12 Coastal Hazards

12.1 Coastal Hazards: Main Points

Pressures

- Coastal subdivision and building with insufficient setbacks and poor consideration of coastal processes has increased the risk or threat of coastal hazards.
- It is likely that future climate change may result in increased periods of storminess and sea-level rise, both increasing the threat of coastal hazards.

State

- The last few years have seen a predominance of La Nina weather conditions. This has seen increased wave energy to the east coast of Northland, shifting large volumes of sand offshore.
- Northland's west coast beaches are considered to be accreting, moving large volumes of sand onshore and building healthy vegetated foredunes along its length.

Response

- The Revised Proposed Regional Coastal Plan includes methods to manage coastal hazards in Northland.
- Coastal Hazard reviews are continuing to assess coastal areas that are likely to be subject to coastal hazards.
- Consent monitoring includes measures to monitor the effects of sand extraction on shoreline retreat.

12.2 Introduction to Coastal Hazards in Northland

A coastal hazard results from natural phenomena such as storm surge, tsunami and other wave action resulting in either erosion, landslip or flooding. Low lying coastal margins such as the estuarine areas behind barrier spits can be vulnerable to flood inundation from increases in sea level due to storm surge or tsunami.

Storm surge at Matapouri

Coastlines, particularly soft sediment coastlines, are dynamic according to the changing conditions of the sea. During high-energy events such as storms, beaches will draw upon sediment locked up in foredunes or other features above mean high water mark.

Storm waves causing extensive erosion at Bream Bay

A hazard exists where people have built too close to or on top of foredunes, and on the tips of sand barriers. Traditionally this has been the practice with holiday baches and many properties are now situated in areas considered to be 'high risk'.

Sea level rise may also increase the frequency with which beaches retreat (erode) and may also result in a net long-term erosion of much of the Northland shoreline.

12.3 Regional Policy Statement Objective

- **To avoid or mitigate the adverse effects of natural hazards by minimising and where practicable, avoiding the risk to life and damage to property, infrastructural services and other aspects of the environment, from natural hazard events.**

12.4 Coastal Hazard Issues

The following is a summary of the significant resource management issues of the region related to natural hazards:

- The threat to existing and future communities from natural hazards, the potential and nature of which may be unknown.

- Recognition and understanding of the range of existing natural hazard threats and the likely frequency and magnitude of particular events.

- Identification of areas of high hazard risk, especially those prone to erosion, flooding and land instability, and provision of related information on avoidance measures to people.

- Incorporation of comprehensive systems of hazard identification and analysis into the resource consent and building consent processes.

- Damage to natural systems through inappropriate hazard protection measures.

- The contribution which certain land use activities have in increasing the hazard threat especially in high risk areas. Such activities include:

    - clearance of vegetation by mechanical or other means in areas exposed to the elements and/or with poor soil structures.
    - earthworks, including mineral extraction, in sensitive foreshore and riparian areas.
    - erection of structures, especially buildings, in flood plains.

- Maintenance of existing protection works, including flood control schemes, and effectiveness of future works.

- Recognition of global warming and the effects of rising sea levels on future land use and subdivision activities along the coast.

- Recognition that small communities often cannot bear the costs associated with natural hazard disasters. Local authorities need to coordinate disaster recovery operations and where appropriate, seek financial assistance from central government.

12.5 Pressures Affecting Coastal Hazards

12.5.1 Coastal Subdivision

A direct pressure on the coastline comes from the continued demand for coastal property. Large sections of the coastline previously undeveloped or previously farmed, are now being considered for subdivision to cater for this demand.

Although coastal hazards are predominantly a product of nature and the dynamics of the coastal environment, they can be added to by the impacts of human activities (for example the modification of natural foredunes).

Coastal subdivision and buildings, with inadequate setbacks and poor consideration of coastal hazards, increases the risk or threat of coastal hazards.

Erosion at Matapouri Bay

12.5.2 Global Climate Change

While the exact linkages between global climate change and sea-level rise are not well understood, it is known that our climate is changing. Increases in average global temperatures, increased rainfall and increased storminess are among a few of the major changes being experienced. Global sea-levels are rising, but at varying rates around the globe and at varying rates around New Zealand. The recent Intergovernmental Panel on Climate Change (IPCC) forecast for sea-level rise, predicts a global average increase of 5mm per year for the next 100 years (IPCC, 2001).

