COASTAL MANAGEMENT CONSULTANCY LIMITED

TECHNIQUES FOR ASSESSING COASTAL HAZARD AREAS FOR THE GISBORNE DISTRICT COAST

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TECHNIQUES FOR ASSESSING COASTAL HAZARD AREAS FOR THE GISBORNE DISTRICT COAST

by
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Coastal Hazards Areas within the Gisborne District will be assessed by one of two techniques. Technique I is an assessment of Areas Sensitive to Coastal Hazards which will be applied to medium priority sections of the coast. Technique II is an assessment of Coastal Hazard Zones including Risk Zonation, for highly priority sections of coast.

Priority ranking for sections of the coast will be determined according to the level of existing development at ris, and/or the attractiveness, potential, or suitability of the coastal area for future development. In Methods …, Council has determined the sections of coast it regards as high and medium priority for the assessment of Coastal Hazard Areas.

Where Council resources are not immediately available for mapping Coastal Hazard Zones, in priority areas of coast, then an interim analysis of Sensitivity of the coast to Coastal Hazards will be undertaken. In the case that a significant proposal for development occurs within an area previously identified as being potentially at risk by an assessment of Sensitivity to Coastal Hazards, then Council will require a Coastal Hazard Zone assessment by the proponent. Should the proponent choose to site the development inland of the Area Sensitive to Coastal Hazards, no Coastal Hazard zone assessment will be required.

I. ASSESSMENT OF AREAS SENSITIVE TO COASTAL HAZARDS

An initial assessment of the sensitivity of medium priority areas to coastal hazards will be made using a standardised Coastal Sensitivity Index (CSI) technique, where:

CSI = Elevation + storm wave runup + gradient + tsunami runup + lithology + landform + horizontal trend + short-term fluctuation.

The **CSI** will integrate information from the 8 physical parameters ranked into 5 classes from Very Low to Very High Sensitivity using the following Table:

CLASS VARIABLE	1 Very Low	2 Low	3 Medium	4 High	5 Very High
Elevation above MHWS (m)	>20.0	20.0-10.1	10.0-5.1	5.0-2.0	<2.0
Max. Storm Wave Runup Level above MHWS (m)	<1.0	1.0-1.5	1.6-2.5	2.6-5.0	>5.0
Gradient (deg)	>20	20-11	10-6	5-2	<2
Max. Tsunami Wave Runup Level above MHWS (m)	<0.5	0.5-1.5	1.6-4.0	4.1-10.0	>10
Lithology					
Igneous	Plutonics. Intrusives.				
Metamorphic	Metamorphics (high to medium grade).	Low grade metamorphics.	Sheared metamorphics.		
Volcanic	Volcanics (lava, dikes).	Very densely & densely welded ignimbrites. Volcanic breccia.	Partially welded ignimbrite.	Non-welded ignimbrite. Consolidated volcanic ash. Lahars.	Unconsolidated volcanic ash.
Sedimentary		Densely indurated sedimentary rocks (greywacke, solid argillite). Well cemented, sedimentary rocks (limestones, quartzite).	Moderately indurated sedimentary rocks (sandstones argillite, conglomerate).	Weakly indurated sedimentary rocks (mudstones, weak argillite, weak conglomerates). Relict sands. Lignite. Loess.	Unconsolidated sediments (colluvium, alluvium, gravels, sands, silts, muds). Peat. Swelling bentonites.
Natural Landform	Very hard rock platforms & sea cliffs	hard rock platforms & sea cliffs	Moderately hard rock platforms & sea cliffs Moraines	Soft rock platforms & sea cliffs. Alluvial deltas. Saltmarsh/ mangroves.	Sand barriers, beaches, dunes & spits. Gravel barriers, beach ridges & spits. River mouths. Cuspate forelands.
Long-Term Trend (m/year)	>+0.50 Advance	+0.50 to -0.02	-0.03 to -0.49	-0.50 to -2.00	>-2.00 Retreat
Short-term Fluctuation (m)	<2	2-5	6-10	11-30	>30

The CSI's will be derived by numerically integrating the 8 variables and ranking the number so obtained into one of the 5 sensitivity classes listed in the following Table:

Very Low	Low	Medium	High	Very High
8-13	14-20	21-27	28-34	35-40

Coastal areas of Medium, High and Very High sensitivity to natural hazards will be mapped. Safety Factors of 2.0, 1.75, and 1.5 will be applied to *Very High*, *High*, and *Medium* Sensitivity areas respectively to determine the extent of the area of land at risk.

