

2016 June 4 - 7 East Coast Low Flood / Coastal Storm Event Remediation Assessment

1. **Ulladulla Harbour foreshore protection** – major erosion of a 30 metre section of the existing rear harbour revetment and the loss of the tidal beach affecting park infrastructure and public amenity.

Short term safety measures \$3500

Response includes temporary hazard fencing and removal of parks infrastructure

Asset custodians	Assets at risk	cost
Social Infrastructure	Park assets footpaths, picnic tables	\$10,000
Natural Resources	Shoreline protection	\$50,000
Roads and Maritime Services	Navigation aids and Princess Highway footpath	
TOTAL		\$60,000

Proposed remediation \$50,000:

- Investigation \$2500 survey
- Remediation \$45,000 based on 2012 works including extension of protection and rock fill of the upper embankment and beach scraping. Relocating sand from the northern beach and nourishing the southern beach.



2. **Currarong Beach:** Significant beach sand loss under elevated tide and NE storm conditions with damage to park and road assets at the rock pools and Dolphin Reserve.

Short term safety and clean up measures **\$25,000 (estimated)**

- Response includes temporary hazard fencing and remediation of parks infrastructure around Abrahams Bosom reserve carpark sand recovery and rock pools remediation
- Beach access hazard closure and reshaping of beach access at Peel St and Currarong Creek
- Land survey of erosion
- Coastal engineering advice from Advisian repeating hazard mapping and Royal Haskoning adaptive response design, and community consultation

Asset custodians	Assets at risk/proposed management option	Short term	Medium term
Social Infrastructure	Park assets footpaths, picnic tables /relocate-sacrifice	\$5,000	
Natural Resources	Beach access/replace some	\$50,000	\$50,000
Natural Resources	Warrain Crescent/private properties / coastal protection	\$15,000	\$500,000
Natural Resources	Beecroft Pde/shoreline protection	\$20,000	\$20,000
Roads	Stormwater assets Dolphin Reserve/remediate	\$10,000	
Shoalhaven water	Sewer (Beecroft parade)	tba	
TOTAL		\$100,000	\$575,000

Remediation

- Investigation \$25,000 survey and coastal engineering design
- Beach scraping nourishment along Warrain Crescent \$15,000
- Beach / revetment interim repair Beecroft Parade Yalwal St boat ramp \$40,000
- Dolphin Reserve remediation \$10,000

Long term remediation

- \$500,000 trial geo fabric groyne, nourishment and dune vegetation



Beach access at Currarong before event. There were 8 beach access ways at Currarong Beach.

The surviving access at the western access at the end of Peel Street was repaired to maintain one safe access.



The sand tracks that led to each of the accesses, now finish at a 4 to 5 metre high sand cliff



Abrahams Bosom Reserve after the event (left) and following initial clean up (right)

3. Lake Tabourie

The 80m foreshore boardwalk was lifted during the combined ocean storm / flood event and damaged beyond repair.

Short term responses included hazard signage temporary fencing with the removal of the structure completed on 8/6/2016 approximately **\$5,000**.



Asset custodian	Assets at risk-management options	Short term	Medium term
Natural Resources	Beach access survey design	\$10,000	
	Sand nourish track		
Natural Resources	Boardwalk /replace	\$10,000	\$250,000
TOTAL		\$20,000	\$250,000

4. Shoalhaven Heads:

Site 1 the River Rd foreshore has moderate erosion impacts as the flood notch breached allowing significant ocean swell / king tide to enter combining with local flooding.



Site 2 Shoalhaven Beach access ways were damaged with beach erosion warning signs still in place since the 2015 event. Contactors were engaged to reshape the main beach access points for public safety with other access points remaining closed.

Short term responses **\$25,000** including tree inspection, hazard signage and beach reshaping

Asset custodians	Assets at risk	Short term	Medium term
Natural Resources	Beach / foreshore access	\$50,000	
Natural Resources/Roads-Assets and Works	Coastal engineering advice	\$25,000	\$25,000
Roads/Assets and Services Natural Resources	Shoreline protection River Road (monitoring design and selective)	\$10,000	\$1,500,000 estimate
Natural Resources	Shoreline tree management	\$20,000	
Roads	Stormwater assets and road	\$100,000	\$100,000
Endevor Energy	power		tba
TOTAL		\$210,000	\$tbc

5. Mollymook beach

Site 1 South end damages included Golf Club gabion wall, Ocean St sandstone sea wall and sand blockage of the road stormwater system.



Site 2 Black Water Creek training wall / sand nourishment was slightly damaged and is under monitoring and maintenance.

Site 3 Creek training wall damaged at north end of the beach with landslips North Mollmook Mitchell Rd triggered by the 2015 flood under design, monitoring and remediation.

Short term safety measures \$3500

Asset custodians	Assets at risk/remediation options	Short term	Long term
Social Infrastructure	Park assets footpaths, picnic tables		
Natural Resources	Natural Area landslip/remediate in accordance with Coffey advice	\$20,000	
Natural Resources	Seek coastal engineering advice (in progress)	\$25,000	
Shoalwater, Assets and Works, Golf Club, Recreation and Infrastructure Natural Resources	Golf Club, sewer pumping station, shared path, road - staged shoreline protection	\$20,000	\$3,500,000
Natural Resources	Beach access	\$50,000	
Roads	Stormwater assets road	\$200,000	
Shoalhaven Water	Mitchell Road sewer landslip		
TOTAL		\$315,000	\$tbc

Royal Haskoning have drafted a Concept Design Report for Foreshore Stabilisation at Mollymook Beach (South) for long term protection of the southern end of Mollymook beach including sewer pump station, Golf Club, Golf Avenue road reserve and extending to the surf club precinct. The gabion structure partly protecting the Golf Club and shared path is approaching the end of its useful life. Consultation with the Golf Club has commenced and a separate report to Council and consultation forums will be scheduled.

6. Culburra Beach,

Southern beach access ways were damaged from The Haven north along the entire beach with some rock outcrops uncovered.

Short term responses include preliminary staff inspection and engagement of contractors to inspect and reshape some beach access points where feasible **\$5000**.



Asset custodians	Assets at risk	Short term	Long term
Natural Resources	Beach access/repair/replace	\$50,000	\$200,000
Natural Resources	Natural area		
TOTAL		\$50,000	\$200,000

Inspection and repair work will continue in the 2016-17 financial year under the annual coastal risk assessment in July.

7. Vincentia,



Site 1 Collingwood Beach stormwater outlets eroded and erosion fronting shared pathway along Collingwood Beach.

Site 2 Nelson Beach.

Asset custodians	Assets at risk/management option	Short term	Long term
Social Infrastructure	Park assets footpaths, picnic tables	\$10,000	
Natural Resources	Coastal engineering advice	\$25,000	\$25,000
	Beach access reinstatement Orion & Nelson Beaches	\$200,000	200,000
Roads	Stormwater assets road		tba
TOTAL		\$235,000	\$225,000

Short term safety measures **\$3500**

Inspection and repair work will continue in the 2016-17 financial year under the annual coastal risk assessment in July.

8. Greenwell Point Foreshore



Site 1 Adelaide St minor erosion of existing shoreline protection.

Site 2 Titania Park erosion / undermining of shared footpath that will require short term remediation and long term relocation of some assets or extension of shoreline protection.

Site 3 Sandstone Wharf site: damaged in 2015.

Short term safety measures **\$3500**

Asset custodians	Assets at risk/management options	Short term	Long term
Social Infrastructure	Park assets footpaths, picnic tables	\$10,000	\$250,000
Social Infrastructure -Natural Resources	Shoreline protection	\$10,000	\$200,000
TOTAL		\$20,000	\$450,000

9. Coastal Headlands the NE storm was shown to increase in intensity in south coast locations with Bega experiencing a 1 in 85 year event. As experienced at Currarong, exposed north facing sites experienced long period wave damage with the spring tide allowing wave attack at the rear of the beach.

Short term safety measures \$5000

- Cunjurong Point: main stair access point to Green Island undermined needing emergency barriers and beach scraping to reinstate
- Kioloa Beach Caravan Park: potentially hazardous erosion scarp requiring warning signage and barriers

10. Shoreline Protection

- Ulladulla Harbour
- St Georges Basin sites including the RSL frontage and regional boat ramp at Sussex Inlet Lions Park were substantially damaged in 2015 and again in 2016
- Burrill Lake Dolphin Point caravan park has minor damage reported that will need repair to the sand nourished public access beach

Re-inspection of all foreshore protection structures is now required with damages currently unknown to fishing platforms and other elevated stair ways.

DRAFT

Shoalhaven City Council
Shoreline Protection Condition Assessment
5 Year Update
Final Report

July 2016

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1. Introduction

1.1 Background

In 2010, GHD was engaged by Shoalhaven City Council to complete a Shoreline Protection Assessment Report (the report) to assess the state of 37 sites in the Shoalhaven Local Government Area. The report included description each protection asset, along with recommendations for repair, maintenance or rehabilitation.

Five years on, GHD has been re-engaged by Shoalhaven City Council to develop an addendum to the original report, with updated assessments, descriptions and detailed scopes of works required with associated cost estimates.

1.2 Purpose of this report

The 2016 addendum has been developed by GHD to provide an update on the current condition of the 32 sites identified in the report, and should be read in conjunction with the report. An additional 5 sites (Site 33-37) have been identified by the Shoalhaven City Council as additional sites to be assessed and have been included in the assessment. The priority ratings used to assess the condition of the shoreline protection assets are as per Section 4 of the report. The timeframes that detail the urgency of the remediation are as follows:

- High Priority: within 1 (one) year;
- Medium Priority: within 3 (three) years; and
- Low Priority: within 5 (five) years.

1.3 Objectives and limitations

The objectives of the addendum are as follows:

- Provide update to the condition of the sites assessed in the report;
- Provide geographical co-ordinates of the assets;
- Provide photographs highlighting the current condition and areas requiring remediation;
- Recommend a scope of remediation works (if required);
- Recommend additional works (if required);
- Provide a preliminary cost estimate for remediation works; and
- Provide an updated relative priority.

