Appendix B: Location Summaries

B.1 Durras and Cookies Beaches

Durras Beach is a 2.3 km long beach with a low gradient, facing south-east and east (Figure B-1). It is backed by a continuous well-vegetated foredune and a high, healthy hind dune, which is subsequently backed by the 1 km long entrance channel to Durras Lake (Figure B-2). A reef exists 100 m offshore of the entrance to Durras Lake at the northern end of the beach. When the lake is open (it is generally closed) as it was at the time of the inspection (5 December 2012), the reef and tidal shoals produce additional bars, channels and currents in this area. At mid tide, heavy shoaling is observed within the entrance and a sand bar forms seaward of the entrance. Protected shore birds were observed on the shoals near the Durras Lake entrance. The centre of the beach is backed by urban development including the Durras Lake community and a caravan park (Lakesea Park).

The foredune continues to the southern rocks where a small creek (Durras Lake) crosses the beach. The entrance to the creek is controlled by the Durras Road bridge and existing scour protection for the concrete abutments. Scour protection on the northern side of the entrance is composed of granite rock primary armour with an approximate size of 0.5 m. No secondary armour or geotextile underlayer was observed on the structure. There is a natural wall of rock along the southern side of the creek.

To the south-east of Durras Beach, Wasp Island provides protection from wave attack. Therefore, the wave climate exposure generally reduces from north to south along Durras Beach.

Durras Beach has several informal access points across the dune which are found along Durras Lake Road. The road is well protected by the fronting foredune and the beach is not visible from the road.

Cookies Beach (South Durras) is an 800 m long beach with a low gradient, facing east and north-east (Figure B-1). It is located between two low, unnamed rocky headlands. It is backed by a continuous, well-vegetated foredune, which is subsequently backed by a 2 ha lake and the surrounding Cookies wetland area (Figure B-3). The wetland drains via a small creek in the southern corner. At the time of the site inspection (5 December 2012), the creek entrance was closed.

Cookies Beach is exposed to a moderate wave climate, which usually maintains an attached bar with a rip against the northern rocks. The southern end of the beach appears to be exposed to a lower wave climate due to the rocky outcrops around the southern point. During a higher wave climate, rips can form against the southern rocks.

Beach access is available from the northern and southern ends of the beach. The northern end provides pedestrian access to the beach from a small community of houses situated landward of Dilkera Street. Beach access at the southern end is via a designated pedestrian track and a concrete boat ramp, which is situated adjacent to the southern rocks and crosses the beach. A small picnic area and car park at the southern end are in close proximity to the beach and lie at low elevations. A summary of sand sample analysis is shown in Figure B-4

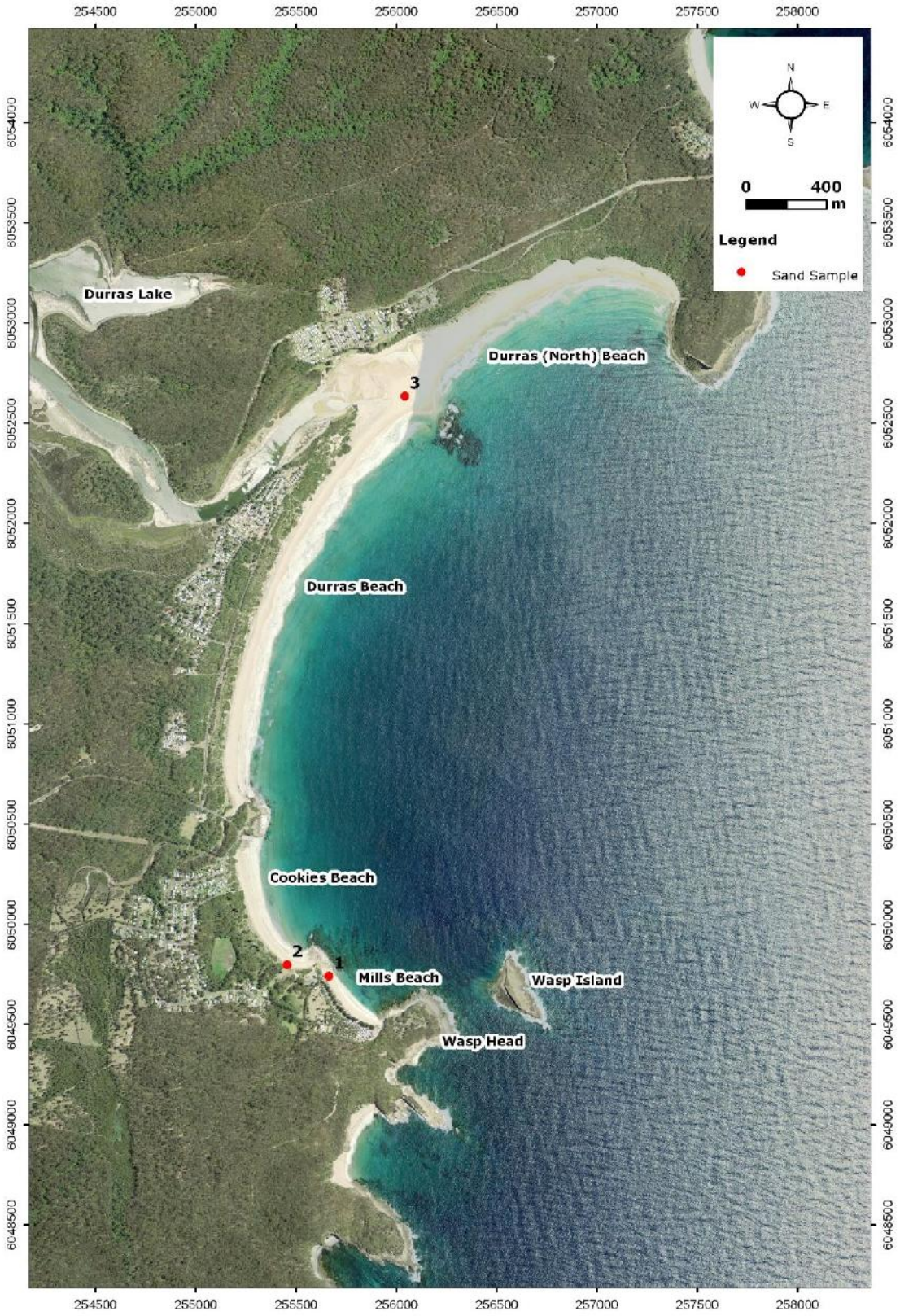


Figure B-1: Durras and Cookies Beaches Site Details

a) View of beachface looking north

b) Durras Lake entrance at northern end

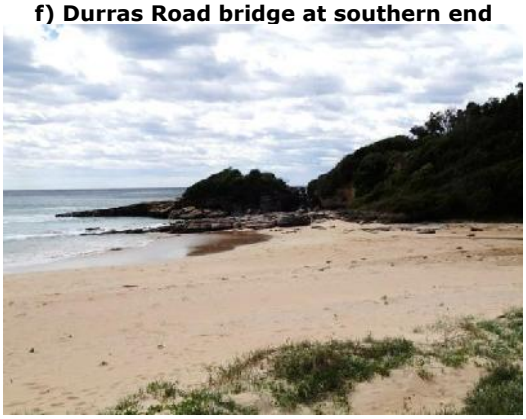
c) Well vegetated dune looking south

d) Well vegetated dune looking north

e) Durras Creek entrance at southern end

f) Durras Road bridge at southern end

g) Dune scarp at the centre of the beach



h) Rock/reef at southern end

Figure B-2: Durras Beach (south) Site Inspection

a) View of beach looking north

b) View of beach looking south

c) Boat ramp at the southern end

d) Rock/reef at southern end

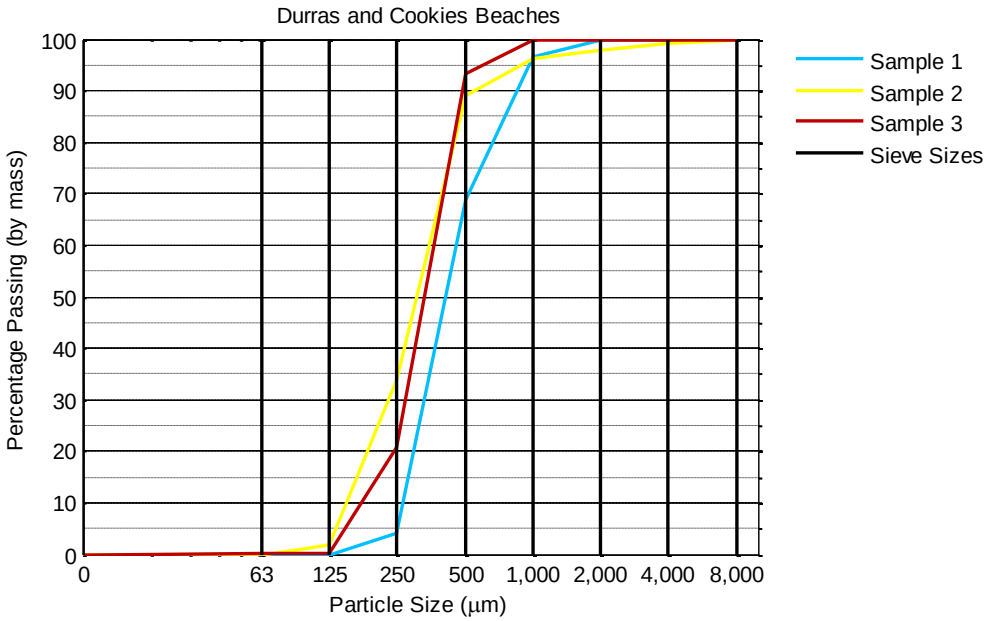
e) Moderate dune vegetation

f) Position of property relative to dune

g) Stormwater outlets at the southern end

h) Formal access way and toilet amenities

Figure B-3: Cookies Beach Site Inspection



Sample 1

Sample 2

Sample 3

Figure B-4: Durras and Cookies Beaches Sediment Samples

B.2 Maloneys Beach

Maloneys Beach is 810 m long with a low gradient facing south (Figure B-5). A well vegetated and relatively steep, stabilised dune exists with a crest level of approximately 6 m AHD for most of the beach, decreasing to 3 m AHD at the eastern and western ends (Figure B-6). There are several breaks in the dune to allow for public pedestrian beach access. At the time of the inspection (1 November 2011), a small scarp was noted at the western end of the beach with one of the public beach access points closed as a result. The entrance to Maloneys Creek exists at the western end of the beach but was not open at the time of the inspection. This creek entrance appears to be quite stable as it is controlled by a box culvert at the bridge and constrained by rock walls on its western side. This creek connects to a large freshwater wetland approximately 800 m upstream. It is understood that beach boat launching occurs from the eastern end of the beach. The beach is backed by a small urban settlement with a ground level of approximately 5.0 m AHD, although there are lower lying areas near the wetland (3.5 m AHD). Car parks exist at both ends of the beach. Reefs exist off the eastern and western ends of the beach providing some protection from wave attack. A summary of sand sample analysis is shown in Figure B-7.

