

Infrastructure to Enhance the Natural Capacity of the Environment to Support a Tourist Economy - A Coastal Case Study: The Northern Gold Coast Beach Protection Strategy

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SUMMARY The Gold Coast is Australia's premier tourist destination that offers some of the best and most popular surfing beaches in Australia. Tourism is the Gold Coast's largest industry however it is at risk of significant losses due to storm events. While an oceanfront boulder wall has been successful in stopping buildings from being lost into the ocean it has also accelerated the loss of sand from the beach and slowed the recovery of the sandy beach following a storm. Hence the Gold Coast's boulder wall is not successful in protecting tourism from economic loss, as tourists do not wish to visit areas without sandy beaches. A case study is presented that shows how the Gold Coast City Council is investing in infrastructure that enhances the natural capacity of the environment (IENCE) to support our tourist economy. The Northern Gold Coast Beach Protection Strategy (NGCBPS) aims to decrease the risk of economic loss following storm events by increasing the volume of sand within the storm buffer seaward of the oceanfront boulder wall. The NGCBPS has the dual objectives of increasing the sand volume within the dunal buffer through sand nourishment and improving surf quality through the establishment of an artificial surfing reef.

1 INTRODUCTION

The Gold Coast has the benefit of approximately 52 kilometres of clean golden Pacific Ocean beaches. It offers some of the best and most popular surfing beaches in Australia, and accordingly, is a major tourist attraction and coastal recreation area. The Gold Coast is now a "world class" coastal resort city with the Surfers Paradise beachfront area being the "Heart of the City" (Figure 1) (Jackson (1)).

Tourism forms a significant component of the Gold Coast economy. As a major tourism area, the Gold Coast City Council has recognised the need to provide infrastructure that enhances the natural capacity of the environment (IENCE) to support, manage and protect the beaches which form the base of the tourism industry.

The Northern Gold Coast Beach Protection Strategy (NGCBPS) has been developed to provide a sustainable long term coastal management solution for the Northern Gold Coast. The strategy aims to improve and protect the beaches as thus provides for tourism infrastructure needs.

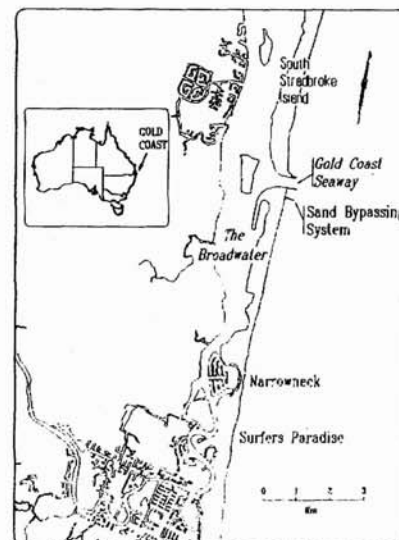


Figure 1: Location of the Gold Coast

Traditionally coastal management has focused on the protection of property. Storms can lead to erosion of the golden sandy beaches and a loss of the asset that draws the tourist to the coast.

2 ECONOMIC LOSS FROM EROSION

2.1 Physical Damage

Significant private and public development is located along the Gold Coast beachfront that has been historically prone to erosion. For example, the erosion that occurred during the storms of the 1960's created scarps that eroded into beachfront properties, parks and esplanades. Protection works resulted in few structures being lost but erosion of the beaches had a huge impact on tourism. This highlighted to Gold Coast City Council that protection of structures should not be the only focus of beach protection.

Council and private residents began to construct protective walls in order to protect buildings and other structures. In 1975 the Council adopted a standard design for the construction of protective boulder walls and a foreshore seawall alignment for those walls. It is now Council policy that all new developments on the beachfront have a certified boulder wall in place before development can occur. Through this process, a continuous line of "hard protection" is being put in place.

While the boulder wall has been successful in stopping infrastructure from being washed into the sea, it can have an adverse effect on the City's beaches. During storms sand moves off the upper beach to form storm bars. Large storms can remove all of the "dry useable beach" sand seaward of the boulder wall. Hence the boulder wall protects the infrastructure landward of the wall, but increases the loss of sand from the "dry useable beach" and slows the recovery of the sandy beach following the storm.

