Know Your Coast

Palm Beach
Palm Beach is located at the southern end of the Gold Coast and is approximately 4 km long. It is bounded by the trained entrances of Currumbin Creek to the south and Tallebudgera Creek to the north.
At the far northern end of Palm Beach, the Tallebudgera Creek estuary enters the ocean adjacent to Burleigh Headland. The entrance was stabilised with a training wall. Construction commenced in 1975 (stage 1) and was completed in 1981 (stage 2). Subsequent accretion re-aligned the northern 500 m of beach and it is now considered to be of sufficient width to withstand moderate to extreme wave inundation (GCCM 2008).
The southern extremity of Palm Beach is dominated by the Currumbin Creek system. Due to its weak river discharges, Currumbin Creek is characterised as a tidal inlet rather than an estuary (estuaries have persistent freshwater flow). The stabilisation of the creek entrance was achieved in 1972 with the construction of a groyne as a recommendation of the Delft Report (1970). The southern groyne extends a distance of 200 m and connects Currumbin Rock to the mainland. In 1981 a shorter training wall was built directly north of the Currumbin Creek entrance in order to improve the stability of the entrance to allow an increase in the volume of the upper beach towards Palm Beach.
In 1980 the Federal government financed the design and implementation of two additional groynes built adjacent to 11th and 21st Avenues. It is generally acknowledged that the short groynes at 11th Ave and 21st Ave have little impact on the littoral drift along Palm Beach. Groynes are less favourable as coastal protection these days as they do not provide additional sand and nourishment is still required to widen the beach.
Palm Beach reef is located centrally along the beach and extends approximately 1.2 km offshore with additional smaller patches of reef nearer to shore known as the bait reef. The reef is popular for open water diving and fishing. Palm Beach reef has been described as:

“A series of rocky ridges and gullies covered with extensive hard and soft coral growth, anemones, ascidians and sponges. Commencing at a depth of 24 metres it spreads over a large area up to the 8 metre bottom depth. In some areas the top of the reef is only 5 metres from the surface.”

- Local diver, Ian Banks (2006)
Hazards and Surf Lifesaving

Palm Beach has been given a hazard rating of 6 with an average wave height of 1.5 m (Short 2000) and is patrolled by three surf lifesaving clubs: Tallebudgera, Pacific and Palm Beach. Short describes the general configuration of the beach as a ‘200 m wide double bar system with the inner bar usually cut by deep rip channels every 200 to 300 m’. Double bar beaches usually have a well-defined trough separating the bars and in the case of Palm Beach, Short notes that the ‘outer bar (is) cut by more widely spaced rips (than the inner bar)’. 
The swell direction experienced at Palm Beach is influenced by the large-scale weather patterns prevalent on the East Coast of Australia. There are three dominant regimes, influenced by distinct meteorological phenomena:

- The eastward migration of high pressure systems
- Tropical cyclones
- East Coast Lows
Eastward Migration of High Pressure Systems
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Sub-tropical high pressure systems typically migrate eastwards across the continent through New South Wales during Winter and Spring.

The movement of these systems is driven by global air circulation patterns that are catalysed by the sun and rotation of the earth (NSW DPI 2007).

The anticlockwise wind around these high pressure systems generates persistent SE winds and swell aimed towards Gold Coast beaches (Strauss and Tomlinson 2011).
Tropical Cyclones
Tropical cyclones usually form in the Coral Sea and can track south towards the Gold Coast.

Even if occurring far north in Tropical North Queensland, these cyclones can generate a powerful NE-E swell on Gold Coast beaches, depending on speed, power and direction of travel (Strauss and Tomlinson 2011).

This phenomenon is the dominant influence on swell during summer on the Gold Coast.
East Coast Lows are intense low pressure systems driven by the temperature gradient between the Tasman Sea and the cooler air moving across continental Australia. They most commonly form off the south-eastern Australian coast during Autumn and Winter months (BOM 2012).

In May 2009, Palm Beach was the most heavily eroded beach on the Gold Coast after an East Coast Low.

These systems are most often associated with high energy E-SE swells in the Tasman Sea.
The shape and orientation of Gold Coast beaches contributes to a longshore gradient in wave height.

Swell from the south is refracted by Point Danger.

The southern Gold Coast beaches are effectively in the ‘wave shadow’ of this easternmost point on the mainland, and thus the swell that reaches the Gold Coast (predominantly south-easterly) has more of an easterly bias (Strauss and Tomlinson 2011).

When dealt an easterly or north-easterly swell, the wave height at Palm Beach (and along most Gold Coast beaches) increases, due to the increased exposure afforded by the ‘direction’ that the beach is oriented.
Prior to the construction of the Currumbin Rock groyne there was periodic flow between the rock and the shore as the entrance migrated freely. The permanent closure and construction of the southern groyne wall has resulted in increased wind protection for southern Palm Beach during periods of strong south to south east winds.
Palm Beach Morphology

Photograph Date: 10/01/1973

The presence of an offshore ‘storm’ bar is formed during large and prolonged storm events. The eroded sediment from the beach and inner surf zone bars is transported offshore and deposited beyond the break point.

