THE STRAND REDEVELOPMENT
MANAGING COASTAL IMPACT – A SUCCESS STORY

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DAY 2 – SATURDAY MORNING SESSION

WELCOME FROM TOWNSVILLE

Townsville is a major regional city in North Queensland. It is some 1800km north of Brisbane so it has a need to be independent and self-supportive. We affectionately call it the capital of North Queensland.

WHAT IS TOWNSVILLE?

Townsville is a mixture of light industry and is home to Queensland's third largest industrial port. The port is an important part of the City and has played a vital role in the economic increase of the cane, fertiliser and mineral industries. Whilst the port is very important to Townsville's economic growth it also has a down side. The regular dredging of platypus channel has prevented the regular littoral sand drift, as it now is trapped in the channel. This in addition to the construction of a dam and weirs on the Ross River means that the Strand is now starved of sand and that any sand lost in extreme events is lost forever. In co-operation with the port, a number of other factors caused major disruption to the flow of sand including the construction of the breakwater marina.

HISTORY OF THE STRAND

The Strand was the coastal icon of Townsville however without the natural replenishment of sand it was slowly losing its appeal. Cyclone Althea was a large cyclone that hit the coast in 1971. The damage to the City was significant, as was the damage to the sea wall at the Strand. Approximately 55% of the sea wall was replaced with a new larger boulder revetment with a nominal facing slope of 1:1.5 and a raised crest level to 6.1 meters which was approximately 1m higher than the original wall. The high rock wall however meant that the beach was lost to the view of people. The Strand however had seen many sky shows as well as VP 50 and celebrations for the battle of the Coral Sea. In 1993 Council conducted a "design competition" to start the process of developing and improving the Strand. The competition attracted wide interest with many submissions received. Gillespie Peddle Thorp – Brisbane, submitted the winning entry. The designs included a number of interesting design concepts, including piles in the sea with replicas of marine animals on them, a lagoon to return the area to its pre settled configuration, and many others. Unfortunately there was limited funds and these works were not undertaken. In addition the Council over the years had struggled with the problem of sand loss and what to do.

In 1996 as a result of a further dredging application by the Townsville Port Authority Sinclair Knight Mertz were commissioned to investigate beach erosion issues in Townsville. (1) This report was comprehensive and forms the basis of ongoing investigations. The "problems" that Townsville faced in sand loss were four fold: -

1. The Townsville Port Authority contributed to the lack of sand by way of the modification of the beachfront, reclamation dredging and maintenance dredging of the Platypus channel.
   The report estimated that approximately 48,000 tonnes of suitable beach sand is lost annually.

2. The construction of the Ross River Dam and three downstream weirs also prevented the flows of sediment by:-
   - Trapping sediment behind their walls.
   - The flood retarding effect of the weirs, in that they cause water to flow more slowly resulting in a lower sediment carrying capacity.

- § The report estimated that the weirs and dam trap approximately 68,000 tonnes per year.

3. The Queensland Department of Natural Resources and Mines allow the extraction of up to 260,000 tonnes per year from the Ross River upper reaches. Sand supply rates into the Ross River system are estimated at 34,000 tonnes per year. The net loss is not a simple subtraction but could be in the order of 200,000 tonnes per year.

4. Storm water flows through urban catchments is usually of higher velocity however with improved drainage structures, sediment flows are predominately debris and waste from the urban area. The urban catchment also comprises only a small part of the total catchment (approximately 42 square kilometers of approximately 750 square kilometers).

The report identified a long-term problem that had to be resolved.

THE DISASTER No. 1

In March 1997 the residents of Townsville were warned of the approaching tropical cyclone Justin. Before crossing the coastline the cyclone disintegrated into a tropical rain depression and settled over the city. The result was a declared disaster, with many homes flooded and people displaced. The Strand experienced a severe wind storm event, most likely in the order of 1 in 50 year event, and suffered a major loss to the remaining sand. The persistent wave action over several weeks during ex-cyclone Justin resulted in the undermining of the central portion and subsequent failure of approximately 33% of the wall. The event was of such magnitude that Natural Disaster Financial Assistance Arrangements were triggered. The costing of the repair was $1.8m.

