# TWEED RIVER ENTRANCE SAND BYPASSING PROJECT POST-COMMISSIONING COASTAL BEHAVIOUR

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## 1. INTRODUCTION

The Tweed River Entrance Sand Bypassing System is located on the East Coast of Australia at Lat 28 degrees 10 minutes South. The system uses a pier mounted jet pump system to bypass sand around a trained river entrance from south to north. This bypassing improves navigation conditions, and nourishes the Gold Coast beaches to the north.

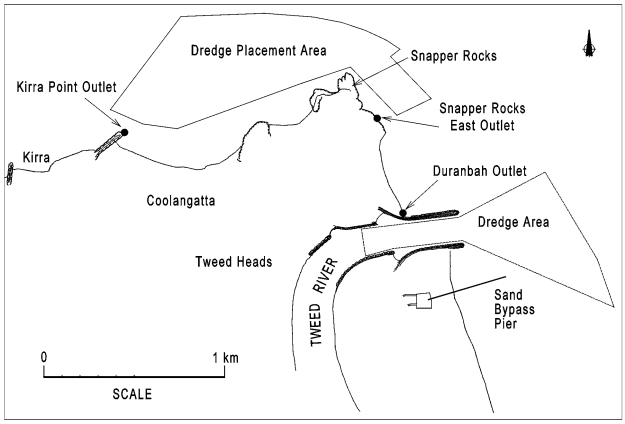
There is a significant rock headland about 1 km north of the river entrance, but the coastline is generally sandy. The mostly quartz sand has a narrow grading with a median grain diameter of about 0.23 mm. The coast is fully exposed to the Pacific Ocean with a long-term average net northwards sand drift estimated to be 500,000 cubic metres per annum (Hyder et. al. 1997).

## 2. DREDGING AND BEACH NOURISHMENT

River entrance channel dredging using trailer suction hopper dredges commenced in April 1995 and finished in November 2001. Approximately 3.9 million cubic metres have been moved by this method. Most of this sand was deposited by bottom dumping into the nearshore zone close to beaches about 1 to 3.5 km north west of the river entrance. The beaches have gained a net volume increase of about 2.5 million cubic metres as a result of this dredging.

## 3. SAND BYPASSING SYSTEM

The fixed system has 11 jet pumps, which operate at depths of 6.5 to 15 metres below mean sea level (MSL). The seabed level at the end of the pier at commissioning was about –6m MSL. Each jet pump uses a 50mm diameter, 35 to 50m/s water jet to entrain the surrounding sand and water mixture. This mixture is thickened in a slurry pit to a specific gravity of about 1.4, and then pumped via a 400mm diameter polyurethane lined steel pipe to the outlets. The system's mechanical capacity is about 1,500 cubic metres of slurry per hour, which is equivalent to about 500 cubic metres of beach sand per hour. There are four outlets from 500 metres to 2 km to the north and northwest of the sand bypass pier. The main outlet is at East Snapper Rocks, 1 km to the north.




**Locality Plan**

## 4. COMMISSIONING

The jet pumps were installed in January 2001, and the first slurry was pumped to the Snapper Rocks East outlet on 27th February 2001. Significant pumping commenced on 8th March 2001 to test the system. Sand trap cone development under the pier developed gradually, with side slopes as high as 1: 1. Initially, some of the cones did not extend to the pump level. Instead there appeared to be a cylindrical tube extending from the cone apex to the pump that was several

metres long. This phenomenon may have been due to heavily compacted sand, compaction due to the pile driving, mild cementing of the sand or the sand "hanging up" on the pile and pipework. However, within months, a trough developed under the pier that improved the sand trapping ability of the system.

By the time the sand bypassing system was commissioned on 4th May 2001, 184,636 cubic metres of sand had been pumped to Snapper Rocks East. The maximum daily rate achieved was 12,321 cubic metres.

**5. FIRST YEAR OF SAND BYPASSING**

As expected, the beach at the pier eroded. By January 2002, the beach had receded by 70 m at the pier and by 50 m at a distance of 100 m each side of the pier. The recession at 500 m south of the pier was 25 m, and there was no measurable recession 1 km to the south of the pier.

At the primary outlet at Snapper Rocks East, the slurry plunges about 4 m onto rocks, and the sand moves north around the tip of Snapper Rocks by natural processes. On occasions, a beach has built up and a small 4.5m diameter plunge pool has formed. Surrounding this pool the sand pancakes up in the shape of a shallow cone, with a side slope of about 1: 25 (slightly steeper than the natural swash zone beach slope of about 1: 30). If discharge ceases, or if there is significant wave action then the sand moves away quickly and the beach erodes. The location of this outlet was recommended by Hyder et al. because the longshore drift indicated by modelling was higher than elsewhere. The absence of a wide beach indicates that this recommendation was sound.

Discharge onto Duranbah Beach commenced on 17th April 2001. This discharge was onto the southern end of the upper beach, which had been recently eroded. After a discharge of 5,000 cubic metres a 3.0m high shallow cone had formed. The details were similar to East Snapper except that wave action had very little effect. Subsequent discharges produced a linked series of cones along the northern side of the northern entrance training wall. After placing 67,000 $m^3$ in April/May 2001, "closing out" conditions limited surfboard riding. However, quality surfing conditions returned reasonably quickly.

Discharge to Kirra Point commenced on 1st August 2001. This discharge was from near the end of a rock groyne into the swash and surf zone. Sand placed in this area was rapidly redistributed such that a cone did not develop. 97,000 $m^3$ of sand was placed from August to October 2001. Further sand was placed in February 2002.

At the time of writing, it was expected that over 700,000 cubic metres of sand would be pumped in the first year.

**6. RESPONSE IN NOURISHMENT AREAS**

The beaches to the west of Snapper Rocks accreted significantly. Wave generated currents and the proximity of surfers sometimes made swimming difficult at some locations, and this attracted criticism. However, swimming conditions have now improved.

Surfing conditions have greatly improved in the area to the west of Snapper Rocks. The area now boasts one of the world's longest surf breaks. The surf at Kirra has also improved, with excellent conditions being recorded in January 2002.

**7. RESPONSE IN ENTRANCE AREA**

The removal of the bar considerably increased navigation depths and improved navigation conditions. However, conditions are still difficult during the last 3 hours of an ebb tide. Also, waves now penetrate further into the river.

The effectiveness of the sand bypassing system on navigation conditions cannot be assessed at this time as the entrance was dredged until November 2001, and the nearshore sand store updrift of the entrance is still receding.

It is anticipated that the sand bypassing system will now maintain improved entrance navigation conditions by starving the ebb tide shoal. However, occasional future dredging is likely following some major weather events.

**8. ENVIRONMENTAL MANAGEMENT**

An extensive monitoring program has been implemented to ensure any environmental impacts would be identified at an early stage, and that data would be available to address any problems. No unexpected environmental impacts have been identified.

**9. COMMUNITY CONSULTATION**

The project has attracted a considerable amount of public interest. Extensive and ongoing consultation with community groups has been undertaken, and newsletters and computer web sites have been used to disseminate information and expel local concerns.

**10. ACKNOWLEDGMENTS**

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www.tweedsandbypass.nsw.gov.au

www.env.qld.gov.au/sandbypass