

BEACH SAND PROFILE NORTH OF BAMBRA REEF AT ROCHES BEACH



Prepared by Aquenal Pty Ltd
Marine, Estuarine and Coastal Analysts



FOR

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1 INTRODUCTION AND PROJECT BRIEF

The proposal for the removal (scraping) of beach sand at Roches Beach for the purpose of nourishing its dunes has the potential to impact macrofaunal communities inhabiting the beach. Investigating sediment profiles of the beach will assist in determining the volume of sand available for removal with the aim to minimise the potential impact on macrofaunal communities. With this in mind, Clarence City Council commissioned Aquenal Pty Ltd to design a sampling regime to characterise the sediment profile of north of Bambra Reef at Roches Beach.

2 SURVEY METHODS

The sampling design has been developed to provide information about the depth at which coarse shell grit can be found and the particle size distribution of sediments at various locations along the beach.

The design consisted of the sampling of six locations, distributed evenly along the length of Roches Beach north of Bambra Reef (Figure 1 & Table 1). Sites were located using a GPS, accurate to three metres. At each site a marker was placed at the base of the sand dunes and a tape measure was run perpendicular to the shore down to the water's edge. A depth profile and sediment sample were collected from three locations along the transect, (dune base, 10m and low water mark, (LWM)). Low water mark was situated between 20 and 30 metres for each transect. Depth profiles (see Figure 2) were recorded where shell grit was encountered during excavation of beach sediment to a maximum depth of 50 cm.

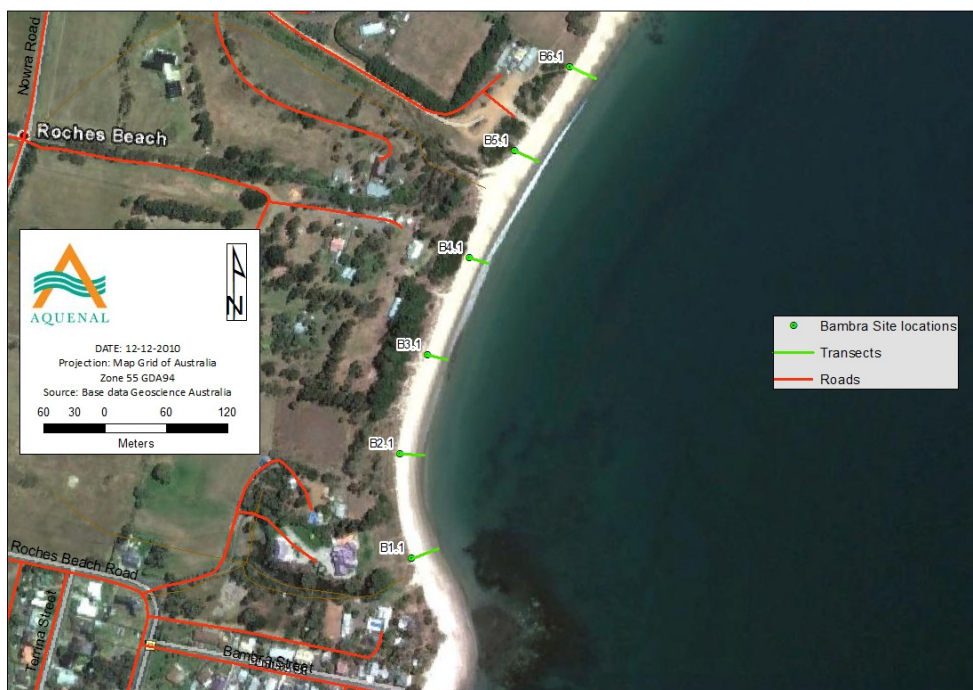


Figure 1 Roches Beach north of Bambra Reef sediment profile locations



Figure 2 Excavations of beach sediment at Site B1, Roches Beach north of Bambra Reef, showing its depth profile (45cm), and sampling of sediment for particle size distribution analysis.

Table 1 GPS coordinates of sample locations north of Bambra Reef at Roches Beaches (WGS 84, Zone 55).