THE DISASTER No. 2

The evening of Saturday 10th January 1998 was a land mark day in Townsville. All for the wrong reasons. During the course of the night Townsville Airport (a traditionally dry place) recorded in excess of 474 mm in a period of five hours, other unofficial rain gauges recorded in excess of 700 mm for the same time. This translated into a record rainfall event of anywhere between 1 in 120 year up to 1 in 233 year event, depending on which expert you speak to.

Tropical cyclone Sid was around long enough to whip up a strong swell, which stripped the remaining sand off the Strand. A severely weakened rock wall was then breached both by ocean swell and storm water runoff. Approximately 120 m of wall was lost along with the road and other infrastructure. In all about 60% of the wall was damaged. Again financial assistance was granted in the order of $1.4m

THE REPAIR

The old saying of "good things come out of adversity" fell true for Townsville. The Premier of Queensland, standing on a wind swept rock front after having seen the flooding and hardship, agreed that to allow the City to continue, the State Government would allocate significant funds to repair the Strand.

The January 1998 event had started the planning. We had the concept for a recreational design and an understanding of the technical problems. It was also decided to design for a much higher level of immunity and 1 in 100 year event became the design criteria.

The usual problems were there. What to do with the storm water outlets that don't look attractive flowing across the sand. How to keep the sand etc. The result was that we had to step in and do what nature once did. The saving grace was that in all but extreme events the sand was held in the Cleveland Bay basin and was just moved around to the tune of 70% south and 30% north. All we need to do was to truck it back!

THE PROPOSAL

The problem was assessed and Council decided that whatever solution was adopted it had to be a long-term solution. It was from this that the headland concept was introduced. The idea of compartmentalizing the beach and increasing the time the sand was trapped solved a number of problems. It remedied the stormwater outlets, gave Council some land to do something with as well as reduced the ongoing maintenance costs for sand replacement.

What we did

The aims of the redevelopment were:

- Secure the coastline with a civil structure designed and constructed to withstand a 1:100 year storm event;
- Restore the foreshore using a technique designed to minimise the need for future wall maintenance and sand replenishment;
- Redevelop by reinstating a beach alignment slightly offshore, providing greater opportunities for improved amenity and passive recreation opportunities;
- Redevelop to create stable "sandy beach" compartments and extend active recreation such as swimming and fishing;
- Provide all of the above and, at the same time, minimise the risk of environmental harm.

Council had retained Coastal Engineering Solutions as their consultant after cyclone Justine. They were given the brief to design a wall to provide the desired protection. The Beach Protection Authority of Queensland had commissioned extensive storm tide studies for Townsville. The following table was developed: -

Storm Frequency	Storm Tide Level
5	2.2m
10	2.2m
20	2.5m
50	2.8m
100	3.1m

The Highest Astronomical Tide is 2.2m. It was therefore theoretically possible but highly unlikely for a storm tide to reach 4 to 6m. Fortunately most cyclones have crossed the coast at a period near low tide.

Townsville is shore side of Cleveland Bay with a wave set up in the order of 2m but with a short wave period. The bay is shallow water with a gently shoaling seabed that allows larger waves to break before reaching shore.

Other waves considered included those generated by a cyclone in the Coral Sea. These waves were potentially the largest but were attenuated greatly as they passed over the shallow Great Barrier Reef. Also waves generated between the Great Barrier Reef and the coastline were considered. These waves set the design criteria.

For the Storm Tide Frequency of 100 years the Storm Tide level was 3.1m, the water depth was 4.7m and the maximum wave was 2.8m.

All options were considered with the optimum protection being a beach that in the long term equilibrium can be maintained with minimal effort. Given that the beach had been relatively stable prior to those external sand supply effects a beach system seemed to be the answer. It also met some of the expectations of Council for recreational facilities.

The concept of foreshore protection and tidal land reclamation is often based on placement of large quantities of sand with the realisation that nature will eventually create the beach profile. While protection through rock armoring is by no means a new technique, its application is an inexact engineering science.

The reclamation of the land from the sea was undertaking by the placement of the 'shot rock' causeway. This was utilised to not only provide a stable working platform for heavy machinery but also to minimise the loss of fines during the construction of the revetment walls.