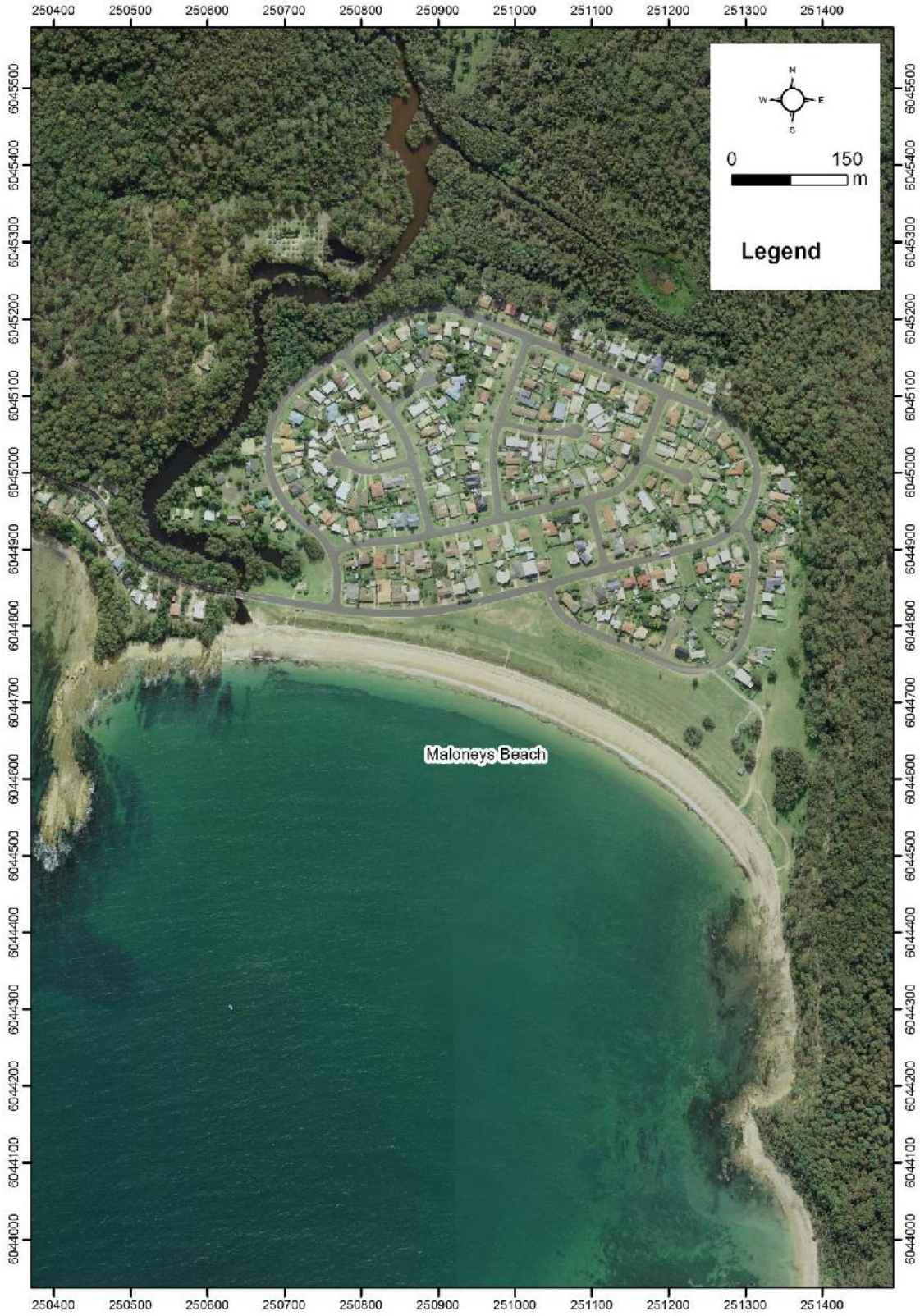


Figure B-5: Maloneys Beach Site Details

a) Rock/reef at eastern end

b) View of beach face looking west

c) Area leeward of the dune (east)

d) Area leeward of the dune (west)

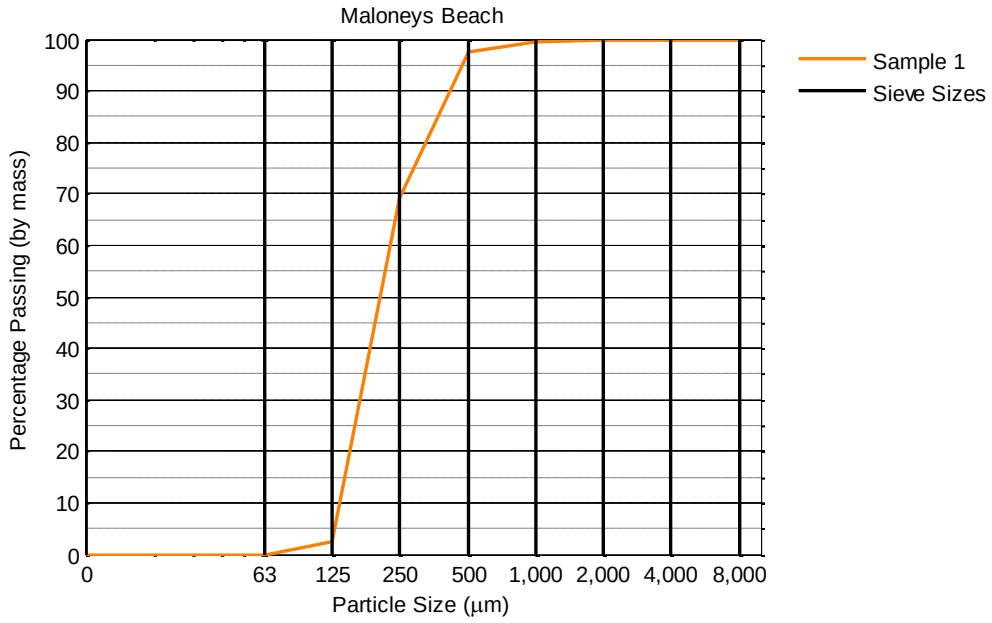
e) Typical well vegetated dune face

f) Scarp at western end of the beach

g) Maloneys Creek outlet

h) Rock/reef at western end

Figure B-6: Maloneys Beach Site Inspection



Sample 1

Figure B-7: Maloneys Beach Sediment Sample

B.3 Long Beach

Long Beach is 2.15 km long with a low gradient facing south and south-east (Figure B-8). Wave climate exposure increases from east to west along Long Beach. Reef exists off the eastern end of Long Beach providing some protection from wave attack.

The eastern third of Long Beach has private properties facing the beach on the northern side of Bay Road (Figure B-9). Two concrete stormwater outlets are located within this section. The foreshore either side of the westernmost stormwater outlet where Fauna Avenue intersects with Bay Road is protected by a rock revetment wall constructed during the 1980s (WMA, 2006). The condition of this wall is unknown (SMEC, 2010), however, WRL estimates that the primary armour is basalt with a typical size of 0.3 to 0.4 m. The wall is largely buried and has an irregular crest level of 3.0 to 3.5 m AHD. Since the structure is largely buried and construction details are unavailable, the alongshore extent of the seawall in Figure 2.7 is approximate only. The dune either side of this wall is poorly vegetated and relatively low, with a similar elevation as the wall. At the time of the inspection (31 October 2011), a small scarp was noted at the eastern end. The ground levels for most properties within the eastern third of Long Beach are above 3.5 m AHD, however, several properties have an elevation of 3.0 m AHD. Four wheel drive (4WD) beach access is available from the eastern end for boat launching. A car park also exists at the western end of this section.

Reed Swamp backs the central third of Long Beach and has an outlet at Sandy Place (100 m west of Long Beach Road). This creek entrance appears to be moderately stable as it is controlled by a box culvert. It is constrained by rock gabions upstream of the culvert, but there is no sidewall protection downstream. The dune height is approximately 5 m AHD except near the Reed Swamp outlet where it drops to approximately 3 m AHD. The back beach area is developed on the southern side of Sandy Place. Seaward of this development the dune is moderately vegetated, but to the west of the developed section, the dune is well vegetated.

The western third of the beach has a dune height of approximately 5 m AHD and is well vegetated (Figure B-10). There are several breaks in the dune to allow for public pedestrian beach access. The back beach area is relatively undeveloped except for a new sub-division on the southern side of Sandy Place. This development is well setback compared to those properties in the eastern and central thirds of the beach. A summary of sand sample analysis is shown in Figure B-11.

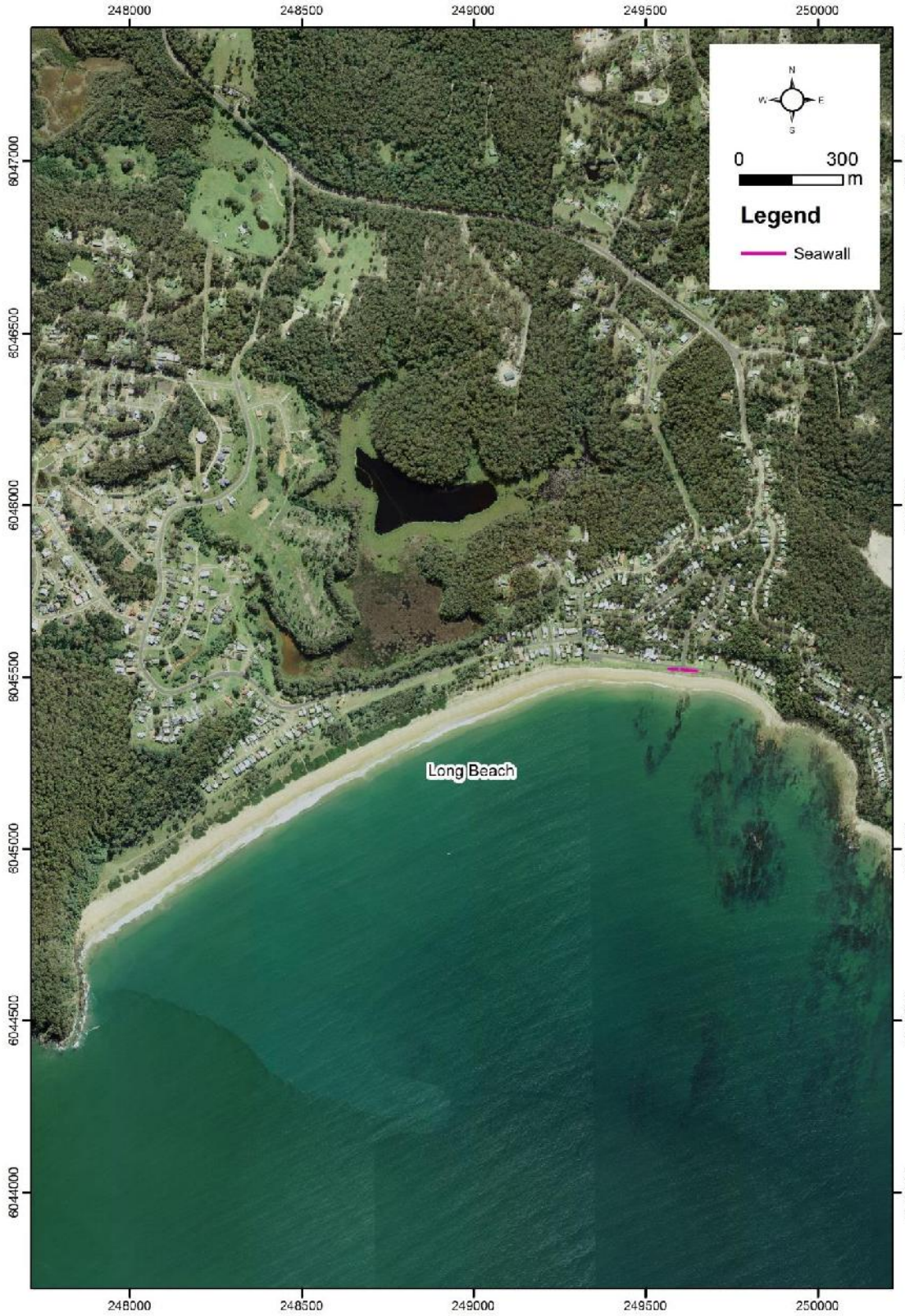


Figure B-8: Long Beach Site Details

a) Scarp at eastern end of the beach

b) View of beach looking west

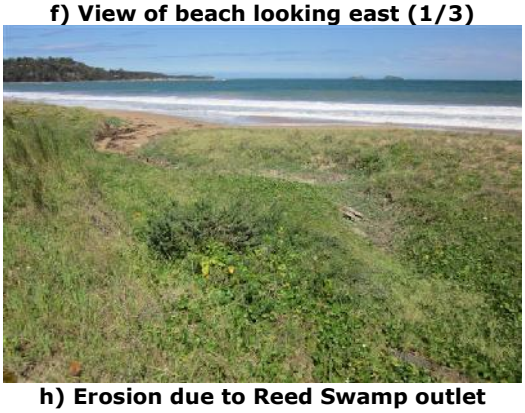
c) Stormwater Outlet 1

d) Partially buried rock revetment wall

e) Stormwater Outlet 2

f) View of beach looking east (1/3)