Location	Easting	Northing
B1	540874	5250896
B2	540863	5250998
B3	540890	5251094
B4	540931	5251189
B5	540970	5251293
B6	541023	5251375

2.1 CALCULATION OF SAND VOLUMES:

At each location the volume of sand was estimated by splitting a 100m section of beach in to two blocks. The upper block was 100m by 10m (extending from the dune base to 10m down shore). The second block extended from 10m to the low water mark. Each block had an upper and lower depth, estimated from the three depth profiles (see Figure 3). From these dimensions the total volume of sand was estimated. Additional calculations estimated the volume of sand excluding the first five metres shore ward from the dunes. This was considered a potential area for deposition of sand. Estimations for the exclusion of buffer zones and for mosaic scraping were also included. Sand profile data collected in a previous survey (see Aquenal 2010a) was re-analysed to estimate the volume of sand potentially available at Roches beach south of Bambra Reef. As the survey methods were slightly different for this survey, the method of calculation of volume involved three blocks in some cases.

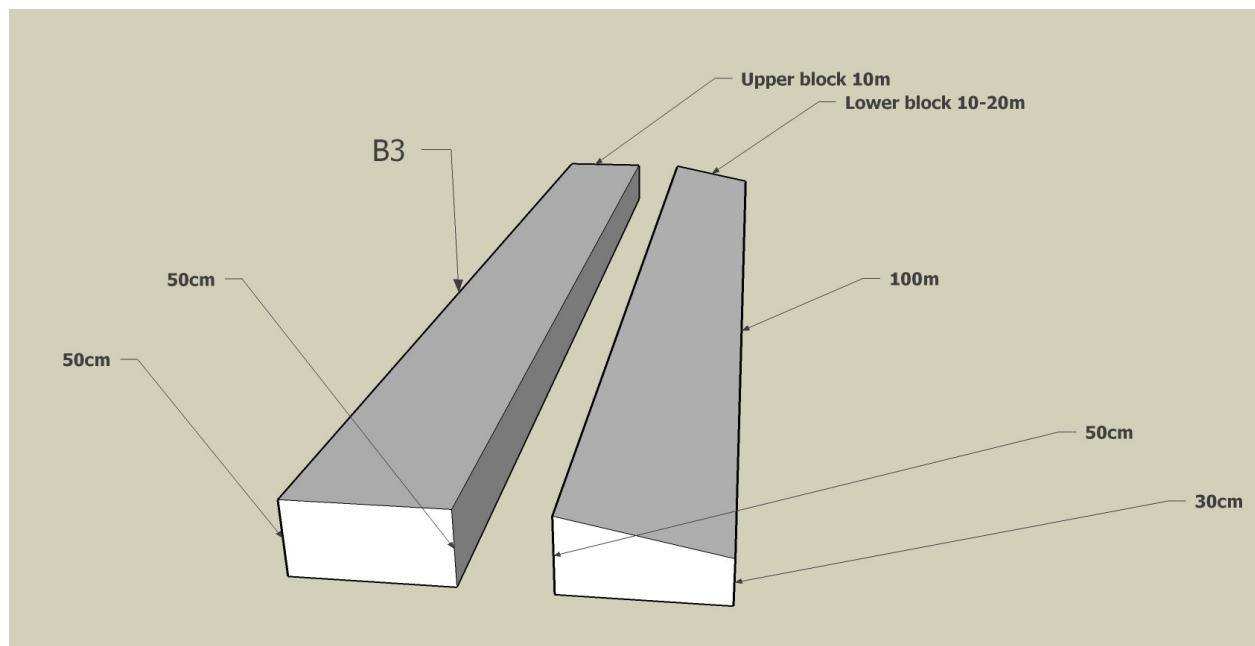


Figure 3 Schematic representation of method used to estimate sand volume. Example site B3.

