Natural bypassing of headlands

On a local level, as waves approach a headland they refract (bend) around the headland and approach the beach in a position parallel to the shore thereby losing wave height. A loss of wave height results in an escape current developing that disrupts the normal sand movement direction forming a rotating hydraulic cell. Sand can also continue past the cell further offshore\(^1\). This is illustrated in Figure 1.

Cyclic changes of a tidal inlet

Tidal inlets are dynamic in nature and entrances often move both north and south under the process of spit migration. This involves the infilling of the channel with ocean sand and the development of a spit during periods of calm weather. During flooding the waters push through the spit changing the alignment of the channel.

Figure 1. Longshore drift around a headland and the formation of a circulation cell

Figure 2. Currimbin Creek in (a) 1961 and (b) 1967 with a natural realignment of the channel after the 1967 storm events (yellow: sediment drift, blue: creek flow)
**Currumbin Creek: A change in processes**

Currumbin Creek is a tidally influenced waterway with minimal freshwater flows. A seawall (groyne) connects Currumbin Rock to the mainland (constructed in 1973) along with a training wall on the northern side of the entrance (constructed between 1978 and 1981). These modifications have resulted in changes to the coastal processes occurring within and around the creek.

Currumbin Rock currently acts like a headland with sand trapped to the south of the groyne and the formation of a circulation pattern behind the headland.

Additionally, sand is naturally transported north along Currumbin Beach, via longshore drift, around Currumbin Rock and across the channel entrance forming sand bars (which form part of the ebb-tide delta). Sand is then transported, through wave action, into the creek mouth and infilling occurs. Figure 3 illustrates these processes.

During periods of intense rainfall, increased flow through the creek entrance transports sand back out towards the ocean.

**Dredging Currumbin Creek**

The training walls have been highly successful in fixing the entrance to Currumbin Creek. The Creek entrance is a flood-tide dominant estuary (i.e. where sand naturally migrates into the estuary); therefore, the current management strategy is to regularly dredge Currumbin Creek entrance, placing this sand on the spit at the southern end of Palm Beach.

**Finding a balance**

After dredging takes place, a sink is created and sand naturally returns to refill the depression in the seabed left by the dredging. The primary sources of the sand infilling are the sand bars forming seaward of the entrance (ebb-tide delta) and a portion of the sand that was placed on the nourished beach that re-enters the creek as it strives to find its natural equilibrium. This process is likely to occur whether or not dredged sand is placed directly onto the spit. Without the beach nourishment, there is the possibility that erosion of the spit would occur. Investigations into the extent and effects of dredging Currumbin Creek are ongoing.

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