g) Reed Swamp outlet



h) Erosion due to Reed Swamp outlet

Figure B-9: Long Beach Site Inspection (1 of 2)

a) Vegetation at Reed Swamp outlet

b) Pedestrian beach access at western end

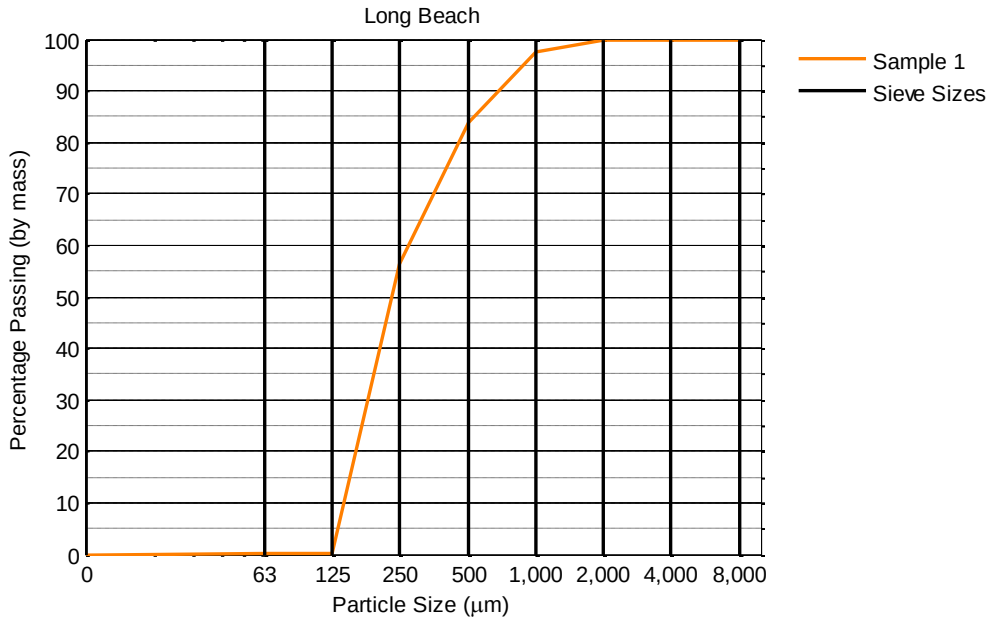
c) View of beach looking west (1/3)

d) View of beach looking east (2/3)

e) View of beach looking west (2/3)

f) Setback development at western end

Figure B-10: Long Beach Site Inspection (2 of 2)



Sample 1

Figure B-11: Long Beach Sediment Sample

B.4 Cullendulla Beach

Cullendulla Beach is a 660 m long beach with a low gradient facing south (Figure B-12). The beach is backed by a series of low beach ridges, then mangroves and inner beach ridges. The back beach area is well vegetated and has a relatively low elevation of between 1.5 and 2.0 m AHD. A scarp running along the length of the beach and vegetation loss due to recession were evident at the time of the site inspection (1 November 2011, Figure B-13). There is no residential development landward of this beach. However, an important sewer rising main, a telecommunications cable and a disused access track run along the back of the beach. The entrance to Cullendulla Creek does not have any artificial training structures, but is naturally constrained on its eastern side by rock shelves and cliffs. It was open at the time of the inspection. The creek connects to a large wetland upstream. A large ebb tide delta extends up to 1 km offshore at the eastern end of the beach. Square Head provides significant protection from swell wave attack for most of the beach. Reef also exists off the western end of the beach (Hawks Nest) providing some additional protection from wave attack. A summary of sand sample analysis is shown in Figure B-14.

Figure B-12: Cullendulla Beach Site Details

a) View of beach face looking north

b) Rock/reef at eastern end

c) View of beach face looking east

d) Scarp at eastern end of the beach

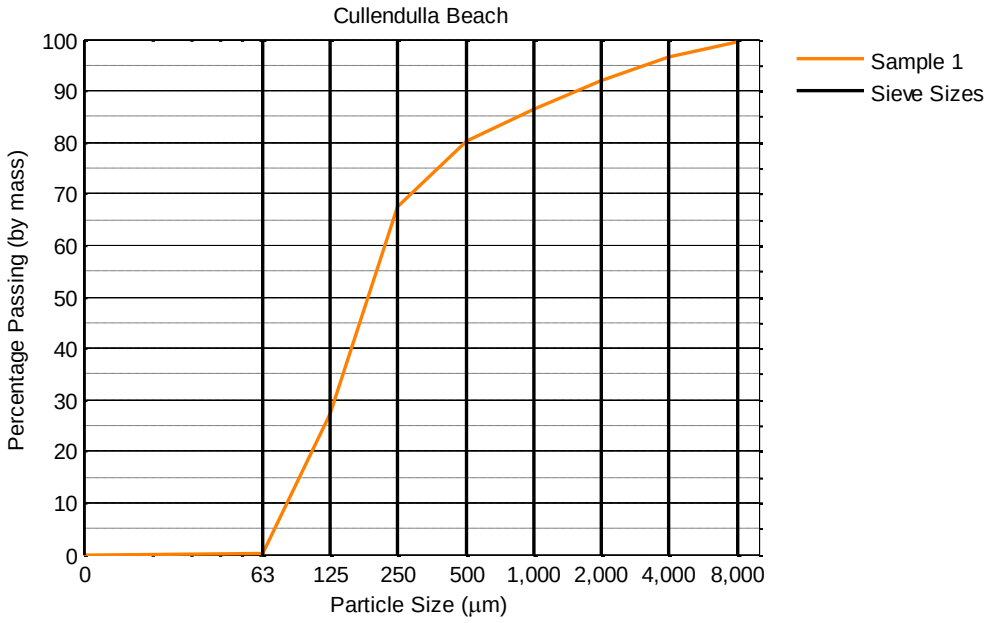
e) Scarp at the centre of the beach

f) Loss of vegetation due to recession

g) Evidence of recession along the beach

h) View of Square Head looking east

Figure B-13: Cullendulla Beach Site Inspection



Sample 1

Figure B-14: Cullendulla Beach Sediment Sample

B.5 Surfside Beach (East and West)

Surfside Beach is sub-divided into two different compartments for the purposes of this Coastal Hazard Assessment, Surfside Beach (East) and Surfside Beach (West) (Figure B-15).

Surfside Beach (East) is an 850 m long beach with a low gradient facing south-east (Figure B-16). The beach dune height is approximately 2.5 m AHD and is moderately well vegetated (although highly variable) along its length. The beach is backed by residential development (seaward of Myamba Parade) with a relatively low ground level of approximately 2.3 m AHD along its full length. Stormwater outlets exist at the northern (outlet damaged at the time of inspection, 31 October 2011) and southern ends of the beach and a sewage pumping station is also located behind the dune. The are several breaks in the dune to allow for public pedestrian beach access, and a car park also exists at the eastern end of the beach. Reefs exist off the northern and southern ends of the beach.

Surfside Beach (West) is a 270 m long beach with a low gradient facing south (Figure B-17). In other reports this same beach has also been referred to as McLeods Beach, Timbara Beach or Wharf Road (East). The beach dune crest is approximately 1.6 m AHD and is vegetated only with grass. The beach is backed by residential development (seaward of Myamba Parade) at the eastern end of the beach. The entrance to Surfside Creek exists at the western end of the beach but was not open at the time of inspection (31 October 2011). This creek extends 400 m from the opening where it joins a freshwater wetland. The creek entrance appears to be quite stable as it is controlled by a three pipe culvert under McLeod Street. The pipe culverts were half blocked due to sediment infilling from the beach. Reefs exist off the eastern and western ends of the beach providing some protection from wave attack. During the site inspection (31 October 2011), it was noted that waves approached the beach at an oblique angle producing a net longshore current westwards along the beach. A summary of sand sample analysis is shown in Figure B-18 and Figure B-19.

Figure B-15: Surfside Beach (east and west) Site Details

a) Rock/reef at northern end

b) Sewage pumping station

c) View of beach face looking north

d) View of beach face looking south

e) Pedestrian beach access at the centre

f) Typical setbacks of development

g) Stormwater outlet at southern end

h) Rock/reef at southern end

Figure B-16: Surfside Beach (east) Site Inspection

a) Rock/reef at eastern end

b) Typical oblique wave approach

c) View of beach face looking east (1/2)

d) View of beach face looking west

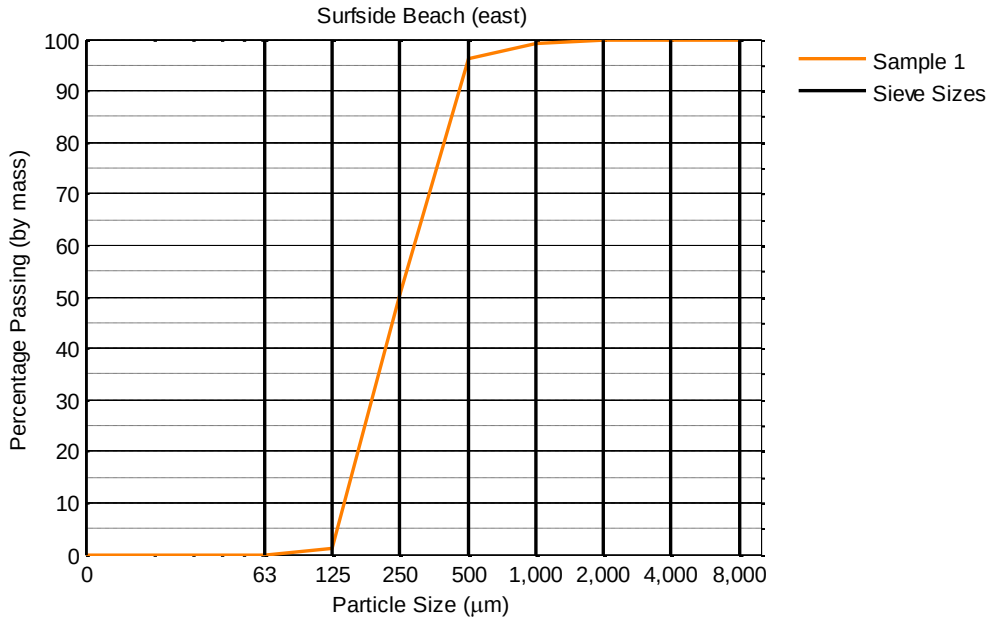
e) Typical setback of development

f) Surfside Creek outlet

g) View of beach face looking east (2/2)