The limitations of this addendum are as follows:

- The updated conditions of the first 32 sites (Site 01-32) assessed are current as of 15/01/2016 and the last 5 sites (Site 33-37) assessed are current as of 18/05/2016, any changes in condition following this date is not covered in this addendum; and
- All preliminary cost estimates are for remediation works only and have been based on market prices as of 15/01/2016. The estimates are considered to be in a certainty range of $\pm 50\%$ for the preliminary scope of works defined within, and subject to the objectives and limitations stated.

2. Summary – Priority Levels, Actions and Cost Estimates

Table 1 below provides a summary of the priority rating for each of the shoreline protection asset assessed in the addendum along with remediation works and cost estimates.

The total expected cost outcome for each level of priority following the assessment of the 37 sites is as follows:

1. High priority works: \$140,000.
2. Medium priority works: \$1,019,000.
3. Low priority works: \$94,000.

Table 1 Summary of priority levels for remediation

Site Number	Location Land Ownership	Priority	Scope of Work	Cost Estimate	Custodian(s) Potential sources of Funding
28	Ulladulla Harbour Rear Protection Wall Crown Lands (SCC Trust Manager)	High	<ul style="list-style-type: none"> - Cover Geotextile material. - Remediate voids developed - Implement new protection where bank is exposed and failing. 	\$ 60,000	Natural Resources RMS/Council
15	Sussex Inlet RSL Frontage Crown Lands (SCC Trust Manager)	High	<ul style="list-style-type: none"> - Replace displaced timber retaining wall and inundated protection with armour rock revetment 	\$ 80,000	Social and Infrastructure Planning Coastal-Estuary grant/Council

13	Hyams Beach BLR Crown Lands (SCC Trust Manager)	Medium to High	<ul style="list-style-type: none"> - Remediate protection around boat ramp. - Extend existing shoreline protection along the full length of the boat ramp to create a groyne like structure to prevent further erosion. - Remediate slumping of bank along shoreline. 	\$ 30,000	Assets and Works Council/RMS
18	Alamein Rd Caravan Park, Sussex Inlet Crown Lands (this Crown Land is not managed by Council and is leased to the caravan park)	Medium-High	<ul style="list-style-type: none"> - Remove existing builder's rubble. - Implement armour rock revetment along foreshore. 	\$ 340,000	Crown Land Crown Land
21	Edwin Avenue Lake Conjola Council	Medium-High	<ul style="list-style-type: none"> - Implement armour rock revetment along the shoreline 	\$ 160,000	Natural Resources Coastal-Estuary grant/Council

			to prevent further erosion.		
2	Scenic Drive, Nowra Crown Lands (SCC Trust Manager)	Medium	<ul style="list-style-type: none"> - Bank restoration behind revetment. - Remediate damaged Gabion mattress. - Cover exposed Geotextile material. 	\$ 16,000	Assets and Works/Social infrastructure Coastal-Estuary grant/Council
3	Nowra Sea Scout Hall Paringa Park Crown Lands (SCC Trust Manager)	Medium	<ul style="list-style-type: none"> - Extend rock revetment at Scenic Drive Nowra along the length of the site. - Monitor overhanging trees. 	\$ 180,000	Social and Infrastructure Planning/Assets and Works Coastal-Estuary grant/Council
8	Orient Point Boat Ramp Crown Lands (SCC Trust Manager)	Medium	<ul style="list-style-type: none"> - Implement shoreline Protection along unprotected area. 	\$ 16,000	Assets and Works Council/RMS
19	Lake Conjola Entrance Boat Ramp Crown Lands (SCC Trust Manager)	Medium	<ul style="list-style-type: none"> - Replace displaced rock armour along revetment. - Remediate highly eroded areas. 	\$ 22,000	Assets and Works Coastal-Estuary grant /Council/RMS

23	Narrawallee Inlet Crown Lands (SCC Trust Manager)	Medium	<ul style="list-style-type: none"> - Cover exposed Geotextile material. - Remediate exposed base material and displaced medium armour rock. 	\$ 70,000	Natural Resources Coastal-Estuary grant/Council
24	Mollymoke Farm Creek training wall, Mollymook Council Crowns Lands	Medium	<ul style="list-style-type: none"> - Remediate failed gabion mattress. 	\$ 24,000	Natural Resources Coastal-Estuary grant/Council
35	Kioloa Boat Ramp Carpark Protection Crown Lands Crown Lands (SCC Trust Manager)	Medium	<ul style="list-style-type: none"> - Extend armour rock revetment from site 32 along the extent of the foreshore. 	\$ 130,000	Assets and Works Coastal-Estuary grant /Council/RMS
1	Nowra Sailing Club Crown Lands (SCC Trust Manager)	Low to Medium	<ul style="list-style-type: none"> - Remediate damaged groyne. - Cover exposed Geotextile material. 	\$ 6,000	Natural Resources Coastal-Estuary grant/Council
6	Greenwell Point Foreshore	Low to Medium	<ul style="list-style-type: none"> - Remediate damaged 	\$ 40,000	Social and Infrastructure Planning/Assets and Works Coastal-Estuary grant/Council

	Crowns Lands- SCC Trust manager		toe protection. - Cover exposed geotextile material.		
4	Greys Beach, Nowra Crowns Lands- SCC Trust manager	Low to Medium	- Remediate displaced medium armour rock along the extent of the shoreline.	\$ 20,000	Social and Infrastructure Planning Coastal-Estuary grant/Council
9	Orient Point Urban Area Crowns Lands- SCC Trust manager	Low to Medium	- Cover exposed geotextile material.	\$ 8,000	Social and Infrastructure Planning Coastal-Estuary grant/Council
16	Seacrest Caravan Park, Sussex Inlet Crowns Lands- SCC Trust manager	Low to Medium	- Remediate eroded base material behind retaining wall. - Cover exposed geotextile material.	\$ 10,000	Social and Infrastructure Planning Coastal-Estuary grant/Council
29	Burrill Lake Lions Park Crowns Lands- SCC Trust manager	Low to Medium	- Remediate exposed banks and implement toe protection along the extent of the foreshore.	\$ 16,000	Social and Infrastructure Planning Coastal-Estuary grant/Council
11	Currambene Creek, Woolamia	Low to Medium	- Implement armour rock	\$ 18,000	Assets and Works

	Council road Crowns Lands- SCC Trust manager		protection along exposed shoreline. - Remediate exposed base material.		Coastal-Estuary grant/Council
5	Comerong Island Ferry Council	Low	- Monitor during large flood events.	Nil.	Assets and Works Coastal-Estuary grant/Council
7	Crookhaven River Boat Ramp, Culburra Beach Crowns Lands- SCC Trust manager	Low	- Remediate displaced armour rock.	\$ 6,000	Assets and Works Council/RMS
10	Myola Groyne Crowns Lands- SCC Trust manager	Low	- Cover exposed base material with medium armour rock.	\$ 14,000	Assets and Works Council/RMS
12	Voyager Park, Huskisson Crown Lands- SCC Trust manager	Low	- Monitor following large storm events.	Nil.	Social and Infrastructure Planning Coastal-Estuary grant/Council
14	John Williams Reserve Sanctuary Point Crown Lands	Low	- Cover exposed Geotextile material.	\$ 12,000	Assets and Works/ Social and Infrastructure Planning Crown Lands/ Coastal- Estuary grant/Council/RMS

17	Lions Park BLR, Sussex Inlet Crown Lands- SCC Trust manager	Low	- Remediate erosion behind timber retaining wall.	\$ 6,000	Assets and Works/ Social and Infrastructure Planning Council/RMS
22	Carroll Ave, Lake Conjola Council	Low	- Remediate minor erosion and exposed base material due to displaced armour rock.	\$ 6,000	Social and Infrastructure Planning/Natural Resources Coastal-Estuary grant /Council
25	Mollymook Golf Club Gabion Protection Council	Low	- Cover exposed gabion mattress.	\$ 16,000	Social infrastructure/Shoalwater/Natural resources Coastal-Estuary grant /Council/Golf Club?
30	Maria Avenue BLR Burrill Lake Council	Low	- Monitor during storm events for inundation .	Nil.	Assets and Works RMS/Council
31	Kendall Crescent BLR Burrill Lake Council road	Low	- Monitor small cracks in concrete binder. - Remediate exposed shoreline.	\$ 6,000	Assets and Works RMS/Council
34	Kioloa Marine Rescue Crown Lands- SCC	Low	- Nil	Nil.	Assets and Works Council

	trust manager				
20	Lake Conjola Holiday Haven Caravan Park Crown Lands- SCC trust manager	Low	- Monitor following large rain events.	Nil.	Holiday Haven Holiday Haven/Council
26	Mollymook Beach sea wall Council road	Low	- Monitor following large storm and rain events.	Nil.	Assets and Works
27	Bogey Hole, Mollymook Council	Low	- Monitor following large storm and rain events.	\$ 8,000	Social infrastructure
32	Dolphin Point Caravan Park Crown Lands	Low	- Monitor following large rain events.	Nil	Natural resources
	Blackwater Creek Training Wall and beach nourishment Council/Crown Lands	Nil	- Monitor following large rain events.	Nil	Natural Resources/Shoalwater/Assets and Works

3. Findings and Recommendations

3.1 Nowra Sailing Club (Site 1)

<p>Site Location: Riverview Rd intersection, Nowra 2541</p> <p>Co-ordinates</p> <table> <tr> <th>Downstream</th><th>Upstream</th></tr> <tr> <td>034° 51' 53.8" S</td><td>034° 51' 54.7" S</td></tr> <tr> <td>150° 36' 14.7" E</td><td>150° 36' 08.8" E</td></tr> </table>	Downstream	Upstream	034° 51' 53.8" S	034° 51' 54.7" S	150° 36' 14.7" E	150° 36' 08.8" E	<p>Location Map</p> 
Downstream	Upstream						
034° 51' 53.8" S	034° 51' 54.7" S						
150° 36' 14.7" E	150° 36' 08.8" E						
<p>Description</p> <p>The Shoalhaven River shoreline at the Nowra Sailing Club is protected with a series of three rock groynes with rock shoreline protection in between. The total asset extends from the Sailing Club to approximately 150 metres downstream.</p>	<p>Site Condition</p> <p>As shown below in Photo 1, the central groyne has been undercut and the structure has experienced partial collapse. Exposed geotextile material is present between the central and upstream groyne, highlighted in Photo 2. Elsewhere, shoreline protection is working effectively along the bank preventing significant erosion.</p>						
<p>Photo 1 Undercut Central Groyne</p> 	<p>Photo 2 Exposed Geotextile Material</p> 						
<p>Recommendation and SOW</p> <p>Remediate undercutting of central groyne by placing new armour rock to match existing. This will reduce the risk of further undercutting at the toe and potential collapse of the structure. Undertake beach nourishment to cover exposed geotextile material visible on site to prevent further deterioration.</p>							
<p>Priority Low-Medium</p>	<p>Cost estimate \$ 6,000</p>						

3.2 Scenic Drive, Nowra (Site 2)

Site Location:

Scenic Dr, Nowra 2541

Co-ordinates
Downstream

034° 51' 55.6" S

150° 36' 07.9" E

Upstream

034° 52' 00.3" S

150° 35' 50.5" E

Location Map

Description

Nowra Scenic Drive consists of approximately 450 metres of a medium sized armour rock revetment spanning from Nowra Bridge to the Nowra Rowing Club followed by approximately 25 metres of gabion wall protection along the artificial beach.