With an increased frequency of oscillations between La Niña and El Niño in recent decades and an improved understanding of the Inter-decadal Pacific Oscillation, extended periods of 'storminess' may exist. Such phenomena would almost certainly place increased pressures on our coastline and increase the threat of coastal hazards.

12.6 State of Coastal Hazards

The last few years have seen a predominance of La Niña conditions affecting the country. With these conditions comes a reversal of the southwesterly flow that dominates over the country during El Niño. The dominant east-northeast La Niña flow brings increased wave energy to the Northland's east-coast, resulting in changes to many of the beaches along its length.

Some beaches are affected more than others by the increased wave energy, shifting large volumes of sand off the beach to form long-shore bars in the surf zone. This has resulted in erosion to the beach face and foredune of many east-coast beaches.

Foredune erosion at Bream Bay

In time a significant portion of this sand will be moved back on shore, rebuilding the beach profile and eventually rebuilding the foredune. Beaches are dynamic, responding to changes on scales of seasons to years and even inter-decadal (10-20 years).

Northland's expansive west coast beaches, while also dynamic, are generally considered to be in a positive condition. The predominantly offshore winds along much of the west coast have allowed the swell waves to move large volumes of sand onshore and the building of healthy vegetated foredunes along much of their length.

It is important to realise that the combination of natural coastal processes and human settlement increase coastal hazards. Northland's west coast beaches don't have the same degree of development, and combined with their generally positive condition, have a much lower coastal hazard risk than the east coast.

12.7 Responses

12.7.1 Northland Regional Council

Policies and Plans

The **Regional Policy Statement for Northland** provides an overview of resource management issues in Northland, including those in the coastal marine area.

The Regional Policy Statement also defines objectives for the management of the coastal resource. These aim to minimise or avoid the effects of natural hazards on people, property, and other aspects of the environment.

The management of coastal hazards is an issue that involves the consideration of factors above and below Mean High Water Springs. The **Revised Proposed Regional Coastal Plan for Northland** includes methods to manage coastal hazards.

Principal options for managing natural hazards in the coastal environment are catgeorised in the Plan as follows:

- environmental planning (eg. buffer zones in erosion-prone areas)
- resource consent conditions
- dune management (eg. revegetation of dunes, provision of boardwalks)
- protection works and structures

The Plan encourages methods other than coastal protection works to manage coastal hazards, and these are only permitted where they are the best option, are in accordance with natural processes and are designed to avoid adverse environmental effects.

Coastal Hazard Surveys and Reviews

The Northland Regional Council has a responsibility under the Resource Management Act (1991) to identify hazards where they exist. This information is then provided to the district councils for inclusion into their respective district plans.

The process of identifying coastal hazards was first initiated in 1988, prior to the formation of the Northland Regional Council.