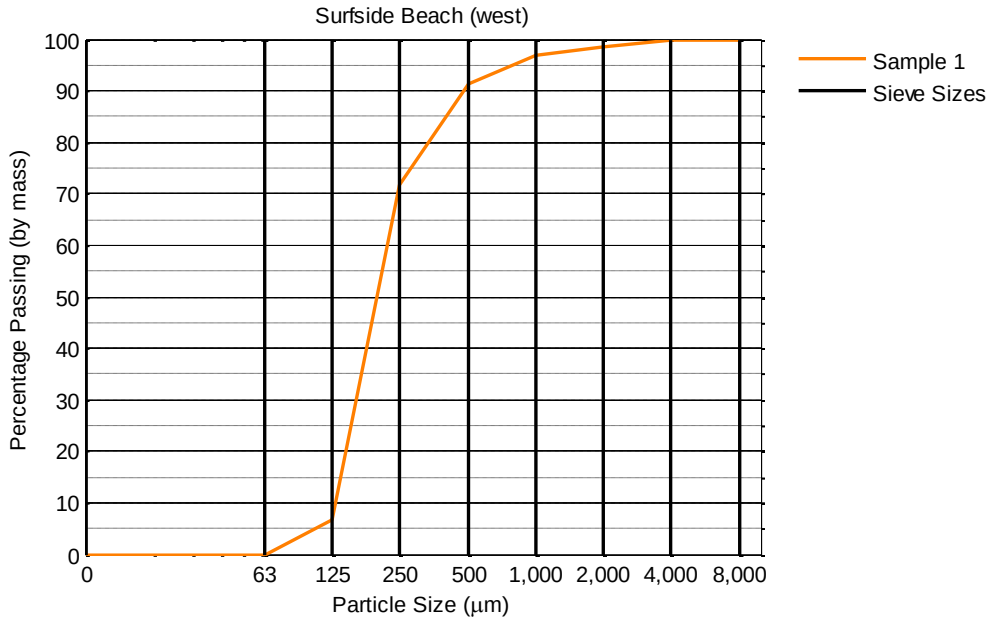
h) Rock/reef at western end

Figure B-17: Surfside Beach (west) Site Inspection



Sample 1

Figure B-18: Surfside Beach (east) Sediment Sample



Sample 1

Figure B-19: Surfside Beach (west) Sediment Sample

B.6 Wharf Road

Wharf Road is a 900 m crenulate strip of sand fronted by dynamic tidal sand flats up to 200 m wide, then a series of tidal channels and shoals extending up to 600 m into the bay and edge of the deep channel (Figure B-20). This sub-section of the coastline is bound to the east by Surfside Beach (West) and to the west by the entrance to the Clyde River with a control point on the northern Princes Highway bridge abutment. It faces to the south-east around to the south-west. At the eastern end of this sub-section, several properties are located seaward of McLeod Street. Access to these areas by WRL was limited as it was private property. The westernmost of these properties is fronted by an unapproved groyne which ESC has requested to be removed (Figure B-21). It appears to WRL that the primary armour on the groyne is basalt, however, building waste has also been included. At a bend in Wharf Road itself, a rock revetment wall protects the road from erosion. WRL considers that at least two different types of rock have been used as armour on this rock revetment. At the eastern end of this wall, the armour had been grouted together with mortar. A caravan park (BIG4 Batemans Bay at Easts Riverside Holiday Park) is located seaward of Wharf Road in the central part of this coastline sub-section. A car park also exists at the western end of the sub-section. A second rock revetment wall protects the caravan park and the car park (Figure B-22) with a crest level between approximately 1.5 and 1.9 m AHD. Again, it appeared that at least two different types of rock with a wide grading have been used as armour on this second revetment. A local stormwater outlet from the caravan park is located within the face of the revetment. At the western end of Wharf Road, the rock revetment wall is completely buried. Note that there is an unprotected section of coastline between the revetment protecting the road and the revetment protecting the caravan park. At the time of the inspection (31 October 2011), a large sand spit was located seaward of the western end of Wharf Road. A small, moderately vegetated dune was located in its lee. It was observed that wave energy at Wharf Road is highly dependent on the tide.

Figure B-20: Wharf Road Site Details

a) View of beach looking east

b) Unapproved groyne

c) Rock armour at the head of the groyne

d) Building waste used as groyne armour

e) Rock revetment wall

f) Wall armour is grouted together

g) Rock wall armour properties are mixed

h) View of beach looking west

Figure B-21: Wharf Road Site Inspection (1 of 2)

a) Eastern end of rock revetment wall

b) View of revetment wall looking west

c) Rock wall armour properties are mixed

d) Stormwater outlet from caravan park

e) View of revetment wall looking east

f) Moderately vegetated dune face

g) Sand spit at western end

h) View of beach looking east

Figure B-22: Wharf Road Site Inspection (2 of 2)

B.7 Central Business District

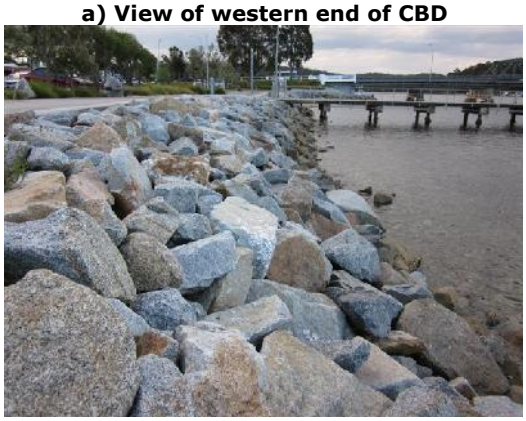
The Central Business District (CBD) coastline sub-section has a length of 680 m (Figure 2.18) facing north-east. It is bound to the west by the entrance to the Clyde River and to the east by the Boat Harbour sub-section. The entire coastline of the CBD is highly developed and armoured. A rock revetment wall protects the full length of the CBD from erosion (Figure 2.19). A pedestrian footpath with elevation varying between 1.7 and 2.2 m AHD is located leeward of the rock revetment wall. Most of the CBD area is at or below the level of the revetment crest. At the time of the inspection (1 November 2011), a small pocket beach existed at the western end of the sub-section. Two box culverts (at the centre and eastern ends of the sub-section) drain stormwater into Batemans Bay. Many smaller local stormwater outlets are also located within the face of the revetment, particularly at the eastern end (Figure 2.20). There are three timber structures creating public space above and seaward of the revetment wall and four wharves for vessels to dock against. This sub-section receives protection from offshore shoals which induce incident wave breaking. At the time of the site inspection (1 November 2011), an onshore breeze was blowing white water up and onto the pedestrian footpath from waves breaking on the revetment.

Overall, the condition of the rock revetment wall around the CBD is considered to be reasonable. However, WRL recommends that ongoing monitoring of the condition of the wall be undertaken by ESC according to coastal engineering guidelines (USACE, 2006). At the western end of the CBD (up to the second wharf), the revetment is mainly composed of granite with an approximate size of 0.4 m. In this region, the armour appears to have recently been topped up. The structure slope in this region is relatively steep at approximately 1V:1.2H. There is a change in armour between the second wharf and the third wharf (Innes Boatshed), with at least two different types of rock (granite and another unknown material) used on the revetment. The granite has an approximate size of 0.3 m and the unknown rock type has a size of 0.9 m. The structure slope in this region is relatively flat at approximately 1V:2.0H. It should be noted that directly under the Innes Boatshed there is no rock revetment. Instead, the rock wall temporarily discontinues and is replaced by a vertical concrete besser block wall. Some pavers in the footpath were noted to be settling in this area, probably due to undermining or loss of fill through the wall. East of the third wharf (Innes Boatshed) the armour was mainly composed of granite with an approximate size of 0.4 m and a structure slope of 1V:2.0H. A geotextile filter was generally evident under the armour along the full length of the revetment.

Figure B-23: CBD Site Details

a) View of western end of CBD

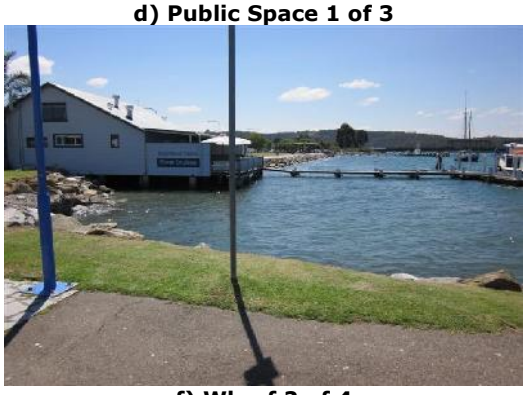
b) Wharf 1 of 4



c) View of revetment wall looking west 1

d) Public Space 1 of 3

e) View of revetment wall looking west 2



f) Wharf 2 of 4

g) Stormwater outlet

h) Wharf 3 of 4

Figure B-24: CBD Site Inspection (1 of 2)

a) View of revetment wall looking south

b) Public Space 2 of 3

c) Public Space 3 of 3

d) Wharf 4 of 4

e) Typical local stormwater outlet

f) View of revetment wall looking north

g) Geotextile underlayer visible

h) Stormwater outlet

Figure B-25: CBD Site Inspection (2 of 2)

B.8 Boat Harbour

The Boat Harbour coastline sub-section has a length of 2.07 km (Figure B-26) facing north-east. It is bound to the west by the CBD and to the east by Corrigans Beach. A single, medium-density residential building is located seaward of Beach Road at the centre of the sub-section. Further to the east are a car park and buildings associated with the marina. A rock wall protects the full length of the Boat Harbour sub-section from erosion (Figure B-27). Where this structure runs parallel to the river channel it is considered to be a training wall (crest 1.8 to 2.2 m AHD). It is considered to act as a breakwater for the Boat Harbour itself. For the remainder, it is considered to be a revetment (crest approximately 1.5 to 2.0 m AHD). Three stormwater outlets are located within the face of the revetment. Each of these was originally fitted with a floodgate. At the time of the inspection (1 November 2011), one floodgate was missing and two were blocked due to sediment infilling from the beach. Three distinct reef sections run perpendicular to the revetment, trapping sand in a manner similar to groynes. Again, this sub-section receives protection from offshore shoals which induce incident wave breaking.

WRL understand that ESC is responsible for the maintenance of the revetment where Beach Road is located immediately in its lee (up to 50 m east of Herarde Street). The condition of the rock revetment wall under the responsibility of ESC is considered to be fair, however, one section requires immediate attention. Ongoing monitoring of the condition of the remainder of the wall should be undertaken by ESC. At the western end, the revetment is mainly composed of granite with an approximate size of 0.7 m, a geotextile underlayer and a relatively steep slope of approximately 1V:1.0H. Opposite "The Old School House" (TOSH, 10 Beach Road), the revetment structure and its condition changes considerably; this region requires immediate attention from ESC. The rock type is unknown with an approximate size of 0.4 m and a structure slope of 1V:1.0H. No geotextile underlayer was visible. In this region, the crest of the revetment is below the level of Beach Road and fines are being lost through the wall over a distance of approximately 100 m. East of this section, the revetment rock changes back to granite with an approximate size of 0.7 m and a slope varying between approximately 1V:1.2H and 1V:1.6H. No geotextile underlayer was visible in this region.

While a review of the internal marina and the intertidal basin is beyond the scope of this study, it has significantly infilled with sediment. The outlet of Hanging Rock Creek is also within the marina. The Hanging Rock boat ramp is located towards the eastern end of the sub-section (Figure B-28). Extensive urban development is located landward of the marina and the boat ramp. Properties seaward of Beach Road and Tuna Street have variable degrees of protection from coastal processes. Again, this sub-section receives protection from offshore shoals which induce incident wave breaking.