Site Condition

Exposed Geotextile material is located along the revetment at multiple points. At the base of the gabion wall a failure point has occurred as shown in Photo 3. Areas of minor erosion behind the revetment are occurring causing loss of topsoil and bank instability as shown in Photo 4.

Photo 3 Damaged Gabion Mattress



Photo 4 Erosion behind revetment


Recommendation and SOW

Monitor cracking in Photo 4 located under the bridge and vegetate eroded areas to match adjacent existing vegetation behind the revetment to prevent further bank erosion and reduction in bank stability. Fill any voids and cover exposed geotextile material with armour rock to match existing. Remediate damaged gabion highlighted in Photo 5 located at the artificial beach to match existing to prevent further collapse of the gabion mattress.




Priority

Medium




Cost estimate

\$ 16,000




3.3 Nowra Sea Scout Hall/Paringa Park (Site 3)

<p>Site Location: Paringa Park, Nowra 2541</p> <p>Co-ordinates</p> <table> <tr> <th>Downstream</th><th>Upstream</th></tr> <tr> <td>034° 52' 00.0" S</td><td>034° 52' 02.7" S</td></tr> <tr> <td>150° 35' 51.0" E</td><td>150° 35' 44.9" E</td></tr> </table>	Downstream	Upstream	034° 52' 00.0" S	034° 52' 02.7" S	150° 35' 51.0" E	150° 35' 44.9" E	<p>Location Map</p> 
Downstream	Upstream						
034° 52' 00.0" S	034° 52' 02.7" S						
150° 35' 51.0" E	150° 35' 44.9" E						
<p>Description</p> <p>Paringa Park foreshore spans approximately 175 metres along the Shoalhaven River. Intermittent small armour rock as shown in Photo 5 is located at the toe of the bank.</p>	<p>Site Condition</p> <p>Limited coastline protection along the span of Paringa park. Areas of significant erosion of the banks along the shoreline are evident as shown in Photo 6. Trees extending from the banks are currently supporting the banks, however could cause significant bank damage if tree collapse occurs. Steep unstable banks which may erode significantly in storm events if not protected.</p>						
<p>Photo 5 Random Rock Protection</p> 	<p>Photo 6 Eroded Shoreline</p> 						
<p>Recommendation and SOW</p> <p>Implement shoreline protection using rock revetment to prevent further erosion of the existing shoreline. Monitor existing overhanging trees to prevent collapse of the already significantly eroded bank and following significant flood and storm events. Potentially prevent further damage through stumping of overhanging trees to reduce lever arm.</p>							
<p>Priority Medium</p>	<p>Cost estimate \$ 180,000</p>						

3.4 Greys Beach North Nowra (Site 4)

<p>Site Location:</p> <p>Fairway Dr, North Nowra 2541</p> <p>Co-ordinates</p> <table> <tr> <th>Downstream</th><th>Upstream</th></tr> <tr> <td>034° 51' 46.0" S</td><td>034° 52' 06.6" S</td></tr> <tr> <td>150° 35' 53.2" E</td><td>150° 35' 31.7" E</td></tr> </table>	Downstream	Upstream	034° 51' 46.0" S	034° 52' 06.6" S	150° 35' 53.2" E	150° 35' 31.7" E	<p>Location Map</p> 
Downstream	Upstream						
034° 51' 46.0" S	034° 52' 06.6" S						
150° 35' 53.2" E	150° 35' 31.7" E						
<p>Description</p> <p>Greys Beach shoreline protection consists of approximately 800 metres of armour rock protection spanning from the Nowra Golf Club to the downstream boat-launching ramp.</p>	<p>Site Condition</p> <p>Small areas of base material are exposed because of slight collapse and displacement of the armour rock below the Nowra Golf Club parking facility. Dense grass vegetation exists over areas of shoreline protection improving bank stability. Multiple areas of steep unprotected areas and undercutting due to collapse of the bank and displacement of armour rock.</p>						
<p>Photo 7 Eroded Rock Unstable bank</p> 	<p>Photo 8 Collapse of bank</p> 						
<p>Recommendation and SOW</p> <p>Remediate shoreline protection and eroded areas by implementing additional large armour rock to replace displaced rock to protect shoreline from additional erosion. Monitor undercutting and development of steep banks following large rainfall events until remediation is undertaken.</p>							
<p>Priority</p> <p>Low-Medium</p>	<p>Cost estimate</p> <p>\$ 20,000</p>						

3.5 Comerong Island Ferry (Site 5)

<p>Site Location:</p> <p>1188 Comerong Island Rd, Numbaa NSW</p> <p>Co-ordinates</p> <table> <tr> <td>Downstream</td> <td>Upstream</td> </tr> <tr> <td>034° 53' 03.6" S</td> <td>034° 52' 57.4" S</td> </tr> <tr> <td>150° 42' 42.9" E</td> <td>150° 42' 47.4" E</td> </tr> </table>	Downstream	Upstream	034° 53' 03.6" S	034° 52' 57.4" S	150° 42' 42.9" E	150° 42' 47.4" E	<p>Location Map</p> 
Downstream	Upstream						
034° 53' 03.6" S	034° 52' 57.4" S						
150° 42' 42.9" E	150° 42' 47.4" E						
<p>Description</p> <p>Comerong Island Ferry shoreline protection consists of medium to large armour rock spanning approximately 35 metres downstream of the access ramp and medium armour rock spanning approximately 190 metres upstream.</p>	<p>Site Condition</p> <p>The shoreline protection asset is in good condition and is functioning as intended. No areas of erosion or significant displacement of armour rock visible.</p>						
<p>Photo 10 Upstream shoreline protection</p> 	<p>Photo 9 Downstream shoreline protection</p> 						
<p>Recommendation and SOW</p> <p>Protection working as intended. Monitor following significant rain and flood events.</p>							
<p>Priority Low</p>	<p>Cost estimate Nil.</p>						

3.6 Greenwell Point Foreshore (Site 6)

Site Location:

Shoreline along Adelaide St, Greenwell Point 2540

Co-ordinates
Downstream

034° 54' 30.1" S

150° 44' 07.3" E

Upstream

034° 54' 07.1" S

150° 43' 49.7" E

Location Map

Description

Greenwell point foreshore spans approximately 930 metres and consists of mixed coastal protection assets; two small rock groynes, five medium-large rock groynes, large armour rock bank retaining walls, small armour rock toe protection and randomly placed rock protection.

Site Condition

The rock groynes along the foreshore are in good condition. Multiple areas of exposed geotextile material are located along the retaining wall structure. Failure of toe protection and displacement of small armour rock has led to erosion of the bank and exposure of geotextile material (Photo 11). Sections of beach are experiencing bank erosion due to lack of coastal protection putting the pathway at risk (Photo 12).

Photo 11 Toe protection failure



Photo 12 Exposed bank erosion


Recommendation and SOW

Remediate damage to toe protection by using larger armour rock to prevent further erosion, loss of gravel and further exposure of geotextile material. Cover exposed geotextile material with gravel to match existing. Fill voids behind large armour rock with secondary armour rock to prevent erosion.

Recommended additional works

Implement sand nourishment to beach areas to prevent further bank erosion. Vegetate area behind revetment adjacent to footpath to prevent further erosion leading to damage to the footpath.

Priority

Low-Medium

Cost estimate

\$ 40,000

3.7 Crookhaven River Boat ramp, Culburra Beach (Site 7)

Site Location:

Prince Edward Ave, Culburra Beach 2540

Co-ordinates**Left side of boat ramp**

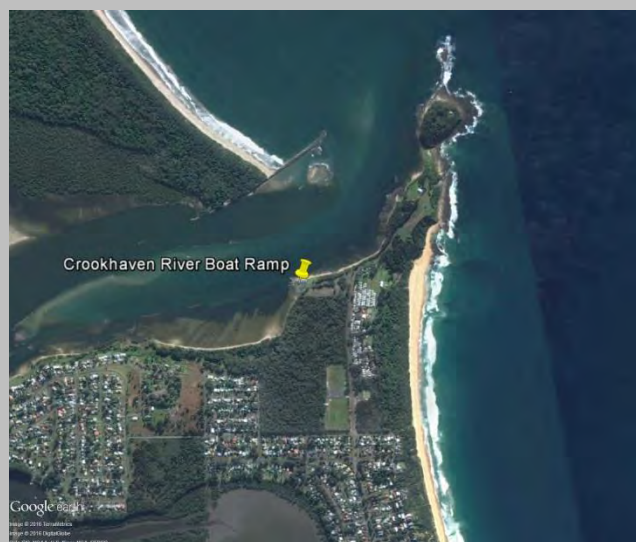
034° 54' 21.1" S

150° 45' 36.4" E

Right side of boat ramp

034° 54' 19.2" S

150° 45' 37.4" E

Location Map**Description**

Crookhaven River boat ramp offers access for multipurpose watercraft to the mouth of the Crookhaven River. The banks and carpark at the boat ramp are protected by medium to large armour rock revetments spanning approximately 130 metres along the shoreline.