2.2 PARTICLE SIZE DISTRIBUTION

To obtain particle size distributions, a representative volume of beach sediment, about 77ml from each sampling site was collected, and its actual volume was determined. This material was then washed through a stack of sieves by shaking them under a moderate water spray. The sieve aperture sizes were 4mm, 2mm, 1mm, 500 μ m, 250 μ m, 125 μ m and 63 μ m. The contents of each sieve were drained and transferred to a 100ml (\pm 0.5ml) measuring cylinder containing 20ml of water, starting

with the coarsest fraction and progressively working through to the finest. The cumulative volume in the measuring cylinder was recorded after the contents of each sieve were transferred. The percentage by volume of each fraction was then calculated for the original sample. The combined percentage of measured fractions was subtracted from 100 to give the percentage of the <63µm fraction.

3 RESULTS

3.1 SHELL GRIT DEPTH

Depth profiles and sediment samples were collected at six locations along Roches Beach, north of Bambra Reef, from the base of the dune (0m), 10m and low water mark (20-30m). At each location the depth at which shell grit was encountered was greater than 50cm for all sites at the base of the dunes with the exception of location B1 where shell grit was encountered at 45cm depth. At the 10m sites shell grit was encountered on the surface at location B5, and 30cm at B6. At all other locations shell grit was not encountered at 50cm. Typically shell grit at low water mark sites was encountered at less than 50cm with the exception of sites B1. These results suggest that shell grit becomes closer to the surface with increasing distance from the dune base (see Figure 4).

3.2 SAND VOLUMES

Figure 5 and Table 3 show the total volumes of sand available at each location. Table 2 shows the figures used for estimating the sand volumes. Volumes range from 1125m³ at location B1 to 600m³ at B5 and B6. Overall the total volume of sand available at Roches Beach north of Bambra reef is 5360m³. This is the total amount and does not factor in the need for buffer zones around sensitive areas (reef and within 5m of the dunes), or mosaic sediment removal. If the first five metres of each location is not counted the available sand volume becomes 8179m³ (see Table 4), and if buffers and a mosaic pattern of sand removal is applied (no removal at locations B1, B3, B6) the volume of potentially removal sand is reduced to 1960 m³.

Similarly for Roches Beach the total sand volume is 13318 m³, without the top five metres is 8279 m³, and not counting buffer zones and a mosaic removal pattern (no removal from locations R1, R2, R5, R8), the remaining volume of potentially removal sand is 5365 m³. Overall combining both beaches a total of 7325 m³ may potentially be removed.