Figure B-26: Boat Harbour Site Details

a) Western end of rock revetment wall

b) Stormwater outlet (missing floodgate)

c) Revetment rock armour type 1 of 2

d) Revetment rock armour type 2 of 2

b) Stormwater outlet (blocked floodgate)

f) Stormwater outlet (blocked floodgate)

g) Eastern end of rock revetment wall

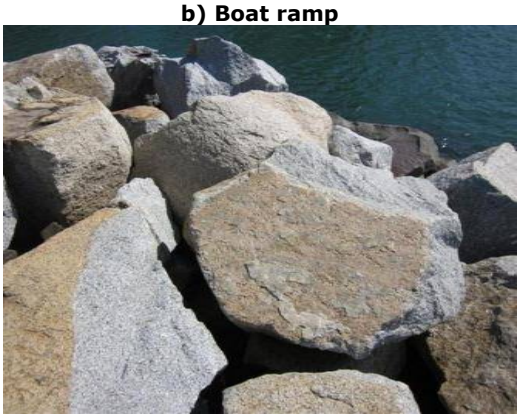
h) Western end of rock training wall

Figure B-27: Boat Harbour Site Inspection (1 of 2)

a) View of boat harbour looking west

b) Boat ramp

c) Concrete cube wall seaward of development



d) Typical primary rock armour

b) View of rock training wall looking east

f) View of rock training wall looking west

g) Typical secondary rock armour

h) Eastern end of rock training wall

Figure B-28: Boat Harbour Site Inspection (2 of 2)

B.9 Corrigans Beach

Corrigans Beach is a 1.8 km long artificially accreted beach with a low gradient facing north-east (Figure B-29). This beach commences at the eastern end of the Boat Harbour training wall (Figure B-30). Construction of the training wall was initially completed in 1905 but it was extended eastward in 1991. As a result of both these works, sand accumulated on the southern side of the training wall, accreting the shoreline by up to 600 m since 1905 to form Corrigans Beach. The foredune dune is low (typical elevation of 2.5 to 3.0 m AHD), wide and moderately vegetated. The low foredune height is largely attributable to the rapid accretion rate experienced here for more than 110 years (i.e. insufficient time for a higher foredune to develop). The dune is backed by a large flat area of relatively new, accreted land.

The entrance to Joes Creek exists at the centre of the beach but was not open at the time of the inspection. The seaward part of the creek entrance is not visibly structurally controlled save for the Beach Road bridge further inland. Three smaller creeks also have outlets at the southern end of the beach. 4WD beach access for boat launching and a car park exist at the southern end.

Development in the lee of Corrigans Beach consists of two caravan parks at the centre (BIG4 Batemans Bay Beach Resort) and southern end of the beach (Clyde View Holiday Park) with typical ground elevations of 1.6 m AHD and several freestanding buildings at the southern end.

In addition to sand accumulation due to the presence of the training wall, sand dredged from the Clyde River (ebb tide) bar has repeatedly been placed at the northern and centre thirds of Corrigans Beach over many years. Buildings in the northernmost caravan park are set back further from the shoreline that those in the southern caravan park. The foreshore of the southern caravan park is protected by a rock revetment wall. The condition of this wall is unknown and was predominantly buried at the time of the inspection (1 November 2011). Since construction details are unavailable, the alongshore extent of the seawall in Figure B-29 is approximate only.

Reef exists off the southern end of the beach providing some protection from wave attack. Additional protection from wave attack is provided by Observation Head and Snapper Island.

Figure B-29: Corrigans Beach Site Details

a) Training wall at northern end of beach

b) View of beach looking south

c) View of beach looking north

d) Moderately vegetated dune face

b) Joes Creek outlet

f) Typical setback of northern tourist park

g) 4WD beach access corridor

h) Predominantly buried rock revetment wall

Figure B-30: Corrigans Beach Site Inspection

B.10 Caseys Beach

Caseys Beach is an 850 m long beach with a low gradient facing east (Figure B-31). A rock revetment wall protects most of the foreshore from erosion (Figure B-32). Beach Road is located immediately in the lee of the revetment and its elevation varies between 3 and 4 m AHD. The beach itself does not have a notable dune system. While there is significant urban development landward of Beach Road, a sewage pumping station is the main asset seaward of the road. There are several breaks in the revetment to allow for public pedestrian beach access typically via stairs. Three stormwater outlets are located within the face of the revetment. One of these was fitted with a floodgate which was blocked due to sediment infilling from the beach at the time of the inspection (31 October 2011, Figure B-33). Short Beach Creek also has an outlet at the southern end of Caseys Beach. It runs under the Beach Road bridge and is constrained by the bridge abutments. At commencement of the site inspection, the creek entrance was initially closed but "broke out" during the inspection. Car parks exist at both ends of the beach. Reefs exist off the northern and southern ends of the beach providing some protection from wave attack.

Overall, the condition of the seawall along the northern part of Caseys Beach is considered to be poor and requires immediate action and ongoing monitoring by ESC. The reader is referred to WRL's detailed condition assessment and design advice report for this seawall (Blacka and Coghlan, 2016).

Since WRL's original site inspection on 31 October 2011, WRL also prepared a detailed condition assessment and design advice report for the seawall along the southern part of Caseys Beach which protects the sewage pumping station (Coghlan and Drummond, 2013). In April 2017, upgrade works on this seawall section were completed.

Figure B-31: Caseys Beach Site Details

a) Rock/reef at northern end

b) View of beach looking south

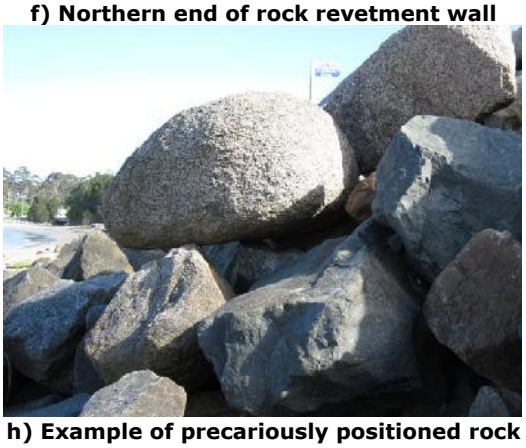
c) Stormwater outlet

d) Stormwater outlet

e) Typical pedestrian beach access

f) Northern end of rock revetment wall

g) Some slumping of armour at the crest



h) Example of precariously positioned rock

Figure B-32: Caseys Beach Site Inspection (1 of 2)

a) Short Beach Creek outlet

b) Creek outlet following "break out"

c) Scour protection at bridge abutments

d) Unprotected section of beach

e) Sewage pumping station

f) Stormwater outlet (blocked floodgate)

g) Southern end of rock revetment wall

h) Rock/reef at southern end

Figure B-33: Caseys Beach Site Inspection (2 of 2)

B.11 Sunshine Bay

Sunshine Bay is a 520 m long beach with a low gradient, facing east to north-east (Figure B-34). The bay is semi-circular and is located between two well vegetated 20 m high headlands. The beach gradient reduces north to south with scarps noticeable along the foreshore. It is bordered and fronted by considerable rock and reef resulting in a low wave climate. There is no natural dune at Sunshine Bay (Figure B-35). A natural rock outcrop at the northern end of the beach had formed a small salient at the time of the site inspection (5 December 2012). Additional protection from wave attack is also provided by the Tollgate Islands to the south-south-east.

Beach Road runs just behind the beach with a small parking area towards the southern end, opposite a caravan park (Pleasurelea Tourist Resort). The car park is positioned landward of a low point in the beachface providing informal pedestrian access to the beach. Adjacent to the south side of the car park are several houses including a boatshed with a launching ramp and small wooden retaining wall. These structures are located at low elevations in close proximity to the beach. A summary of sand sample analysis is shown in Figure B-36.

Figure B-34: Sunshine Bay Site Details

a) View of beach looking north

b) View of beach looking south

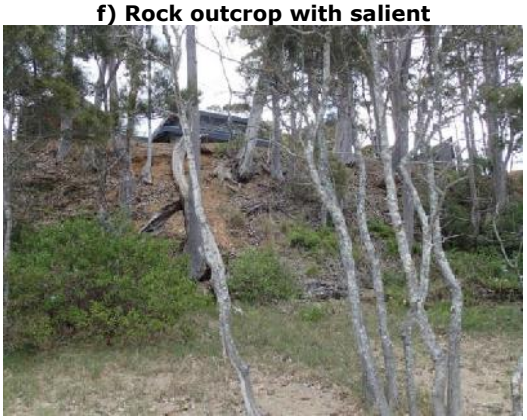
c) Loss of vegetation

d) Scarp at the southern end of the beach

e) Wooden retaining wall at southern end

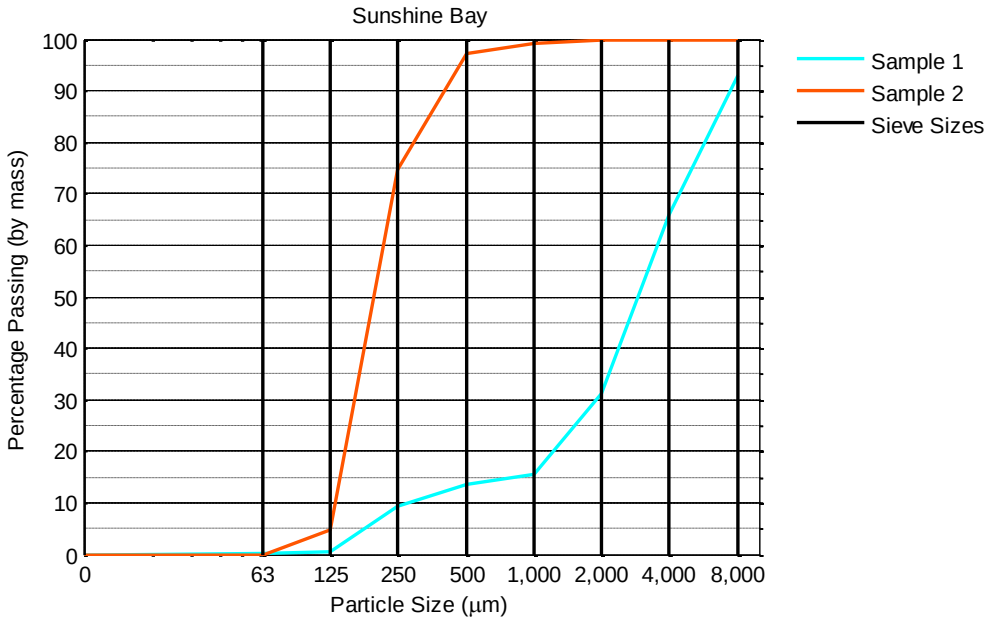
f) Rock outcrop with salient

g) Informal pedestrian beach access



h) Typical house located at northern end

Figure B-35: Sunshine Bay Site Inspection



Sample 1 Sample 2

Figure B-36: Sunshine Bay Sediment Samples

B.12 Malua Bay

Malua Bay is a 510 m long beach with a low gradient, facing east (Figure B-37). It is bordered by Malua Head to the north and the base of Pretty Point to the south. Two creeks drain across the beach: Reedy Creek at the northern end and a small creek at the southern end (Figure B-38). Reedy Creek entrance is typically open and drains across a rock bed at the base of Malua Head, whereas, the creek mouth at the southern end is rarely open. These typical entrance conditions were observed at the time of the site inspection (5 December 2012). Both creeks are heavily vegetated along their banks and are controlled by culverts under George Bass Drive. Reedy Creek is controlled by three 3 m wide box culverts approximately 200 m landward of the beach and the southern creek is controlled by three 1.8 m concrete pipes approximately 100 m landward of the beach.

Malua Bay is exposed to a moderate wave climate which usually maintains an attached bar with a rip against the northern rocks. Higher waves produce a southern boundary rip and a shifting central rip, which are at times linked by a continuous trough.

There is no natural dune at Malua Bay, but the beach is backed by a grassed picnic area allowing uncontrolled pedestrian access along the entire beach. The park contains the Malua Bay SLSC, a picnic area with public amenities, walking paths, a playground and shops fronting George Bass Drive. Parking is available next to the shops at the northern end and on landward of Malua Bay SLSC.

At the eastern end of Kuppa Avenue, an apartment block and a telecommunications pit are located at low elevations in close proximity to the beach. Some houses at the southern end of Malua Bay are also in close proximity to the beach.

Some houses at the southern end of Malua Bay are protected by a revetment wall. Primary armour on the revetment is composed of approximately 0.7 m size rock but no underlayer or secondary armour are apparent. The structure slope of the revetment wall is steep at approximately 1.0V:1.0H. A summary of sand sample analysis is shown in Figure B-39.