IS THIS OURS?**Site Condition**

As highlighted in Photo 13, minor erosion has occurred on the southern side of the boat ramp due to displacement of the medium armour rock. Areas of minor scour on the northern hand side of the boat ramp are present. However, the asset is working as intended and is in generally good condition.

Photo 13 Minor erosion



Photo 14 Armour Rock Protection

**Recommendation and SOW**

Remediate area of exposed base material as shown in Photo 13 above with medium armour rock to prevent further erosion and displacement of base material. Monitor annually and following significant rain events for erosion and displacement of armour rock.




Priority

Low


Cost estimate:

\$ 6,000

3.8 Orient Point Boat Ramp (Site 8)

<p>Site Location: Orontes St, Orient Point 2540</p> <p>Co-ordinates</p> <p>Boat ramp 034° 54' 42.8" S 150° 44' 39.4" E</p> <p>IS THIS OURS?</p>	<p>Location Map</p> 
<p>Description</p> <p>Orient Point boat ramp is located on the Crookhaven River. The site consists of a jetty and a boat ramp, and limited coastal protection.</p>	<p>Site Condition</p> <p>Both banks adjacent the boat ramp and under the boat ramp are experiencing significant undercutting and erosion of the banks. The extent of the erosion is highlighted in Photo 16.</p>
<p>Photo 16 Unprotected shoreline</p> 	<p>Photo 15 Undercutting due to beach erosion</p> 
<p>Recommendation and SOW</p> <p>Implement coastal protection using either medium armour rock or sand nourishment along exposed area to prevent further erosion and potential damage to carpark and boat ramp assets.</p>	
<p>Priority Medium</p>	<p>Cost estimate: \$ 16,000</p>

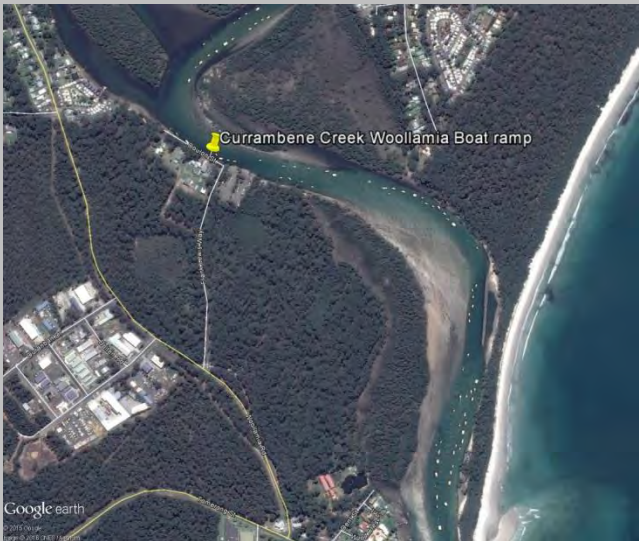


3.9 Orient Point Urban Area (Site 9)

<p>Site Location:</p> <p>Orama Cres, Orient Point 2540</p> <p>Co-ordinates</p> <table> <tr> <td>Upstream</td><td>Downstream</td></tr> <tr> <td>034° 54' 28.0" S</td><td>034° 54' 27.1" S</td></tr> <tr> <td>150° 44' 33.4" E</td><td>150° 44' 37.3" E</td></tr> </table>	Upstream	Downstream	034° 54' 28.0" S	034° 54' 27.1" S	150° 44' 33.4" E	150° 44' 37.3" E	<p>Location Map</p> 
Upstream	Downstream						
034° 54' 28.0" S	034° 54' 27.1" S						
150° 44' 33.4" E	150° 44' 37.3" E						
<p>Description</p> <p>The Orient Point Urban Area consists of four rock groynes located across approximately 100 metres of foreshore. These groynes are the only coastal protection along the foreshore.</p>	<p>Site Condition</p> <p>The recent implementation of rock groynes is working as intended with evidence of sediment control along the shoreline. Between the rock groynes, areas of geotextile material have been exposed and are experiencing degradation (Photo 18). The areas without shoreline protection downstream are experiencing significant erosion (Photo 17).</p>						
<p>Photo 18 Exposed Geotextile Material</p> 	<p>Photo 17 Erosion of unprotected bank</p> 						
<p>Recommendation and SOW</p> <p>Cover exposed geotextile material by sand nourishment to prevent further degradation. Monitor unprotected areas for further erosion following large rain events.</p> <p>Recommended additional works</p> <p>Continue rock groyne along the full extent of the foreshore, implement bank restoration along eroded areas and sand nourishment.</p>							
<p>Priority</p> <p>Low-Medium</p>	<p>Cost estimate:</p> <p>\$ 8,000</p>						




3.10 Myola Groyne (Site 10)

<p>Site Location:</p> <p>Catherine St, Myola 2540</p> <p>Co-ordinates</p> <table> <tr> <td>Upstream</td> <td>Downstream</td> </tr> <tr> <td>035° 01' 44.1" S</td> <td>035° 01' 49.7" S</td> </tr> <tr> <td>150° 40' 24.6" E</td> <td>150° 40' 22.8" E</td> </tr> </table>	Upstream	Downstream	035° 01' 44.1" S	035° 01' 49.7" S	150° 40' 24.6" E	150° 40' 22.8" E	<p>Location Map</p> 
Upstream	Downstream						
035° 01' 44.1" S	035° 01' 49.7" S						
150° 40' 24.6" E	150° 40' 22.8" E						
<p>Description</p> <p>The Myola Groyne consists of small rock rip rap in a compacted binder material with medium armour rock protection. The groyne extends approximately 180 metres into Currambene Creek acting as a creek training wall and preventing breakthrough along the adjacent shore.</p>	<p>Site Condition</p> <p>At the beginning of the groyne area, the base binder has degraded causing minor erosion and displacement of the armour rock highlighted in Photo 20. The structure is still in good condition and operating as intended.</p>						
<p>Photo 19 Minor erosion of base material</p> 	<p>Photo 20 Exposure of base material</p> 						
<p>Recommendation and SOW</p> <p>Place medium armour rock along eroded area to prevent further erosion of the base material. Monitor exposed base material following high rainfall and flood events until remediation has been undertaken.</p>							
<p>Priority Low</p>	<p>Cost estimate: \$ 14,000</p>						

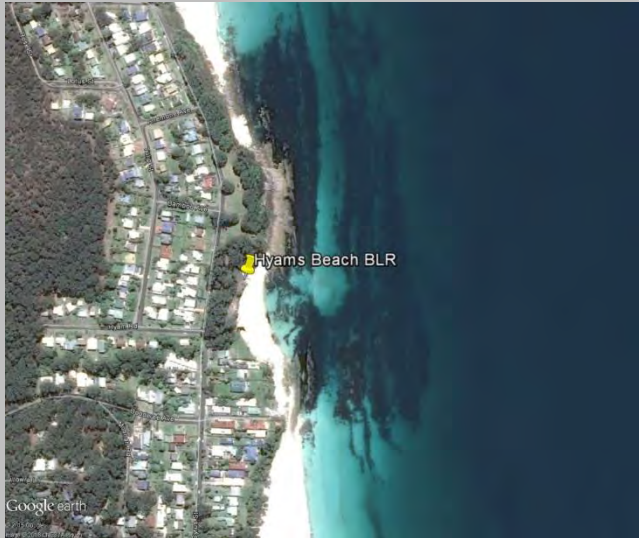


3.11 Currumbene Creek Woollamia boat ramp (Site 11)

<p>Site Location:</p> <p>Frank Lewis Way, Woollamia 2540</p> <p>Co-ordinates</p> <table> <tr> <td>Upstream</td><td>Downstream</td></tr> <tr> <td>035° 01' 28.9" S</td><td>035° 01' 32" S</td></tr> <tr> <td>150° 39' 52.9" E</td><td>150° 39' 59.5" E</td></tr> </table>	Upstream	Downstream	035° 01' 28.9" S	035° 01' 32" S	150° 39' 52.9" E	150° 39' 59.5" E	<p>Location Map</p> 
Upstream	Downstream						
035° 01' 28.9" S	035° 01' 32" S						
150° 39' 52.9" E	150° 39' 59.5" E						
<p>Description</p> <p>The protection along Currumbene Creek spans approximately 200 metres and consists of medium armour rock revetment protecting the steep bank along Coulon St to the Frank Lewis Way intersection. From this intersection to the boat ramp consists of sandstone armour rock bound by concrete.</p>	<p>Site Condition</p> <p>The recently implemented armour rock revetment located along Coulon St is in good condition and working as intended. The armour rock located between the Coulon St junction and the boat ramp has been displaced leading to erosion and exposure of the base material as well as voids in the armour rock as shown in Photo 22. Areas of no protection are experiencing undercutting.</p>						
<p>Photo 21 New rock revetment</p> 	<p>Photo 22 Eroded base material</p> 						
<p>Recommendation and SOW</p> <p>Place medium armour rock (to match existing) along eroded area to prevent further erosion of the base material and to fill voids in existing asset. Extend existing rock armour along small unprotected areas to prevent further undercutting and erosion. Monitor exposed base material following high rainfall and flood events until remediation has been undertaken.</p>							
<p>Priority</p> <p>Low-Medium</p>	<p>Cost estimate:</p> <p>\$ 18,000</p>						