2.2 The Tourism Economy

Tourism is a major Australian industry. In 1996 alone, travel and tourism in Australia is estimated to have generated:

- \$59.6 billion of gross output, or 10.5% of GDP;
- over \$14.7 billion in taxes; and
- 11.5% of total employment (one in every nine jobs) (KPMG (2))

These figures are forecast to grow by 43.1% (in real terms) to reach \$136 billion by 2006.

The Gold Coast is Australia's premier tourist destination and receives approximately 4 million visitors every year. These visitors spend approximately \$2.5 billion per annum and tourism is the largest industry on the Gold Coast. Surveys of tourists have indicated that the world famous golden sand surfing beaches are the main attraction they come to visit.

Loosing the sandy beach could have a disastrous effect on Gold Coast tourism. However, loss to the tourism economy following erosion is not always the result of loss of all useable beaches. While some parts of the Gold Coast may

have faced significant erosion, many other parts remain in a useable condition. Unfortunately the media focuses on the loss of sand at the few badly affected sites giving the impression that the entire Gold Coast is unusable. Articles such as June 1966 article in the Sydney Morning Herald (Figure 2) can do significant damage to the tourism economy. The media will always report a story and the easiest one is "EROISION DEVASTATES BEACHES" with pictures taken by cameramen lying on the sand for dramatic angles. If the public are given positive information then the impacts on the tourist economy may not be so severe. The highest economic loss is not due to the loss of infrastructure such as buildings, steps, or fences, but is actually the loss of tourists visiting. The tourists decision not to come is usually based on their perception that they can not have a beach holiday on the Gold Coast because there are no beaches. This is usually a reaction to over-dramatic media stories than a consideration of the actual physical condition of the beach.

The Sydney Morning Herald

Five houses collapse into pounding sea

DOZENS MORE
IN DANGER
STORM HAVOC

Five houses were swept into the sea today as a storm hit the Gold Coast. The houses were located on a narrow strip of land between the beach and the sea. The storm was the worst in years and caused widespread damage to property and infrastructure. The houses were completely destroyed and the debris was scattered across the beach. The storm also caused significant erosion of the beach and the sea wall. Dozens more houses are in danger of being swept into the sea if the storm continues.



Figure 2 Article from the Sydney Morning Herald, June 1966

A direct relationship between a decrease in tourism and erosion events has been determined (Raybould and Mules (3)). Erosion associated with the a 1 in 25 year event, similar to that which occurred in 1967, would be expected to cost the Gold Coast approximately 13% of annual tourism dollars or approximately \$305 million (1996 dollars) (Raybould and Mules (3)).

Even a minor erosion event, for example a 1 in 5 year event, can cost the Gold Coast approximately 2% of annual tourism dollars or approximately \$47 million (1996 dollars) (Raybould and Mules (3)).

3 INFRASTRUCTURE TO SUPPORT TOURISM

The natural environment has a capacity to support a limited level of use. As use levels increase, the natural systems, with their natural variability, can no longer sustain tourist requirements without management. For successful tourism based on the natural environment, infrastructure needs to be provided. The development of tourism infrastructure has had considerable impacts on the environment in the past. A recognition of the behaviour of the natural environment allows one to develop infrastructure that achieves its purpose and can also either enhance the beneficial features of the natural environment and/or mitigate the impacts of negative environmental events.

Infrastructure that enhances the natural capacity of the environment (IENCE) allows the adverse effects of natural variability to be mitigated.

3.1 Infrastructure that Enhances the Natural Capacity of the Environment (IENCE) Projects

IENCE type projects are being proposed more and more frequently. A situation where IENCE projects are being proposed usually consists of the following:

- 1) a large existing functioning economy based on a specific physical environment;
- 2) an environmental location that can at times experience natural events that can affect the local economic processes;
- 3) memory within the economic community of a past environmental event that caused significant economic hardship;
- 4) a perception within the economic community that a similar event today would be far worse due to growth of the economy;
- 5) the ability to control the actual economic loss suffered due to a natural environmental event through the implementation of a control strategy.

Examples of IENCE projects include:

- artificial snow making to extend a ski season or to allow skiing during unusually warm weather;
- satellite mirrors to extend daylight hours in arctic cities;
- beach nourishment that reduces the loss of tourists following storms;
- artificial surfing reefs to increase the frequency of surfability.

