Wainui Beach Management Strategy (WBMS) – Summary of Existing Documents

Review of the 1995 Wainui Beach Coastal Hazard Zone

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Scope –

In 1995 Dr. Jeremy Gibb from Coastal Management Consultancy Ltd. produced a report for Gisborne District Council on coastal hazard zones for Northern Poverty Bay and Wainui Beach. Then, in 2001, Gisborne District Council commissioned Dr. Gibb to review his hazard zone assessment in relation to Wainui Beach. This summary focuses on the later report.

The report includes an extensive summary of information from a range of sources and previous studies on the geological and coastal processes that affect Wainui Beach.

Three types of coastal hazard zones are assessed:

- **erosion zones** encompassing land likely to be subject to erosion from coastal processes
- **landslip zones** for land likely to be subject to coastal landslips; and
- **coastal flooding zones** where land is likely to be subject to temporary inundation from either storm wave runup or tsunami.

Dr Gibb carried out a new assessment of the erosion zones using a GIS computer model. The model calculates erosion zone widths from an empirical equation that incorporates factors such as long term rates of shoreline advance or retreat, the planning horizon, and the potential volumes of sand involved in short-term duneline fluctuations. Assumptions were made for each of these factors based on the information gathered.

For the landslip zones Dr Gibb adopted his previous 1995 assessment with only minor changes. The landslip zone widths are defined using an empirical equation incorporating factors such as the long-term historic retreat of cliffline and the planning horizon. Again, assumptions were made for each factor based on the information gathered.

The erosion and landslip zones are divided into extreme, high, moderate and risks zones, as well as a safety buffer. The extreme risk zone is intended to show the area likely to be affected in the short term; the high risk zone is intended to show the area likely to be affected in the period to 2050AD (i.e. a 50 year planning horizon); the moderate risk zone is intended to show the area likely to be affected in the period to 2100 (i.e. a 100 year planning horizon); and the safety buffer is a further area where the risk is considered to be low until after the year 2100.

Dr Gibb's coastal flooding zone is intended to also take a 100 year planning horizon. However he recognises that it is only possible to take a scenario approach to tsunami due to uncertainty around the hazard.

The report is accompanied by GIS maps of the erosion and landslip zones, which have been incorporated into Council's Resource Management plans with associated

policies and rules for each zone. The coastal flood zones were not mapped but are defined by specified elevations above mean sea level.

Key Coastal Hazard Components –

Geological processes relating to Wainui Beach:

- Over the last 2,000 years erosion processes have dominated over emergence from tectonic uplift. Average tectonic uplift rates have been calculated as 2.6m per thousand years for northern Wainui Beach and 1.5m per thousand years for southern Poverty Bay. This is likely to occur in major uplift events. Between uplift events, coastal subsidence may occur, which would enhance coastal erosion by lowering the level of the land with respect to the sea.
- Wainui Beach is cradled between the arms of two major reef systems that extend southeast from Tuaheni and Makorori Points. The reefs provide some protection from heavy seas from the south, East and North East but leave open direct attach from seas from the Southeast. Severe erosion tends to happen during South-easterly storms.
- Sand deposits suggest a net North-easterly longshore drift of sand along the coast with unknown amounts of fine sand being transported from Wainui Beach around Makorori Point during southerly storms.
- The major sources of sand for Wainui Beach are likely to be the near shore seabed, followed by the eroding coastline and headlands. Sand generally extends out to about 10m water depth. Sand must be considered a finite resource, in need of careful management.

Coastal dynamics at Wainui Beach

Erosion Processes

- Under north-easterly sea conditions the north end of the beach decreases in width, the south end increases in width and the Hamanatua Stream offsets south. Under south-easterly conditions the opposite happens. A wide beach absorbs wave energy and protects the dunes, while a narrow beach exposes the dunes to erosion. Thus, the southern half of Wainui Beach is most vulnerable to erosion during prolonged south-south-easterly storms when the beach is narrowed.
- Complex rip current processes can result in up to 15-20m of erosion at unpredictable places along the foredune.
- The soft silt substrate underlying the beach from Tuahine Crescent to the Hamanatua Stream is extremely susceptible to irreversible erosion once the protective dune and beach sand cover is removed during localised erosion processes.
- There have been at least 11 significant erosion events over approximately 60 years (1940-2000), of which 3 have caused short-term retreat of the foredune of about 15-20m along Wainui Beach. This would suggest that major localised short-term erosion events have a return period of about 20 years.
- The International Panel on Climate Change forecasts the severity of storms will increase, which could affect erosion processes.