Figure B-37: Malua Bay Site Details

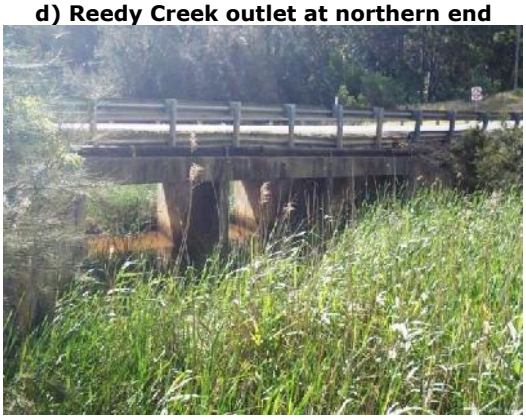
a) View of beach looking north

b) View of beach looking south

c) Blocked stormwater pit at southern end

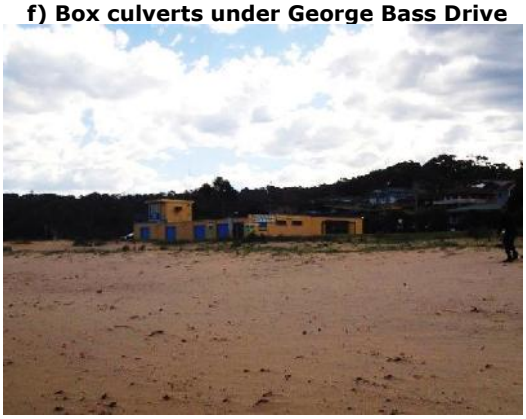
d) Reedy Creek outlet at northern end

e) Well vegetated dunes



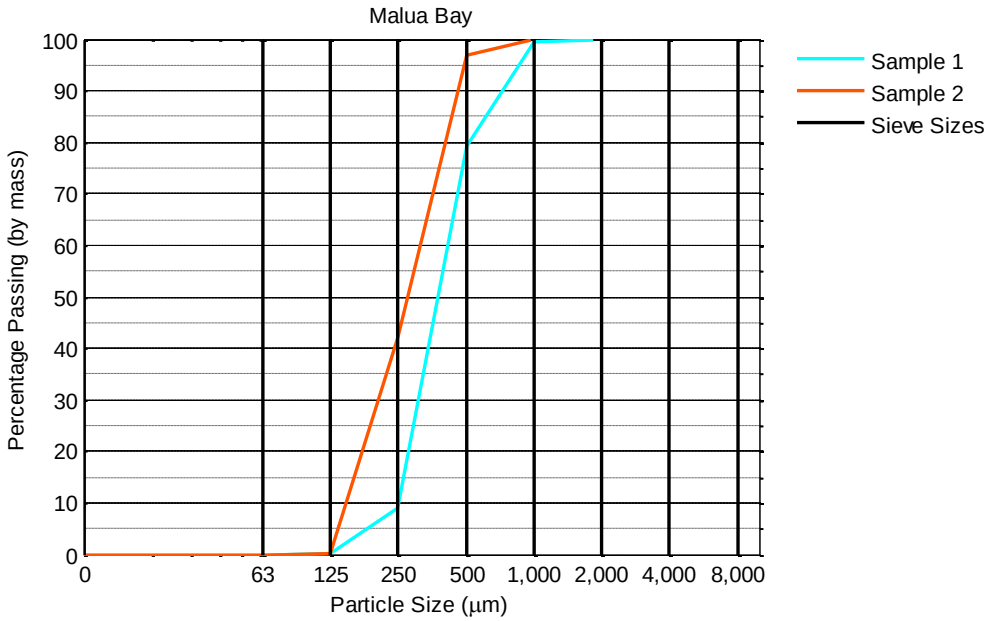
f) Box culverts under George Bass Drive

g) Rock revetment at southern end



h) Malua Bay Surf Life Saving Club

Figure B-38: Malua Bay Site Inspection



Sample 1 Sample 2

Figure B-39: Malua Bay Sediment Samples

B.13 Guerilla Bay

Guerilla Bay is a 290 m long beach with a high gradient, facing north-east (Figure B-40). It is located at the southern end of a 500 m wide bay. The beach is bordered by a 200 m long rock platform to the north and the base of Burrewarra Point to the south. It is backed by vegetated bluffs with a creek mouth at its centre (Figure B-41). This creek entrance is typically closed; this was the case at the time of the site inspection (5 December 2012). The control point for the creek is two 0.5 m culverts located under Beach Parade.

The beach is well protected from incident waves from all directions except north-east. It is generally free of rips except during higher seas when one flows out against the northern rocks.

A large, healthy dune is located landward of the beach. Guerilla Bay can be accessed via a small car park off Ocean Street. Houses at the northern and southern ends of the beach are located on rock cliffs. At the time of the site inspection, recent undercutting of the cliff was observed at the southern end. There are several properties with varying degrees of development located at low elevations in close proximity to the beach. A summary of sand sample analysis is shown in Figure B-42.

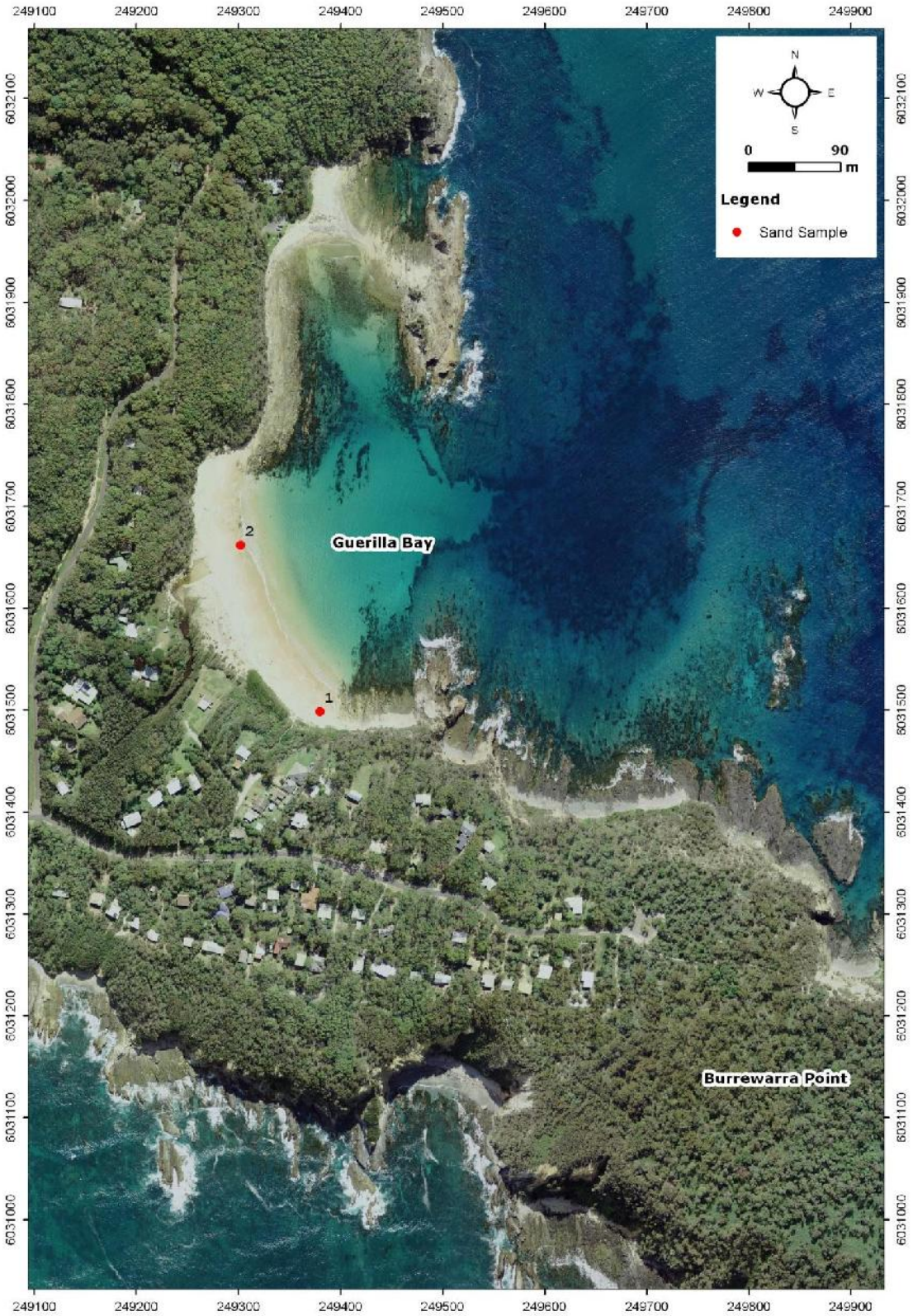
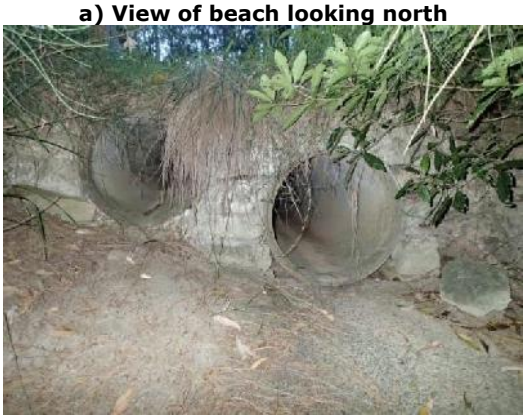