3.12 Voyager Memorial Park Huskisson (Site 12)

<p>Site Location:</p> <p>Currambene St, Huskisson 2540</p> <p>Co-ordinates</p> <table> <tr> <td>Upstream</td><td>Downstream</td></tr> <tr> <td>035° 02' 16.9" S</td><td>035° 02' 16.8" S</td></tr> <tr> <td>150° 40' 23.6" E</td><td>150° 40' 17.3" E</td></tr> </table>	Upstream	Downstream	035° 02' 16.9" S	035° 02' 16.8" S	150° 40' 23.6" E	150° 40' 17.3" E	<p>Location Map</p> 
Upstream	Downstream						
035° 02' 16.9" S	035° 02' 16.8" S						
150° 40' 23.6" E	150° 40' 17.3" E						
<p>Description</p> <p>Voyager Park seawall is located at the entrance of Currambene Creek and is composed of a primary and core rock armour. The structure extends approximately 180 metres from Huskisson boat ramp beside a pedestrian footpath.</p>	<p>Site Condition</p> <p>The seawall structure is in good condition and is operating as intended. There is no evidence of scour or toe failure along the seawall and no erosion behind the armour rock wall.</p>						
<p>Photo 23 Voyager Park Seawall</p> 	<p>Photo 24 Voyager Park Seawall</p> 						
<p>Recommendation and SOW</p> <p>Seawall structure working as intended and is in good condition. Monitor on a biannual basis and after storm events to assess the development of voids along the seawall.</p>							
<p>Priority Low</p>	<p>Cost estimate: Nil.</p>						

3.13 Hyams Beach boat launching ramp (Site 13)

Site Location: Cyrus St, Hyams Beach 2540	Location Map 	
Co-ordinates Boat ramp 035° 05' 59.7" S 150° 41' 35.8" E IS THIS OURS?	Site Condition Significant beach erosion and scour occurring at the bottom of the boat ramp as shown in Photo 25. Multiple voids forming in armour rock between large and smaller armour rock at the toe of the shoreline protection causing slumping.	
Description Hyams Beach boat launching ramp is a watercraft access point protected either side by randomly placed armour rock. This protection runs adjacent to the boat ramp structure and extends along the back of the bank.	Photo 25 Erosion 	
Photo 28 Boat ramp protection 		Recommendation and SOW Remediate adjacent armour rock to the boat ramp and extend into a groyne-like structure to prevent beach erosion, improve usability and prevent further scour of the boat ramp. Remediate voids in existing rock revetment with primary armour to match existing along the bank to prevent further slumping failure and erosion. Consider limiting the use of the boat ramp at low tide due to drop off at the end of the ramp until remediation has been implemented.
Priority	Medium-High	Cost estimate: \$ 30,000

3.14 John Williams Reserve Sanctuary Point (Site 14)

<p>Site Location:</p> <p>Sanctuary Point Rd, Sanctuary Point 2540</p> <p>Co-ordinates</p> <p>Boat launching ramp Southern end of Reserve</p> <p>035° 06' 52.2" S 035° 06' 57.6" S</p> <p>150° 38' 24.1" E 150° 38' 19.6" E</p>	<p>Location Map</p> 
<p>Description</p> <p>The John Williams Reserve shoreline protection consists of a combination of three rock groynes and timber bank protection spanning approximately 200 metres along the foreshore. Private?</p>	<p>Site Condition</p> <p>The John Williams Reserve groynes are working as intended with silty-sand accumulating between them. Exposed geotextile material is located on the northern groyne due to displacement of small armour rock - Photo 26. Slight erosion occurring between groynes in areas that are unprotected.</p>
<p>Photo 26 Exposed Geotextile Material</p> 	<p>Photo 27 Unprotected Shoreline</p> 
<p>Recommendation and SOW</p> <p>Remediate exposed geotextile material to prevent further degradation, monitor timber retaining walls following large flood and storm events.</p> <p>Recommended additional works</p> <p>Implement shoreline protection along unprotected areas using medium armour rock to prevent further erosion of the bank.</p>	
<p>Priority Low</p>	<p>Cost estimate: \$ 12,000</p>

3.15 Sussex Inlet RSL Frontage (Site 15)

Site Location:

Jacobs Drive, Sussex Inlet 2540

Co-ordinates**Downstream**

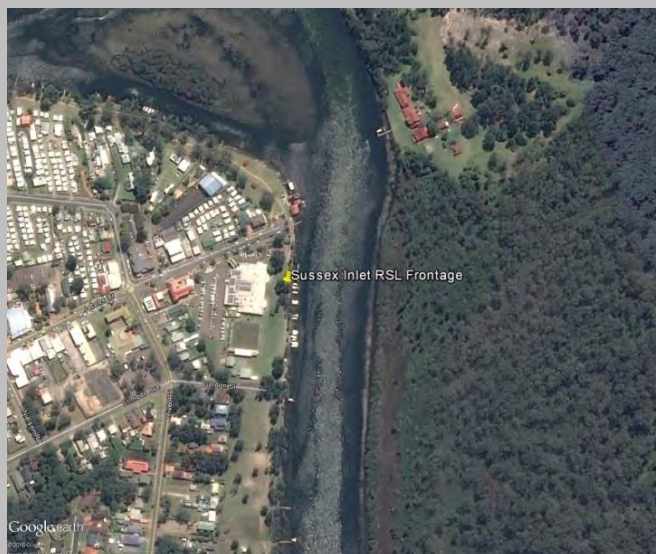
035° 09' 30.5" S

150° 36' 11.3" E

Upstream

035° 09' 25.2" S

150° 36' 16.7" E

Location Map**Description**

The reserve in front of the RSL is protected by timber plank and log retaining walls which span approximately 220 metres along the inlet at Sussex Inlet.

Site Condition

Components of the timber log retaining wall located along the foreshore have displaced causing significant erosion and undercutting highlighted in Photo 28. Other areas along the foreshore are experiencing inundation due to failure and displacement of the shoreline protection techniques employed. The shoreline is also experiencing erosion and undercutting in unprotected areas.

Photo 28 Displacement of Protection



Photo 29 Displacement of Protection

**Recommendation and SOW** What about plank section?

Remediate displaced timber log retaining walls and immersed sections with an armour rock revetment to prevent further erosion of the bank. Monitor bank following significant rain events until remediation is undertaken.

Recommended additional works

Continue protection along unprotected shoreline to prevent further erosion and undercutting of the bank. If beach access needs to be maintained, use sand nourishment, otherwise continue armour rock revetment.




Priority

High

Cost estimate:

\$ 80,000

3.16 Seacrest Caravan Park Sussex Inlet (Site 16)

<p>Site Location:</p> <p>Lakehaven Dr, Sussex Inlet 2540</p> <p>Co-ordinates</p> <table> <tr> <td>Downstream</td> <td>Upstream</td> </tr> <tr> <td>035° 10' 17.3" S</td> <td>035° 10' 14.2" S</td> </tr> <tr> <td>150° 35' 26.1" E</td> <td>150° 35' 30.1" E</td> </tr> </table>	Downstream	Upstream	035° 10' 17.3" S	035° 10' 14.2" S	150° 35' 26.1" E	150° 35' 30.1" E	<p>Location Map</p> 
Downstream	Upstream						
035° 10' 17.3" S	035° 10' 14.2" S						
150° 35' 26.1" E	150° 35' 30.1" E						
<p>Description</p> <p>The shoreline protection spans approximately 140 metres along the front of the bowling club to the Seacrest Caravan Park. It consists of a timber plank retaining walls and four rock groynes.</p>	<p>Site Condition</p> <p>The rock groynes are functioning as intended and have no significant voids. Geotextile material and erosion is visible behind the timber retaining wall as highlighted in Photo 31 below. Exposed geotextile material also located along the shoreline. Minor erosion along the bank due to displacement of armour rock has occurred, however the protection is working as intended.</p>						
<p>Photo 31 Erosion behind retaining wall</p> 	<p>Photo 30 Damaged protection</p> 						
<p>Recommendation and SOW</p> <p>Remediate retaining wall (Photo 31) by implementing an additional base plank and back filling to prevent further erosion and degradation of the geotextile material. Remediate minor erosion due to displacement of armour rock as shown (Photo 30), and cover exposed geotextile material located along the bank to prevent further degradation.</p>							
<p>Priority</p> <p>Low-Medium</p>	<p>Cost estimate:</p> <p>\$ 10,000</p>						

3.17 Lions Park BLR Sussex Inlet (Site 17)

Site Location:

Lakehaven Dr, Sussex Inlet 2540

Co-ordinates**Downstream**

035° 10' 22.3" S

150° 35' 24.2" E

Upstream

035° 10' 18.4" S

150° 35' 25.6" E

IS THIS OURS?**Location Map****Description**

Lions Park boat ramp foreshore protection spans from the Lions Park boat ramp downstream approximately 130 metres to the minor inlet. The shoreline protection asset is made up of timber plank and large armour rock retaining walls.

Site Condition

The shoreline protection asset is in good condition along Lions Park and around the Lions Park boat ramp. One area has experienced erosion behind the wall as shown (Photo 32). The structure is operating effectively and is in good condition in all other locations.

Photo 32 Erosion behind retaining wall






Photo 33 Timber Retaining Wall

**Recommendation and SOW**

Remediate erosion behind timber plank retaining wall as identified in Photo 32 above by filling to match existing to prevent further erosion. Cover exposed geotextile material to prevent further degradation.

