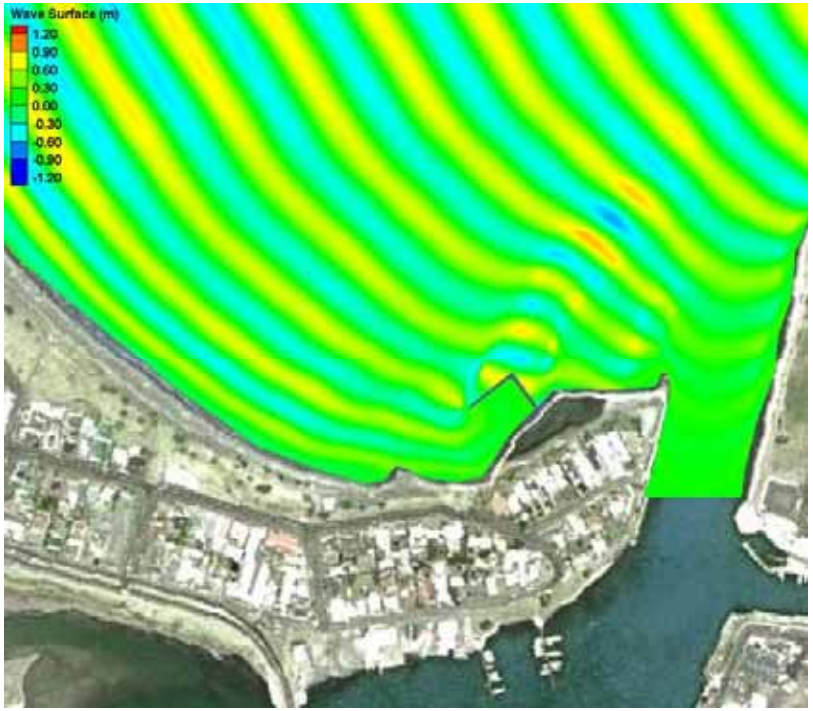
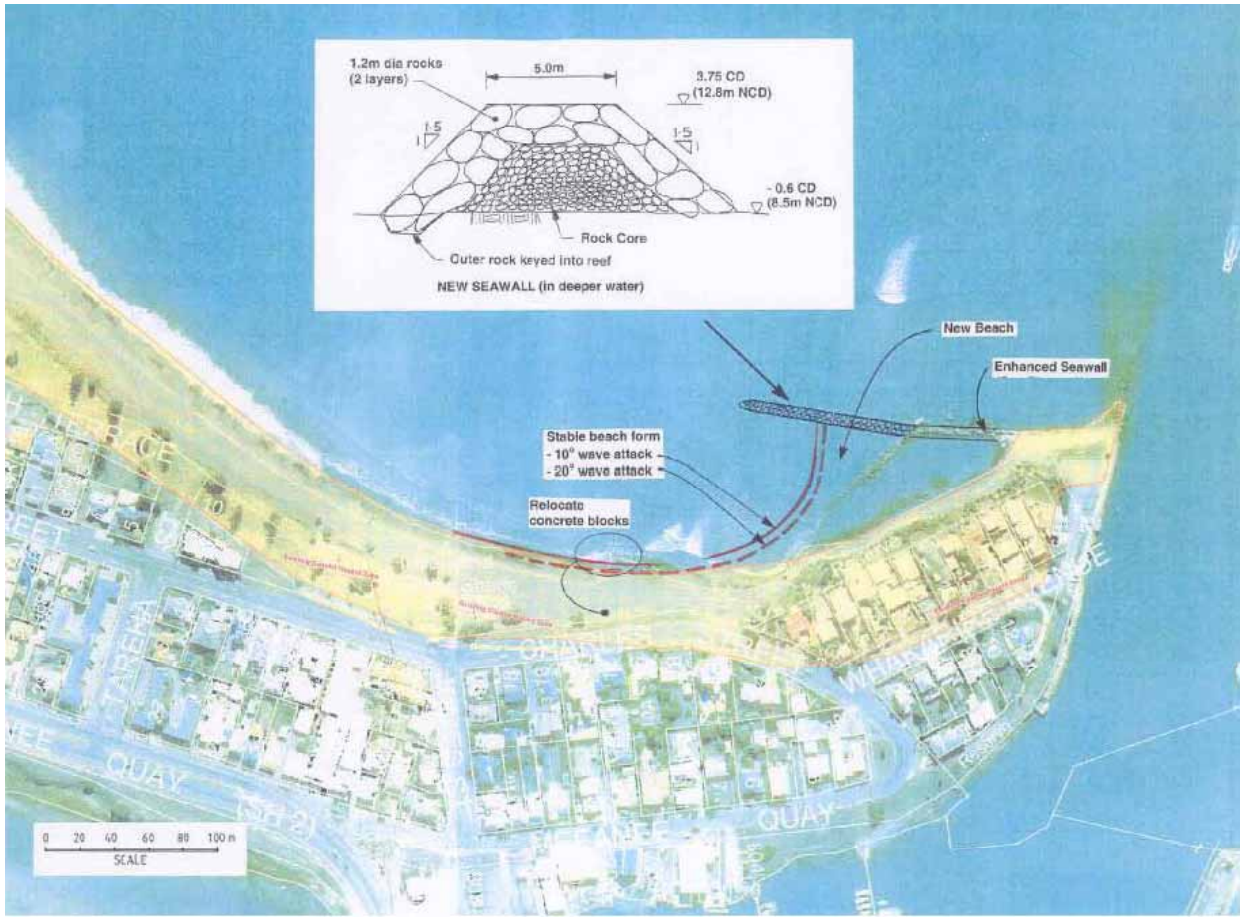
Whakarire Ave Wave Reflections



