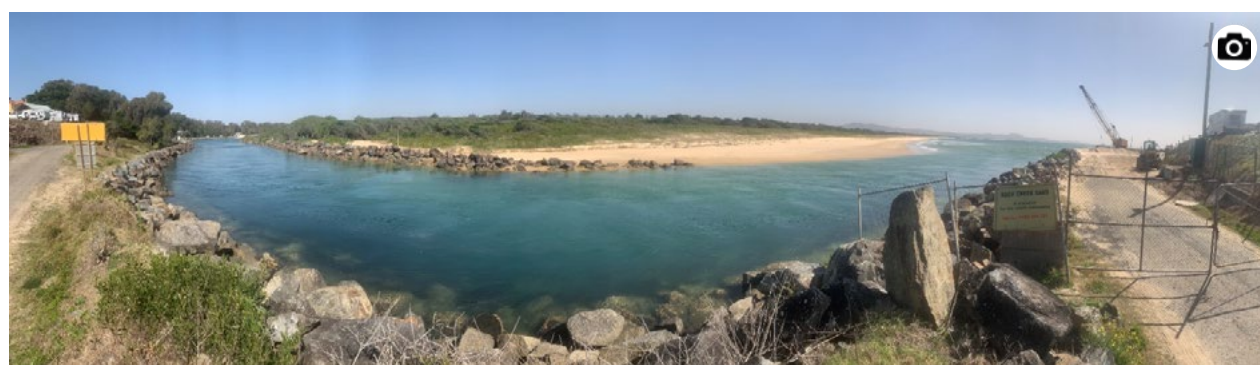
Nil



South West Rocks Creek southern breakwater: (1) the southern breakwater; (2) dredge drag-line crane *Credit: Six Maps*

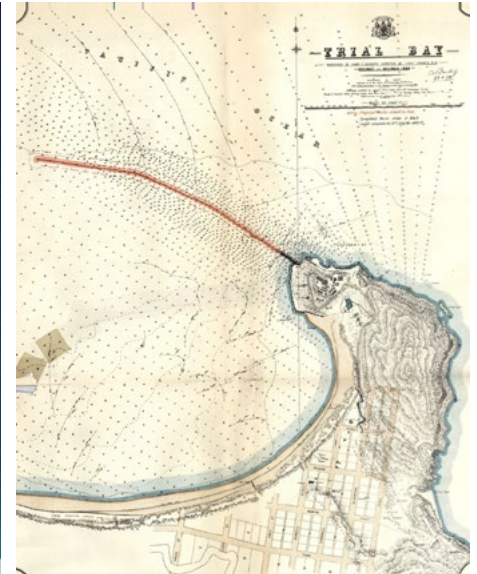
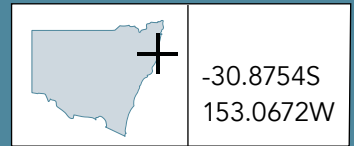


Commercial drag-line dredging operation in South West Rocks Creek



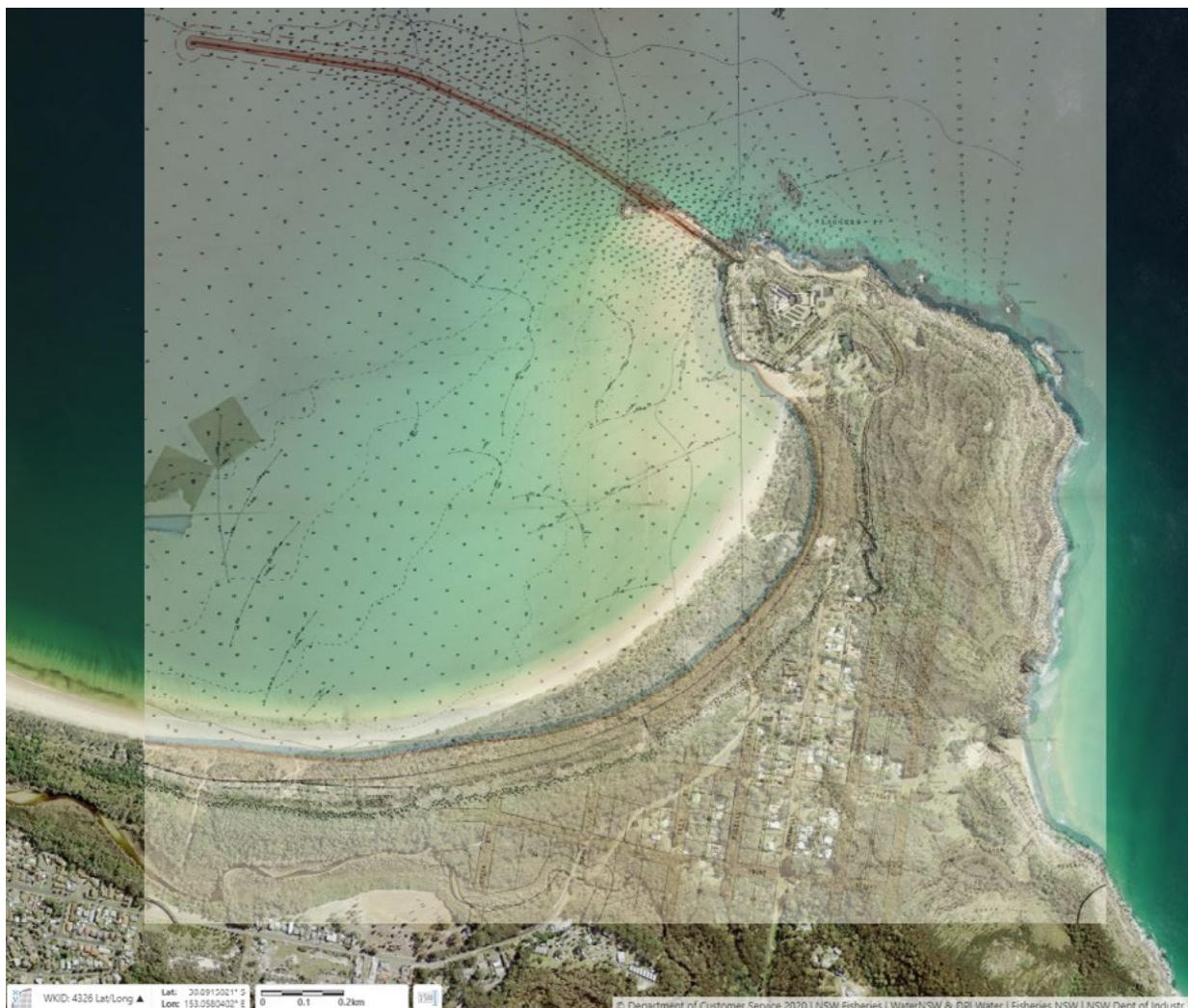
South West Rocks estuary entrance

Laggers Point historical change



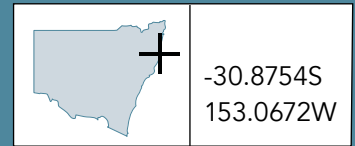
Trial Bay and South West Rocks in 2020 with (1) Laggars Point breakwater; (2) shoaling within Trial Bay; (3) accretion of sand and growth of vegetation advancing into Trial Bay *Credit: nearmap*

A chart showing progress on works at the Laggars Point breakwater in 1894. The black marking shows completed work, and the red area is still to be completed
Source: NSW Public Works Department 1894 Annual Report



Changes in the shape of the foreshore since 1894 are shown by merging the above two images.