The beaches were designed using state of the art modelling software to model both the expected seasonal movements of the beaches, and the beaches response to storm wave activity. The modelling was part of a wider coastal processes study which examined in detail the coastal processes of the Cleveland Bay foreshores for both the existing and future developed cases.

The project represents the innovative use of soft engineering solutions to solve the foreshore erosion problems. It serves a unique double purpose in that it uses a structural foreshore protection solution in the form of beaches to create an extensive recreational beach for the public.

The project involved the construction of three headlands which feature recreational facilities, restaurants and headquarters for lifesavers. The headlands were devised for a dual role. Apart from their public amenity, the headlands will protect the new seawall and beach. They are in areas that have been most vulnerable to cyclone damage and are designed to trap sand and break the force of waves.

In all 250,000 tonnes of armor rock, 400,000 tonnes of sand, 390,000 tonnes of fill 70,000 sq. m of turf, 16,000 trees and shrubs, 900 palms and 22,5000 native groundcover plants were required to complete the protection program.

COMMITMENT TO ENVIRONMENTAL RESPONSIBILITIES

The waters of Cleveland Bay, immediately offshore from mean low water along The Strand fall within the Great Barrier Reef World Heritage Area. The area is also listed on the National Estate. The nearest portion of the Great Barrier Reef Marine Park is approximately 2km west of the RockPool.

The Strand redevelopment required appropriate controls and monitoring to ensure that environmental values were not compromised, owing to the proximity of an area of outstanding universal natural value.

Numerous aspects of environmental management were adopted at the site including:

- § an Environmental Management System framework consistent with ISO 14000 series with elements such as:
  - staff and management responsibility
  - environmental awareness training
  - communication and reporting
  - documentation and records, and
- § preferred operation and construction methodologies described in Environmental Management Plans such as:
  - maintaining water quality values
  - transporting materials to the site
  - placing rock, fill and sand
  - managing chemicals and fuels
  - incident and spill response plans
  - minimising dust, noise or other environmental nuisance
  - measuring and assessing marine impacts.

ENVIRONMENTAL VALUES IN PLANNING

The project objectives required completion in accordance with statutory requirements and engineering and environmental approvals. The applicable environmental approvals, standards and guidelines were: Harbours Act 1955; Fisheries Act 1994; Beach Protection Act 1968; Coastal Protection and Management Act 1995; Environment Protection Act 1994; Great Barrier Reef Marine Park Act 1975; World Heritage Properties Conservation Act 1983; State Development and Public Works Organisation Act 1971, and Numerous pieces of Legislation and Approval conditions.

MINIMISING ENVIRONMENTAL IMPACTS

Redevelopment of the Strand required tight controls to ensure that environmental values were not compromised. Intensive monitoring of turbidity and seagrass health also occurred outside the development envelope to assess ambient conditions and the overall performance of the civil works.

Various methods have been adopted on the Redevelopment site to provide a mixture of risk minimisation and mitigation of environmental effects including:

- § Restricting physical disturbance to within the "envelope of the footprint" of Redevelopment site shown on design drawings. A Marine Monitoring Program was implemented, as agreed to by the

Scientific Advisory Group, as described below.

- Placing fill, rock and sand into a marine environment has inherent problems in that it causes turbidity. Turbidity plumes have been caused and have occurred, frequently at times, beyond the "envelope of the footprint". However, it is considered that without the level of environmental management actions adopted, the frequency and magnitude of turbidity would have been greater than that observed. There were several means of limiting or controlling the generation of turbidity beyond the "envelope" including:
  - using shot rock material of good quality (with small amounts of associated dirt and fines)
  - lining the inside of shot rock berms and outside of fill platforms with geotextile fabric to prevent long-term erosion and sediment losses to the ocean (though some short-term loss of fines to the water column did occur)
  - excavating the toe of headland rockwalls at low tide when the risk of resuspending excavated marine sediments was reduced (excavation of marine sediments and replacement with armour rock was required for structural integrity)
  - preventing the entry of machinery below the tide level
  - installing and maintaining silt curtains around the first 3 headlands to limit the turbidity to inside the 'envelope of the footprint'. Large tidal ranges and wind stress made these difficult to keep in place though, at times, capture of turbidity inside the curtains meant that ambient light levels outside the 'envelope' were preserved.
  - lining the inside of realigned wall with geotextile fabric prior to armouring with rock. This technique minimised the area of fill material exposed to rain and runoff.
  - using sand imported to the site to form a downstream filter bund below exposed fill material to limit the egress of poor quality stormwater.
  - minimising the 'fines' content of sand imported to the site.
  - depositing sand along a beach crest allowing flood and ebb tidal action to naturally redistribute imported sand (rather than push sand direct into the sea).

