GRAEME SMART PhD, MIPENZ
FLUVIAL CONSULTANT

BOX 28067, CHRISTCHURCH, NEW ZEALAND, Tel.+64 (3) 332 9333 rivers@free.net.nz

Report on the River Mouth Situation at Paroa

On Friday 11 June I visited the Paroa – Camerons coastal strip south of Greymouth. This is where the Salt Water Creek (catchment area 27 km^2) and the New River (catchment area 117 km^2) combine and flow into the Tasman Sea. I inspected the coastal strip and discussed with local residents the conditions which are causing concern.

Historical Situation (Bill Johnston).

In pre-European times the Taramakau R. had its mouth at Paroa (according to Maori legend and borehole evidence).

In the 1860's there was a boat-able lagoon system stretching from near the Taramakau R. to near Greymouth.

In the 1940s there were footbridges across the lagoons to access available land area seaward of the lagoons (Figure 1).

Figure 1. Present situation near Trickies Rd, Gladstone. In the 1940s there was a football field across the main road which was accessed by footbridge.

By the early 1950's the combined mouth of the New River and Saltwater Creek was directly opposite the present Salt Water Creek road bridge.

By early 1957 the mouth had moved to the north of the present Regional Council offices to enter the sea opposite Clough Rd.

In 1957 the mouth became blocked, water backed up during a flood and a new mouth burst out 4.8 km South of Paroa near Pandora Av., Camerons.

From 1957 the mouth again slowly progressed northwards.

In the early 1960s the position of the mouth was stable for 4-5 years opposite the New R. road bridge (Figure 2).

Figure 2. Present situation looking West opposite the New River road bridge. This was the location of a stable river mouth in the early 1960s.

From 1965 the river mouth location moved northwards again.

In the 1978 flood (Figure 3) a new mouth formed near the confluence of Salt Water Creek and New River (Figure 4).

Figure 3. Salt Water Creek and Paroa Hotel during 1978 flood.

Figure 4. December 2008 photograph showing the confluence of Salt Water Creek (foreground) and New River (top of picture). The 1978 flood formed a new mouth opposite the confluence.

The mouth moved south again by 1995 and since then has continued to move northwards.

The northwards movement seems to accelerate during freshes. During dry spells and neap tides the mouth may close for a week and then reopen. Water backs up into the old lagoons when the mouth is closed.

Diagram of progression.

Three sequences of mouth migration since 1951 are shown on Figure 5.

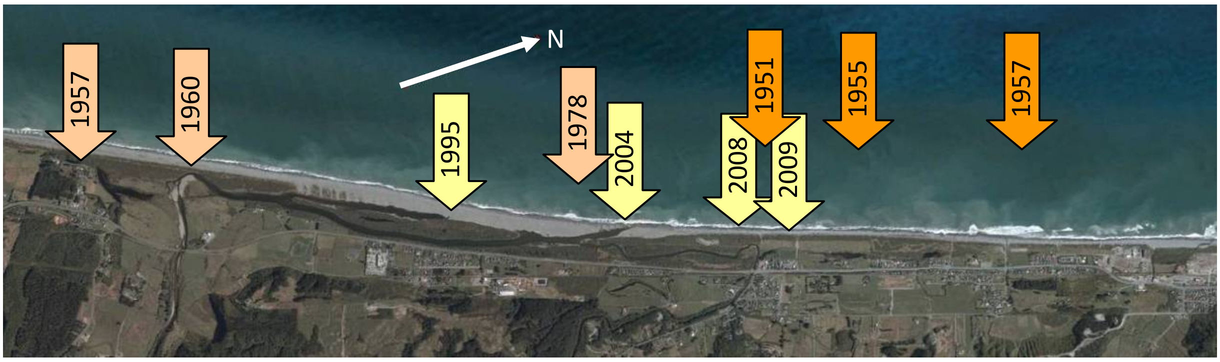

Figure 5. Sequences of mouth migration since 1951, shown on 2004 air photo. The dark coastal lagoons are remnants of previous river channels.

Other factors according to local residents.

According to Karl Tolley, the coastline south of the Taramakau River mouth is sandy and some places have receded at 50 m per year over the past 3 years. The Taramakau River delivers 2.5 million tons of sediment to the sea each year.