Scope

Evaluate the likely effects on the surf quality due to proposed seawall modifications at Whakarire Ave, Napier.



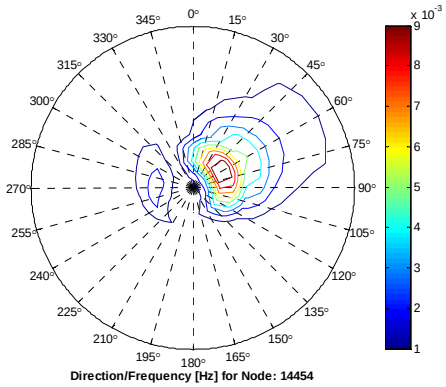
Methods

Use numerical wave models to simulate:

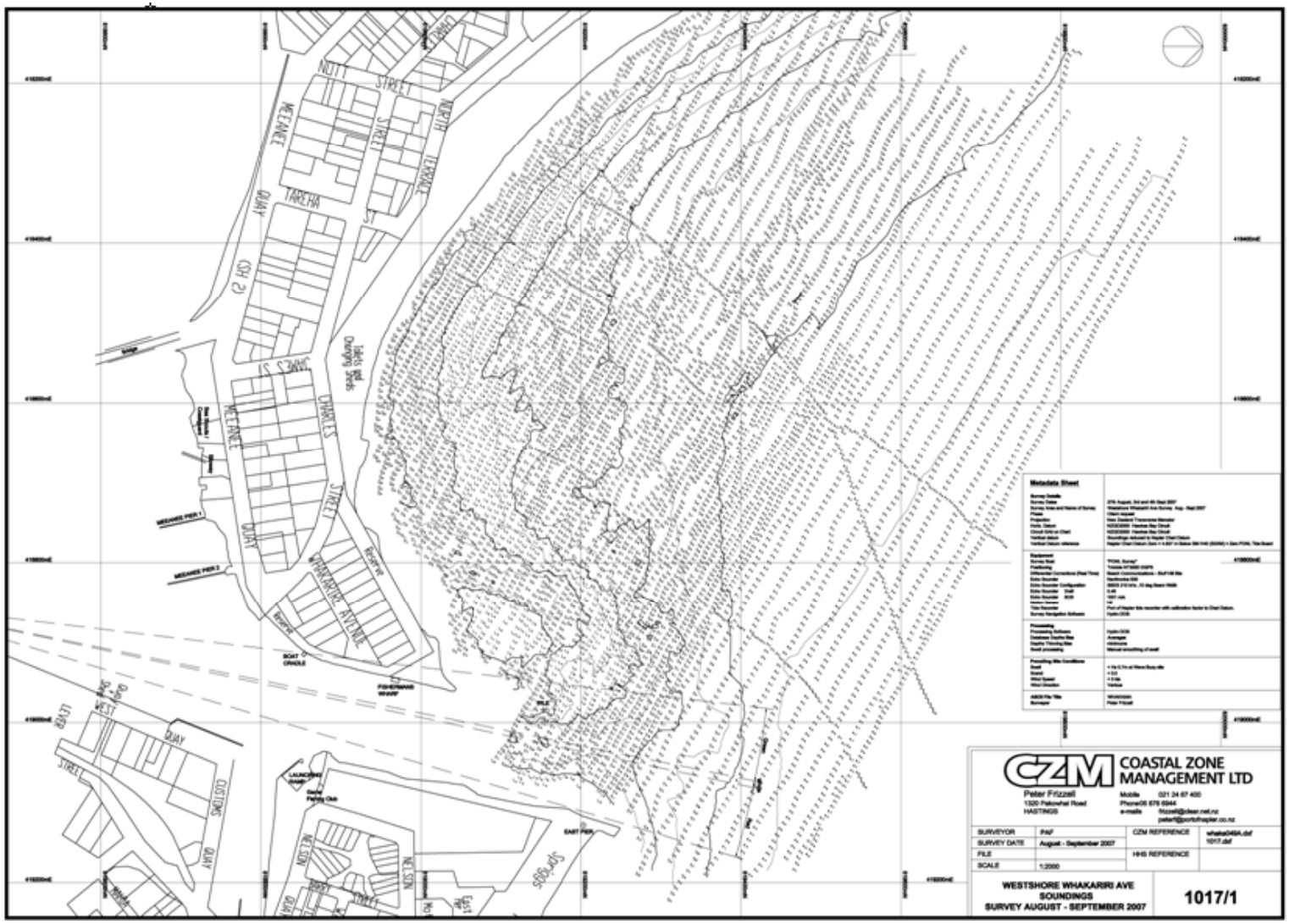
- the wave climate in the Napier region
- the wave climate in the Westshore region
- wave patterns at the existing surf break
- wave patterns with the seawall modifications