- Refuelling and minor maintenance off-site inside a secure, HTPE liner.
- Oil and fuel spill readiness (should a machine fall into the water) with absorbent material and floating booms.
- Dust suppression by tanker trucks watering exposed sediments and roadways.
- Adhering to limited work hours (7am to 6 pm) six days per week to reduce noise and impact on amenity of the area. Nighttime work was required to excavate the toe of headland rockwalls during November 1998.
- Importing fill, rock and sand along a predetermined road transport route.

COMMITMENT TO ONGOING MONITORING AND ASSESSMENT

Ongoing monitoring programs of the area surrounding the Strand will also attribute to the sustainability of the development. These programs include:

- Turbidity Monitoring:
  Two types of turbidity monitoring were undertaken - Instantaneous Events and Long-term Turbidity Levels. Seagrass monitoring and noise monitoring are also being monitored and will continue to be.

THE RESULT

Townsville City Council needed to design a foreshore protection system but also incorporate a design that would return the Strand back to the residents and visitors to the region.

The Strand now includes two stinger enclosures, a basketball court, water play park, cafes/restaurants, children's enclosed play area, BBQ's, public toilets and various exercise obstacles along the boulevard. The Tobruk Pool renovations, funded partially by Townsville City Council, which included a new 25-metre pool, two-way kiosk, gymnasium, clubhouse and refurbished foyer were incorporated into the Strand redevelopment. The Picnic Bay Surf Lifesaving Club took the opportunity to build their new $400,000 headquarters on the Burke Street headland. The 60 metre Strand Pier was constructed on the Stuart Street Headland and provides a venue for the keen fisherman.

The Strand Redevelopment has been aimed at the community with access being a major contributing factor to its success. Plenty of parking is provided the entire length of the foreshore with off street parking also provided. The lighting in all areas has been improved to provide a high level of safety along with the introduction of regular security patrols.

Pedestrian crossings have been installed and traffic management procedures have been put in place in the form of roundabouts and speed humps. Taxi ranks and Bus Stops are provided at points along the Strand, with bus routes now incorporating these areas into their schedules. Bicycle lanes are also becoming a prominent feature on Townsville roads making access to the Strand via a bicycle much safer.

DISABILITY ACCESS

Access for people with disabilities was a major factor in the design of the Strand therefore all crossings and entryways are suitable for wheelchair access including the main restaurants and cafes. There is plenty of disabled parking spaces along the entire length of the foreshore (twice the Australian Standard and strategically located).

Every aspect of accessibility to the Strand foreshore has been assessed and implemented to make the experience of visiting the Strand an enjoyable one.