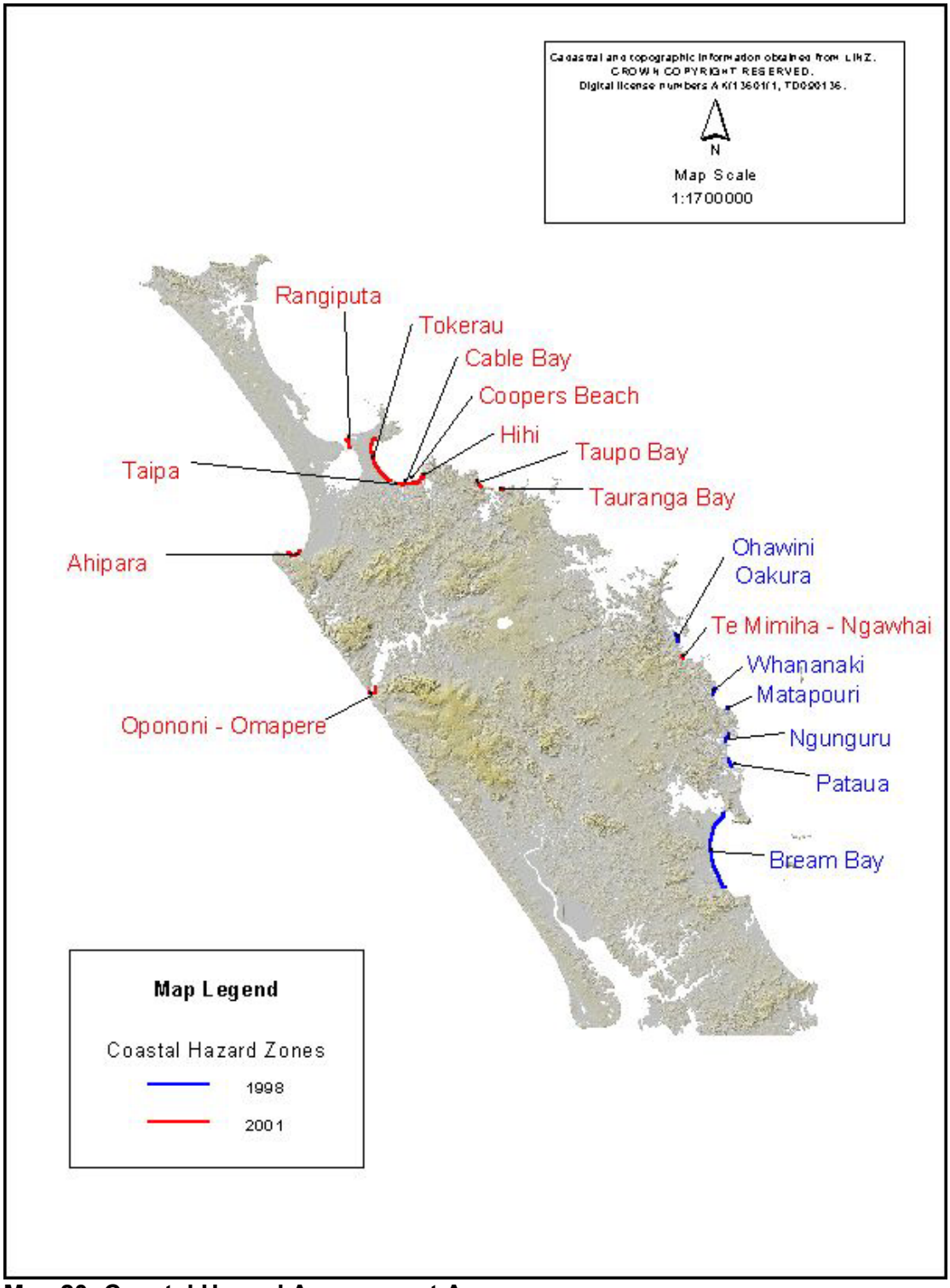
- Whangarei county area (*NRC* 1988*)*
- Former Mangonui county area (*NRC* 1991)
- Omapere-Opononi area (*NRC* 1991)

A review of this coastal hazard information was begun in 1998 and is still continuing. Most of the sites formerly surveyed have been reviewed, and some additional sites not previously surveyed have also been included.

Coastal hazard information is presented on maps in the form of Coastal Hazard Zones. These zones identify coastal areas that are subject to, or are likely to be subject to adverse effects from identified actual or potential natural coastal hazards.

Coastal Hazard Review 1998

Hazard zones for 11 of the original 22 areas surveyed within the Whangarei District were revised during 1998 (Map 21). These areas included Bream Bay, Pataua, Ngunguru, Matapouri, Whananaki, Oakura and Ohawini. This revision resulted in an additional setback to the hazard lines in some areas, with little or no change to some lines in other areas.



Map 20: Coastal Hazard Assessment Areas

Studies of the coastal hazard zones and processes along sections of Northland's coast show that certain areas are extremely dynamic, with large areas of mobile sands, such as the areas around the tips of many of Northland's sand spits. Traditionally, people have built too close to these and other areas such as foredunes. Some properties are now situated in areas considered to be 'high risk'.