Ecologically sustainable development (ESD) principles would suggest that IENCE projects should not be used to develop pristine areas. Where possible, infrastructure should be located outside the sphere of negative environmental influence, so that it is not necessary to control the process to avoid economic loss, ie. it is not realistic or desirable to put a ski resort in an area, which does not have snow. The ESD principle is valid and is the reason that many

environmentalists might oppose IENCE projects. There has been a debate within the environmental group, United States Surfrider Foundation, about the construction of artificial surfing reefs. Members of the group are experiencing conflict between their desire to "not mess with nature" and the excitement about the potential of having new world class surfing breaks.

Although the principle of locating economic systems outside of the sphere of negative environmental influence is valid, this is not practical in many situations, particularly where there already is large existing tourism centres. The cost of loss of beaches on the Gold Coast is immense when compared with the implementation cost of the Northern Gold Coast Beach Protection Strategy.

Tourism based on natural systems may need to be supported by infrastructure that allows established economic regions to continue to expand and increase the return for existing investment. Using the example of a ski field, the normal ski season results in the construction of infrastructures such as roads, chalets and lifts. Investment in artificial snow making can reduce the impact of warmer years (equates to a storm on our beach) and allow a normal season to occur despite the weather. Making artificial snow on a slope without the existing economy and infrastructure may not be warranted, however extending the season for existing ski villages through IENCE can result in greater returns per \$ invested in traditional infrastructure such as roads, lifts and chalets.

The NGCBPS is primarily an IENCE project as it will not only protect the beach, but will enhance the beach asset (a wider beach) and enhance the natural process of wave breaking but still produce waves that are naturally capable of forming within the existing natural wave variation. The authors believe that IENCE is usually appropriate in already developed situations, such as the Gold Coast where the environment is no longer in a pristine state. IENCE should not automatically be assumed to be bad and can result in real economic benefits to provide jobs and raise standards of living for real people while not having significant adverse impacts on already modified environments. IENCE is justified where there is a large existing economic infrastructure, eg. hotels, roads etc., and there is potential for huge losses due negative environmental influence events, eg. a loss of a beach due to a storm with 50 year return period.

An adequate beach profile and good surf is as important to Surfers Paradise as providing adequate ski slopes in a ski resort. Just as a ski resort will use artificial snow makers and groomers, we need to ensure our beach meets the demands of the tourism industry. An artificial reef can be designed to provide the best possible surfing conditions and will provide protection to the newly nourished beach.

4 A LONG TERM STRATEGY

The Gold Coast City Council has recognised that the beach is an important asset that needs its own protection and maintenance. Maintaining an appropriate beach profile with a reasonable amount of "dry useable beach" will ensure that tourism is catered for. The Council has the following long term aims for its beaches:

- 1 Widen and maintain all Gold Coast beaches to a standard capable of withstanding at least a 1 in 50 year storm and sea level rise without exposing the seawall;
- 2 Provide additional control points and sand at suitable locations to stabilise the beaches, improve surfing conditions and allow sea level rise impacts to be mitigated; and
- 3 Facilitate the construction of a continuous seawall to the design standards to protect private and public beachfront assets.

This strategy will ensure the coastline is managed in a way that will protect both the beachfront assets and the beach itself.

5 NORTHERN GOLD COAST BEACH PROTECTION STRATEGY

The Northern Gold Coast Beach Protection Strategy (NGCBPS) is a major coastal management strategy that proposes a fundamental change to the Northern Gold Coast coastal system. The strategy is aimed at the stretch of coast between Burleigh Heads and has two main objectives:

1. to widen the beach and dunes along the Surfers Paradise Esplanade to
 - a) increase the volume of sand within the storm buffer; and
 - b) provide additional public open space; and
2. to improve surf quality at Narrowneck by the construction of a submerged artificial reef to stabilise the nourished beaches.

Figure 3 gives an overview of the main components of the strategy. Jackson *et al.* (4) gives a detailed background of the strategy and the design and impact assessment studies involved. Other papers to be presented to this conference describe the physical modelling, numerical modelling and environmental monitoring program (Turner *et al.* (5), Carley *et al.* (6), Walsh *et al.* (7), Black (8), and Hutt *et al.* (9)).