Laggers Point Breakwater



Responsible Authority:	NSW State Government
Built:	1889–1903 Abandoned 1903
Primary purpose when first built:	Ocean harbour for coastal shipping
Current uses:	<ul style="list-style-type: none"> – Popular heritage feature – Fishing and dive spot
Regulatory matters:	<ul style="list-style-type: none"> – <i>Heritage Act 1977</i> – Arakoon National Park

Multi-use features:	– Heritage
Eco-features:	<ul style="list-style-type: none"> – Within 50 m of natural reef – Mimics an artificial reef – Reduces erosion impacts on the foreshore of Trial Bay
<p>The breakwater is a key part of the Arakoon National Park and the Trial Bay Heritage area managed by National Parks and Wildlife Service.</p> <p>The breakwater may have accelerated accretion in Trial Bay and could now be a key control for the foreshore camp ground area and reserved estate.</p>	

Recommendation: evidence-based management to maximise environmental, social, cultural and economic values in the marine, intertidal and reserved estate areas

Future multi-use features	Future eco-features
Nil	Nil

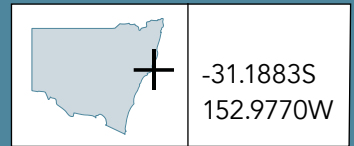


The breakwater was never completed and has resulted in accretion in Trial Bay *Source: nearmap*



The breakwater in 2021; The breakwater during 1894 *Source NSW Public Works Department 1894 Annual Report*; Old infrastructure near the breakwater

Killick Creek Training Wall



Responsible Authority: Unknown

Built: 1950s

Primary purpose when first built: Trained entrance for urban development and flood mitigation

Current uses: – Entrance management and protects urban development

Multi-use features: – Metal safety stairs

Eco-features: – Within 50 m of natural reef

The training works undertaken at Killick Creek increase the frequency and duration of connection to the sea.

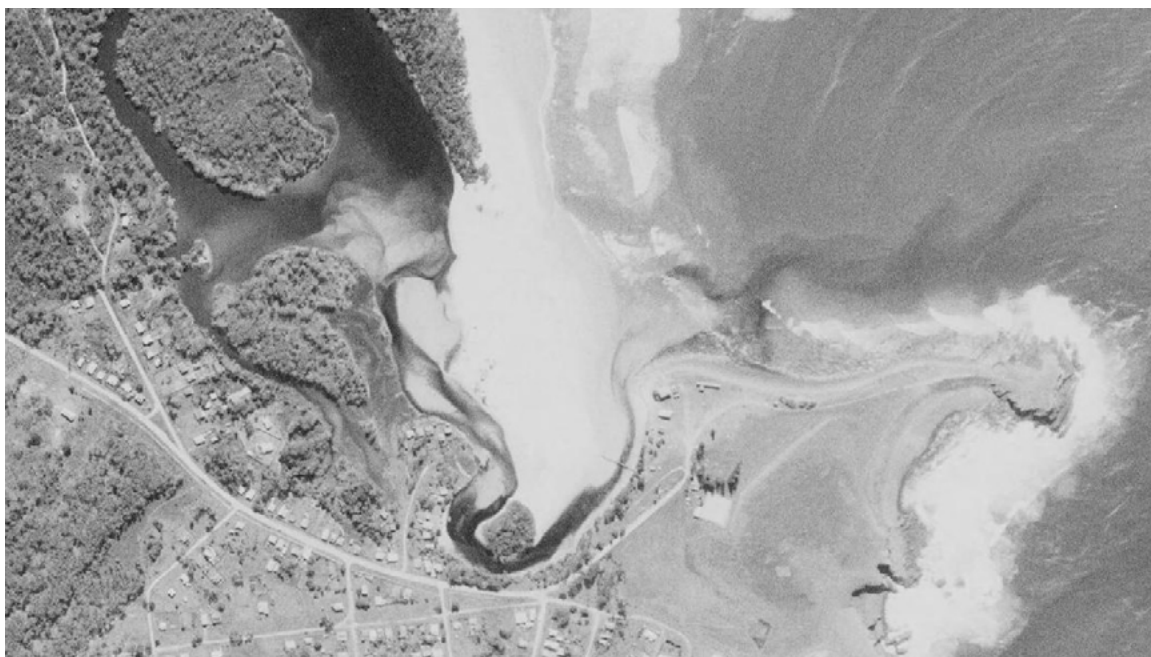
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

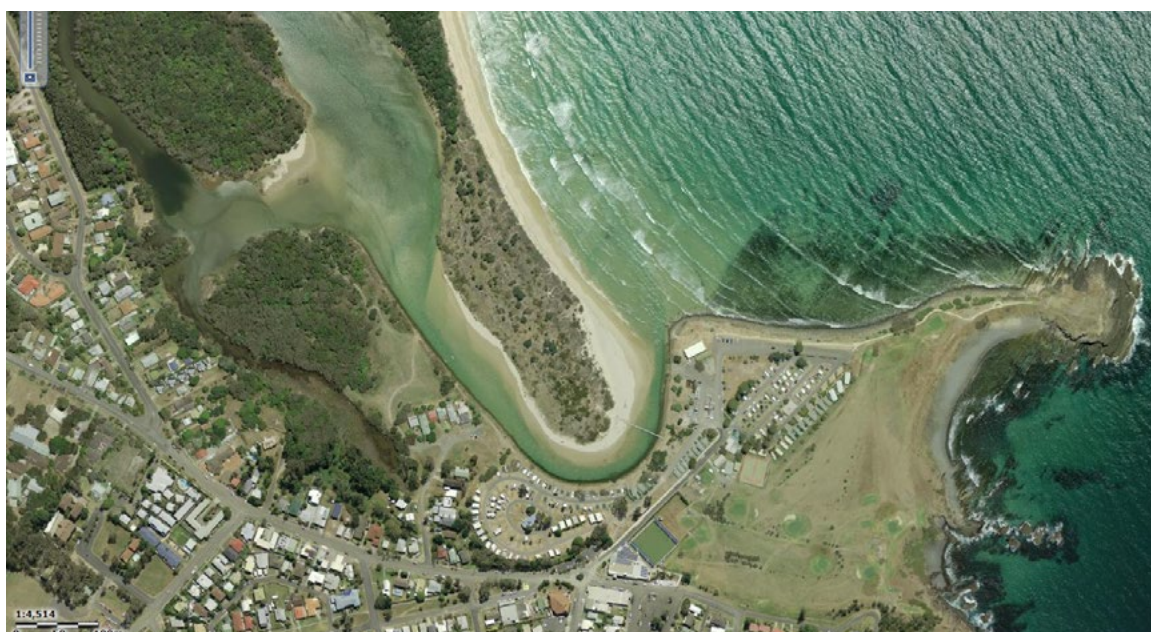
Nil

Future eco-features

Nil



Killick Creek at Crescent Head in 1956 prior to being straightened and partially trained in the late 1950s facilitating development of the holiday park and as part of flood mitigation and coastal wetland draining works *Source: Crown Lands*



Contemporary aerial photo of Killick Creek at Crescent head showing the straightened southern bank and entrance *Source: Six Maps*

Hastings River estuary-wide change

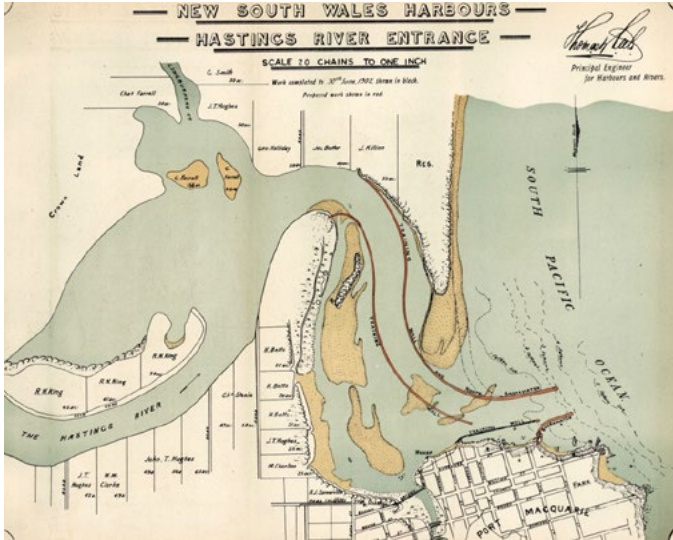
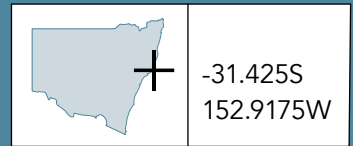


