



Sydney Northern Beaches NSW02.03.02

Regional Setting

The dominant regional processes influencing coastal geomorphology in this region are the humid warm to cool temperate climate, micro-tides, south-easterly Tasman Sea swells, easterly seas, dominantly quartz (terrigenous) sediments with northerly longshore transport in the northern part, and the El Nino Southern Oscillation (driving beach erosion/accretion cycles, cyclone frequency).

Regional hazards or processes driving large scale rapid coastal changes include: East Coast Lows (extra-tropical cyclones), mid-latitude cyclones (depressions), and storm surges (<1m).

This compartment extends from Barrenjoey Head to North Head.

Justification of sensitivity

Sensitivity rating is a 4. There is a limited supply of sand from offshore. Several beaches are already eroding, either because they are receded barriers or exacerbated by development on foredune and seawalls, as at Narrabeen-Collaroy.

Other comments

Sydney's northern beaches extend from Barrenjoey Head to North Head, comprising 19 beaches that occupy 17km (42% of the otherwise rocky coastline). There have been extensive studies of several of these beaches and offshore sediment conditions (Gordon and Hoffman, 1989; Gordon, 2009), most notably at and off Narrabeen-Collaroy, in the middle, for Palm Beach at the northern end, and for Manly Beach at the southern end. There is considerable variation between beaches in the availability of sediment. Several beaches such as Avalon are carbonate rich as a result of limited offshore quartz sand and shell production on hard offshore



substrates (see Figure 1 which highlights the distribution of rock reefs restricting sediment exchange between tertiary compartments). Recently, the Sydney Coastal Councils Group has contracted a review of offshore sand sources linked to beach conditions (Beach Sand Nourishment Scoping Study, 2010).

Narrabeen Beach fronts a progradational sand ridge, implying an ongoing supply of sediment in the past; this is in contrast to Dee Why, which is a receded barrier with backbarrier muds and peat occasionally exposed on the beach (Martin, 1972). Palm Beach which has had beachrock outcrop on the beach after erosion in some places (Chapman et al., 1982). Beach rotation is observed on Narrabeen Beach, related to the El Niño-Southern Oscillation variation (Ranasinghe et al., 2004; Harley et al., 2011; Short et al., 2014). Nevertheless, the sediment budget for Narrabeen indicates loss of sediment into the flood tide delta in Narrabeen Lagoon, from which there is periodic beach replenishment, supplemented by further beach nourishment with sands from outside this compartment. Ad hoc seawalls to protect property along this beach have exacerbated the erosion problems. The beach has recovered after storms but it is uncertain how long this recovery will continue post storm as sea level rises. Detailed monitoring by WRL of UNSW is being undertaken to observe future changes in beach position. Modelling of future beach changes using probabilistic methods has been used at Manly (Cowell, et al., 2006). Gordon (1987) has studied sand loss and gain from these beaches during and after storms, as well as seawall structures.

Confidence in sources

Medium confidence: Whereas the Narrabeen and Palm Beaches have been well studied, many of the others have not received sufficient research to establish their longer term trajectory.



Additional information (links and references)

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Ranasinghe, R., McLoughlin, R., Short, A.D., Symonds, G., 2004. The Southern Oscillation Index, wave climate, and beach rotation. *Marine Geology* 204, 273-287.

Short, A.D., 2007. Beaches of the New South Wales Coast. Australian Beach Safety and Management Program, Sydney.

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Beach Sand Nourishment Scoping Study (2010)

http://www.sydneycoastalcouncils.com.au/Project/Sand_Nourishment_Scoping_Study

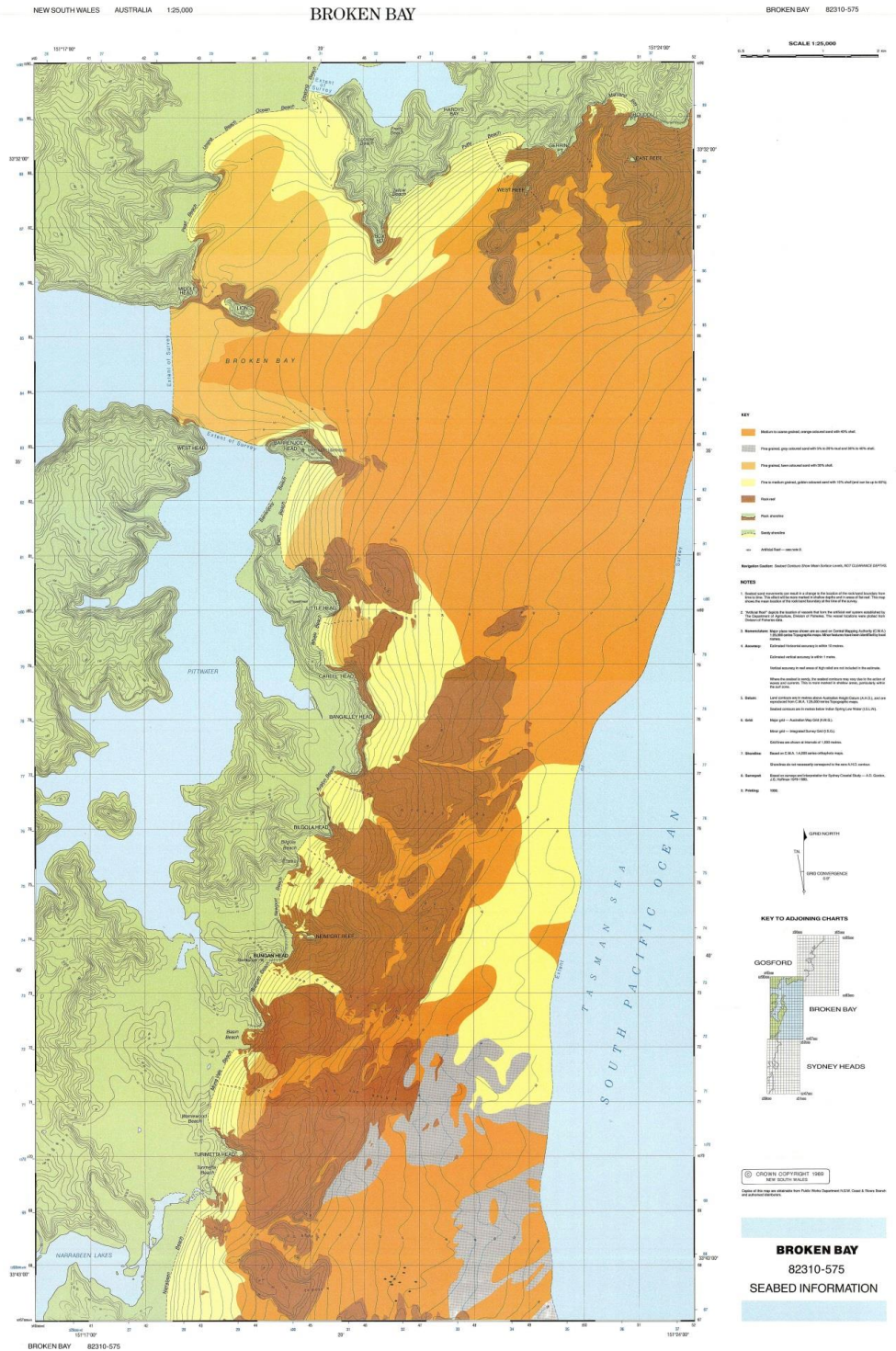


Figure 1. Offshore sediment and rock reef distribution for tertiary compartments within the northern Sydney beaches secondary compartment (Gordon and Hoffman, 1989).