The wave models applied include the relevant physical process such as:

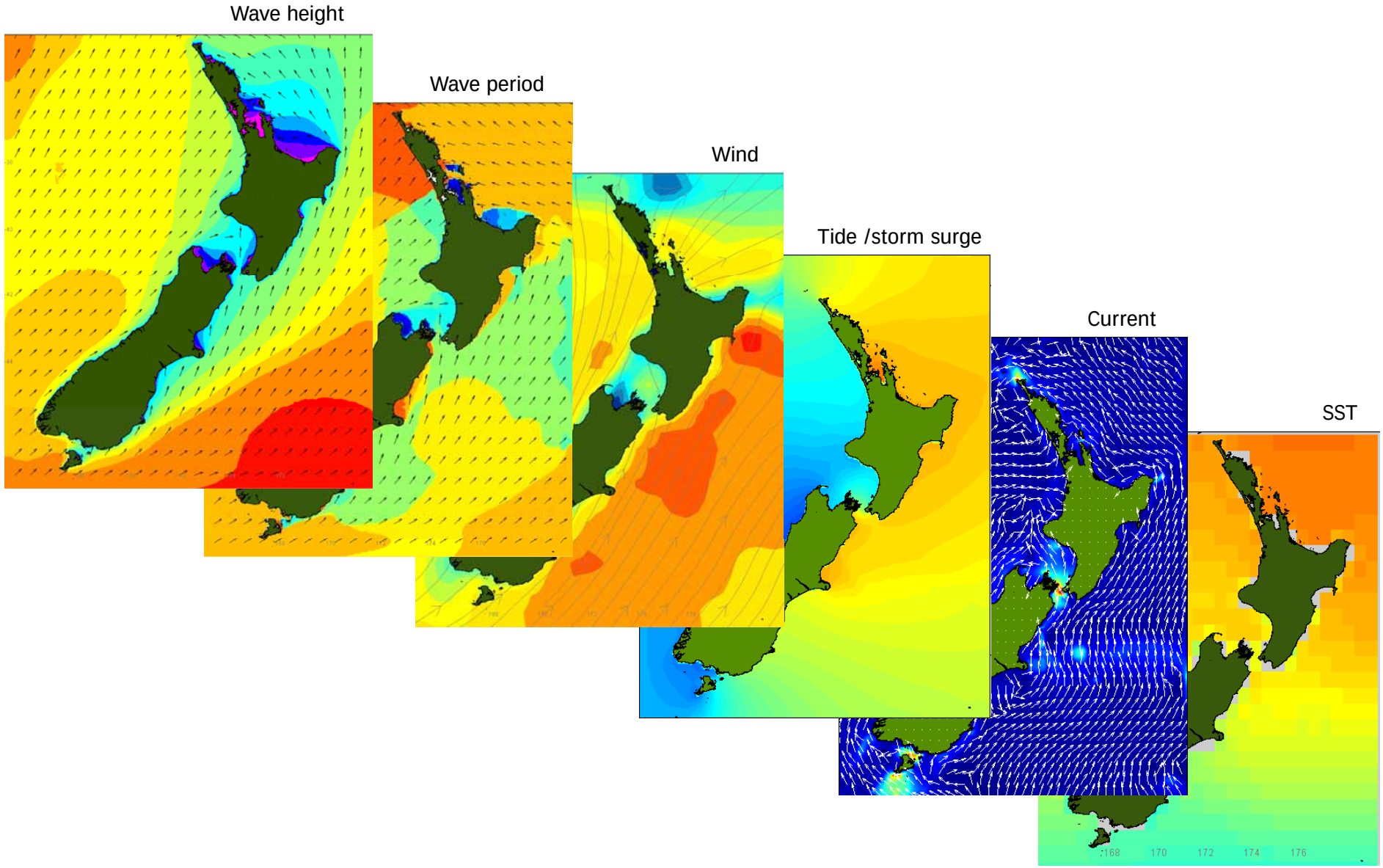
- Generation and propagation
- Seabed friction
- Refraction and diffraction
- Reflection
- Wave spectra