Chart showing progress on entrance training works at the Hastings River in 1902
Source: NSW Public Works Department 1902 Annual Report



Hastings River estuary entrance in 2020
Credit: nearmap

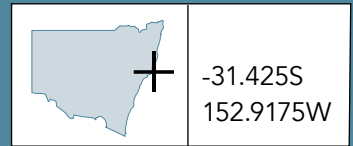


Changes in the shape of the Hastings River estuary since 1902 due to the training walls are shown by merging the above two images



The 1933 aerial photograph from the Fairfax Collection (left) shows backwater areas behind the southern breakwater. These areas have progressively been reclaimed for a car park, playground facilities and caravan park (right)

Hastings River Breakwater (North)



Responsible Authority: NSW State Government

Built: 1930s

Modified: Lengthened 500 m in 1978–79

Primary purpose when first built: Trained entrance for coastal shipping

Current uses:

- Ocean access for boating
- Fishing spot
- Forms an estuarine wave-trap beach

Regulatory matters: Shipwreck of vessel 'Ballina'

Multi-use features:

- Walking and driving pathway
- Stabilises a wave-trap beach

Eco-features: Nil

The breakwater is accessible. It is close to parking, and driving is possible on the breakwater.

An estuarine training wall extends upstream for about 900 m.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

- Rock placement for emergency safety stairs

Future eco-features

- Adjacent osprey tower
- Increase submerged habitat complexity

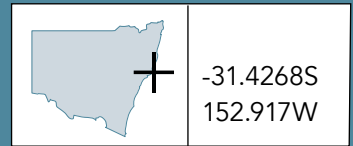


A 1977 aerial photo shows the approximate location of the then-proposed northern breakwater
 Source: NSW Public Works Department 1977 Annual Report



Hastings River Breakwater: (1) northern breakwater built in 1979; (2) wave-trap beach; (3) original breakwater built in the 1930s
 Credit: Six Maps

Hastings River Breakwater (South)



-31.4268S
152.917W

Responsible Authority:	NSW State Government
Built:	1890–1901 Lengthened in the 1960s
Primary purpose when first built:	Trained entrance for coastal shipping
Current uses:	<ul style="list-style-type: none"> – Ocean access for boating – Popular coastal walkway – Fishing spot

Multi-use features:	<ul style="list-style-type: none"> – Walking pathway – Fishing platforms – Emergency safety stairs – Enables caravan park
Eco-features:	Nil
<p>The breakwater is very accessible. It is a key feature of the Port Macquarie Town Green precinct and is close to parking, amenities, greenspace and urban areas.</p>	

Recommendations for possible inclusion in future maintenance or upgrade works

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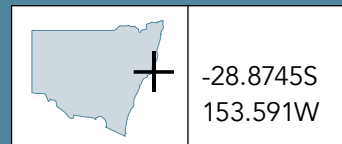


The Hastings southern breakwater at Port Macquarie *Credit: Six Maps*

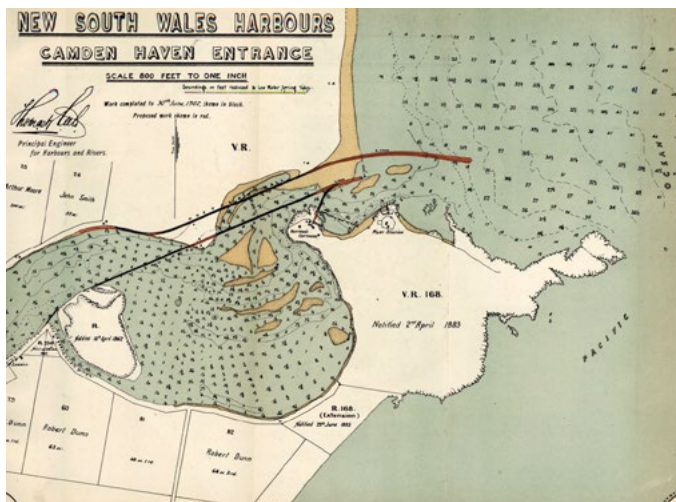


Emergency safety stairs created through careful rock placement during maintenance of the Hastings southern breakwater

Camden Haven River estuary change



A submerged indurated sandstone bar was blasted and removed when the entrance was initially trained.



A 1902 chart showing progress on the Camden Haven River entrance training works
 Source: NSW Public Works Department 1902 Annual Report

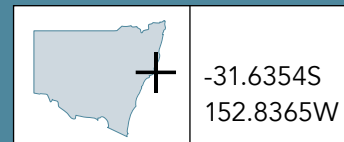


The Camden Haven River estuary entrance in 2013
 Credit: Google Earth



Changes in the shape of the Camden Haven River estuary due to the training walls are shown by merging the above two images detailing: (1) northern breakwater; (2) original southern breakwater; (3) new southern breakwater; (4) Gogleys Lagoon; (5) North Haven boat harbour precinct

Camden Haven River Breakwater (North)



Responsible Authority: NSW State Government
Built: 1909–11
Primary purpose when first built: Trained entrance for coastal shipping
Current uses:

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

Multi-use features: – Walking pathway elevated
Eco-features: – Estuarine intertidal inlet
The breakwater is accessible. It is close to parking, amenities, greenspace and urban areas. An estuarine training wall extends 1.5 km upstream, including the Camden Haven Ocean Drive Harbour.

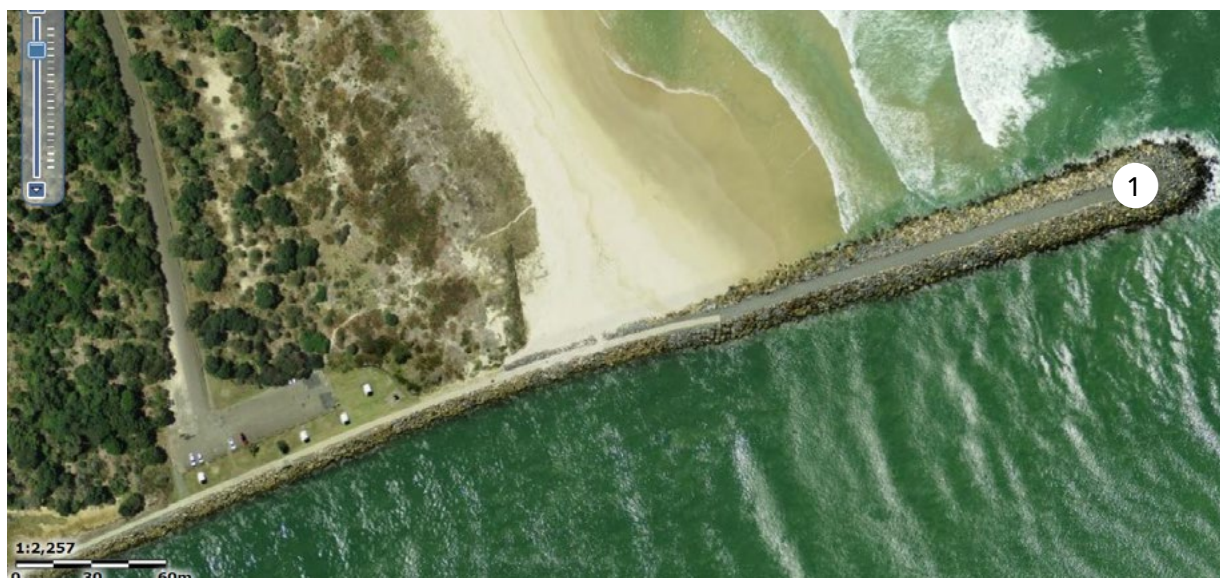
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