Priority Low**Cost estimate:****\$ 6,000**

3.18 Alamein Rd Caravan Park Sussex Inlet (Site 18)

<p>Site Location: Alamein Rd, Sussex Inlet 2540</p> <p>Co-ordinates</p> <table> <tr> <td>Downstream</td><td>Upstream</td></tr> <tr> <td>035° 10' 33.2" S</td><td>035° 10' 23.6" S</td></tr> <tr> <td>150° 35' 25.9" E</td><td>150° 35' 24.6" E</td></tr> </table>	Downstream	Upstream	035° 10' 33.2" S	035° 10' 23.6" S	150° 35' 25.9" E	150° 35' 24.6" E	<p>Location Map</p> 
Downstream	Upstream						
035° 10' 33.2" S	035° 10' 23.6" S						
150° 35' 25.9" E	150° 35' 24.6" E						
<p>Description</p> <p>The shoreline protection at Alamein Rd Caravan Park consists of variable material retaining structures at irregular intervals spanning approximately 300 metres along the foreshore of Sussex Inlet.</p>	<p>Site Condition</p> <p>The shoreline protection is experiencing inundation in some areas - Photo 34 - where slumping and erosion have occurred. Due to the variable nature of the material, potential erosion risks are present leading to void generation and shoreline erosion.</p>						
<p>Photo 34 Inundated Protection</p> 	<p>Photo 35 Deteriorated protection</p> 						
<p>Recommendation and SOW</p> <p>The shoreline protection is experiencing areas minor of deterioration and slumping as highlighted above. Due to the variable and unknown behaviour of the builder's rubble, potential risk to the public is present and it is not considered an effective means of bank protection. Remove existing protection and implement an armour rock revetment similar to Scenic Drive Nowra along the foreshore to remove potential hazard to the public and prevent further bank erosion.</p>							
<p>Priority Medium-High</p>	<p>Cost estimate: \$ 340,000</p>						

3.19 Lake Conjola Entrance Boat Ramp Reserve (Site 19)

<p>Site Location:</p> <p>Lake Conjola Entrance Rd, Lake Conjola 2539</p> <p>Co-ordinates</p> <table border="0"> <tr> <td>Downstream</td> <td>Upstream</td> </tr> <tr> <td>035° 16' 10.9" S</td> <td>035° 16' 08.0" S</td> </tr> <tr> <td>150° 30' 04.2" E</td> <td>150° 29' 58.9" E</td> </tr> </table>	Downstream	Upstream	035° 16' 10.9" S	035° 16' 08.0" S	150° 30' 04.2" E	150° 29' 58.9" E	<p>Location Map</p> 
Downstream	Upstream						
035° 16' 10.9" S	035° 16' 08.0" S						
150° 30' 04.2" E	150° 29' 58.9" E						
<p>Description</p> <p>The shoreline of the Lake Conjola Entrance Boat Ramp Reserve consists of approximately 160 metres of varying sized armour rock. Beyond this protection, areas of unprotected shoreline are exposed to erosion and degradation.</p>	<p>Site Condition</p> <p>In areas protected by armour rock - Photo 36 - visible signs of bank erosion and large voids are evident. In areas without coastal protection, more extensive bank erosion and collapse are evident shown in Photo 37.</p>						
<p>Photo 36 Erosion behind protection</p> 	<p>Photo 37 Erosion of Unprotected Shoreline</p> 						
<p>Recommendation and SOW</p> <p>Remediate behind the rock armour shoreline protection by implementing additional armour rock and utilising geotextile material to prevent further bank erosion. Implement additional scour protection on underside of boat ramp downstream of revetment to prevent further scour.</p> <p>Recommended additional works</p> <p>Implement soft protection such as elcorock or beach nourishment along un-protected beach access points to prevent further bank erosion. Monitor after storm and flood events.</p>							
<p>Priority Medium</p>	<p>Cost estimate: \$ 22,000</p>						

3.20 Lake Conjola Holiday Haven Caravan Park (Site 20)

Site Location:

Lake Conjola Entrance Rd, Lake Conjola 2539

Co-ordinates**Downstream**

035° 16' 08.0" S

150° 29' 58.0" E

Upstream

035° 16' 04.0" S

150° 29' 42.0" E

Location Park**Description**

The shoreline protection located at Holiday Haven caravan park in Lake Conjola spans approximately 420 metres along the shoreline consists of medium rock protection with large sections bound with concrete. Concrete retaining structures have also recently been implemented near the new pedestrian access stairs and in areas of failure of the existing protection as shown in Photo 67.

Site Condition

The coastal protection is operating as intended along the foreshore. The concrete binding is experiencing cracking; however, no significant displacement of the armour rock or failure of the protection is evident.

Photo 66 concrete bound armour rock



Photo 38 Concrete retaining wall

**Recommendation and SOW**

The shoreline protection is operating effectively and is in good condition. Monitor annually and following large storm and flood events.

Priority Low**Cost estimate:**

Nil.

3.21 Edwin Avenue Reserve Lake Conjola (Site 21)

Site Location:

Edwin Avenue, Lake Conjola 2539

Co-ordinates**Downstream**

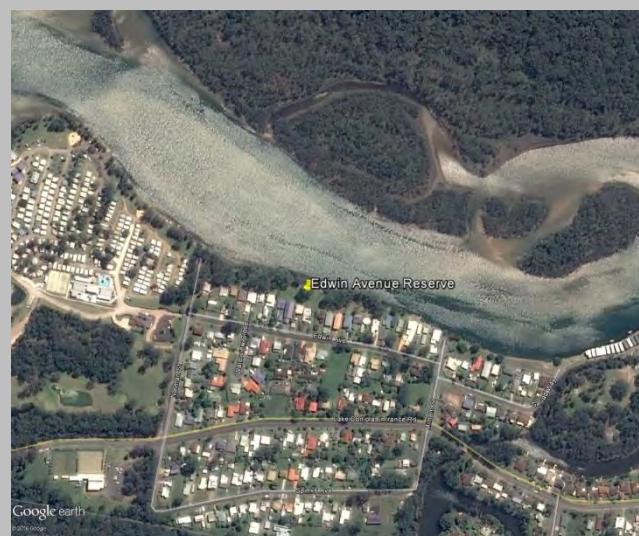
035° 16' 03.0" S

150° 28' 55.1" E

Upstream

035° 16' 01.2" S

150° 28' 46.6" E

Location Map**Description**

Edwin Ave shoreline protection spans approximately 190 metres along the foreshore of the Edwin Avenue Reserve and is made up of variable material including intermittently placed armour rock and builders rubble.

Site Condition

Areas of visible erosion are present along foreshore behind the intermittently placed shoreline protection as shown in Photo 39 and Photo 40 below. Visible signs of slumping are evident. Significant erosion of unprotected areas is also present.

Photo 39 Erosion behind protection



Photo 40 Randomly Placed Protection

**Recommendation and SOW**

Implement armour rock along the extent of the foreshore behind existing slumping and along unprotected areas to prevent further erosion. Due to the variable and unknown behaviour of the builder's rubble, potential risk to the public is present and it is not considered an effective means of bank protection. Remove existing protection and implement an armour rock revetment. Monitor following significant flood events until protection is implemented.

Priority

Medium-High




Cost estimate:

\$ 160,000




3.22 Carroll Avenue Reserve Lake Conjola (Site 22)

Site Location: Carroll Avenue, Lake Conjola 2539		Location Map 							
Co-ordinates <table><tr><td>Downstream</td><td>Upstream</td></tr><tr><td>035° 16' 04.6" S</td><td>035° 16' 03.7" S</td></tr><tr><td>150° 29' 36.8" E</td><td>150° 29' 27.5" E</td></tr></table>		Downstream	Upstream	035° 16' 04.6" S	035° 16' 03.7" S	150° 29' 36.8" E	150° 29' 27.5" E		
Downstream	Upstream								
035° 16' 04.6" S	035° 16' 03.7" S								
150° 29' 36.8" E	150° 29' 27.5" E								
Description The shoreline protection along Carroll Avenue Reserve consists of armour rock revetments and timber plank retaining walls spanning approximately 240 metres.		Site Condition The shoreline asset is in good condition along the reserve with minimal voids. One area of visible erosion is shown in Photo 41. The timber retaining walls are operating as intended and are in good condition.							
Photo 41 Exposed Base Material 		Photo 42 Newly implemented revetment 							
Recommendation and SOW Remediate minor erosion highlighted in Photo 41 above with medium armour rock to prevent further erosion. Shoreline protection working as intended in all other areas.									
Priority	Low	Cost estimate:	\$ 6,000						

3.23 Narrawallee Inlet Bank Protection (Site 23)

Site Location: Marton Porter Dr, Narrawallee 2539		Location Map 							
Co-ordinates <table><tr><td>Downstream</td><td>Boat ramp</td></tr><tr><td>035° 18' 17.9" S</td><td>035° 18' 19.6" S</td></tr><tr><td>150° 28' 22.9" E</td><td>150° 28' 14.4" E</td></tr></table>		Downstream	Boat ramp	035° 18' 17.9" S	035° 18' 19.6" S	150° 28' 22.9" E	150° 28' 14.4" E		
Downstream	Boat ramp								
035° 18' 17.9" S	035° 18' 19.6" S								
150° 28' 22.9" E	150° 28' 14.4" E								
Description The shoreline protection along the bank of Narrawallee inlet consists of five rock groynes and rock revetment spanning approximately 225 metres. Smaller spans between the rock groynes are experiencing undercutting and erosion.		Site Condition Significant displacement of the armour rock is visible along the shoreline creating voids - Photo 44 - leading to significant erosion of base material and exposure of geotextile material.							
Photo 43 Rock Groyne 		Photo 44 Eroded Rock Revetment 							
Recommendation and SOW Remediate by replacing armour rock to prevent further erosion and degradation. As existing armour rock is being dislodged, implement larger armour rock to fill voids. Limit pedestrian access along unprotected steep bank areas to prevent further erosion and reduce potential hazards.									
Recommended additional works Extend the rock revetment along unprotected banks upstream using large armour rock to prevent further erosion of the steep unstable banks.									
Priority	Medium	Cost estimate:	\$ 70,000						

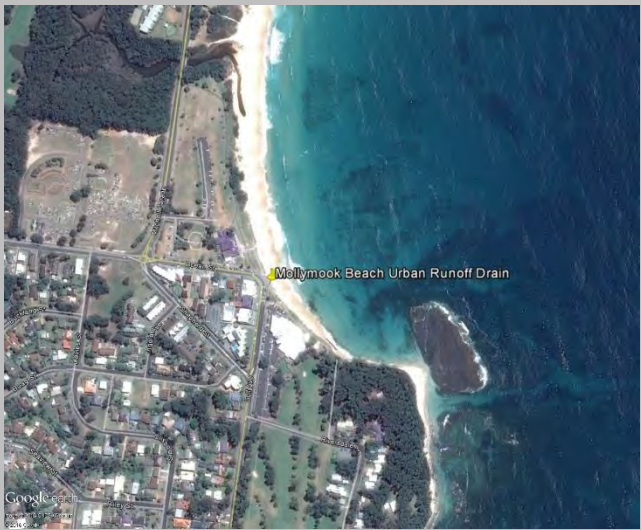


3.24 Mollymoke Farm Creek Training Wall (Site 24)

Site Location: Beach Road, Mollymook 2539	Location Map 	
Co-ordinates River training wall 035° 19' 31.6" S 150° 28' 45.6" E	Description The Beach Rd creek protection consists of a gabion training wall to prevent the creek from swinging to the north, threatening the road embankment and sewerage infrastructure.	
Site Condition The end section of the gabion wall has failed - Photo 46 and Photo 45 causing the training wall to be potentially less effective.		Photo 46 Failed Gabion Mattress close up 
Photo 45 Failed Gabion Mattress 		Recommendation and SOW Remediate approximately six failed gabion baskets to prevent further damage to existing structure . Monitor following large rain events until remediation has been undertaken.
Priority	Medium	Cost estimate: \$ 24,000