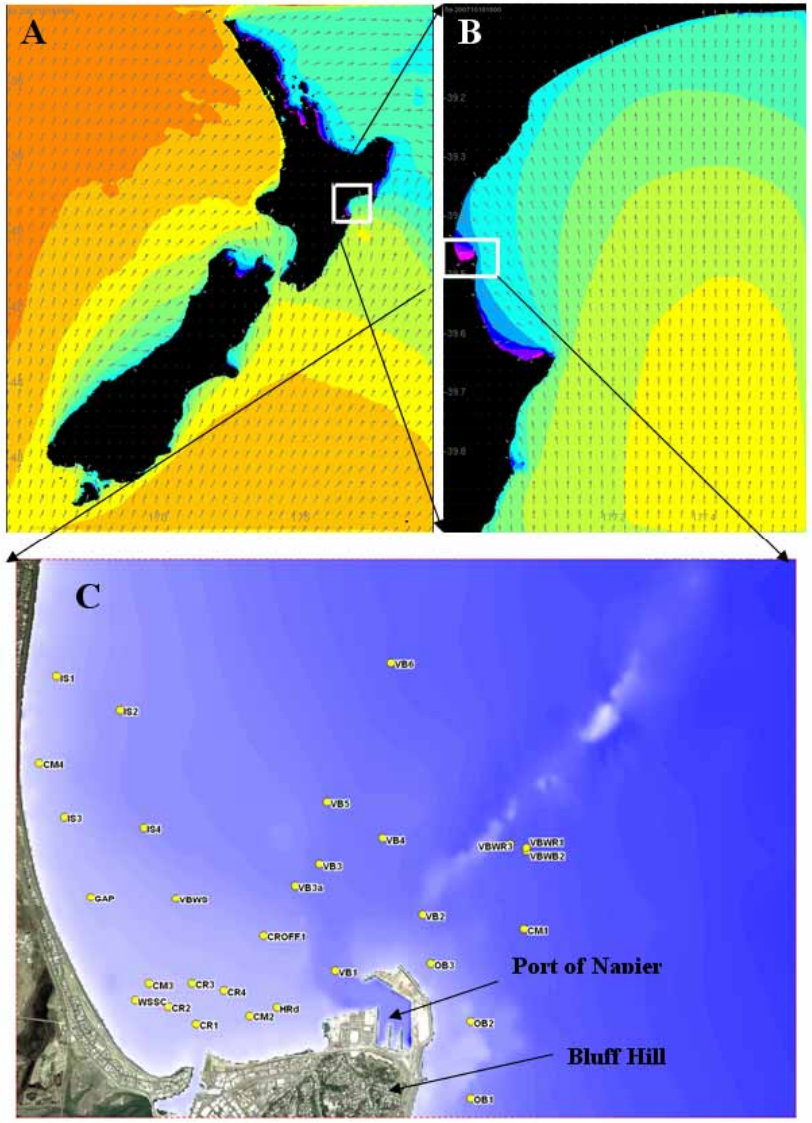
Methods - bathymetry



Methods – wave climate

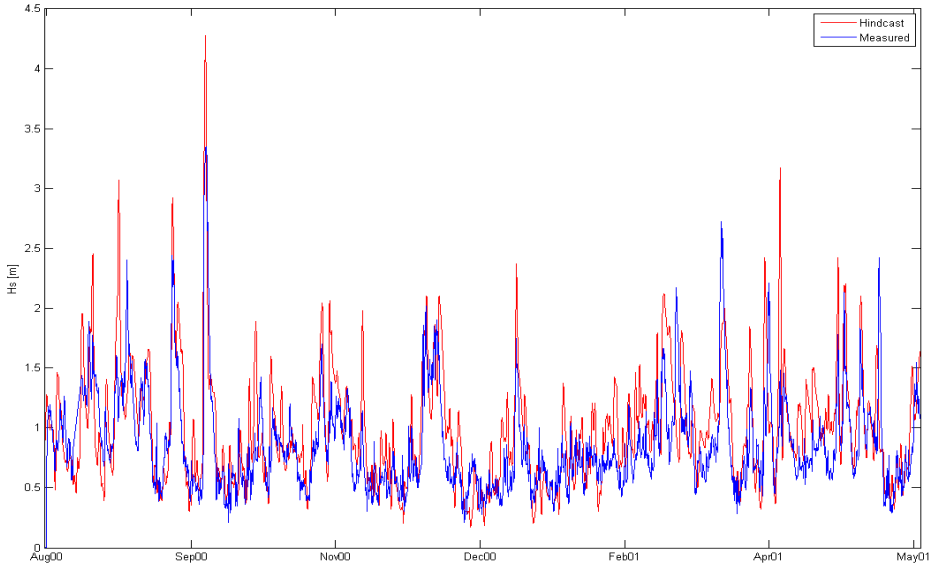


Methods – wave climate

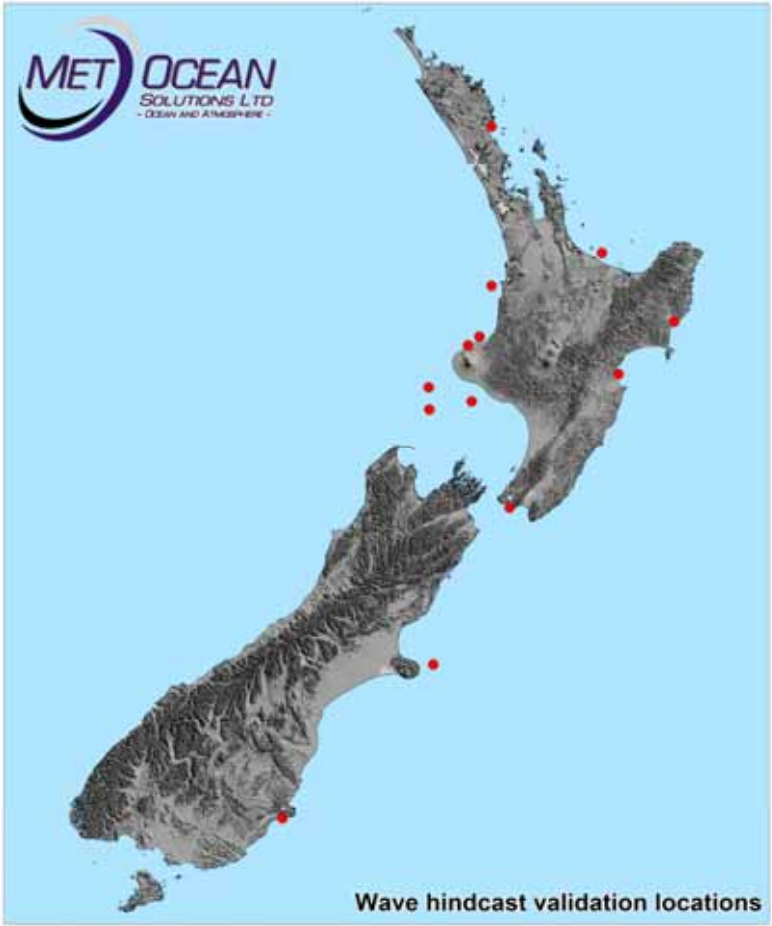


Waves were hindcast for a 10-year period.