Prevailing longshore currents associated with oblique swell direction (S, SE) tend to result in a longshore uniform (straight) offshore bar parallel to the beaches. Sediment being transported by the northwards littoral drift naturally bypasses the headlands as it is re-worked and resuspended by wave breaking and by the orbital velocities of waves near the bed.
The generally moderate but highly variable wave climate of South East Queensland results in ever changing movements of surf zone sand bars and rates of longshore transport. The various forms of surf zone sand bars can be classified according to a scheme developed by Wright and Short (1984) from a study of naturally occurring states of Australian beaches. The range of states varies from reflective at one extreme through intermediate states and then to dissipative at the other extreme.
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Gold Coast beaches tend to exist as intermediate states. The intermediate states can be further classified as:

- Longshore Bar and Trough
- Rhythmic Bar and Beach
- Transverse Bar and Rip
- Low Tide Terrace

These classes of bar states can be used to describe surf zones of double-barred beaches like Palm Beach where the inner and outer bars may be classified differently.
Palm Beach can be considered as three sections divided by the 11th Ave and 21st Ave groynes:

- Tallebudgera Beach (1 km of beach north of 21st Ave groyne)
- Pacific Beach (central 1 km of Palm Beach)
- Palm Beach (2 km south of 11th Ave groyne)
The inner bar of all three beaches is usually classified as Low Tide Terrace (LTT) or Transverse Bar and Rip (TBR). The outer bar of the Tallebudgera and Pacific Beach sections is classified as Rhythmic Bar and Beach (RBB) or Longshore Bar and Trough (LBT) and the southern outer bar is usually classified as LBT.

Generally speaking, the more linear shore-parallel features of LBT and LTT states will coincide with very low peel angles and surf that is prone to breaking fast. Rip currents and transverse bars associated with RBB and TBR states are usually preferred for surfing on open beaches.
Camera systems that take time exposed images are used to monitor the shoreline at Palm Beach and have been positioned on the Royal Palms high rise building. This location enables a good view from Currumbin Creek up to Tallebudgera Creek. Time exposed images have been widely used to remotely identify sand bars and rip channels in surf zones. A monitoring system routinely collects video for shoreline monitoring at Palm Beach which is useful for qualitatively describing surf zones.
Long Shore Bar and Trough

The outer-most surf zone bar is revealed by the preferential wave breaking on the crest of an alongshore uniform bar.

This section of the beach could be classified as a longshore bar and trough (LBT) morphology according to the Wright and Short classification scheme.
Transverse Bar and Rip

Rip currents are often readily detected in timex images such as this example of Transverse Bar and Rip morphology (TBR) of the inner bar.

The white water at the left of the image is due to wave breaking on a bar extending seawards (transverse bar) and a near shore channel of green water in the centre feeds the rip current which exits the surf zone between the transverse bars.
Rhythmic Bar and Beach

The outer break point bars revealed by the white water in the foreground of this example demonstrate Rhythmic Bar and Beach (RBB) morphology.

The outer bar is separated from the inner bar by a continuous longshore trough; however, there is a high degree of curvature of the outer bar. Rip currents are likely to be persistent through the outer bar, but not as energetic as those associated with Transverse Bar and Rip (TBR) morphology.
The final intermediate state encountered on Gold Coast beaches is the Low Tide Terrace (LTT).

The LTT is often associated with periods of low waves and calm conditions. The slow onshore migration of sand under low waves or mild swell conditions results in a gradual infilling of troughs and rip channels leaving a flat area of sand at low tide often accompanied by a steeper beach face (or berm) at high tide (Wright and Short 1984). The section of beach just north of the northern training wall of Currumbin Creek is an example of LTT morphology.
The southern corner of Palm Beach is typically more sheltered from waves due to Currumbin Rock and provides protection from prevailing SE winds. There are generally more consistent surfable waves here than elsewhere on Palm Beach when swell size is adequate. The inner banks at the far southern end of Palm Beach are popular with most forms of surf craft and ranges of abilities. There is regularly an inner low tide terrace here where smaller waves break in shallow water. A northward current can be quite strong during larger swells with a heavy shore break adjacent to the Royal Palms.
There is often a longshore current to the north from Currumbin Rock and Laceys Lane generated by the curve of the coastline and subsequent wave refraction. North of the Royal Palms and Laceys Lane, up to the 11th Ave groyne, the beach is often characterised by a single bar which oscillates between a longshore bar and trough and transverse bar with two or more rip currents. Due to increased exposure to prevailing SE winds, this area is more popular on smaller days and in the early morning with light winds. During larger swells, there may be waves breaking further offshore on a remnant storm bar. The outer bar surf will be highly dependent on the actual bar morphology with rhythmic bar and beach conditions more likely to provide good surfing waves than a linear bar.
Monitoring undertaken by CoastalCOMS and UNSW in recent years has revealed a distinct rhythmic tendency of the bars north of the 11th Ave groyne. The exposure to the predominant SE wave direction increases northwards on Palm Beach, which also results in an alongshore gradient in wave heights. On smaller days with favourable winds (WNW-SW or very light), the northern region from 23rd Ave to 27th Ave is a popular option for surfing.
A vast array of surfing conditions can prevail at Palm Beach for any given day due to the curved orientation of the beach, the presence of creeks and headlands and artificial structures, the presence of offshore submerged reefs; and importantly, the volume of sand present in the beach profile. A highly variable wave climate dominates the coastal response here and the narrow central section is particularly vulnerable to recession during storm wave attack.
The beach is an inherent component of the Gold Coast lifestyle, offering great recreational opportunities for the local community as well as tourists from around the world. It is an integral driver of the regional economy. The city’s beaches also serve as a buffer between property and storm-generated waves; and, ecologically, a habitat for marine life.
Gold Coast beaches are equivalent to the best internationally and need to be maintained, protected and where necessary, enhanced to ensure future generations are able to enjoy them.

– Anonymous, Gold Coast City Council’s Bold Future engagement.
Brought to you by the Palm Beach community and Gold Coast City Council.
For More Information

Gold Coast City Council (GCCC)

Griffith Centre for Coastal Management (GCCM)
www.griffith.edu.au/coastal-management

Bureau of Meteorology
www.bom.gov.au/

CoastalCOMS
http://qccc.coastalcoms.com/

Diving the Gold Coast

Gold Coast City Council

Griffith Centre for Coastal Management