- Maintain elevated pedestrian walkway surface
- Install CoastSnap photo point
- Rock placement for seating opportunities
- Rock placement for emergency safety stairs

Future eco-features

- Adjacent osprey tower
- Increase submerged habitat complexity
- Key fish habitat enhancement along training walls

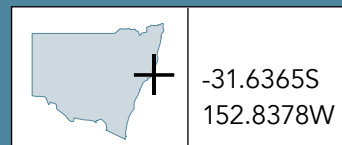


Aerial photo of the Camden Haven northern breakwater



A pathway accessible to all; fish cleaning table; fishing line collection bin

Camden Haven River Breakwater (South)



Responsible Authority: NSW State Government

Built: 1898–1907

Modified: Lengthened 325 m in the 1960s

Primary purpose when first built: Trained entrance for coastal shipping

Current uses:

- Ocean access for boating
- Popular coastal walkway
- Fishing spot
- Forms estuarine wave-trap beach

Multi-use features:

- Walking pathway
- Stabilises a wave-trap
- Pilot Beach

Eco-features: Nil

The breakwater is accessed by an unsealed road to nearby parking. An estuarine training wall extends upstream for 2.1 km. It defines Gogleys Lagoon and includes a netted swimming enclosure at Dunbogan Reserve.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

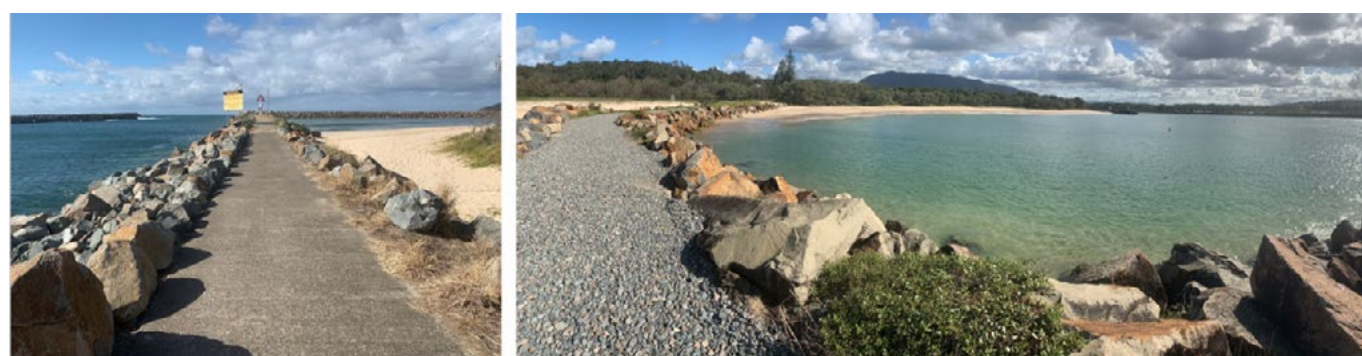
- Maintain pedestrian walkway surface
- Install CoastSnap photo point
- Rock placement for seating opportunities
- Rock placement for emergency safety stairs

Future eco-features

- Adjacent osprey tower
- Increase submerged habitat complexity
- Key fish habitat enhancement along training walls

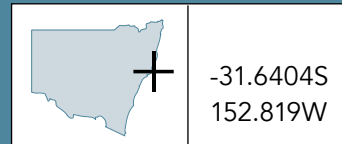


Aerial photo of the Camden Haven breakwaters: (1) new southern breakwater constructed in 1960s; (2) original southern breakwater; (3) northern breakwater; (4) Pilot Beach, a wave-trap beach reliant on the breakwater network



The popular wave-trap Pilot Beach just inside the original southern wall (left) and the new southern breakwater with a crushed pebble surface (right)

Camden Haven River North Haven Boat Harbour



Responsible Authority: NSW State Government

Built: 1950s when estuary training walls were extended

Modified: Harbour facilities added in 1968

Primary purpose when first built: Harbour for fishing and tourism

Current uses: – Boat harbour

Multi-use features: – Swimming enclosure

Eco-features: Nil

The breakwater is accessible. It has nearby parking, amenities, greenspace and urban areas. Part of the harbour area supports important remnant seagrass, mangrove, saltmarsh, and wader and migratory bird habitats.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

Nil

Future eco-features

Nil




Aerial photo of (1) the North Haven Boat Harbour breakwater; (2) the harbour; and (3) the North Haven swimming enclosure



Popular North Haven swimming enclosure. The shape of the breakwater creates the enclosure and a net is fitted to span the entrance to the Camden Haven River estuary.

Crowdy Head Ocean Breakwaters



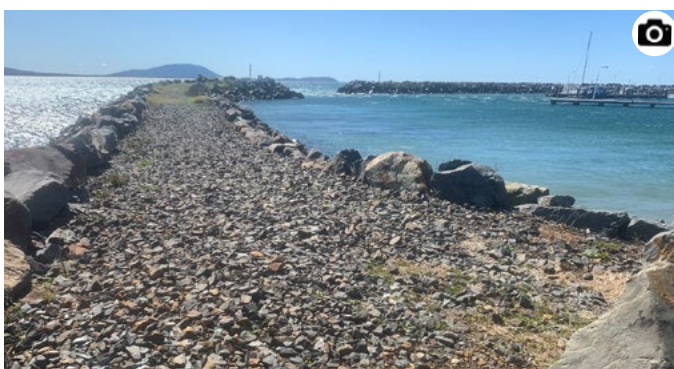
-31.8383S
152.749W

Responsible Authority:	NSW State Government	Multi-use features:	– Walking pathway
Built:	1964	Eco-features:	– Within 50 m of natural reef
Primary purpose when first built:	Breakwater for commercial fishing ocean harbour	The breakwater is very accessible. It is close to parking, amenities, greenspace and urban areas. The rubble surface limits access to some users. The submerged rock shelf within the harbour has been blasted to deepen the harbour.	
Current uses:	– Harbour with ocean access for boating		