Validated against the Port wavebuoy data

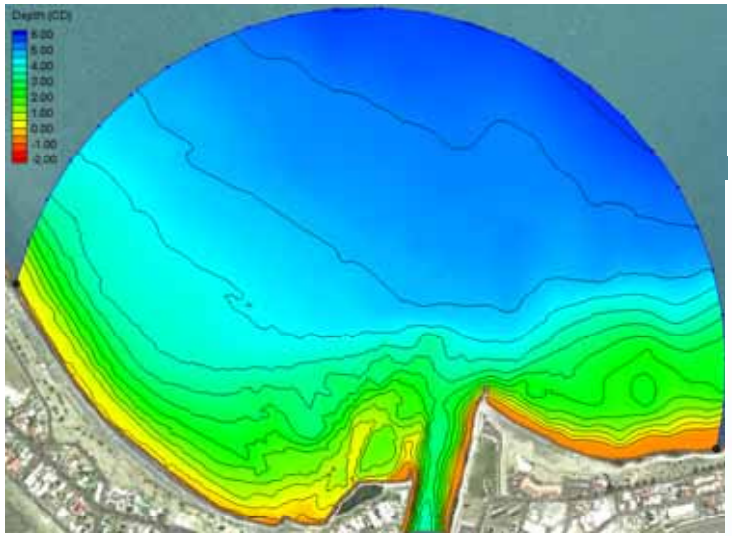


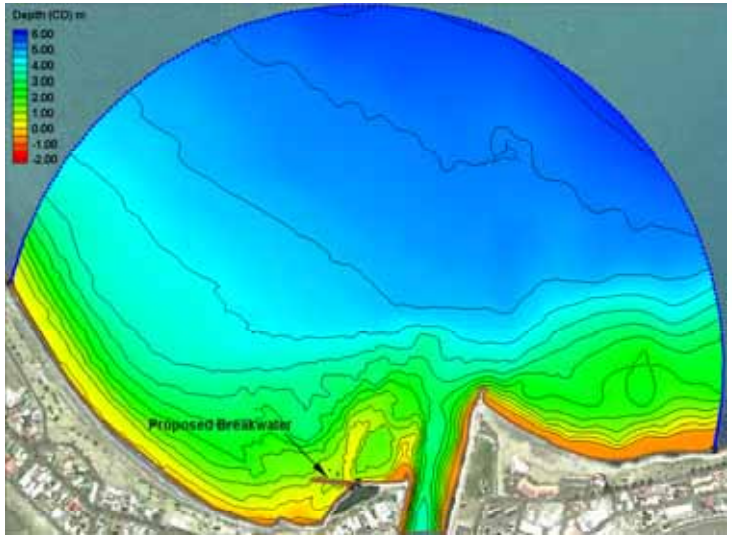
Wave hindcast validation

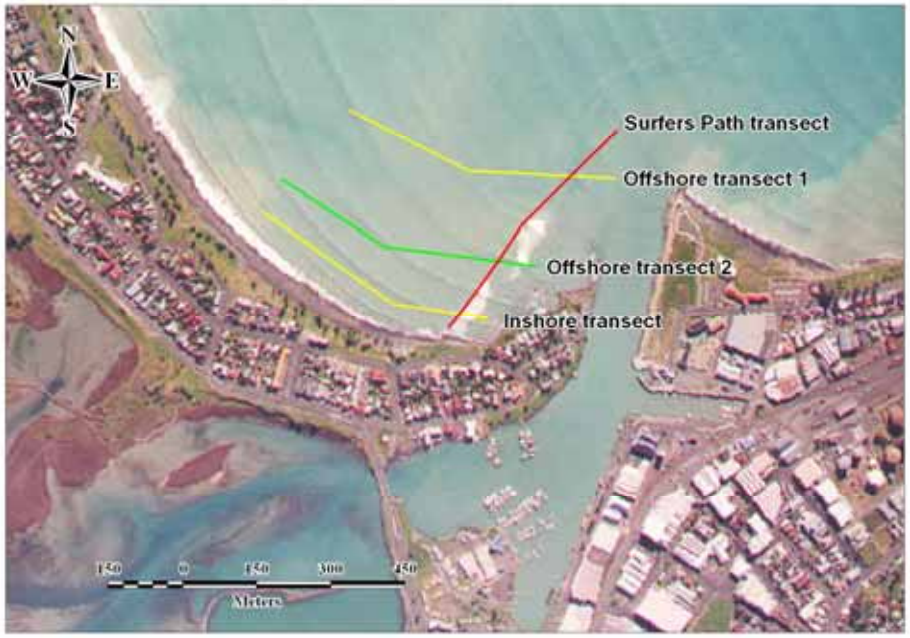


Data location		Mean Hs (m)	Mean Hs^2 (m^2)	Mean wave power (W m^{-1})
Kupe Field	Measured	2.02	5.05	21281
	Modelled	2.02	4.88	22448
Maari Field	Measured	2.23	6.2	27106
	Modelled	2.19	5.67	27213
Pohokura Field	Measured	1.78	3.99	18039
	Modelled	1.94	4.38	20690
Baring Head	Measured	1.26	2.13	9060
	Modelled	1.16	1.88	8380
Steep Head	Measured	2.01	4.69	21847