Hazard Review Methodology

Nearshore profiles were surveyed using a small boat and depth sounder and extended up the foreshore to include the foredune using a theodolite and Electronic Distance Meter (EDM). The seaward edge of the foredune was mapped using Global Positioning System (GPS) equipment, with dune crest heights established using theodolite and EDM survey equipment. Information on the geomorphology is then incorporated with historical survey information and used to determine the extent of both short term and long-term erosion episodes. This then allows development of the coastal hazard zone, which are then used by district councils and adopted into their respective district plans.

Coastal Hazard Review 2000/2001

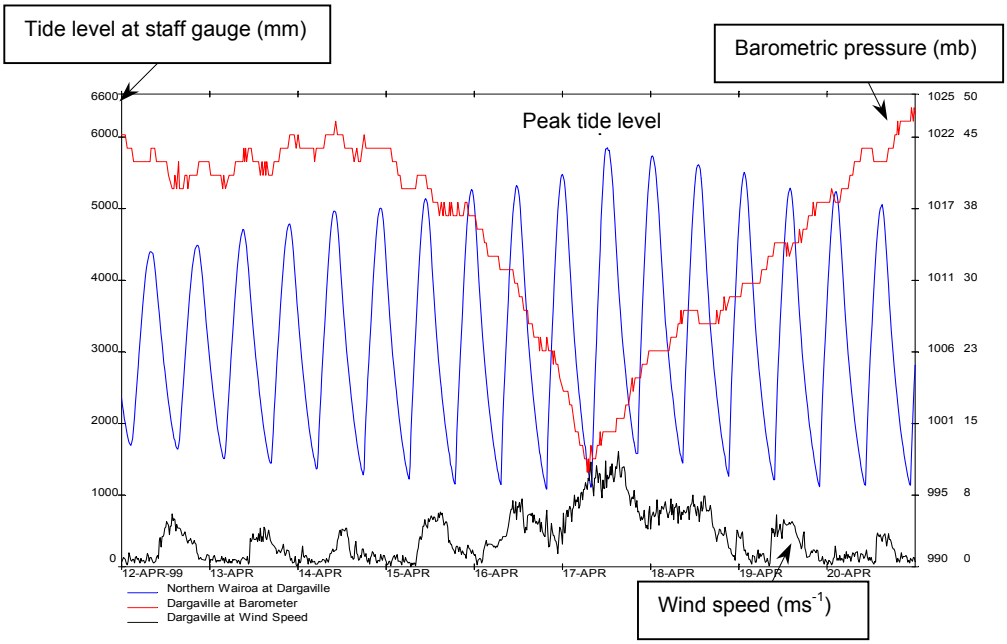
A review of some erosion prone areas and areas that have not previously been surveyed was commenced in 1999. Preliminary site investigations and fieldwork were undertaken at most sites. Further work is still being carried out and the coastal hazard zone review will be completed late in 2001. The areas under review include: Helena and Teal Bay, Taupo Bay, Hihi, Rangiputa, Omapere–Opononi within the Hokianga Harbour and Ahipara. Coastal hazard zone information is also being reviewed or developed for Tauranga Bay, Coopers Beach, Cable Bay, and Taipa.

12.8 Case Study: Dargaville Tidal Surge –17 April, 1999

An investigation into the storm surge/wind set-up that inundated Dargaville was undertaken immediately following the 17 April event. Flood levels were surveyed at Pouto Point, Te Kopuru, Aoroa, Dargaville and at Glinks Gully. These levels were related back to mean sea level and will assist in understanding the nature and magnitude of this event.

It is apparent that this event was due largely to a combination of factors:

- Elevated sea levels of **~180mm** due to the low barometric pressure of **996mb**.
- Relatively high spring tides (less than "King Tides") – 3rd highest predicted tide for the year.
- An elevation of sea level attributable to wind set-up against the west coast of the North Island from the south-west winds of moderate strength (**~20 knots**).
- A localised effect of the wind set-up within the Kaipara Harbour, that resulted in the generation of a long period wave. This wave moved up the Wairoa River and arrived at Dargaville exactly at the time of High Water.



