COASTAL EROSION - KAPITI COASTLINE

NOTES ON THE STORM OF SATURDAY 11 - MONDAY 13 SEPTEMBER 1976

PART 1 : The Event - J G Gibb

PART 2 : Coastal Engineering and the Adminstrative Procedures - D S Wilshere

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PART 1

COASTAL EROSION - KAPITI COASTLINE
SAT 11. - MON 13 SEPTEMBER 1976

Summary Notes

Meteorological Events

Fri 10 — Low pressure zone developed 700 nm west of Cape Egmont. Pressure 990 mb.

Sat 11 — Depression deepened - centred 400 nm west of South Island. Pressure 980 mb. Winds 50 kn at sea from NW.

Sun 12 — Depression stationary. Pressure 970 mb. Winds 50 kn. Swell heights 11-12 m 5-700 nm west of Cape Egmont increased to 13 m, pm.

Mon 13 — Depression moved ESE - centred 50 nm east of Dunedin. Pressure 970 mb. Winds 50 kn south Taranaki Bight.

Tue 14 — Depression moved ESE - centred 400 nm off east coast SI starting to break up. Winds southerly in Taranaki Bight.

At Paraparaumu Airport 1962-1969

Date (Sep 1976)	Mean Wind Speed (Knots)	Highest Gust (Knots)	Direction (Degrees)	Gust Time (GMT)
Sat 11	15	27	040	2240
Sun 12	15-20	44	340	1426
Mon 13	30	67	340	0150
Tues 14	7	27	200	2005

Tides

Standard Port - Port Taranaki - Tidal Reference

Secondary Port - Manawatu River mouth

Tides - Neap tide becoming smaller in range from 10-14 September
Range at New Plymouth

Date	Range(m)
10	2.9
11	2.8
12	2.6
13	2.4
14	2.0

Note: Spring Tide range - Kapiti Island - 1.8 m
Neap Tide range - Kapiti Island - 0.4 m

Expected tidal range at Kapiti Coast 11-13 Sept about 0.5-1.0 m.

Note: Equinoctial tides due 23-28 September 1976.
Highest tides of the year in New Zealand.

Effect on Sea Water Level at Coast

Drift wood line 2.6 m above normal drift wood line.

Low pressure zone sitting stationary for sometime caused STORM SURGE to occur from prolonged wind and wave set up from NW over fetch of 5-700 nm - piling water against coast.

Coastal Erosion

Loss of foredune Kapiti Coast - 11-13 September 1976

	Cumulative Distance (kms) North	Erosion (m)
Centennial Inn Paekakariki	0	
		1-5
Surf Lifesaving Club Paekakariki	2.5	
		> 1
Queen Elizabeth Park	5.4	
		5-10
South Raumati	6.8	
		10-15
North Raumati	9.6	
		1-5
Paraparaumu (Kenakena Point)	13.4	
		> 1
Waikanae River mouth	15.7	
		1-5
Waimehia Stream	18.1	
		5-10
Pekapeka	22.0	

Effect on Beach

Profiles of coarse sand and gravel steepened above MSL ie Paekakariki to Queen Elizabeth 2 Park.

Profiles of medium and fine sand were eroded ie Raumati to Pekapeka.

Eroded sand from beach and foredune has moved offshore.

Longshore drift southwards - debris from protection works as far south as Centennial Inn.

Localised scouring and erosion due to large logs rolling at dune toe - County Bylaw says drift wood must not be removed from beach. This aids erosion.

Geologic Coastal History

Coastal Plain of sand dunes constructed during last 5,000 years.

Foredune from Paekakariki to North Raumati formed from eruptive products from Taupo Eruption 131 AD.

Peat under beach at Raumati indicative that coast has probably eroded over at least the last 1500 years.