II. COASTAL HAZARD ZONE ASSESSMENT

Coastal Hazard Zones (CHZ) will be assessed for the high priority areas affected by one or the combination of the actual and potential natural hazards of sea erosion, wind erosion, landslip, and flooding from the sea.

SEA EROSION AND LANDSLIP

For sea erosion and landslip the CHZ assessments will be based, where appropriate, on combinations of the following factors:

$$\mathbf{CHZ = [(X + R)T + S + D]F + L}$$

Where:

Factor X - is the *Rate* in metres per year of shore retreat in response to local relative sea-level rise, determined by:

- The standardised technique developed by Per Bruun.
- Standardised estimates for potential sea-level rise by 2050 and 2100 A.D. by the New

Zealand Climate change Committee (NZCCC) and the Intergovernmental Panel on Climate Change (IPCC).

- Subtraction of local and regional effects from the projections of global sea-level rise by the NZCCC and IPCC to determine local relative sea-level rise.

- Identification of the seaward limit of beach sediment movement (closure depth) from field evidence.

Factor R - is the *Rate* in metres per year of long-term (historic) net shoreline advance, retreat or dynamic equilibrium for sand and gravel shores and Seacliffs, determined from:

- Coastal Resource maps at 1:5,000 and 1:2,500 Scales.

- Analysis of Cadastral and Vertical Aerial surveys spanning the last century for areas not covered by the Coastal Resource maps.

Factor T - is the *Planning Period* in years extending from the present to the year 2100 A.D. for which CHZ assessments will be made.

Factor S - is the *Magnitude* in metres of either the *maximum* recorded short-term historic shoreline fluctuation along coasts of sand or gravel, or the *maximum* extend of land that has failed from past or present landslides along Seacliffs of relatively consolidated rock, determined from:

- Coastal Resource maps at 1:5,000 and 1:2,500 Scales.

- Analysis of Survey, anecdotal and historical records.

Factor D - is the *Magnitude* in metres of retreat of the top seaward edge of the erosion scarp cut into sand dunes as a result of slumping to attain a stable slope, determined by:

- The angle of repose of dry loose dune sand.

- The height of the dunes above Mean Sea Level (MSL).

Factor F - *is the Safety Factor* that is expressed on a scale from 1.0 (0%) to 2.0 (100%), determined by:

- Averaging the sum of the errors for Factors **R**, **X**, **S** and **D**.

Factor L - is the *Horizontal* distance of representative, relatively unmodified natural features such as the beach, shore platform, foredune complex or primary gravel beach ridge. Such features provide a natural protection of the land from coastal hazards and will be determined by:

- Measurements made in the field and from sequential vertical aerial photographs.

FLOODING FROM THE SEA

The extent of land that is, or is likely to be inundated by the sea eill be delineated by the contour above MSL below which land will be flooded by the combination of maximum storm wave runup during a one-in-100 year storm and local relative sea-level rise.

Storm Wave Runup - is the *Maximum* elevation above Mean High Water Springs (MHWS) of wave runup attained during a severe onshore storm with a frequency of occurrence of approximately one-in-100 years, determined by:

- Measurements made from field anecdotal and historical evidence.

WIND EROSION

The extent of sand dune complexes that are, or are likely to be subject to wind erosion will be determined from sequential vertical aerial photographs by mapping the degree of wind erosion expressed ona scale from **0** (None) to **5** (Extreme), on the basis of percentage area of bare ground as defined in the following table:

Degree of Erosion		Percentage of Bare Ground
None	0	No significant erosion
Slight	1	1 – 10
Moderate	2	11 – 20
Severe	3	21 – 40
Very Severe	4	41 – 60
Extreme	5	>60

Risk Zonation - The CHZ will be subdivided into *Extreme*, *High* and *Moderate Risk Zones* and a *Buffer Zone*. The *Extreme Risk Zone* lies adjacent to the coast and will encompass the area subject to high impact short-term shoreline fluctuations, landslip, flooding from storm wave runup and wind erosion. The *High Risk Zone* lies adjacent and landward of the Extreme Risk Zone and will encompass the area subject to potential sea and wind erosion, flooding or landslip up to the year 2050 A.D. The *Moderate Risk Zone* lies adjacent and landward of the High Risk Zone and will encompass the area subject to potential sea and wind erosion, flooding and landslip for the period 2050 to 2100 A.D. The *Buffer Zone* lies adjacent and landward of the Moderate Risk Zone and will encompass the area determined by the Safety Factor (**F**).

CHZ Reference shoreline - The CHZ width will be measured inland from the seaward toe of the foredune or seacliff, or top seaward edge of the storm berm on gravel beach ridges.