	Modelled	1.74	3.71	17468
Steep Head	Measured	1.99	6.20	19442
	Modelled	1.88	4.11	18900
Bay of Plenty	Measured	0.99	1.36	5094
	Modelled	1.14	1.81	5647

Methods – wave patterns







Results – wave climate

Estimates of surfable time for the Reef and Westshore Beach based on swell (T>6s) and total (T>3s) wave heights, plus favourable winds.

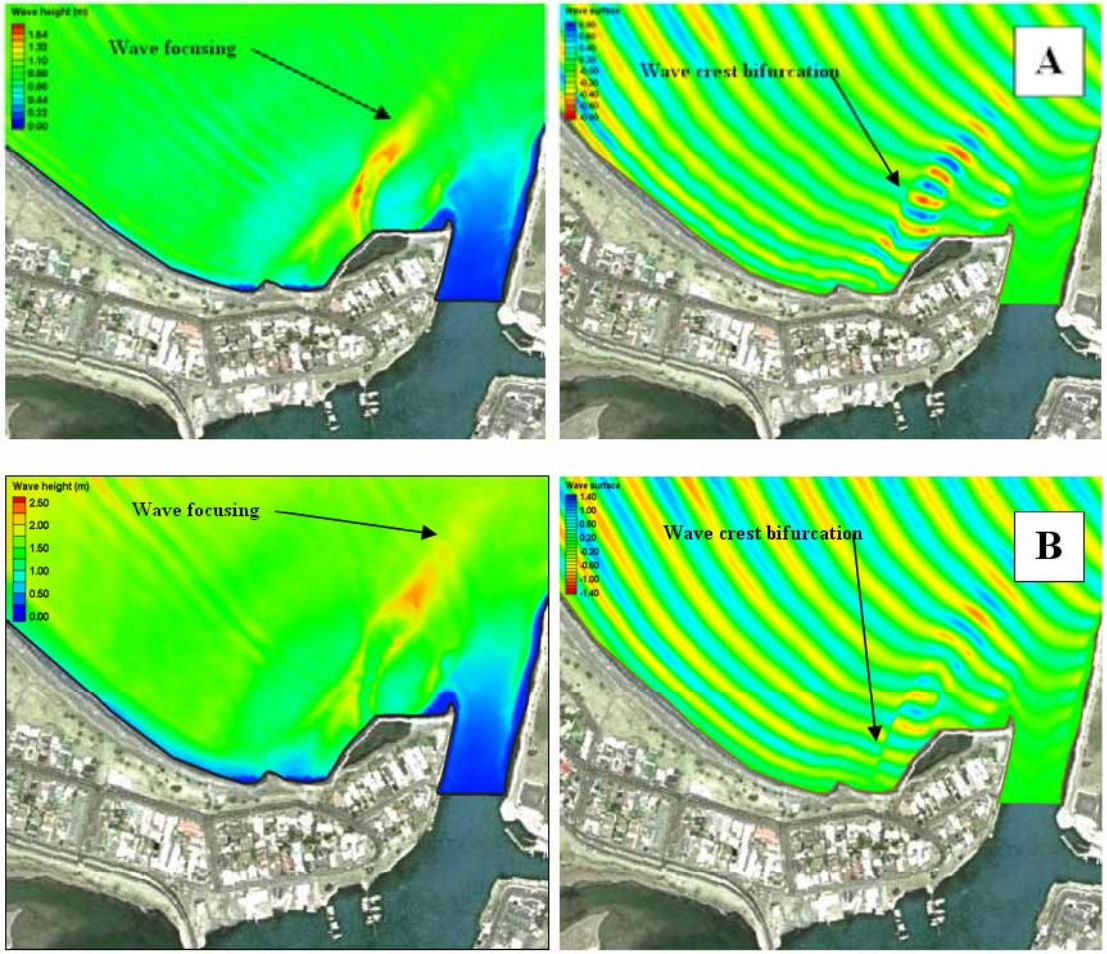
	The Reef		Westshore	
	Swell	Total	Swell	Total
% time good surf	2.89	4.26	3.16	6.28
% time marginal surf	4.32	9.51	4.53	11.91
% time surfable	7.21	13.77	7.69	18.19