Post European History

Shoreline changes

	Period (years)	Coastal Change
Waikanae	1895-1915	40 m erosion
	1915-1966	80 m accretion
Paraparaumu	1877-1892	60 m accretion
	1892-1914	60 m accretion
	1914-1940	40 m accretion
Raumati	1932-1959	60 m erosion
	1959-1976	12-18 m erosion
Paekakariki	1870-1930	No change
	1930-1959	15 m erosion

Last recorded severe storms		Effect
1	July 10-11 1954	Dune toe eroded 2-3 m beach lowered 1.5 m.
2	Oct 12-13 1957	Dune toe eroded

Coastal Processes

Net longshore drift direction - southwards to North Raumati.
northwards Paekakariki to Raumati.

Sand source - rivers to the north
Predominant waves - H_b = 0.5 - 1.4 m T_b 5-11 secs

No sand is at present reaching the coast from Paraparaumu to Paekakariki - probably being deposited offshore as a bank - south of Kenakena Point.

General Notes on Erosion Events

Meteorological Office, Kelburn advise that depressions similar to 11-13 September 1976 event can form at any time, and follow no predictable cyclic pattern.

Serious erosion at Raumati partly due to very depressed beach allowing waves to break closer to foredune. Conversely natural beach profile at Queen Elizabeth Park, allowed waves to dispel energy, hence little or no loss of dune.

Any loss of foredune from Raumati to Paekakariki is permanent as the dune formed about 1800 years ago. North of this point foredune is recent having formed over the last 100 years, hence return of sand to be expected over next months.

Surveys

Golden Coast survey Profiles resurveyed across beach on Friday 17 September.

This will quantify loss of sand in m^3 between Paekakariki and Pekapeka.

Offshore profiles should be surveyed within next week.

J G Gibb

21 September 1976

PART 2

1 The Coastal Observation Programme

1 The initial 18 month programme completed.

2 Regular beach and offshore profiling completed, and plotted but not analysed.

3 Observers data collated but not fully analysed.

4 Kapiti Island tide gauge still operating correlations between New Plymouth, Kapiti, Paremata not yet established.

5 Mineralogical and grain size analysis of beach sands completed.

6 Results to date show predominant liltoral movement N - S north of Kena Kena Point and S - N south of Kena Kena Point.

7 The most active zone of erosion and beach change is at Raumati.

2 The storm event

1 The meteorological conditions were not unusual and could occur frequently.

2 The cyclone caused high water levels and a storm surge which superimposed on waves of average storm height generated at beach water levels of about 2.6m above estimated high tide. The wave run up on top of this was the major factor causing damage.

3 The event caused general planing of the beach profile by approximately 0.5-1.5m parallel to the original and considerable cut back on dune lines of up to 15m leaving erosion scarps up to 3m high.

4 There was little effect at Kena Kena Point in the wave shadow of Kapiti Island or at Queen Elizabeth Park where the natural beach and foredune were very effective buffers.

3 Post event observations

1 The observation programme has been re-initiated.

2 Numerous levels have been taken of the highest water level at Kapiti, Paremata and on the beach.

3 A series of beach profiles has been run and where possible the high water mark and the maximum wave run up noted.

4 It is hoped to run a series of off-shore profiles very soon.

5 The whole coast-line has been walked and photographed.

6 Analysis of data will provide new information on the sediment budget and quantities moved by an event.

4 The current situation

1 There is approximately 5-6km of coastline very vulnerable to an erosive event which could occur during the equinoctial tides expected 23-28 September when the tidal range at New Plymouth is approximately 4m and the high tide level at RL 3.8m compared with 2.8m and 3.1m during the storm. Even a moderate on shore wind would cause problems at high tide.

2 Around 200 houses are threatened 20-30 seriously at Raumati and Paekakariki: The market value of the asset is $5 million.

3 Roads are threatened at Raumati and on the Paekakariki esplanade.

5 Effectiveness of Existing Protection

1 There is no doubt that the existence of protection works at Raumati has added to the erosion there.

2 Present protection is rundown, non-uniform and generally has not been maintained.

3 The most effective protection has been provided by the vertical post and waling tanalised walls erected to Kapiti Borough Council Specifications. These have worked even when overtopped. Up and down coast where walls have not existed there is very significant erosion.

4 The major threat to the walls was floating logs from horizontal rail and log barriers which failed. Propelled by waves these battered and sometimes smashed the walls.