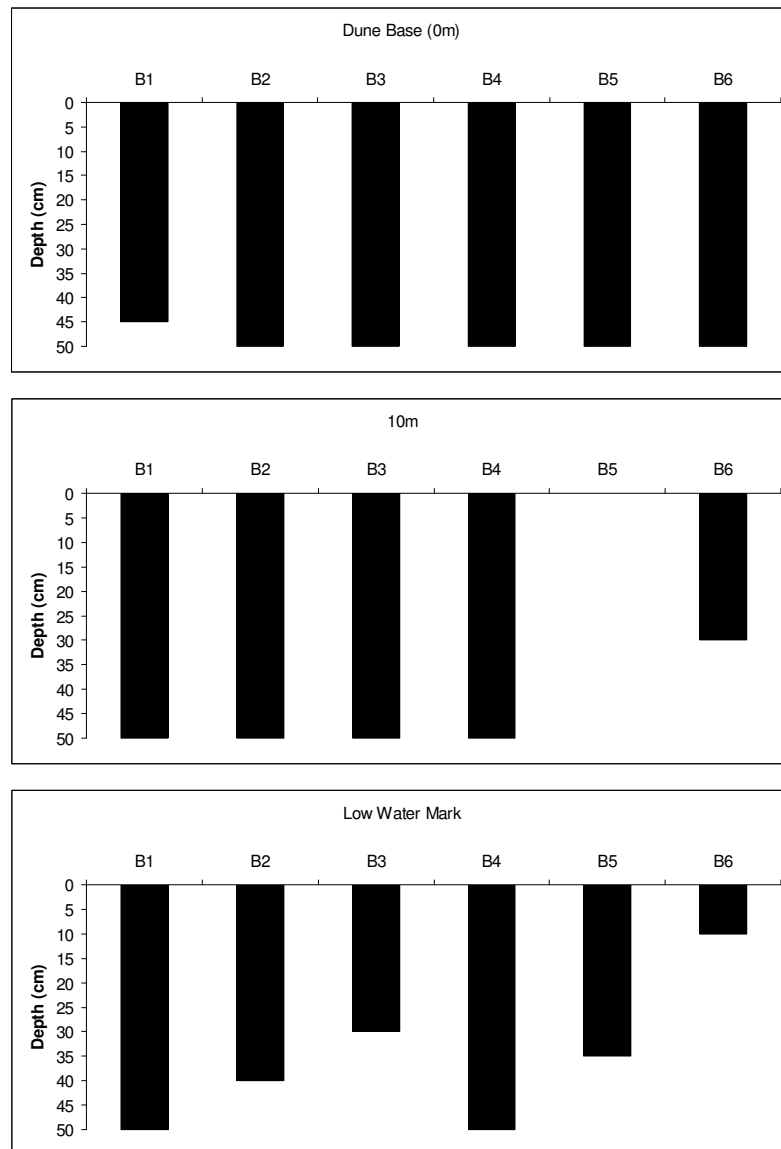


Figure 4 Depth of shell grit occurrences. Top: dune base (0m), Middle: 10m and Bottom: low water mark.

Table 2 Dimensions used to estimate potential sand volumes.

Location	Length (m)	Depth of shell grit (cm)			Width (m) of	
		Dune base	Mid beach	Low tide mark	Upper block	Lower block
B1	100	45	50	50	10	13
B2	100	50	50	40	10	13
B3	100	50	50	30	10	10
B4	100	50	50	50	10	11
B5	100	50	0	35	10	20
B6	100	50	30	10	10	10

Table 3 Estimated sand volumes at each location for Roches Beach north of Bambra Reef (top) and Roches Beach (bottom)

Volume (m ³)				
Location	Upper block	Lower block	Total	Total (-5m)**
B1	475	650	1125	887.5
B2	500	585	1085	835
B3	500	400	900	650
B4	500	550	1050	800
B5	250	350	600	475
B6	400	200	600	400
Total	2625	2735	5360	4047.5

Volume (m ³)					
Location	Upper block	Mid block	Lower block *	Total	Total (-5m)**
R1	0	696	N/A	2376	1179
R2	0	310	N/A	1091	440
R3	0	773	N/A	1840	1306
R4	0	227	N/A	1224	762
R5	0	190	368	1378	964
R6	1534	678	662	2874	2067
R7	1230	549	N/A	1779	1230
R8	425	87	244	756	331
Total	3189	3509	1274	13318	8279

‡ NA = absence of lower block due to narrow beach

‡‡ (-5m) = exclusion of top 5m of shore, for potential deposition of sand

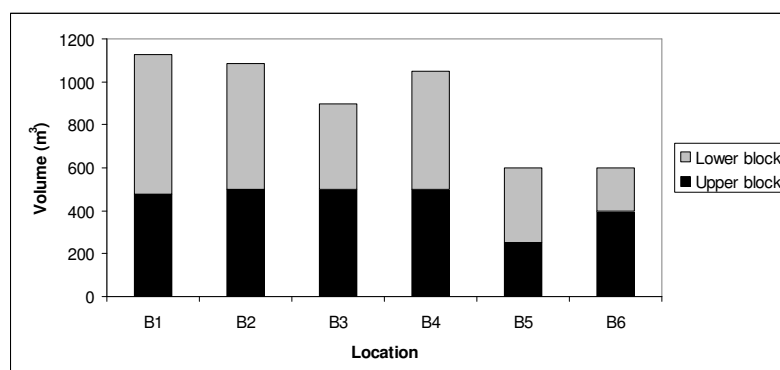


Figure 5 Estimated sand volume at each location for Roches Beach north of Bambra Reef

Table 4 Summary sand volumes

Summary Volumes (m ³)	
Total Sand	
Bambra	5360
Roches	13318
Total	18678
Excluding top 5m	
Bambra (-5m)	4047.5
Roches (-5m)	8279
Total	12326.5
Excluding control locations *	
Bambra mosaic	1960
Roches mosaic	5365
Total	7325

‡ For mosaic scraping and future impact assessment.