Existing surf conditions

Wave period has a relatively small effect on the wave heights along the break, except on the low-energy inside section.

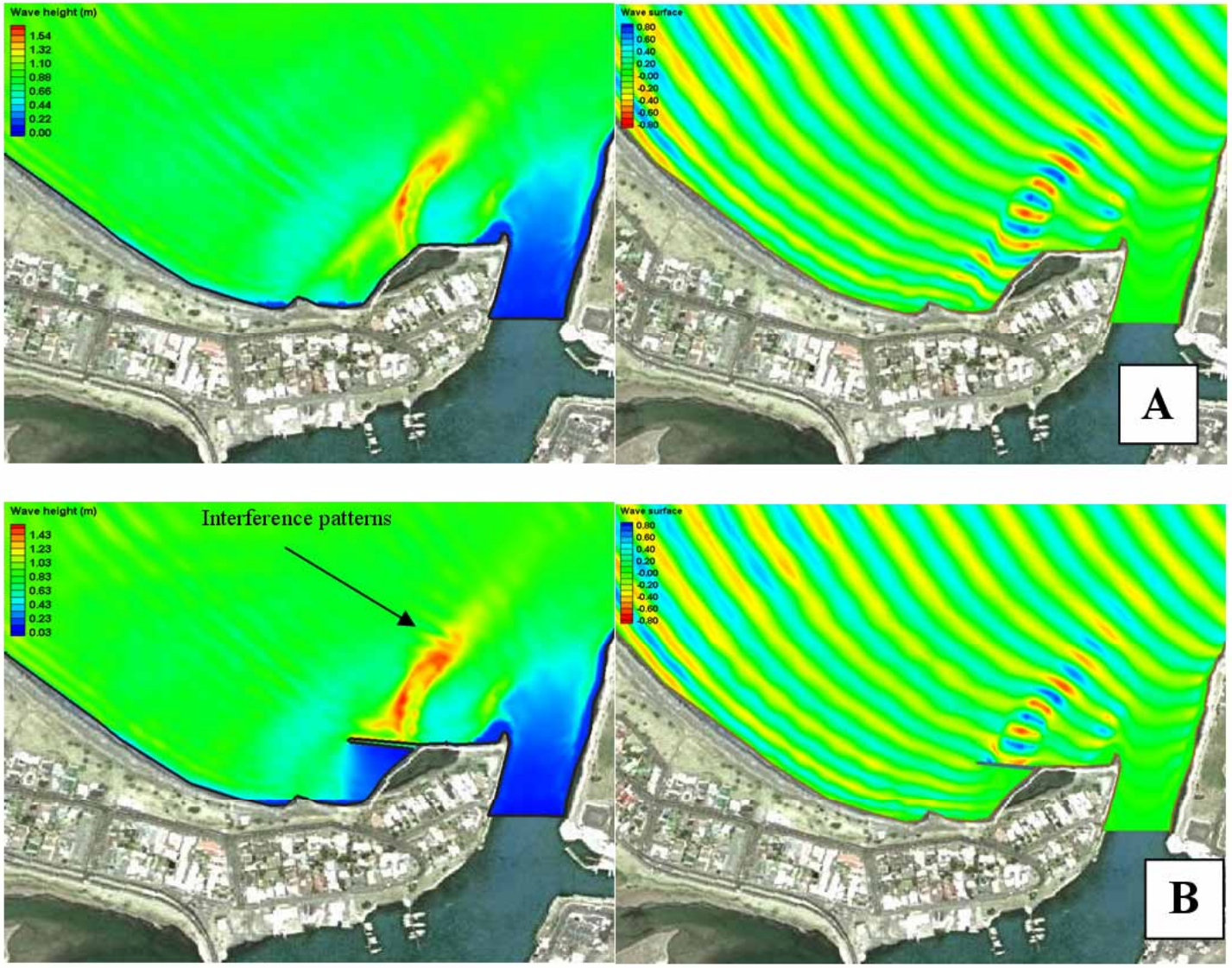
Wave direction has a significant effect on the wave height gradient at the break, as it is exposed to the northerly waves.