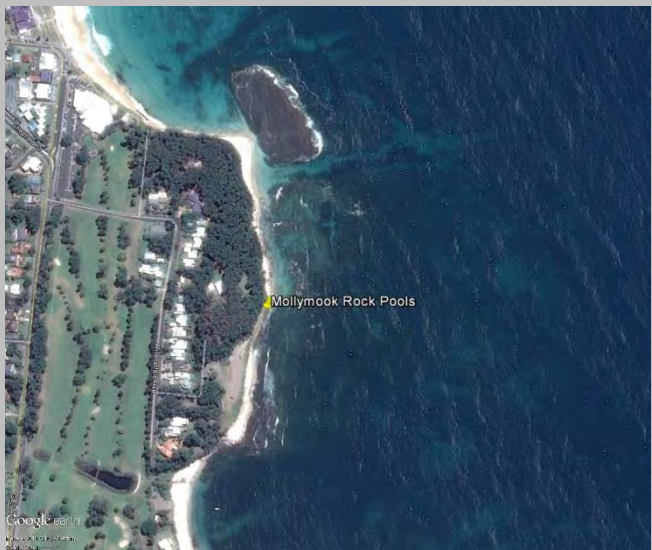


3.25 Mollymook Golf Club Gabion Protection (Site 25)

Site Location: Intersection of Golf Ave and Ocean St, Mollymook 2539		Location Map 	
Co-ordinates			
North End 035° 20' 23.3" S 150° 28' 28.6" E		South End 035° 20' 25.9" S 150° 28' 31.7" E	
Description The Mollymook Golf Club frontage consists of a gabion wall and mattress spanning approximately 110 metres. This asset is needed to protect sewerage infrastructure and the Golf Club.		Site Condition The gabion wall is providing sufficient protection to the golf club foreshore. The gabion wall has been exposed at the toe due to storm erosion (Photo 48). The integrity of the gabion mattress cannot be fully assessed as it is partially covered.	
Photo 47 Gabion Protection Wall 		Photo 48 Exposed Gabion Protection 	
Recommendation and SOW The exposed gabions should be monitored and potentially rehabilitated through sand nourishment. The gabion wall is providing coastline protection as intended.			
Priority	Low	Cost estimate:	\$ 16,000

3.26 South Mollymook Beach sea wall (Site 26)

Site Location: Golf Ave, Mollymook Beach 2520	Location Map 	
Co-ordinates Drain 035° 20' 22.2" S 150° 28' 27.6" E	Description The shoreline protection at south Mollymook Beach consists of approximately 40 meters of a vertical medium armour rock retaining wall protecting the road and adjacent footpath.	
Site Condition The rock retaining wall is working as intended and no displacement or failure of the wall is evident.		Photo 49 South Mollymook Beach 
Photo 50 South Mollymook Beach 		Recommendation and SOW The shoreline protection is operating effectively and is in good condition. Monitor annually and following large storm and/or flood events for significant scouring or failure of the retaining wall.
Priority Low	Cost estimate: Nil.	

3.27 Bogey Hole, Mollymook (Site 27)

Site Location: Riversdale Avenue, Mollymook NSW 2539		Location Map 							
Co-ordinates <table><tr><td>South</td><td>North</td></tr><tr><td>035° 20' 42.1" S</td><td>035° 20' 33.8" S</td></tr><tr><td>150° 28' 35.1" E</td><td>150° 28' 38.4" E</td></tr></table>		South	North	035° 20' 42.1" S	035° 20' 33.8" S	150° 28' 35.1" E	150° 28' 38.4" E		
South	North								
035° 20' 42.1" S	035° 20' 33.8" S								
150° 28' 35.1" E	150° 28' 38.4" E								
Description The shoreline protection consists approximately 70 meters of medium to large armour rock revetment along foot path.		Site Condition Minor displacement of small-medium armour rock is occurring along the however the revetment is in good condition and working as intended. A small section of geotextile material is exposed along the south end of the rock revetment.							
Photo 51 Armour rock revetment 		Photo 52 Displaced armour rock 							
Recommendation and SOW Consider managing pedestrian access along carpark frontage to limit further erosion by implementing designated beach access and using rubber erosion matting on designated access and fencing alternative areas to prevent further erosion of the bank. Monitor annually and following large storm and flood events.									
Priority	Low	Cost estimate:	\$ 8000						

3.28 Ulladulla Harbour Protection Wall (Site 28)

Site Location:

Wason St, Ulladulla 2539

Co-ordinates**Northern End**

035° 21' 17.4" S

150° 28' 30.7" E

Southern End

035° 21' 23.1" S

150° 28' 29.3" E

Location Map**Description**

The shoreline protection inside Ulladulla harbour spans approximately 180 metres and consists of rock revetment which protects the Princes Highway, pedestrian footpaths and the Ulladulla Foreshore.

Site Condition

The rock armour is experiencing slumping at the toe, scour and displacement leading to the exposure of geotextile material, erosion of base material and reduction in the stability of the bank.

Photo 53 Erosion of exposed shoreline

**Recommendation and SOW**

Cover geotextile material with armour rock to prevent further degradation. Remediate voids with larger armour rock to prevent further erosion of the base material and collapse of the revetment. Rehabilitate exposed eroded areas and extend rock revetment along the bank. Monitor revetment following significant storm events.

Recommended additional works

Potentially conduct proper design of shoreline revetment to improve the sustainability of the asset. Implement bank restoration works to prevent damage to the assets being protected.

Priority High**Cost estimate:****\$ 60,000**

3.29 Burrill Lake Lions Park (Site 29)

Site Location:

Dolphin Point Rd, Burrill Lake 2539

Co-ordinates**Downstream**

035° 23' 26.1" S

150° 26' 49.2" E

Upstream

035° 23' 23.3" S

150° 26' 45.3" E

Location Map**Description**

The shoreline protection at Lions Park in Burrill Lake consists of three stub groynes, rock toe protection and vegetation located intermittently along approximately 130 metres of foreshore.

Site Condition

The rock toe protection is experiencing slumping. An overhanging tree - Photo 55 - has the potential to cause significant bank damage. Geotextile material is exposed in areas - Photo 54.

Photo 54 Erosion of exposed bank

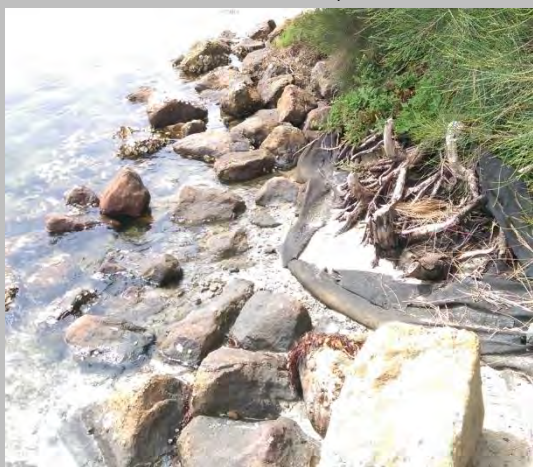


Photo 55 Overhanging tree

**Recommendation and SOW**

To prevent further erosion of the shoreline, implement small armour rock toe protection along the extent of the shoreline and remediate exposed geotextile by sand nourishment.

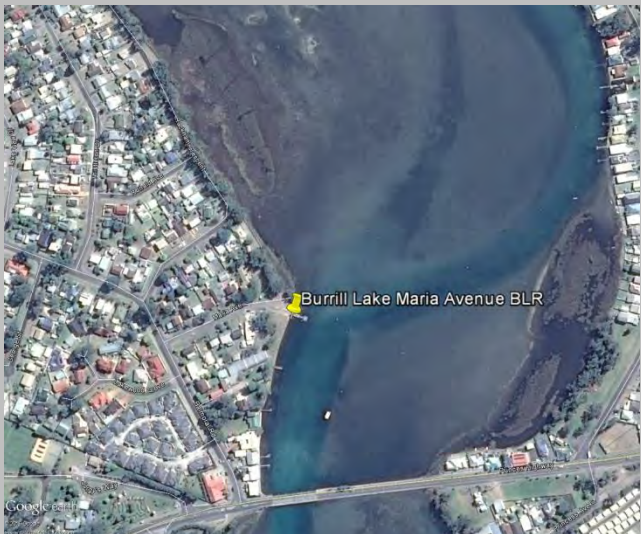


Priority

Low

Cost estimate:

\$ 16,000

3.30 Maria Avenue BLR Burrill Lake (Site 30)

<p>Site Location: Maria Avenue, Burrill Lake 2539</p> <p>Co-ordinates</p> <p>Boat ramp 035° 23' 11.4" S 150° 26' 42.3" E IS THIS OURS?</p>	<p>Location Map</p> 
<p>Description</p> <p>The shoreline at Maria Avenue BLR is protected with two rock groynes as well as a timber log retaining wall.</p>	<p>Site Condition</p> <p>The coastal protection assets are in good condition. The rock groynes are working effectively by accumulating sand and preventing erosion.</p>
<p>Photo 56 Timber retaining wall</p> 	<p>Photo 57 Rock groyne protection</p> 
<p>Recommendation and SOW</p> <p>The shoreline protection is in good condition and is working as intended. The shoreline is not experiencing any erosion.</p>	
<p>Priority Low</p>	<p>Cost estimate: Nil.</p>