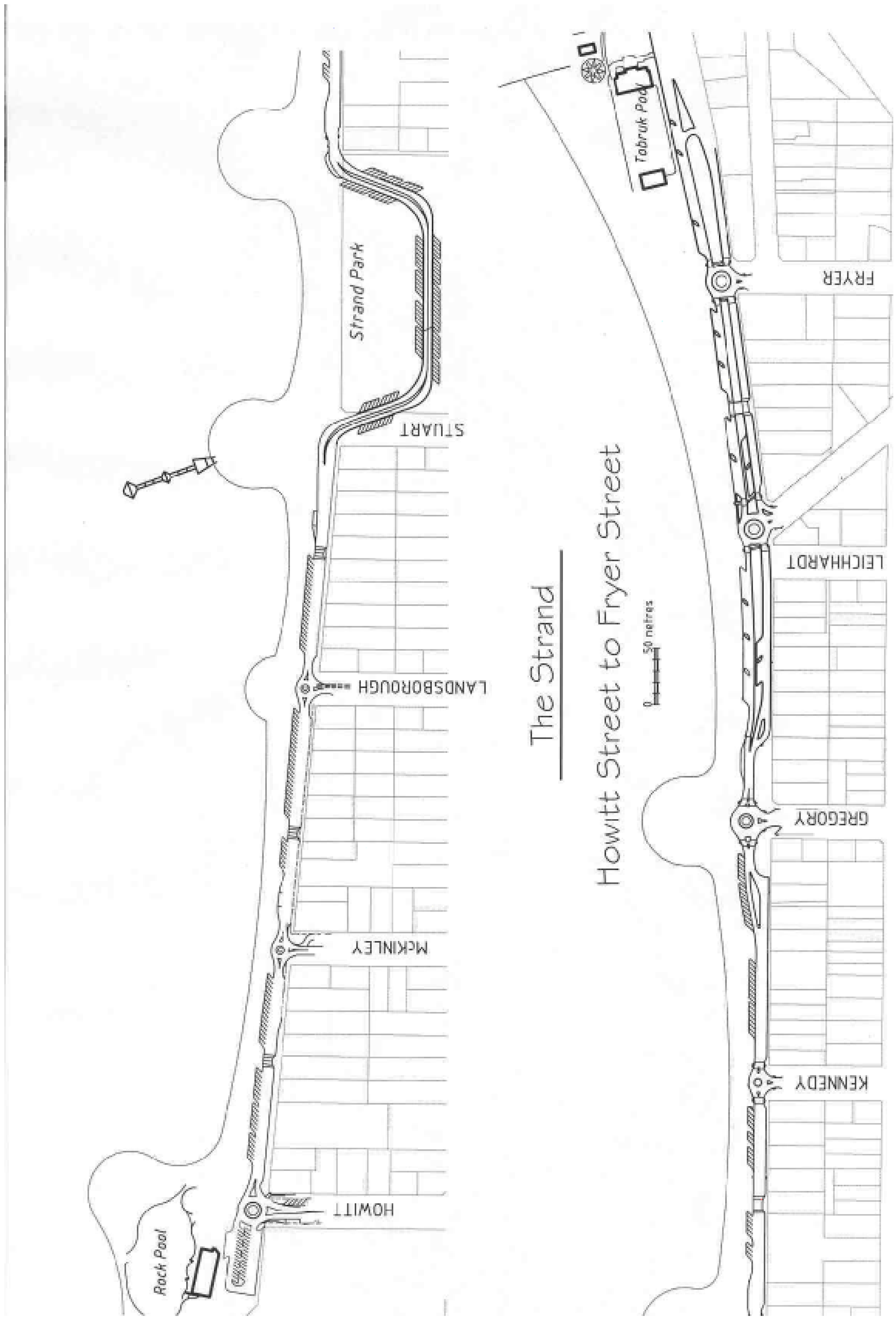
Areas have been designed with age groups in mind. A safe equal access playground was developed where younger children of all ability can play and develop their skills. Picnic areas and barbecues are also included close to this young family facility. A "Teen Park" with equipment orientated towards teenagers has also been included in the design.

Care was taken to ensure all age groups could use the Strand. An equal access consultant was employed to over view the design even to the abilities of wheel chair bound people being able to use the rod holders provided for people fishing.

The Strand now offers a friendly and relaxed atmosphere for locals and visitors to Townsville. Its inclusiveness of people of various ages and interests, visual attractiveness, proximity to the sea and city, cleanliness and sense of safety, and range of recreational and social opportunities available to the community have all been highlighted as attributes. On an average week over 60,000 people visit the Strand to take advantage of the amenities available for use by the public.

CONCLUSION

Through an open approach with both legislators and the community Townsville City Council has been able to transform a disaster area into an icon for the City. Co-operation between all those concerned allowed the work in an environmentally significant part of the Great Barrier Reef Marine Park.


The Strand
Howitt Street to Fryer Street
0
50 metres
Strand Park
Tobruk Pool
Rock Pool
STUART
LANDSBOROUGH
McKINLEY
HOWITT
FRYER
LEICHHARDT
GREGORY
KENNEDY

REFERENCES

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Strand Rejuvenation
Prepared by Coastal Engineering Solutions for the Townsville City Council

Submission for Special Funding Consideration – The Strand Redevelopment
Prepared by Townsville City Council for the Queensland State Government

<u>The Strand Waterpark</u>