The strategy has been implemented in three stages. The first stage involved the production of a master plan. Stage two involved a number of studies to be undertaken. The final stage of the strategy involves the implementation of the works. The initial works involve dredging of 1.1 million m³ from the Broadwater and placing it on the beach and in the near shore zone at Surfers Paradise and the construction of the reef. At the time of writing, the works were about to commence. Ongoing nourishment in the order of 80,000 m³ per annum will be required as maintenance.

The NGCBPS will enhance the existing beach and provide a surfing reef. Both components of the strategy, beach nourishment and the reef, are good examples of IENCE.

5.1 A Wider beach

While the new, wider beach will provide additional space for recreational facilities such as bike paths, picnic areas, barbecue etc., the main purpose of the wider beach is to protect the sandy beach asset for tourism. Extending the beach to a 50 m width should enable it to withstand a 1 in 100 year storm, and will reduce the effects of smaller storms.

The nourishment will enhance the natural beach environment allowing tourism to continue to operate even when erosion occurs.

5.2 The Artificial Surfing Reef

On the Gold Coast one of the major beach users are surfers. In 1994 it was estimated that there were in excess of 2500 people directly employed by the surfing industry on the Gold Coast and that the surfing industry was worth approximately \$160 million per annum to the Gold Coast (Bartholomew and Lee (10)).

The artificial reef will act as a coastal control point and stabilise the nourished beach. The reef also incorporates both a left and right surf break, enhancing and focusing the natural wave energy that the Gold Coast receives.

5.3 Summary

Both components of the strategy are infrastructure that enhances the natural capacity of the environment. The Council has been able to undertake this project because of the recognition within Council of the importance of the tourism economy and the asset that drives it. Investment in the strategy will cost the Council approximately 7 million dollars, but the strategy has been shown to have a very large benefit-cost ratio of 60 to 1 (Raybould (3)).

An important part of the strategy has been working with the media. The NGCBPS will result in a beach that is better prepared to face storms but part of the strategy is also working with media so that they can report more positive aspects of future storms.

5 CONCLUSION

The Gold Coast tourism industry will benefit from the higher protection and amenity offered by the Northern Gold Coast Beach Protection Strategy. The new infrastructure will enhance the natural environment without causing adverse effects on the coast and have a very large benefit-cost ratio of 60 to 1 (Raybould (3)).