3.31 Kendall Crescent BLR Burrill Lake (Site 31)

<p>Site Location:</p> <p>Maria Avenue, Burrill Lake 2539</p> <p>Co-ordinates</p> <p>Boat ramp</p> <p>035° 22' 54.2" S</p> <p>150° 26' 50.2" E</p>	<p>Location Map</p> 
<p>Description</p> <p>The Kendall Crescent shoreline protection includes a rock retaining wall bound by concrete spanning approximately 20 metres.</p>	<p>Site Condition</p> <p>The protection is functioning effectively. Cracks are developing along the concrete binder; however, no failure points are evident. An area of the bank spanning approximately 5 metres is unprotected and is experiencing erosion.</p>
<p>Photo 58 Unprotected shoreline</p> 	<p>Photo 59 Rock retaining wall</p> 
<p>Recommendation and SOW</p> <p>Monitor areas with cracks in the retaining wall to prevent bank failure. Implement medium armour rock along unprotected shoreline as highlighted in Photo 58 to prevent erosion.</p>	
<p>Priority Low</p>	<p>Cost estimate: \$ 6,000</p>

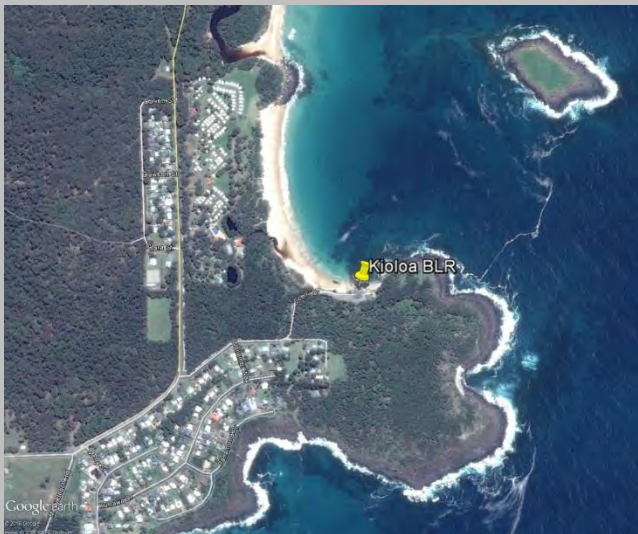


3.32 Dolphin Point Caravan Park (Site 32)

Site Location: Dolphin Point Rd, Burrill Lake 2539		Location Map 							
Co-ordinates <table><tr><th>Upstream</th><th>Downstream</th></tr><tr><td>035° 23' 26.0" S</td><td>035° 23' 40.1" S</td></tr><tr><td>150° 26' 49.3" E</td><td>150° 26' 40.3" E</td></tr></table>		Upstream	Downstream	035° 23' 26.0" S	035° 23' 40.1" S	150° 26' 49.3" E	150° 26' 40.3" E		
Upstream	Downstream								
035° 23' 26.0" S	035° 23' 40.1" S								
150° 26' 49.3" E	150° 26' 40.3" E								
Description The shoreline protection between Lions Park and the southern end of Dolphin Point Caravan Park consists of beach nourishment, two large rock groynes, one smaller rock groyne (at the stormwater run-off drain) and approximately 200 meters of small-medium armour rock revetment spanning between the rock groynes along the caravan park frontage.		Site Condition The rock groynes, armour rock and beach nourishment are in good condition. The major rock groynes are operating as intended capturing sand on the upstream side of the groynes.							
Photo 60 Armour rock revetment 		Photo 61 Armour rock groyne 							
Recommendation and SOW Shoreline protection is in good condition and working as intended. Monitor annually and following large rain and storm events									
Priority	Low	Cost estimate:	Nil.						

3.33 Oak Avenue. Lake Tabourie Channel (Site 33)

<p>Site Location:</p> <p>Short St, Lake Tabourie 2539</p> <p>Co-ordinates</p> <table> <tr> <td>Downstream</td> <td>Upstream</td> </tr> <tr> <td>035° 26' 33.7" S</td> <td>035° 26' 31.3" S</td> </tr> <tr> <td>150° 24' 09.0" E</td> <td>150° 24' 07.8" E</td> </tr> </table>	Downstream	Upstream	035° 26' 33.7" S	035° 26' 31.3" S	150° 24' 09.0" E	150° 24' 07.8" E	<p>Location Map</p> 
Downstream	Upstream						
035° 26' 33.7" S	035° 26' 31.3" S						
150° 24' 09.0" E	150° 24' 07.8" E						
<p>Description</p> <p>The shoreline protection spans approximately 110 metres along the foreshore of Lake Tabourie channel and consists of rock revetments and sand nourishment. This shown below in Photo 63 and Photo 62.</p>	<p>Site Condition</p> <p>The coastal protection is operating effectively. The primary layer is experiencing minor void development due to erosion of the base material and displacement of the armour rock.</p>						
<p>Photo 62 Armour rock revetment</p> 	<p>Photo 63 Armour rock revetment</p> 						
<p>Recommendation and SOW</p> <p>The shoreline protection is operating effectively and is in good condition. Fill voids along revetment with armour rock to match existing.</p>							
<p>Priority Low</p>	<p>Cost estimate: Nil.</p>						

3.34 Kioloa Marine Rescue (Site 34)

Site Location: Scerri Dr, Kioloa 2539		Location Map 	
Co-ordinates			
Eastern Point 035° 33' 29.3" S 150° 22' 59.5" E		Western Point 035° 33' 29.7" S 150° 23' 01.4" E	
Description The shoreline protection spans approximately 90 metres along the frontage of the Coastal Patrol building and consists of rock armour.		Site Condition Areas of displacement of the primary armour rock leading to minor erosion of the base material, however the rock protection is working as intended.	
Photo 64 Kioloa rock revetment 		Photo 65 Kioloa vegetated revetment 	
Recommendation and SOW The shoreline protection implemented at Kioloa BLR is working effectively and is in good condition. Cover secondary armour rock located between the boat ramp and rock revetment with primary armour to prevent displacement during significant rainfall and flood events.			
Priority	Low	Cost estimate:	Nil.

3.35 Kioloa Boat Ramp Carpark (Site 35)

<p>Site Location: Scerri Dr, Kioloa 2539</p> <p>Co-ordinates</p> <table border="1"> <thead> <tr> <th>West</th> <th>East</th> </tr> </thead> <tbody> <tr> <td>035° 33' 28.9" S</td> <td>035° 33' 29.3" S</td> </tr> <tr> <td>150° 22' 55.1" E</td> <td>150° 22' 59.3" E</td> </tr> </tbody> </table>	West	East	035° 33' 28.9" S	035° 33' 29.3" S	150° 22' 55.1" E	150° 22' 59.3" E	<p>Location Map</p> 
West	East						
035° 33' 28.9" S	035° 33' 29.3" S						
150° 22' 55.1" E	150° 22' 59.3" E						
<p>Description</p> <p>The Kioloa boat ramp car park protection spans approximately 100 meters along the shoreline. The protection consists of intermittent armour rock and vegetation.</p>	<p>Site Condition</p> <p>The embankment is experiencing erosion in areas that are not sufficiently protected due to run-off. This erosion is reducing the stability of the shoreline. The armour rock has been displaced.</p>						
<p>Photo 66 Displaced armour rock</p> 	<p>Photo 67 Eroded embankment</p> 						
<p>Recommendation and SOW</p> <p>Implement shoreline protection using a rock revetment along the extent of the site to prevent further erosion and degradation of the embankment. Monitor bank following significant storm events until remediation is undertaken.</p>							
<p>Priority Medium</p>	<p>Cost estimate: \$ 130,000</p>						



Rob Stokes
Minister for Planning

DOC16/285750

Mr Russell Pigg
General Manager
Shoalhaven City Council
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council@shoalhaven.nsw.gov.au

Dear Mr Pigg

Coastal and Estuary Grants for 2016–17

I am pleased to advise that the NSW Government will provide \$83.6 million for coastal management over the next five years from 2016–17 to 2020–21 including:

- \$63.2 million to implement coastal management programs, supporting councils to implement equitable and cost effective actions which reduce exposure to coastal hazards, such as beach erosion, coastal inundation or cliff instability
- \$9.5 million to prepare coastal management programs, helping councils to transition to the new coastal regulatory arrangements, including the requirement for technical studies
- \$7 million to support delivery of statewide scientific and technical advice
- \$3.9 million to enable review and assessment of programs and proposals to ensure consistency with the new coastal management framework.

Applications are being called for Coastal and Estuary Grants for 2016-17. The funding program will have five streams – one for planning and studies, including investigation and design, and cost-benefit analysis, and four for implementing works under each of the coastal management areas under the *Coastal Management Act 2016* (CM Act).

Grant funding will only be available for works that are consistent with a certified Coastal Zone Management Plan (CZMP) or a Certified Coastal Management Program (CMP). Councils who are subject to a Ministerial direction to prepare a CZMP or CMP for a designated coastal erosion hot spot will be able to apply for funding at any time over the next 12 months.

I recognise the majority of coastal councils have dedicated significant time and resources to developing CZMPs to ensure effective management of their coastline. The CM Act includes transitional provisions that allow councils to build on their existing CZMP work and move towards the new CMP arrangements over time. Councils will not be expected to start over with their planning.

The draft Coastal Management Manual outlines a 'fast-track' option, available to councils which are well advanced with their CZMP work when the CM Act takes effect. Under this option not all stages for developing a CMP will need to be undertaken, just those relevant to completing a draft CMP that meets the requirements for submission for certification.

Councils that have received a coastal or estuary management grant to develop a CZMP will be able to transfer the grant to develop a CMP when the CM Act takes effect. Councils that are commencing work on a new CZMP are encouraged to consider the approach for developing CMPs outlined in the draft Coastal Management Manual, and ensure that their initial work includes the development of a scoping study.

Detailed information on the 2016-17 grants process will be available on the Office of Environment and Heritage (OEH) website from 5 July 2016. In the interim, if you have any questions about the grants process, please contact Ms Leah Andrews, Senior Team Leader, Coast, Estuary and Flood Grants, OEH, on 9895 6533 or at leah.andrews@environment.nsw.gov.au.

Yours sincerely



Rob Stokes
Minister for Planning