3.3 PARTICLE SIZE DISTRIBUTION

Figure 6 and Figure 7 show particle size distributions for 18 samples collected at the 6 locations in the present survey. Most samples were dominated by sediments retained in either the 0.125mm sieve or the 0.25mm sieve. Typically the samples collected at the dune base were dominated by sediments retained in the 0.25mm sieve, while samples collected at 10m and at LWM were dominated by sediments retained in the 0.125mm sieve. Overall particles retained in the 0.125mm sieve clearly dominated with 58% of the total volume, with next most common particle size being retained in the 0.25mm sieve (Figure 8). All other particle sizes contributed to less than one quarter of total sand volumes.

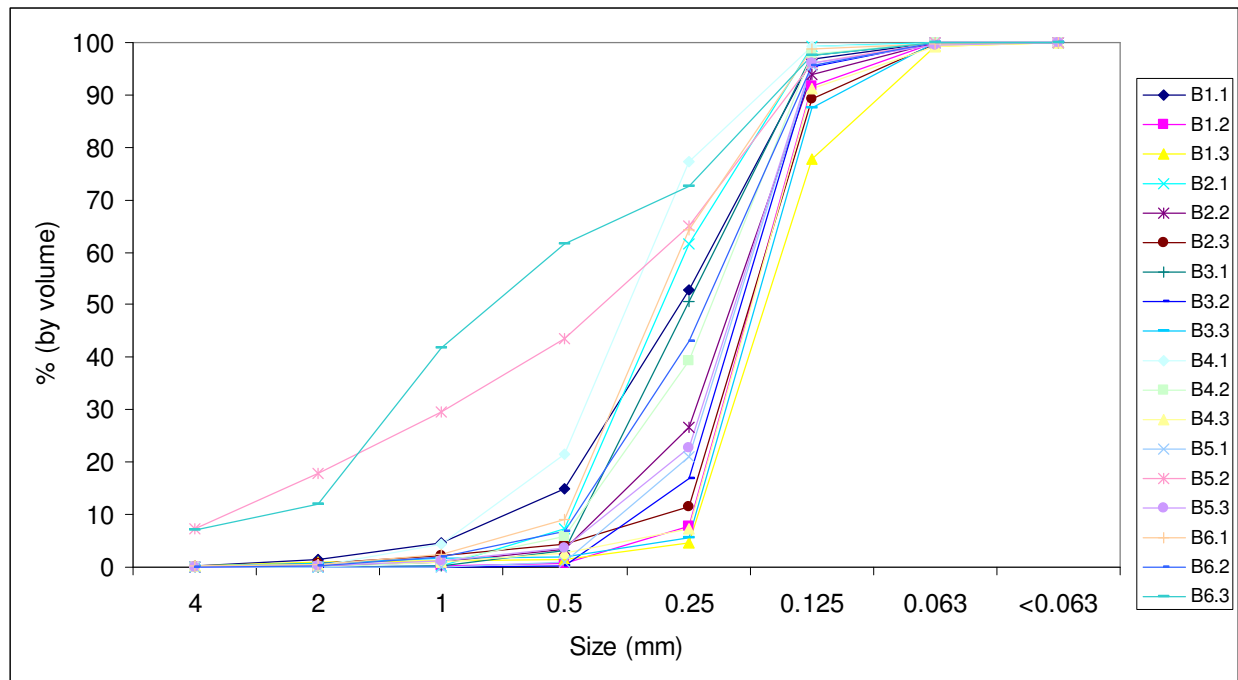


Figure 6 Particle size distributions (mm) for all samples collected north of Bambra Reef at Roches Beach, Line graph. (B1.1 = B1 dune base, B1.2 = B1 10m, B1.3 = LWM)