The surge line at Pouto Point was surveyed at **1.47m** above predicted tide height. Subtracting the effect of barometric pressure (0.180m) leaves **1.29m** attributable to wind set-up and other forcing mechanisms.

Assisting the extreme tide level was the minimum in the barometric pressure coinciding exactly on the spring tide. Coupled with this was the effect of wind set-up against the West Coast and a localised effect within the Kaipara Harbour.

12.9 Case Study: Extreme Sea-level Event –July, 2000

During July 2000, Northland (and most of the east coast of the northern half of the North Island) experienced almost a month of continuous easterly winds. Some of these were quite strong, reaching sustained strengths of 35 knots. It just so happened that at the time of these sustained easterly winds, the earth experienced its largest astronomical tides for the year.

Flooding on the Hatea River, Whangarei

The sustained southeasterly winds resulted in a significant wind set-up against the coast elevating sea-levels around the coast, but more significantly causing the sea level to back up in Whangarei Harbour by 0.39m. In Whangarei, the flooding experienced in and around sections of the Hatea River and Town Basin area on 4 July was caused by the wind set-up within the harbour on top of the largest astronomical tides for the year.

The increased sea-level elevation from the wind set-up coupled with the king tide enabled waves to get further up the beach face. The result was a significant amount of erosion to many sections of the Northland coastline. Areas such as Matapouri and Bream Bay were worst affected. Further erosion to these areas occurred in the weeks following as the continuation of easterly winds (some very strong i.e. 60 knots) resulted in the generation of large waves. Most of the erosion in this 'second wave' occurred during a sustained period of 60 knot winds. Six-metre waves were recorded by the Auckland Regional Council at the Mokohinau Islands during this period. The largest wave recorded was a single wave of 12m.

Surveys (GPS and beach profiles) were undertaken immediately following these events, and showed the beaches to be displaying an extremely low profile. The foredune at the northern end of Bream Bay had been cut back by 10-12m, with the erosion reducing towards the Waipu end of Bream Bay, where the foredunes had been cut back approximately 3m.

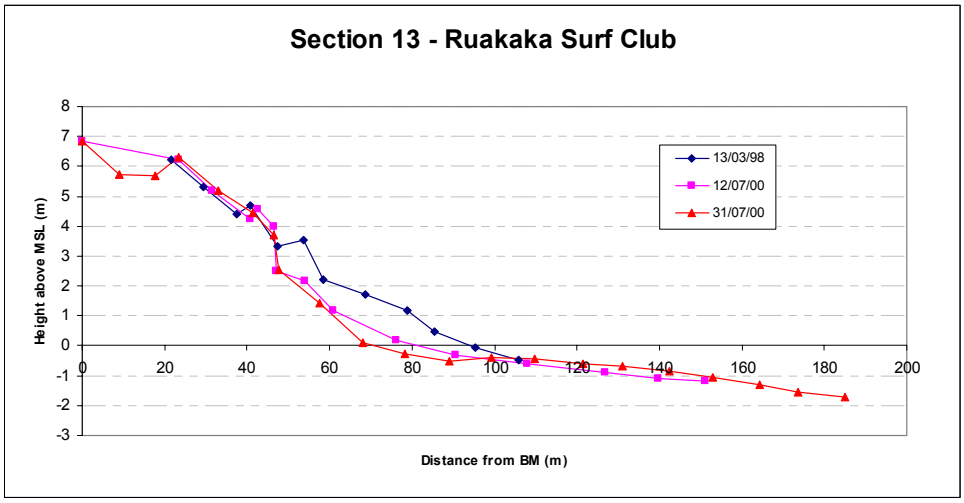


Figure 44: Following the July 2000 storms, the foredune is shown to have cut back by more than 10m and the beach profile significantly lowered.

Matapouri was the other coastal area badly affected. The erosion along Matapouri Beach varied, in that some areas were affected more than others, and at different times. There were two areas worst affected; one at the northern end of the beach, where the foredune was cut back 6-7m, and another section in the center/spit end of the beach which also was cut back 5-6m.

Matapouri 11/07/00
After the first of the two significant July storms

Matapouri 24/07/00
At the end of the July storms