Figure B-40: Guerilla Bay Site Details

a) View of beach looking north

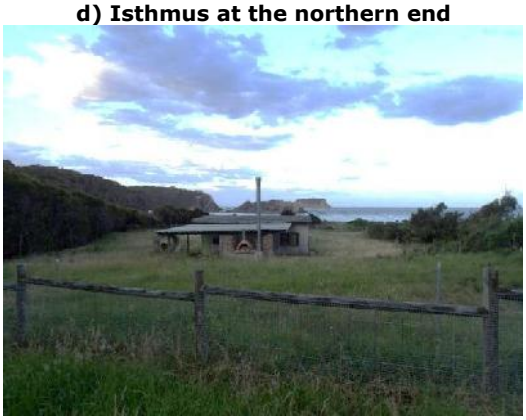
b) Rock/reef at southern end



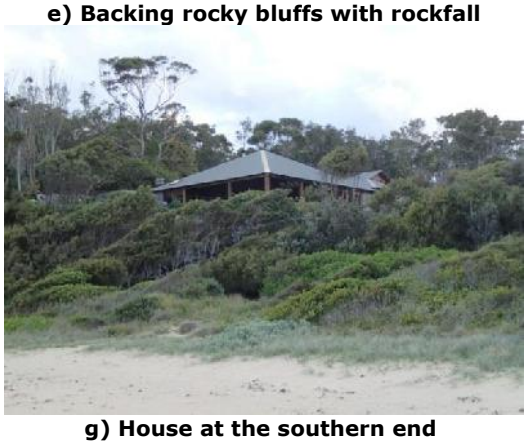
c) Stormwater outlets

d) Isthmus at the northern end

e) Backing rocky bluffs with rockfall



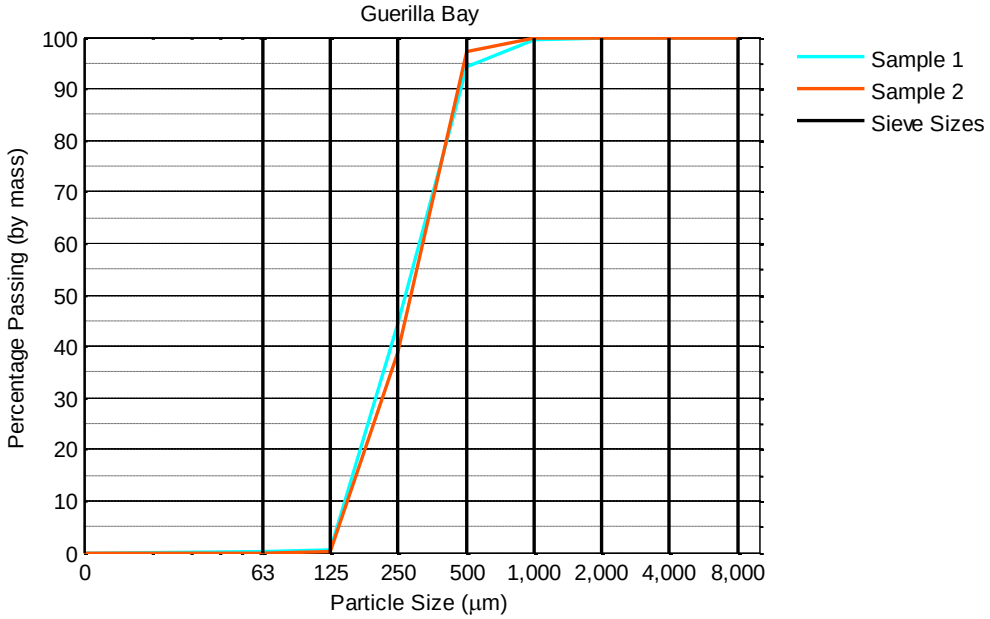
f) Cabin at the centre of the beach



g) House at the southern end

g) Scour of the banks of the creek

Figure B-41: Guerilla Bay Site Inspection



Sample 1 Sample 2

Figure B-42: Guerilla Bay Sediment Samples

B.14 Barlings Beach

Barlings Beach is a 1.11 km long beach with a low gradient, facing south (Figure B-43) which was inspected on 8 December 2012. It is located between the 15 m high Barlings Island (eastern end) and the conical 25 m high Melville Point (western end). The beach is part of a 500 m wide series of regressive foredune ridges, fronted by 100 m of now vegetated transgressive dunes. A creek is landward of the sand dune and terminates in a small wetland area at the eastern end of the beach (Figure B-44). The creek is controlled by five box culverts (2.7 x 1.5 x 1.22 m) and granite rock scour protection located landward of the beach.

Wave climate exposure generally increases from the east to the west along Barlings Beach. This results in a near permanent rip against Melville Point and up to six rips up the beach, usually separated by an attached bar.

A large, well vegetated dune is located landward of the beach. Behind the eastern end of the beach is a caravan park with pedestrian access to the beach. Four-wheel drive beach access for boat launching is available along a dirt track at the eastern end too. At the western end of the beach, a new development is set back behind the foredune (at least 100 m from the beach), with the dune providing a natural buffer against erosion and inundation. Uncontrolled pedestrian access along the western end of the beach is available via the development and a small car park located off Sun Patch Parade. A summary of sand sample analysis is shown in Figure B-45.

Figure B-43: Barlings Beach Site Details

a) View of beach looking east

b) View of beach looking west

c) Box culverts landward of the beach

d) Backing rocky bluffs at western end

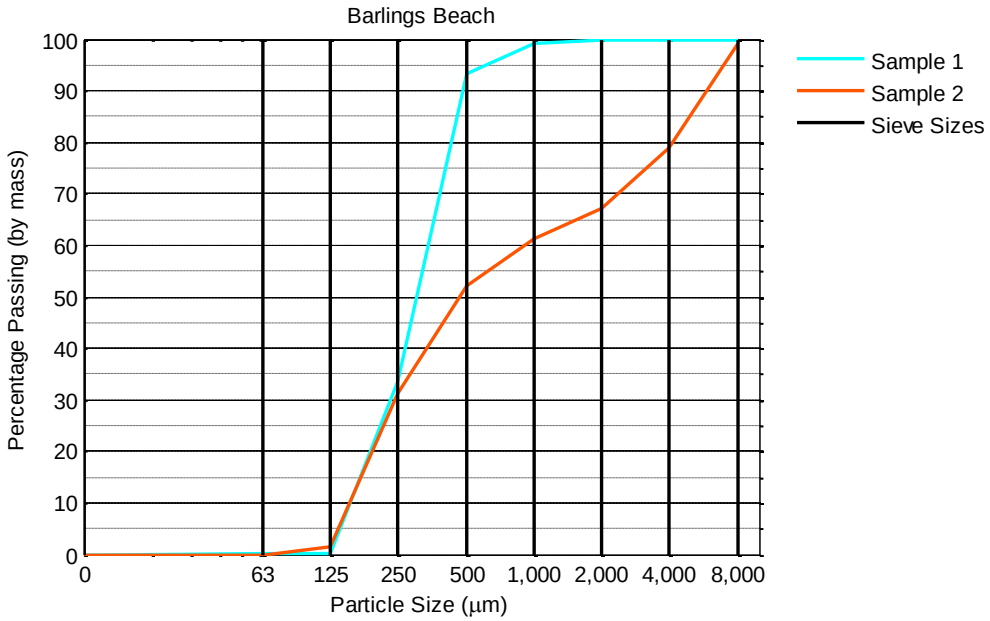
e) Barlings Island at eastern end of beach

f) New development at eastern end

g) 4WD beach access corridor

h) Creek entrance

Figure B-44: Barlings Beach Site Inspection



Sample 1 Sample 2

Figure B-45: Barlings Beach Sediment Samples

B.15 Tomakin Cove and Tomakin Beach

Tomakin Cove is a 270 m long beach with a low gradient, facing south-east (Figure B-46) which was inspected on 8 December 2012. Tomakin Cove is located between Melville Point in the north and a sand tombolo in the lee of a reef in the south. Shallow reefs extend near continuously between these two boundaries resulting in low wave energy impacting the beach (Figure B-47).

A lagoon is located between the base of the cove and the reefs. The cove is backed by a densely vegetated foredune, which provides a buffer against erosion for the houses located in its lee. However, there is no additional set back between the rear of the foredune and the houses. A small stormwater outlet with a diameter of 0.4 m is located at the centre of Tomakin Cove just north of an informal beach access point.

Tomakin Beach is a 900 m long beach with a low gradient, facing south-east (Figure B-46). It is located between Tomakin Cove in the north and the mouth of the Tomaga River in the south. Reefs at the northern end of the beach extend 400 m southward and Mossy Point (south of Tomaga River) protects the southern end of the beach. Wave climate exposure is generally greatest at the centre of the beach, reducing towards either end. During higher waves, the beach terrace is cut by rips in the centre of the beach (Figure B-48).

Shoaling of the river mouth extended up to 200 m behind the beach, creating a flat, wide spit and constricting the narrow river channel between the shoals and the rocks of Mossy Point. The concrete abutments on the Tomakin Bridge on George Bass Drive provide a control point approximately 2 km upstream of the mouth of the Tomaga River. The southern side of the river mouth is constrained by natural rock shelves and cliffs at Mossy Point.

The beach is backed by a vegetated foredune with formal pedestrian beach access available from a small car park off the end of Reid Street. The dune narrows to a 10 m wide sand spit at its centre. There are several houses at the end of Kingston Place (at the northern end of the beach) which are located at low elevations in close proximity to the beach. Several houses, boat sheds and jetties on the southern side of the Tomaga River (Mossy Point) are also located at low elevations. A summary of sand sample analysis is shown in Figure B-49.

Figure B-46: Tomakin Cove and Beach Site Details

a) View of cove looking north

b) View of cove looking south

c) Backing rocky bluffs at the northern end

d) Scarp in the middle of the cove

e) Pedestrian beach access at northern end

f) Houses at the middle of the cove

g) Houses at the southern end

h) Stormwater outlet

Figure B-47: Tomakin Cove Site Inspection

a) Tomakin Beach looking east

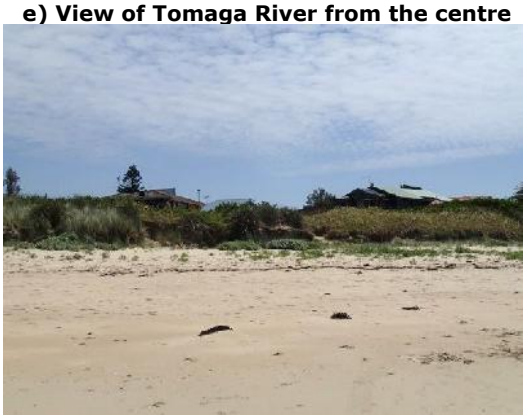
b) Rock/reef at northern end

c) View of beach looking south

d) Typical regenerated dune face

e) View of Tomaga River from the centre

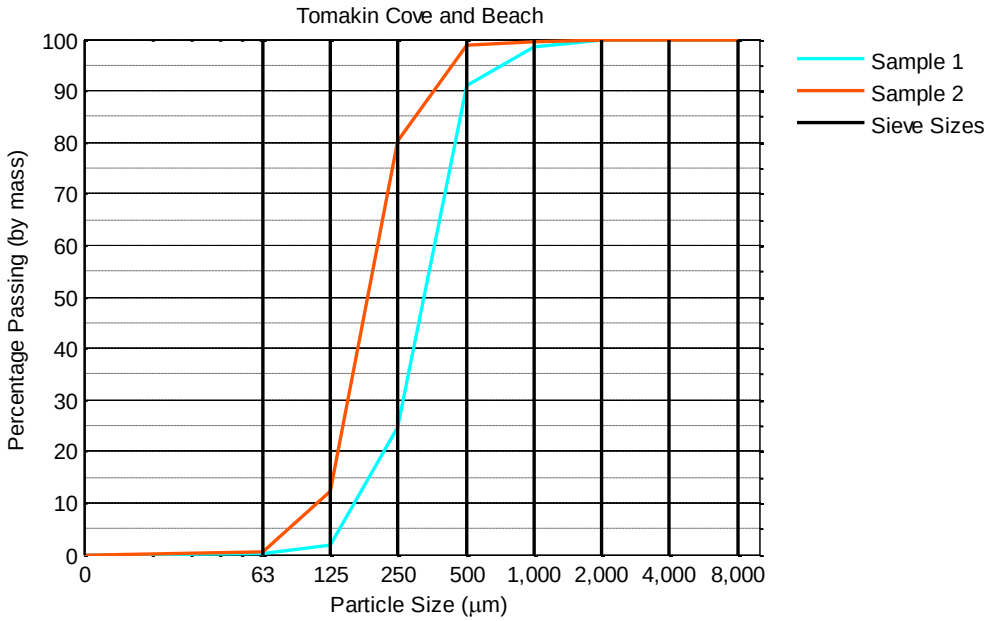
f) Scarp in the middle of the beach



g) Houses at northern end

h) Tomaga River entrance

Figure B-48: Tomakin Beach Site Inspection



Sample 1 Sample 2

Figure B-49: Tomakin Cove and Beach Sediment Samples

B.16 Broulee Beach

Broulee Beach is a 1.74 km long beach with a low gradient, facing east-north-east (Figure B-50). It is bordered by Mossy Point to the north and to the south by a tombolo, known as Broulee Spit, which connects Broulee Island to the mainland. At the time of the site inspection (8 December 2012), Broulee Island was connected to the mainland, that is, Broulee Spit was closed (Figure B-51). However, the island has been separated from the mainland at times in recent decades (see Appendix H). The beach forms the seaward boundary of a 1 km wide foredune ridge plain which has accumulated over the past 6,000 years. The entrance to Candlagan Creek is located at the northern end of the beach across a rock platform at the base of Mossy Point. The Beach Road bridge crosses the creek just upstream of the mouth and its concrete abutments are protected on both sides by revetments comprising approximately 0.7 m rock. The rock protection extends further to the east on the northern side of Candlagan Creek to protect a small car park.