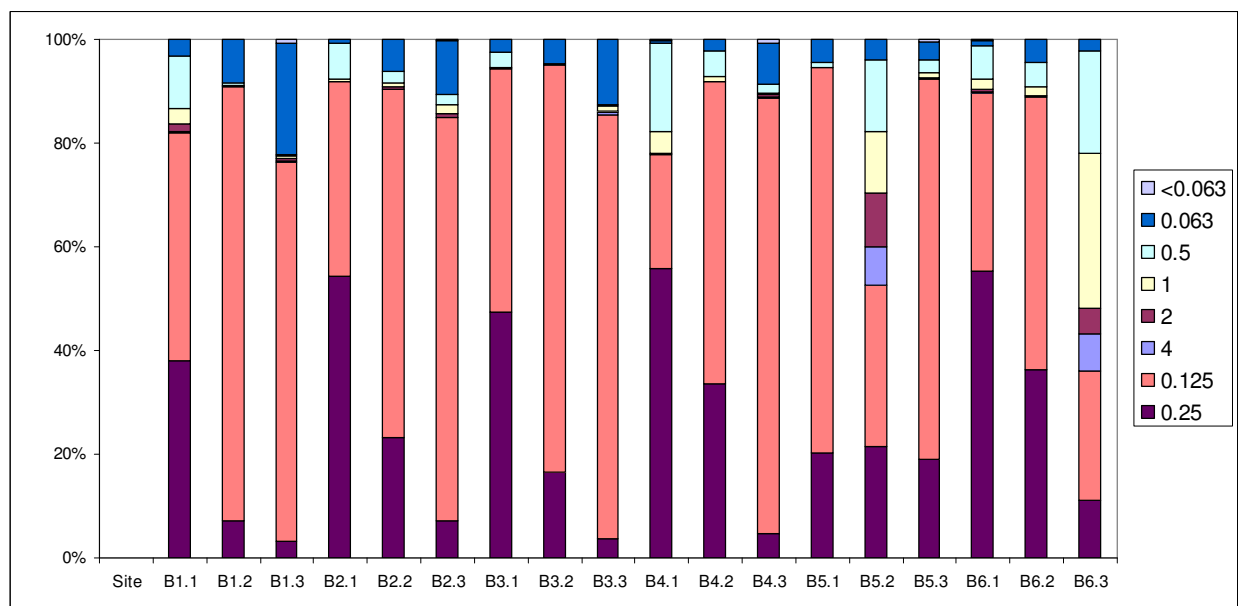


Figure 7 Particle size distributions (mm) for all samples collected north of Bambra Reef at5 Roches Beach, Bar chart. (B1.1 = B1 dune base, B1.2 = B1 10m, B1.3 = LWM)

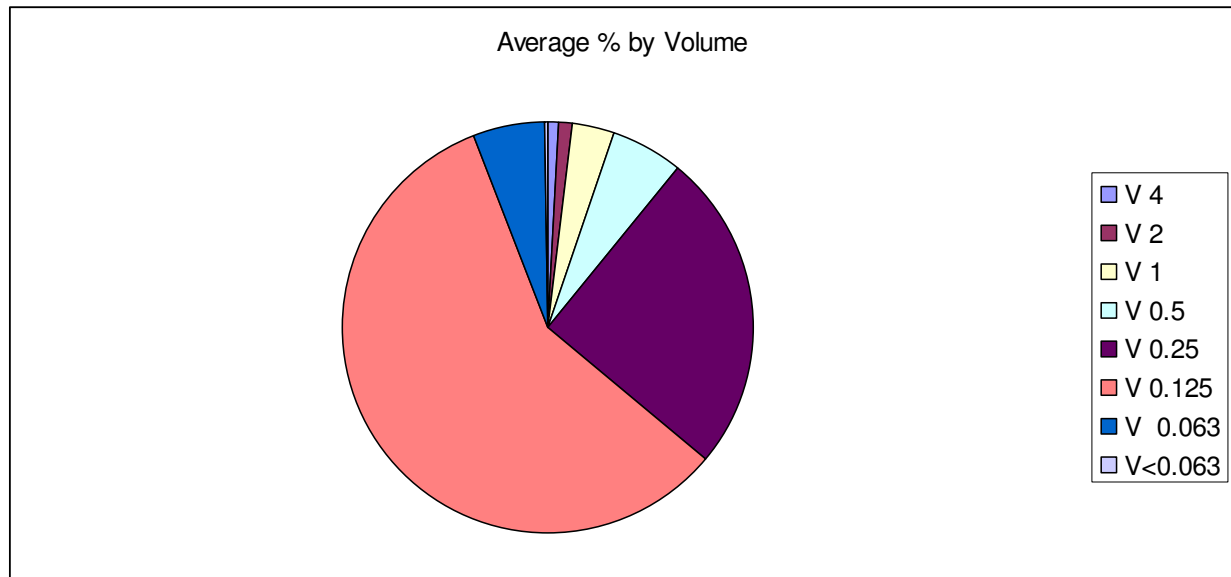


Figure 8 Pie chart of percentage volume of particles averaged over all samples.