There is a large bar off the Taramakau mouth which may affect wave impact and coastal erosion.

The beach north of the Taramakau River mouth is mainly gravel but has increasing amounts of sand in recent years. It has been receding at a rate of 3 m per year at Camerons since 2004 (Doug Baker).

A narrow neck of land is holding the present north boundary of the Taramakau R. mouth. If this neck should erode the Taramakau mouth is likely to move north (Bill Johnston).

The way in which Salt Water Creek discharges into the New River (which has a larger flow) before the outlet to the Tasman Sea causes Salt Water Creek to back up. The backing up is getting worse (Mel Sutherland).

Sediment and water yields.

There has been no major destabilization of sediment in the Salt Water Creek or New R. catchments since the 1968 earthquake.

There has been drainage and land clearance in the New River catchment which may have increased the rate of runoff.

Approx 0.15 million tons of gravel are extracted from the Taramakau R. each year but no reliable figures are available. Selective gravel sizes are removed (Fran Cohen).

Evaluation of the situation.

The configuration of the confluence of the New River and Salt Water Creek as shown in Figure 4, has the New River flowing directly into Salt Water Creek. This will exacerbate flooding in Salt Water Creek when the New River is high.

The northwards displacement of the rivers' mouth is caused by long-shore migration of beach gravel. The gravel encroaches as a bar on the south side of the rivers' mouth and, to maintain the flow, the river erodes the north side of the mouth (Figure 6).

Figure 6. Shows the gravel bar migrating into the river mouth from the south (June 2010 situation).

It would appear that the gravel originates from the Taramakau River but other sources could include coastal erosion north of the Taramakau, gravel from New River sources and bank erosion caused by migration of the rivers.

As rivers preferably erode the outside bank of curves in their channel, this increases the migration rate of a northwards deflected river mouth compared to a “straight out to sea” mouth, or a southwards deflected mouth (Figure 7).

Figure 7. View looking upstream from the June 2010 mouth position showing how the river erodes the outside of the bend where it turns from being parallel to the coast to enter the sea.

Tidal flushing will assist in keeping the mouth open. A mouth associated with a long inland river channel will undergo greater tidal flushing than a mouth from an inland river system with little in-channel storage capacity.

The rivers' mouth will "reset" to a new location when flow is restricted by a blocked or constricted mouth or by a decrease in river slope associated with a long river distance to the mouth. Such a reset would be most likely during high river flows but could also occur when river flow is insufficient to keep the present mouth open. Another reset mechanism could occur if beach erosion intercepted the inland river where it is parallel to the coast.

Because of the complex dynamics of sea-river-sediment interaction, it is not possible to predict the future long-term behavior of a new natural or assisted river mouth opening. Depending on its location it is probable it would either close or migrate northwards with time. However, should a hazardous situation develop (see below) it may be necessary to assist the opening of a new mouth.

Main risks associated with movement of the river mouth.

The present mouth is separated from earlier river courses (lagoons) by a low sand dune. The recent migration of the river is roughly parallel to the shore but unforeseen events such a change in the height or strength of the exposed dune, a stranded log in the river redirecting flow against the dune or strong long-shore transport at the time of a river fresh could all change the heading of the river. If the river should erode through this dune it could flood into old river courses and present a hazard to local infrastructure on the seaward side of the State highway.

At some stage in the future the river mouth will again reset to the south. Depending on the location of the new mouth this could present a hazard.

Possible courses of action (requiring further studies before implementation).

1. Monitor migration of the present mouth. Prepare contingency plans to deal with a potential dune breach (monitor and do nothing option).
2. Survey low-lying areas and narrow sections of the coastal strip to locate points at which a future river channel change or mouth breakout is likely. Discourage and restrict development in parts of the coastal strip that are previous - and potential future - river channel locations (managed retreat option).
3. In conjunction with the above survey, select a preferred position for the next river mouth. Plan for an assisted re-opening of a mouth at the preferred location should this become necessary (assisted mouth switch option).
4. Create a more stable "non closing" mouth by directing the combined rivers 2 km southwards to flow into the Taramakau River instead of flowing into the Tasman Sea (river engineering option).