NORTHERN GOLD COAST BEACH PROTECTION STRATEGY

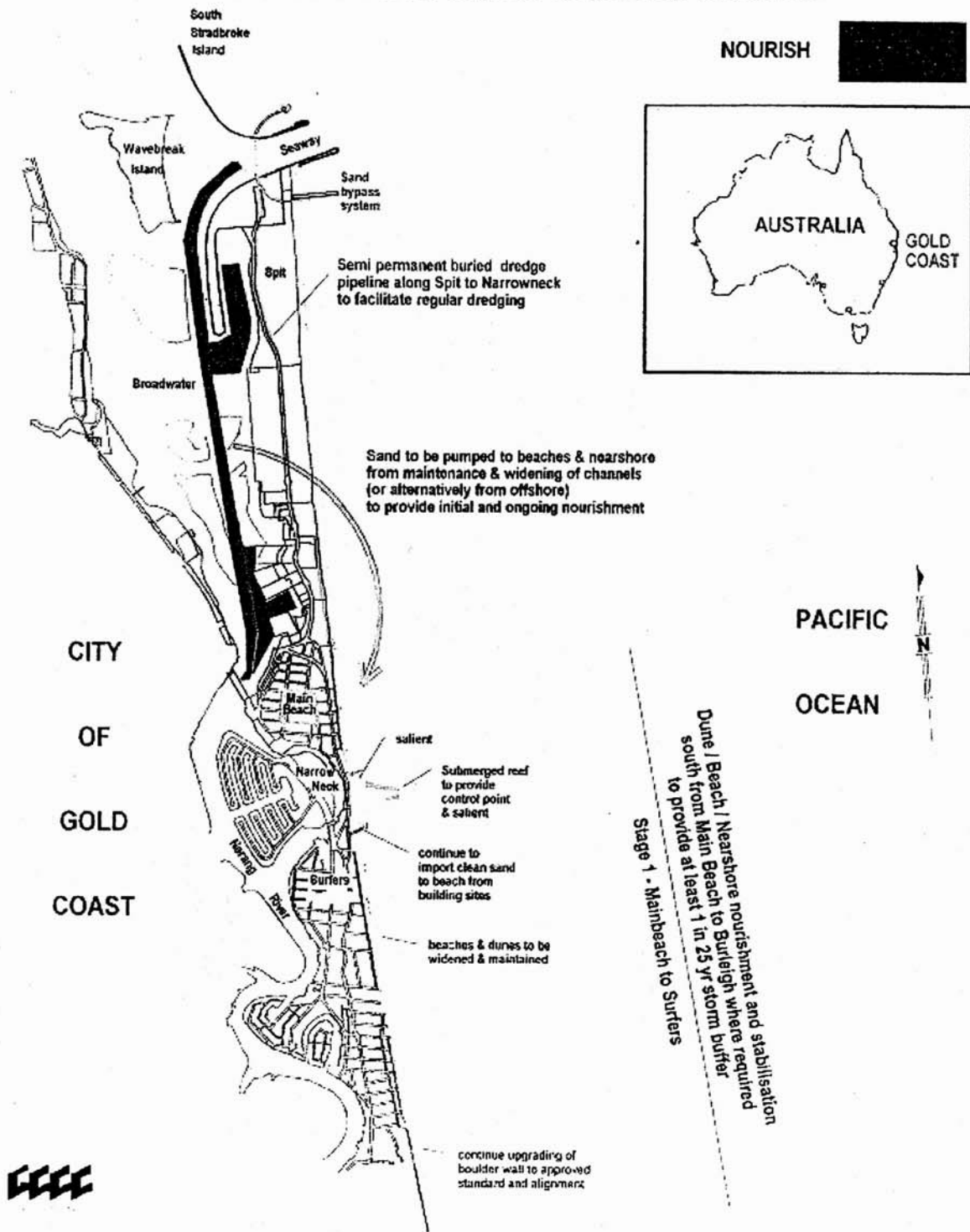


Figure 3 The Northern Gold Coast Beach Protection Strategy

6 REFERENCES

- 1 JACKSON, A. 1998. Northern Gold Coast Beach Protection Strategy Final Report, Prepared for Gold Coast City Council by International Coastal Management.
- 2 KPMG. 1997. The Tourism and Leisure Industry, Company profile summarising statistics collected for the World Travel and Tourism Council.
- 3 RAYBOULD, M., AND MULES, T. 1998. Northern Gold Coast Beach Protection Strategy: A Benefit-Cost Analysis, Prepared for Gold Coast City Council by the Centre for Tourism and Hotel Management, Griffith University.
- 4 JACKSON, A., MCGRATH, J., AND TOMLINSON R. 1997. Strategy for Protection of the Northern Gold Coast Beaches, 279 – 284. Proceedings of the Combined Australasian Coastal Engineering and Ports Conference.
- 5 TURNER, I., LEYDEN, V., COX, R., JACKSON, A., AND MCGRATH, J. 1999. Three-Dimensional Scale Physical Model Investigations of the Gold Coast Artificial Reef. Proceedings of Coasts and Ports '99
- 6 CARLEY, J., TURNER, I., COURIEL, E., JACKSON, A., AND MCGRATH, J. 1999. The Practical Application of Four Commercially Available Numerical Beach Morphology Models on a High Energy Coastline. Proceedings of Coasts and Ports '99
- 7 WALSH, A., TOMLINSON, R., MCGRATH, J., AND JACKSON, A. 1999. Environmental Monitoring of the Northern Gold Coast Beach Protection Strategy. Proceedings of Coasts and Ports '99
- 8 BLACK, K. 1999. Designing the shape of the Gold Coast Reef: Sediment Dynamics. Proceedings of Coasts and Ports '99
- 9 HUTT, J., BLACK, J., JACKSON, A. AND MCGRATH J. 1999. Designing the shape of the Gold Coast Reef: Field Investigations. Proceedings of Coasts and Ports '99
- 10 BARTHOLOMEW, W., AND LEE, B. 1994. Snapper Rocks Surfriders Club Submission to the Tweed River Entrance Sand Bypassing Project.