Broulee Beach experiences a moderate wave climate with exposure generally reducing from north to south. Under typical conditions, the beach maintains an attached bar with a rip against the northern rocks (assisted by flow from Candlagan Creek) and several beach rips are usually present up to the middle of the beach, grading southwards to a low tide terrace along most of the southern half before finishing in a reflective beach in the southern corner. Low wave energy conditions at the southern end creates a wide, flat beach. On the southern side of Broulee Spit, the beach face has a high gradient.

A healthy, vegetated dune exists along the entire beach with several formal beach access points along Coronation Drive. This foredune provides a buffer between the beach and the road. Houses landward of Coronation Drive appear to be located well landward of the active beach. However, five houses at the northern end of the beach and on the southern side of Candlagan Creek are located in close proximity to the beach. These houses sit on the crest of the sand dune with limited sand stores and vegetation on the seaward side.

The southern end of the beach can be reached on foot from Bayside Street, Harbour Drive or a small headland car park at the end of Albert Street. The crest of the dune along the tombolo was approximately 3 m wide at the time of the site inspection (8 December 2012), although it is infrequently cut by large seas from the south (Appendix H). Houses at this end of Broulee Beach were set well back from the shoreline at the time of the site inspection. A sewage pumping station is also located on Bayside Street and is similarly set well back. A summary of sand sample analysis is shown in Figure B-52.

Figure B-50: Broulee Beach Site Details

a) View of the beach looking south

b) Vegetated sand reserve at southern end

c) Candlagan Creek outlet at northern end

d) Beach Road bridge over Candlagan Creek

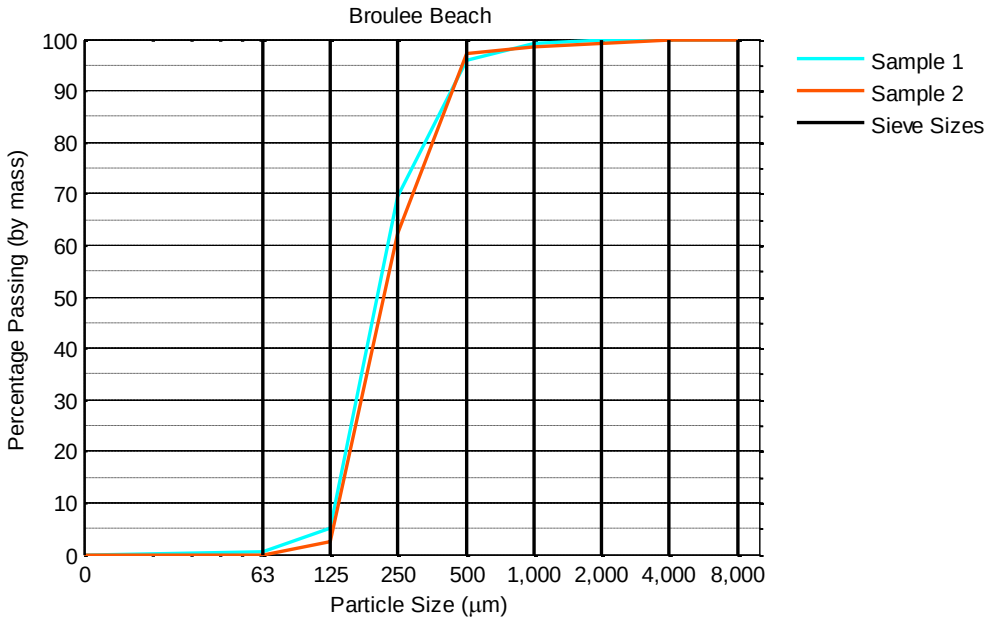
e) Rock protection for small car park

f) Houses at the northern end

g) Sewage pumping station

h) Broulee Tombolo and Island

Figure B-51: Broulee Beach Site Inspection



Sample 1 Sample 2

Figure B-52: Broulee Beach Sediment Samples

B.17 Bengello Beach

Bengello Beach is a 6 km long beach with a low gradient, facing south-east and east (Figure B-53). It is one of the longest beaches on the NSW south coast. Bengello Beach is bordered to the north by Broulee Head and to the south by the northern training wall of the Moruya River. The entire beach is backed by a 1 to 2 km wide series of low, densely vegetated foredune ridges, which formed when the shoreline built out seaward between 6,000 and 3,000 years ago. The usually closed mouth of Waldrons Creek is located near the centre of the beach (Figure B-54). At the time of the site inspection (4 December 2012), Waldrons Creek entrance was closed. Several 3.6 m wide box culverts under George Bass Drive are a control point for the creek.

Wave climate exposure is greatest at the centre of the beach, with Broulee Head (and the surrounding reefs) protecting the northern end of the beach from incident waves north of east and the northern training wall, tidal shoals and Toragy Point (Moruya Heads) protecting the southern end from waves south of east.

The beach is accessible at the northern end where Broulee Surfers SLSC is located. There is a car park next to the SLSC and a second car park at the base of the headland near a small boat ramp and 0.8 m diameter stormwater outlet. The SLSC and caravan park (Big4 Broulee Beach Holiday Park) are located well landward of the dunes, whereas the car park at the base of the headland and the road (Heath Street) are located at low elevations in close proximity to the beach. A gated gravel road runs south behind the beach for 2 km providing vehicular access as far as Waldrons Creek which breaks out across the beach during floods. Large seas in 1975 resulted in the permanent closure of a section of this gravel road which ran the full length of the beach (Short, 2007). George Bass Drive now runs south behind the dunes and is located 1 to 2 km inland. George Bass Drive meets Bruce Cameron Drive which runs along the northern side of the Moruya River and terminates at Moruya Airport. There is also a car park at the southern end providing access to the beach. In addition to Moruya Airport, a caravan park (North Head Camp Ground) is also located landward of the southern end of Bengello Beach.

There are two coastal structures at either end of Bengello Beach. At the northern end of the beach, a small revetment protects the car park situated just off Heath Street. The revetment structure is composed of granite rock primary armour with an approximate size of 0.5 m, with no underlayer or secondary rock visible. The structure slope of the revetment wall is approximately 1.0V:1.5H. At the southern end of the beach, the northern training wall of the Moruya River interrupts littoral sand transport. The northern training wall has a pedestrian footpath along its entire length and has primary armour on both sides consisting of granite rock with an approximate size of 1.0 m, a geotextile underlayer and secondary rock armour. A summary of sand sample analysis is shown in Figure B-55.

Figure B-53: Bengello Beach Site Details

a) View of beach looking south

b) View of beach looking north

c) Boat ramp and rock revetment

d) Moruya River training wall (north)

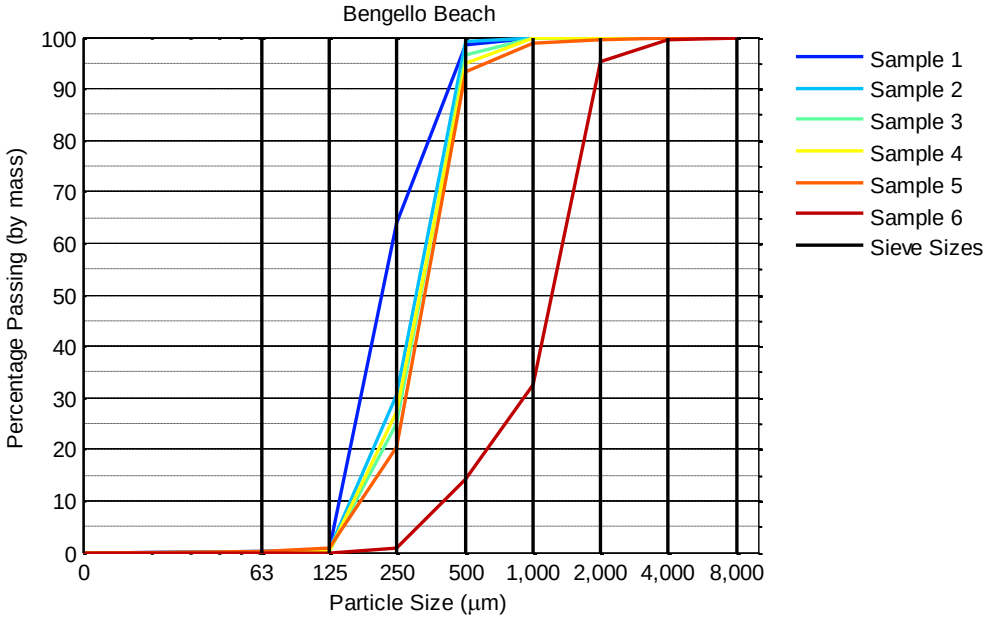
e) Broulee Surfers SLSC

f) Dune scarp in the middle of the beach

g) Waldrons Creek outlet

h) Northern end of Moruya Airport

Figure B-54: Bengello Beach site Inspection




Sample 1

Sample 2


Sample 3


Sample 4


Sample 5


Sample 6

Figure B-55: Bengello Beach Sediment Samples

Appendix C: Photogrammetry

C.1 Preamble

Photogrammetry data was available for a number of the beaches within the Eurobodalla Shire Council region, provided to WRL by NSW OEH and ESC (Jacobs, 2015). Photogrammetry data is one of the only survey datasets sets available in NSW to assess historical, long term changes on the NSW coastline. This appendix summarises the available photogrammetry data, and the analysis of this data undertaken by WRL.

C.2 Photogrammetry Data

Photogrammetry data is available for all of the beaches where erosion modelling has been undertaken. The years of available data are summarised in Table C-1. Every photogrammetry dataset was used in the analysis of underlying recession and storm demand (except for 1942 at Long Beach and 1972 Broulee Beach, Block M).

Table C-1: Summary of Photogrammetric Data
(Source: NSW OEH, 2015 and Jacobs, 2015)

Coastline Sub-Section	Year
Maloneys Beach	1942, 1972, 1990, 1993, 1999, 2007, 2011, 2014
Long Beach	1942*, 1959, 1972, 1990, 1993, 1999, 2007, 2011, 2014
Surfside Beach (east)	1942, 1959, 1972, 1975, 1977, 1990, 1993, 1999, 2007, 2011, 2014
Surfside Beach (west)	1942, 1959, 1972, 1990, 1993, 1999, 2007, 2011, 2014
Sunshine Bay	1962, 1972, 1991, 2011, 2014
Malua Bay	1962, 1972, 1984, 1991, 2003, 2011, 2014
Guerrilla Bay	1962, 1972, 1984, 1991, 2011, 2014
Barlings Beach	1964, 1972, 1975, 1980, 1984, 1993, 2003, 2011
Tomakin Cove	1962, 1972, 1975, 1984, 1993, 2001, 2011, 2014
Broulee Beach	1962, 1972*, 1980, 1993, 2011

* NSW OEH has advised that the 1942 photogrammetry data at Long Beach (both blocks) and 1972 photogrammetry data for Broulee Beach Block M (southern third of the beach) is comparatively less accurate (possibly due to datum shifts) than the other data sets. WRL has excluded this data from its analysis.

The accuracy of photogrammetry is dependent on many factors, including the height at which the image was taken, distortions for physical features of the land (including the curvature of the earth and relief displacement), and distortions from the camera. While all modern cameras used for photogrammetry are calibrated to allow such corrections, no such calibrations were performed for camera distortions prior to 1960 (Hanslow, 2007). Pre-1960's surveys are therefore less accurate. DWLC (1996) provides a summary of photogrammetric accuracy for the photogrammetry surveys around Corrigans Beach, stating accuracies post the 1960's to be 0.4 – 0.5 m in the horizontal direction and 0.3 – 0.4 in the vertical direction. This is similar, although slightly less accurate in the vertical direction, to the approximate general accuracy of all the NSW photogrammetry stated in Evans and Hanslow (1996) and summarised in Table C-2.