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



Aerial photo of the Crowdy Head ocean harbour

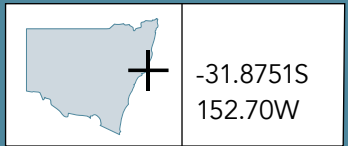


Rubble crest surface on the Crowdy Bay western breakwater

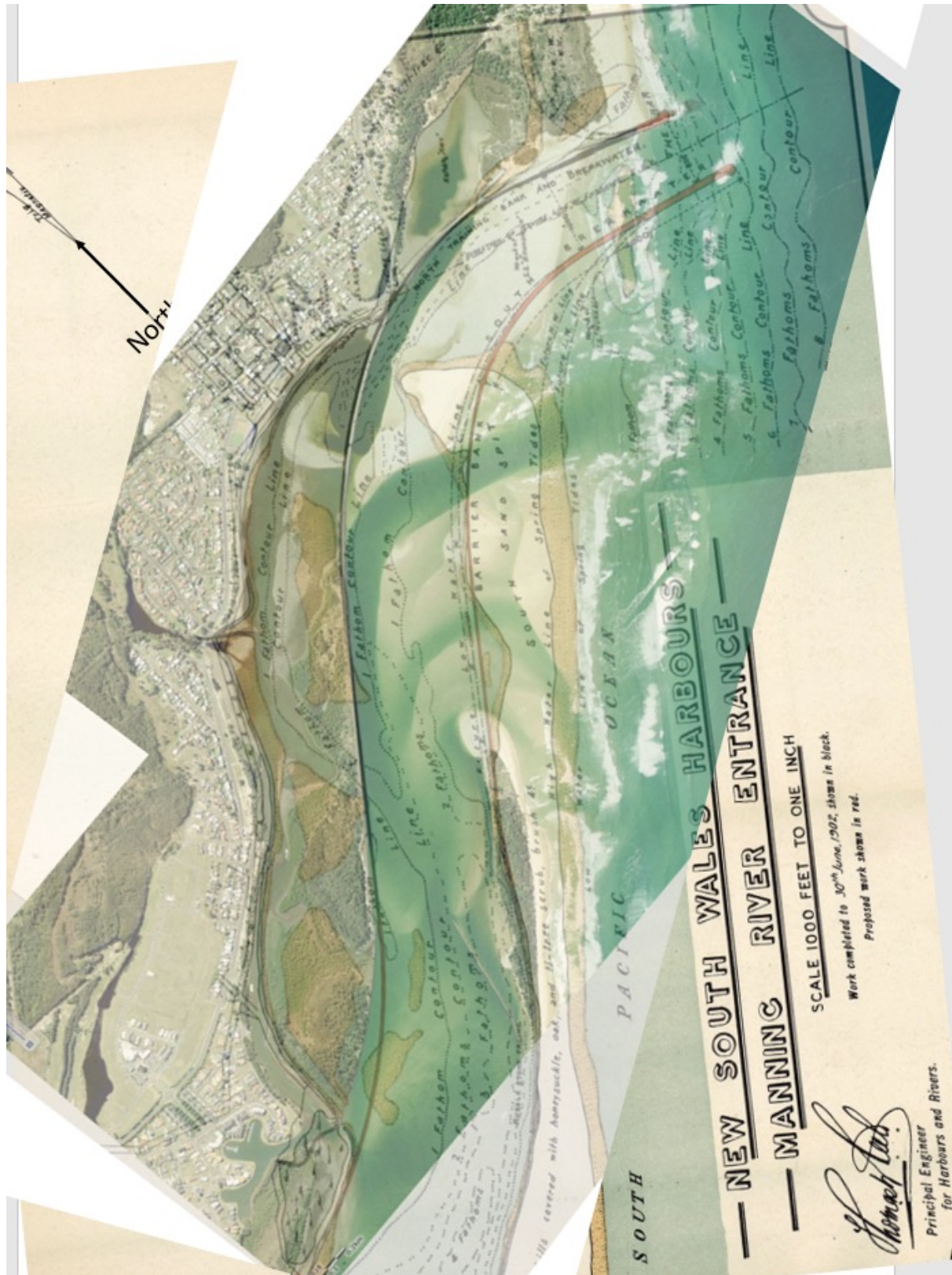


Rubble crest surface on the Crowdy Bay eastern breakwater

Manning River estuary-wide change



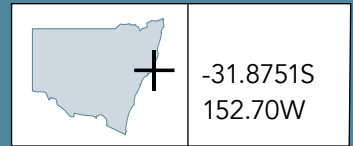
A submerged indurated sandstone bar was blasted and removed when the entrance was initially trained.



An image of the Manning estuary at Harrington created using a Google Earth image and a chart from the 1902 from the NSW Public Works Department Annual Report showing progress in training the entrance of the Manning River. For many years, the entrance followed the northern training wall (see the 2011 image of the Manning River northern breakwater) but it has recently shifted southwards about 700 metres.

Source: NSW Public Works Department 1902 Annual Report, Google Earth

Manning River Breakwater (North)



Responsible Authority: NSW State Government

Built: 1895–1918

Primary purpose when first built: Trained entrance for coastal shipping

Current uses:

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

Multi-use features: – Walking pathway

Eco-features: – Gantry to improve flushing of the backwater area

The breakwater is very accessible. It is close to parking, amenities, greenspace and urban areas. An estuarine training wall extends upstream for 3.4 km and has inlets that support 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
- Rock placement for seating and fishing opportunities
- Rock placement for emergency safety stairs

Future eco-features

- Maintain breakwater fauna refuge area
- Adjacent osprey tower
- Increase submerged habitat complexity
- Fish habitat enhancement along training wall

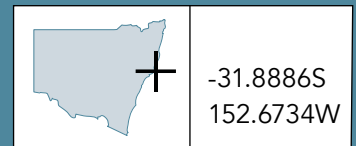


Aerial photo 2011 of the Manning River northern breakwater with the river following the training wall *Credit: nearmap*



The rubble surface on the last 200 m of the northern breakwater of the Manning estuary creates a wildlife refuge area *Credit: nearmap*

Manning River Training Wall (South)



Responsible Authority: NSW State Government
Built: 1902–1904
Modified: Spur training wall was added in the 1920s
Primary purpose when first built: Partially trained entrance for coastal shipping
Current uses: – Ocean access for boating

Multi-use features: Nil
Eco-features: Nil
The training wall is generally inaccessible and is largely covered with sand. An estuarine training wall network extends upstream for about 1.3 km upstream. It has inlets that support seagrass, mangrove, saltmarsh, and wader and migratory bird habitats.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

Nil

Future eco-features

- Maintain training wall fauna refuge area
- Key fish habitat enhancement along training walls




Aerial photo 2019 of (1) the Manning southern training wall and (2) the Manning southern wall spur wall constructed in the 1920s *Credit: nearmap*

The feasibility of a southern breakwater like the one originally proposed in 1902 was recently investigated. The aim was to consider the proposal ‘in terms of contemporary expected benefits and costs’ (MHL 2018). The findings were as follows:

- Cost-effectiveness of the southern breakwater option is not compliant with capital business case criteria.
- Earlier economic analysis supporting the southern breakwater significantly underestimated the cost of the structure.
- If completed, the structure would result in some need for future maintenance dredging costs in addition to the capital cost of breakwater construction.
- A trained entrance would generate higher flow velocities within the channel, changing the hydrodynamics of the area and increasing scour of the entrance channel, which is likely to create a new, larger flood tide delta further upstream and a larger offshore entrance bar.

Racecourse Creek Entrance



-31.9771S
152.5851W

Responsible Authority:	Mid Coast Council
Built:	1992
Primary purpose when first built:	Trained entrance for sand management
Current uses:	– Sand management

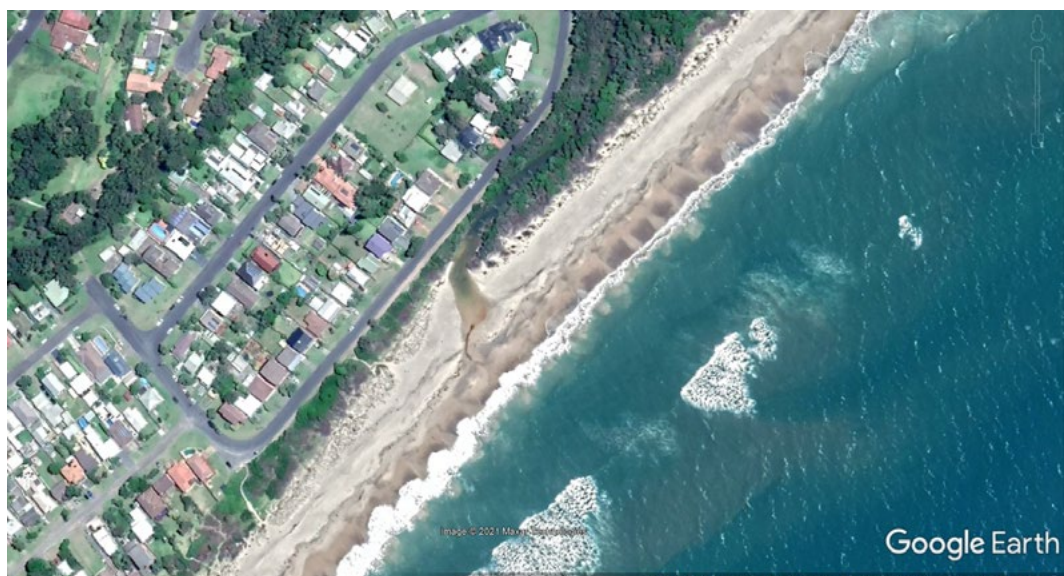
Multi-use features:	Nil
Eco-features:	Nil
Since the entrance was trained with a gabion wall and geotextile mattress in 1992 the entrance has shifted almost 200 metres further north due to erosion of the foredune and loss of vegetation.	