Coastal Landslip

- Tuaheni and Makorori headlands are extremely unstable and landslip prone, the optimum conditions for landslip being the combination of coastal erosion, saturated soil, and vibrations from either earthquakes or heavy breaking surf.
- Landslips pose an extreme risk to houses at the southern end of Tuaheni Crescent.

Sand System

- There is uncertainty around sand processes, including the total sand budget at the Beach, and supply and loss of sand to the system. Geological evidence and the long-term trend of shoreline retreat suggest a long-term net loss of sand. For the period 1942-1999, net losses are estimated to be in the order of 5,000 to 6,000m3 per year.
- However, sand volume seems to have remained constant from the early 1970's to the late 1990's, as the coastline has retreated. It is thought that the retreating foredune is adding additional sand to the system to offset sand losses alongshore and offshore.
- The main foredune on which beachfront houses are located is an important supply source of sand. If this source of sand were locked up by e.g. protection works, beach replenishment in the order of 6,000m3 of sand per year would be required to sustain the amenity of Wainui Beach.

Shoreline and Headland Trends

- Surveys over a 57 year period from 1942 to 1999 record a long-term trend of retreat from erosion of Wainui Beach, at an average rate of -0.15m/year. Erosion rates ranged from -0.02m to -0.51m/year. There was a small area of accretion around the Hamanatua Stream outlet due to the presence of a groyne, which protects the foredune behind. Retreat does not occur uniformly but rather is the result of many site-specific erosion cuts by storm waves. Between storms, short term accretion or dynamic equilibrium may occur.
- Tuaheni Point and Makorori Point also retreated over the same period at average rates of -0.27m/year and -0.21m/year respectively. Landslip is an important component of retreat on the headlands.
- The headlands play an important role in the stability of the beach. As the headlands retreat, the beach does also.
- Retreat processes may accelerate over the next 20-30 years with a switch to a negative IPO in 1997-98 (which tends to enhance La Nina and storminess) and due to climate change.

Sea Level Rise

- Sea level rises of 1.4mm/year measured in Auckland are probably an appropriate indication of historic sea level rise around Gisborne.
- The International Panel on Climate Change forecasts sea level rises (mid-range projections) of 140-180mm above 1990 levels by 2050 and 310-490mm by 2100. *Note – these forecasts are now out of date.*

Storm Wave Runup

- Maximum storm wave run up levels are produced by the complex interaction of the wind, sea, seabed topography and configuration of the coast. During

a severe storm, waves will extend furthest inland during a period of one to two hours during high tide.
- Historic storm wave run up levels of approx. 7-8m above mean sea level have been estimated in a number of previous studies for major storms.
- The International Panel on Climate Change forecasts the severity of storms will increase.

Tsunami
- Tsunami information is limited.
- At least 6 tsunami have been recorded in the Gisborne region over a 142-year period. The largest was the 26 March 1947 event that affected Wainui.

Recommended Hazard Zones:

Gibb's recommended erosion hazard zones range in width from 35m to 83m. All of the properties along the beachfront south of the Hamanatua Stream are affected, but to varying degrees. North of the Hamanatua Stream the erosion zones are mostly confined to the Lysnar Reserve but extend into the State Highway in one location. The extreme erosion zone encompasses most of the foredunes and ranges in width from 20 to 45m, being widest just south of the Hamanatua Stream.

Gibb's landslip zones affect Makorori and Tuaheni point, with large areas identified in the extreme landslip zone.

Gibb recommends using an elevation of 7-8m above mean sea level to define the coastal flood hazard zone for storm wave runup. This is based on the work of Komar (1996) and is intended to approximate a severe storm with a return period of 50-100 years.

As no new information was found on tsunami Gibb confirms his 1995 recommendation to use an 11m elevation above mean sea level to define the coastal flood hazard zone for tsunami. This is based on the inundation experienced in the 1947 tsunami. He acknowledges that flooding to the 10m elevation would extend far inland and suggests it is probably better dealt with as a 'Civil Defence matter'.

Maps of the erosion and landslip zones are attached. The recommended flood hazard zones have not been mapped.

Specific Coastal Hazard Action Points –

Gibb recommends that his coastal hazard zones are adopted by Council and incorporated into Council's Resource Management Plans. This has occurred for the erosion and landslip zones, but not for the coastal food hazard zones.

He also recommends monitoring of the coastal hazards and review of the hazard zones every 10 years or after significant events or changes in climate change forecasts.

Potential Implications for the Wainui Beach Management Strategies –

The report provides an extensive summary of information on coastal processes, which can be used to inform the strategy.

According to Dr Gibb's recommendations, his coastal hazard zones are due for review.

Council has not yet adopted any hazard zones for coastal flooding from storm wave runup or tsunami.