4 DISCUSSION AND CONCLUSIONS

The present survey provides information on baseline conditions at Roches Beach north of Bambra Reef, which complements several previous surveys by Aquenal in the vicinity (Aquenal 2010a, 2010b). Information provided in this report has been designed to assist decisions in regard to the location and extent of potential sand scraping along the beach north of Bambra Reef.

Similar to Roches Beach the greatest depth of sand without shell grit occurs at the dune base. Using the depth of sand to shell grit occurrence, length and width of the beach, sand volume was estimated to be 5360m³. However it was determined that the top five metres of the shore would not be included. This area would be maintained as a buffer zone to protect dune vegetation and would probably receive some of the scrapped sand. Additional buffer zones were designated around Bambra Reef (B1), a central zone (B3), and the small areas of reef at the northern end of the beach (B6). By not removing sand from these areas and sampling in a mosaic pattern it is expected that macrofaunal communities inhabiting the beach would recover at a quicker rate, and any impacts on the reef communities would be reduced. After consideration of buffer zones and mosaic scraping the available sand from Roches Beach north of Bambra Reef is reduced to 1960m³.

Re-analysis of previous data from Roches Beach suggested that with buffer zones and mosaic scraping a potential of 5365m³ of sand may be removed. These estimates make no consideration of coastal geomorphological processes. The impact on coastal erosion or deposition as a result of any beach scraping is beyond the scope of this report and the authors' expertise.

If the scraping of sand from either section of Roches Beach is to go ahead, it is highly recommended that detailed impact assessment and monitoring program be developed to track any ecological impacts and determine rates of recovery in impacted areas. Such a program would need to include physical changes to dune and beach structure, beach macrofauna, and reef fauna and flora.

5 REFERENCES

- Aquenal (2010a) Beach Sand Profile at Roches Beach Tasmania, Report for Clarence City Council.
- Aquenal (2010b) Biological Characterisation of Macrofauna at Roches Beach and Cremorne Beach, Tasmania, Report for Clarence City Council.

6 APPENDIX



Figure 9 Sample locations, Roches Beach

Table 5 Roches Beach block data

Location	Length of block (m)*	Depth of shell grit (cm)			
		Dune base	Upper mid	Lower mid	Low tide mark
R1	480	50	50	8	N/A
R2	427	50	11	18	N/A
R3	368	50	8	50	N/A
R4	293	50	13	18	N/A
R5	263	50	13	16	40
R6	323	50	50	34	48
R7	323	50	18	50	N/A
R8	315	50	4	7	24
R9	158	50	14	18	48
R10	75	50	50	36	N/A

Table 6 Roches Beach location data

Location	Profile Location	Type	Easting	Northing	Distance to HWM (m)
R1	Long Section 3 - No.122 Bayview Dr.	Control	540589	5248470	2
R2	Long Section 4 - Ralphs Bay Canal	Control	540398	5248902	1
R3	Long Section 5 - No.2 Manata St.	Monitoring	540367	5249273	5
R4	Long Section 6 - No.120 Balook St.	Monitoring	540409	5249615	5.8
R5	Long Section 7 - No. 98 Balook St.	Control	540459	5249814	4.9
R6	Long Section 8 - No. 68 Balook St.	Monitoring	540547	5250094	4.5
R7	Long Section 9 - No 34 Balook St.	Monitoring	540671	5250407	6.2
R8	Long Section 10 - No. 2 Balook St.	Control	540812	5250673	0
R9		Control ?	540881	5250914	8.2
R10		Control ?	540876	5250988	6.5