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features	Future eco-features
Nil	Nil

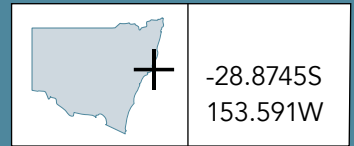


A 2009 aerial photo of Racecourse Creek at Old Bar



A 2021 aerial photo showing the approximately 200-m northward retreat of the Racecourse Creek entrance in response to foreshore erosion

Wallis Lake estuary-wide change



A submerged indurated sandstone bar was broken up and removed when the entrance was initially trained.



Chart showing progress on entrance training works at the Wallis Lake estuary entrance in 1902 Source: NSW Public Works Department 1902 Annual Report

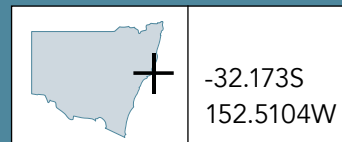


The entrance training at the entrance of Wallis Lake in 2020 Credit: nearmap



Changes in the shape of the Wallis Lake entrance and the adjacent ocean beaches due to the installation of training walls and breakwaters since 1902 are shown by merging the above two images.

Wallis Lake Breakwater (North)



Responsible Authority: NSW State Government

Built: 1965–66

Primary purpose when first built: Trained entrance for coastal shipping

Current uses:

- Ocean access for boating
- Popular coastal walkway
- Fishing spot
- Forms a popular estuarine wave-trap beach

Multi-use features:

- Walking pathway
- Stabilises a wave-trap beach which includes an enclosed swimming area

Eco-features: Nil

The breakwater is very accessible and is close to parking, amenities, greenspace and urban areas. An estuarine training wall extends upstream for 0.5 km.

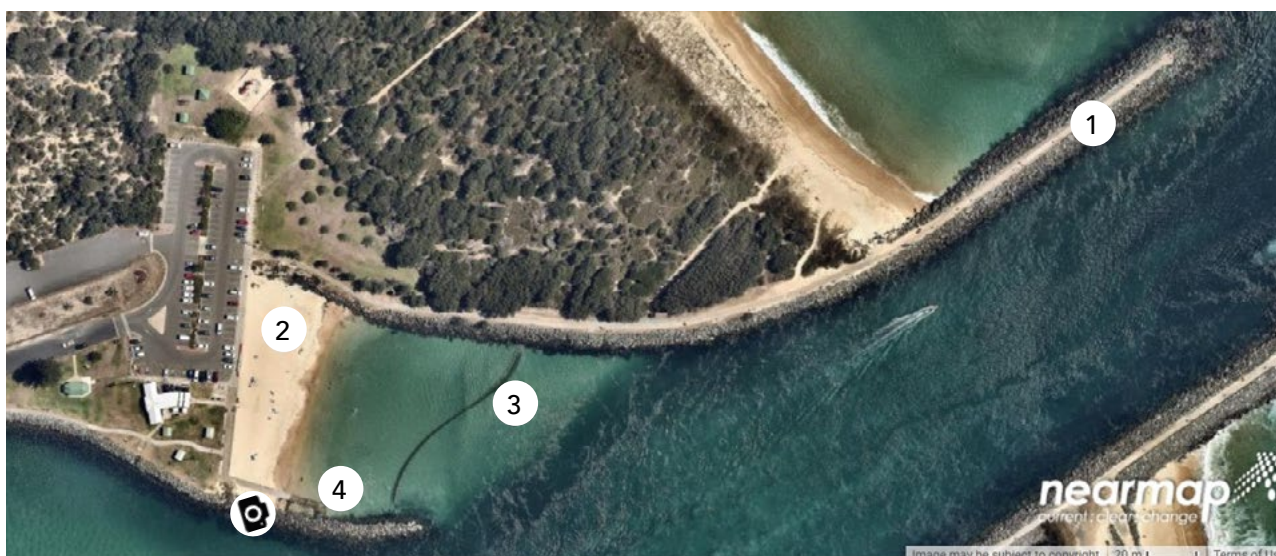
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

- Maintain pedestrian walkway surface and access for people with disability
- Install a CoastSnap photo point
- Rock placement for emergency safety stairs

Future eco-features

- Adjacent osprey tower

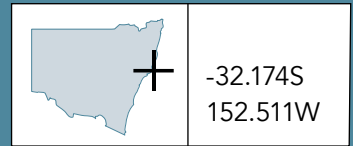


The Wallis Lake (1) northern breakwater; (2) wave-trap beach; (3) enclosed swimming area; (4) access for people with disability *Credit: nearmap*



Popular wave-trap beach with an enclosed swimming area just inside the Wallis Lake northern breakwater, although maintenance is required to maintain functionality of access opportunities for people with disability.

Wallis Lake Breakwater (South)



-32.174S
152.511W

Responsible Authority:	NSW State Government
Built:	1898–1903
Modified:	Extended by 90 m in 1966
Primary purpose when first built:	Trained entrance for coastal shipping
Current uses:	<ul style="list-style-type: none">– Ocean access for boating– Popular coastal walkway– Fishing spot

Multi-use features:

- Walking pathway
- Extends the length of the ocean beach

Eco-features: Nil

The breakwater is accessible. It is close to parking, amenities, greenspace and urban areas. An estuarine training wall extends upstream for 0.6 km. It includes the Forster Harbour precinct, which has a small area of seagrass and mangrove.

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

Nil

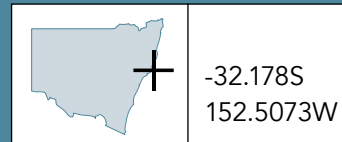


The Wallis Lake and (1) southern breakwater; (2) a backwater wading pool *Credit: Six Maps*



The backwater wading pool relies on tidal flows filtering through the breakwater

Wallis Lake Forster Boat Harbour



Responsible Authority: NSW State Government

Built: 1898–1903

Modified: Harbour facilities installed in 1960s

Primary purpose when first built: Harbour created for fishing and tourism

Current uses:

- Harbour for boating
- Popular coastal walkway
- Fishing spot

Multi-use features:

- Walking pathway
- Fish cleaning tables

Eco-features: Nil

The breakwaters creating the harbour are very accessible. They are 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

Future eco-features

Nil




Forster Boat Harbour within Wallis Lake Estuary
Credit: Six Maps



Pedestrian walkway surface and views at the Forster Boat Harbour.