6 Treatment alternatives

Note: suggest that the decision on alternatives should be positively guided by the findings of the study to be written up by years end.

1 Do nothing - this would allow an equilibrum profile to establish and provide natural protection. Present indications are that in this situation high water mark would be about where most Rosetta Road homes are at present and could in places approach the road. At other locations roads would continue to need protection. Homes would either have to be abandoned or relocated.

2 Establish longitudinal protection

- This would essentially protect the capital assets.

- Would have to be established on the line of present works ie. below high water mark thus making for a sea protection structure axiomatic that this will be accompanied by a continued downcutting of the beach and no possibility of beach establishment ie limited life.

- Could be of the sea-wall type, rubble, rip-rap or commercial material (eg gabimat, gabion basket, gabi block) and could be straight or in cuspate units.

- Would have to be continuous over long reachs and of guaranteed maintenance.

3 Building groynes

- a groyne could assist sediment accumulation.

- Problem of location, knowing that it must be sited where build up is required and will be accompanied by erosion up current. Same applies to a system of groynes.

- Need sediment in transport, it seems that there is no sediment in the system and the historical supply source from the scree slopes south of Centennial Inn is now not active due to the highway.

4 Build Off Shore Structures

- These could be rubble or rip rap mounds or artificial bars, breakwaters or floating booms.

- Essentially these structures reduce wave energy and are useful where direct wave attack is the problem.

- Are navigation hazards.

- Are expensive to install and maintain.

- The problem at Raumati has traditionally not been one of wave attack only. In the last two years there have been higher energy wave climates which have had little erosive effect. Critical situations occur when atmospheric conditions create storm surges on top of depression induced high water levels and strong onshore winds. Off shore structures do not affect overall water levels or wave set up but may reduce wave run-up.

5 Artificial Replenishment

- This could be on its own or in conjunction with other works.

- Input would have to be from the southern end of the reach.

- It is unlikely that sufficient sand is available at the pumping location

- The cost of pumping is high ie $\$4/m^3$ for a total cost of \$2m - \$5m plus the ongoing pumping to replace sediment lost from the system.

- In conjunction with alternative 4 this could result in a cuspate coastline - being formed with a tendancy for cusps to build towards the offshore wave break.

- Local dumping of littoral material is a very short term alternative.

7 Agency involvement

1 In the absence of a catchment board works have historically been the responsibility of first the Hutt County Council and latterly the Kapiti Borough.

2 Since the formation the Wellington Regional Water Board it has been involved with the borough at the administrative level.

3 Any proposal from the Borough will be developed in conjunction with Wellington Regional Water Board and Ministry of Works and Development.

4 Further presentation will require that the broadest aspects of the problem are studied and weighed up.

8 The Borough proposal

- The Borough has suggested that a longitudinal protection of post and walings be built continuously along 1.8km at Raumati and 0.06km at Paekakariki.

- The structure would be located on the line of present protection would be buried 1m and be 1m above highwater. A platform 4m wide would be backfilled behind the wall. The platform would be impermeable.

- It would be the responsibility of owners to establish batters behind this platform.

- This would cost approximately \$100/metre total cost of all protection \$250,000 - \$450,000.

- Ratepayers protected would pay \$100/yr for 20 yrs and be responsible for maintenance costs.

- This has the disadvantages discussed previously.

- A ratepayers meeting on Saturday 18 September 1976 unanimously supported the proposal.

9 Administrative Procedures to be Satisfied

- These could prevent the implementation of a scheme for up to 18 months - ample time for the study to be written up.

1 Environmental Impact Report
- The Borough would have to prepare this.
- Ministry of Works and Development input.

2 Rating Poll and Loan Poll
- Both would be needed for the proposal.
- Ministry of Works and Development comment on LA Loan Board proposal.

3 Ministry of Transport Licence
- This will be necessary as works will essentially be structures in the sea.
- Ministry of Works and Development comment generally sought.

4 SCRCC Support
- Would be needed to justify any subsidy.

D. S. Wilshere

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Wellington
21 September 1976