Port Stephens Hawks Nest Breakwater

	<p>-32.6703S 152.17W</p>
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Responsible Authority:	NSW State Government
Built:	1900s
Primary purpose when first built:	A stone wharf for coastal shipping
Current uses:	<ul style="list-style-type: none"> - Adjacent to a reclaimed area used as a boat ramp
Regulatory matters:	<ul style="list-style-type: none"> - Port Stephens Great Lakes Marine Park

Multi-use features:	Nil
Eco-features:	<ul style="list-style-type: none"> - Creates an intertidal area <p>The breakwater is described as a stone wharf in a 1903 Parish Map for the area. It provides a backwater area ideal for mangrove, saltmarsh, and wader and migratory bird habitats.</p>

Recommendations for possible inclusion in future maintenance or upgrade works	
Future multi-use features	Future eco-features
Nil	<ul style="list-style-type: none"> - Adjacent key fish habitat enhancement

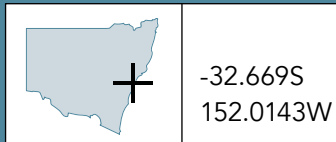


The Hawks Nest breakwater, which is (1) visible at low tide and (2) submerged during the highest tides *Credit: nearmap*



View of the breakwater and the sheltered intertidal area it creates from the Myall Street bridge crossing the Myall River into Hawks Nest.

Port Stephens Carrington Breakwater



Responsible Authority: NSW State Government

Built: 1820s

Primary purpose when first built: Breakwater for coastal shipping

Current uses: – Heritage

Regulatory matters: – *Heritage Act 1977*
– Port Stephens Great Lakes Marine Park

Multi-use features: – Heritage

Eco-features: Nil

The breakwater and lime kilns area are important features in the Carrington Heritage Area and the Australian Agricultural Company history. The Australian Agricultural Company is one of Australia’s oldest companies. It was established by the British Parliament in 1824 and established its headquarters at Tahlee Estate.

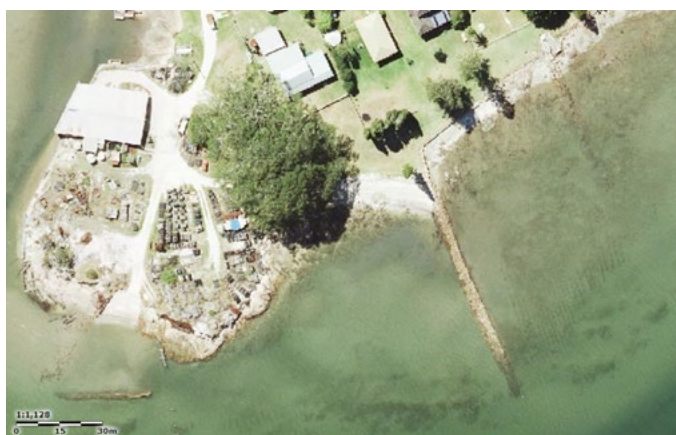
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features
– Heritage

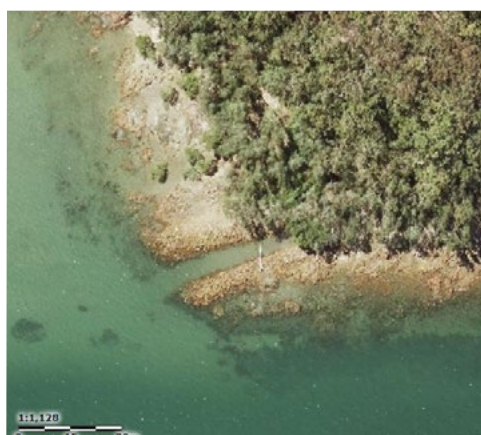
Future eco-features
Nil



The structures around Carrington and Tahlee are some of the oldest in the Port Stephens area constructed around 1826–30. Credit: Six Maps and Noel Butlin Centre within the Australian National University, Australian Agricultural Company, Port Stephens Coastal Survey, drawn by Captain PP King RN. Item 1-465-3

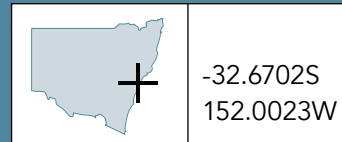


The heritage listing for the breakwater indicates that it was built in 1826, when the area was first managed for the Australian Agricultural Company.
Credit: Six Maps



A small harbour was constructed at Kahrenoyo Point at the entrance to Balberook Cove. It was unsatisfactory, and a second harbour was built at Tahlee House.
Credit: Six Maps

Port Stephens Tahlee Boat Harbour



Responsible Authority: Tahlee Bible College

Built: 1830s

Primary purpose when first built: Boat harbour for coastal shipping

Current uses: – Heritage

Regulatory matters: – Heritage Act 1977
– Port Stephens Great Lakes Marine Park

Multi-use features: – Heritage

Eco-features: Nil

The boat harbour is heritage listed. It was built in the Cornish style of harbours by convict labour.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

– Heritage

Future eco-features

Nil

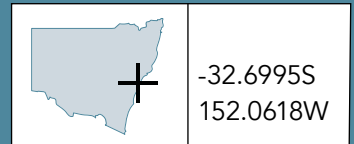


1845 map of Tahlee Estate showing the Tahlee boat harbour Credit: Noel Butlin Centre within the Australian National University, Australian Agricultural Company, Port Stephens Tahlee House and surrounds drawn by Darby, George Eld. Item A98



The Tahlee Estate and the Tahlee boat harbour
Credit: Six Maps

Port Stephens Soldiers Point Breakwater



Responsible Authority: Port Stephens Council

Built: 1990s

Primary purpose when first built: Breakwater for fishing and tourism

Current uses: – Fishing and tourism

Regulatory matters: – Port Stephens Great Lakes Marine Park

Multi-use features: Nil

Eco-features: – Within 50 m of natural reef

The breakwater is very accessible with nearby parking, amenities and greenspace.

Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

Nil

Future eco-features

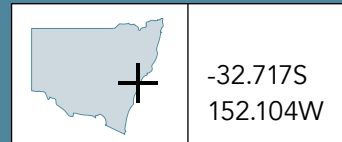
– Increase submerged habitat complexity



The Soldiers Point boat ramp breakwater. The white line shows the cadastral boundary and mean high water boundary when the area was first surveyed. It indicates that some of the area protected by the breakwater was reclaimed.

Credit: nearmap

Port Stephens Corlette Point Breakwater



Responsible Authority: Private developer

Built: 1980s-90s

Primary purpose when first built: Trained estuarine harbour for fishing and tourism

Current uses:

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

Regulatory matters:

- Port Stephens Great Lakes Marine Park

Multi-use features: – Walking pathway

Eco-features: Nil

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

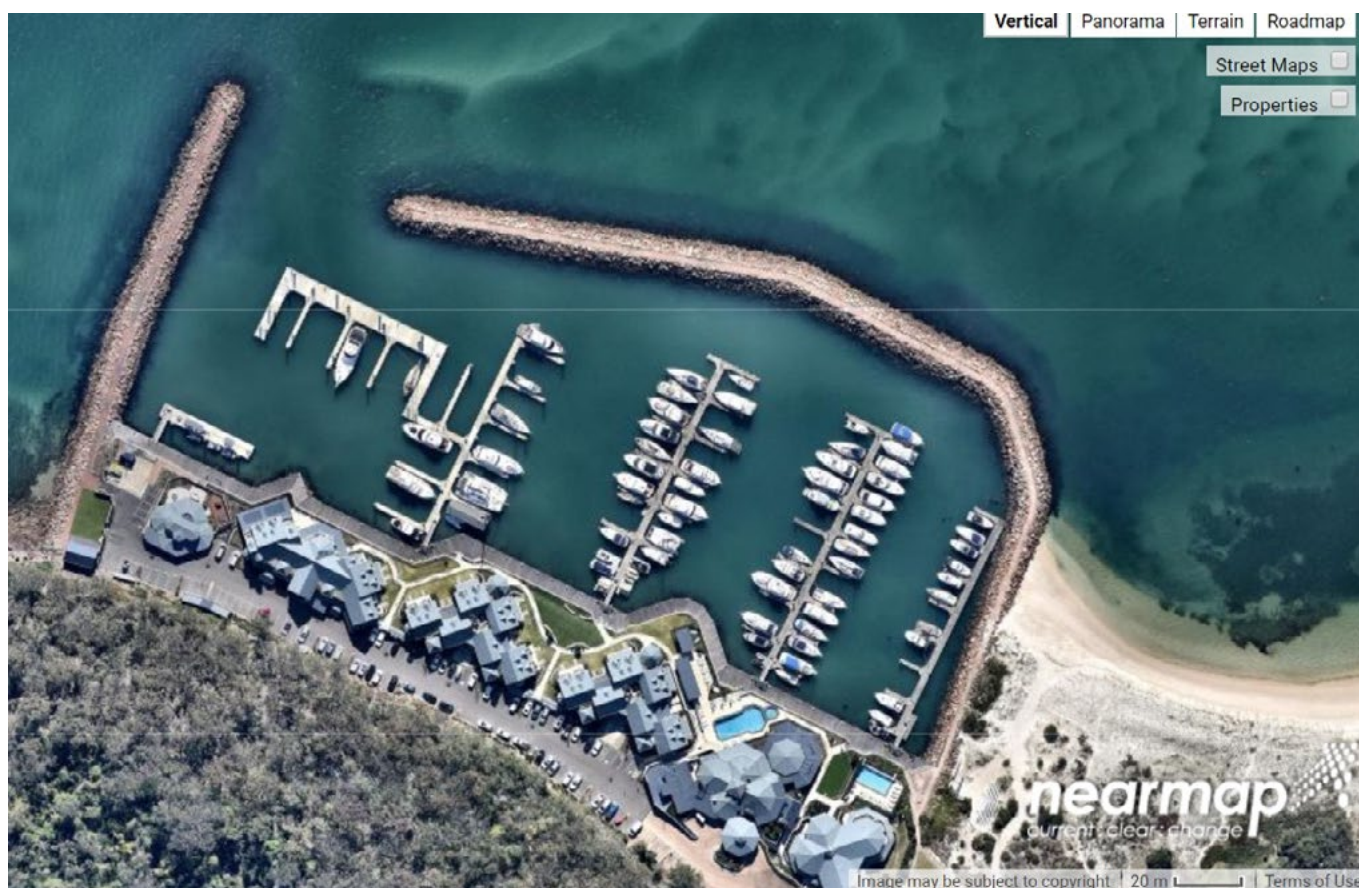
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

- Maintain pedestrian walkway surface
- Rock placement for seating opportunities

Future eco-features


- Increase submerged habitat complexity



The Corlette Port Peppers Anchorage

Credit: nearmap

Port Stephens Nelson Bay Boat Harbour



-32.718S
152.146W

Responsible Authority: NSW State Government

Built: 1973-86

Primary purpose when first built: Trained estuarine harbour for fishing and tourism

Current uses:

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

Regulatory matters:

- Port Stephens Great Lakes Marine Park

Multi-use features: – Walking pathway

Eco-features: Nil

The harbour breakwaters known as d’Albora Marina is very accessible to the Nelson Bay central business district. The harbour forms an important precinct with nearby parking, amenities and greenspace areas.

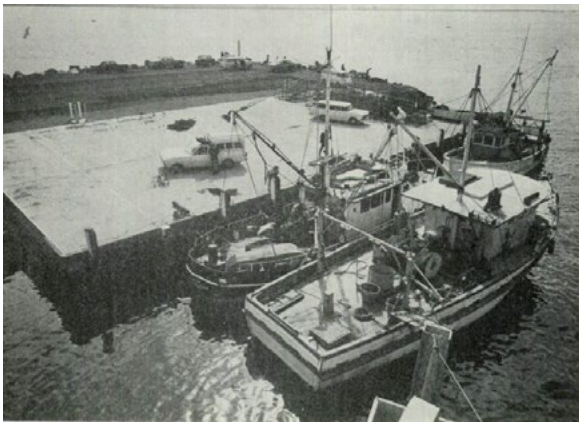
Recommendations for possible inclusion in future maintenance or upgrade works

Future multi-use features

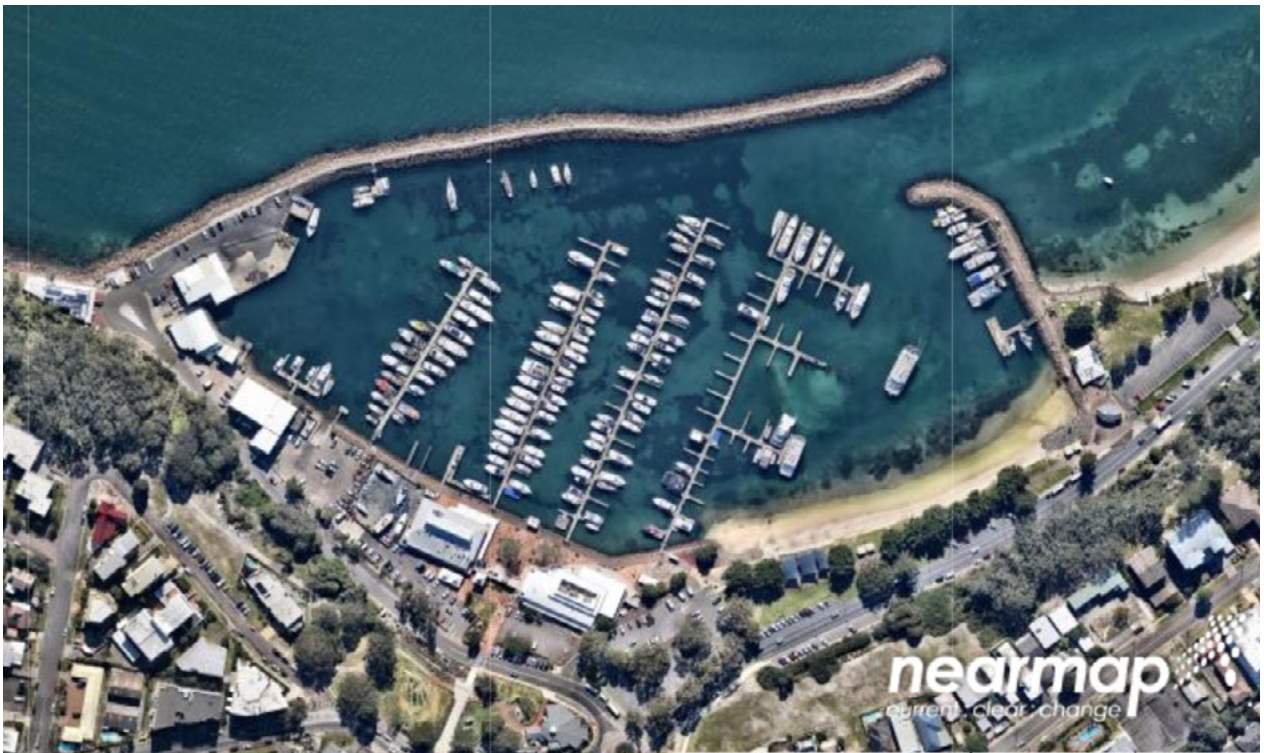
- Maintain pedestrian walkway surface
- Rock placement for seating and fishing opportunities
- Rock placement for emergency safety stairs

Future eco-features

- Increase submerged habitat complexity



Upgrade works in 1975 (left) and 1987 (right) Source: NSW Public Works annual reports



The d’Albora Marina at Nelson Bay in the harbour breakwater Credit: nearmap

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