Tide level has an important effect on the wave patterns and the surfers ride, changing the height gradients along the ride and directly influencing the length.

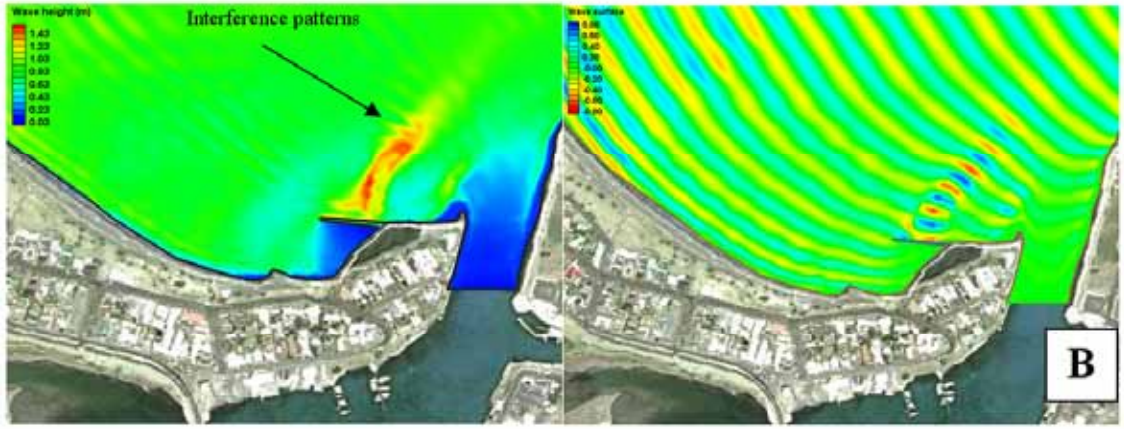


Wave height effects (A=1m, B=2m)

Seawall effects on surf quality



Seawall effects on surf quality

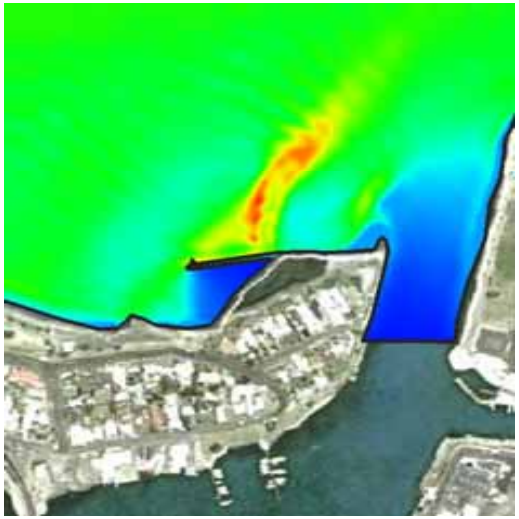


The original seawall option will reflect wave energy back into the path of the incoming crests – predominantly on the inside half of the ride and during smaller wave surf conditions and over the higher tides.

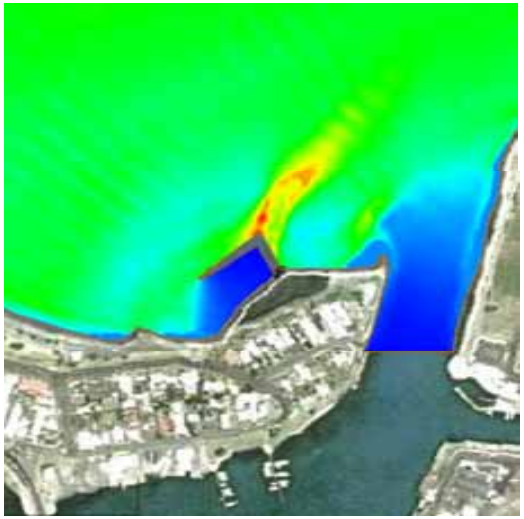
The actual reflectivity of the seawall structure will directly influence the effects on the surfing wave quality. A low-gradient, dissipative structure will have less impact than a traditional breakwater wall.

Changing the seawall orientation can reduce the reflected wave energy, particularly on the inside section of the surfers ride.

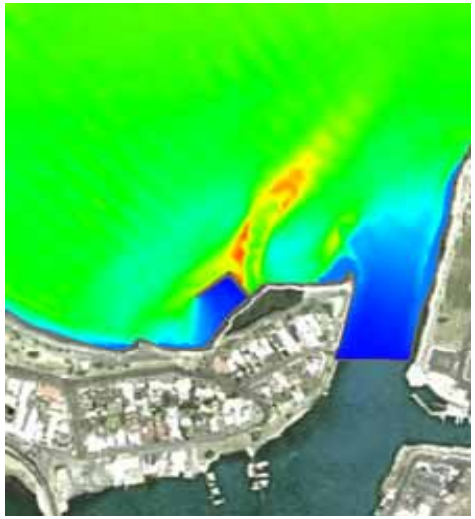
Alternative seawalls



Rotated

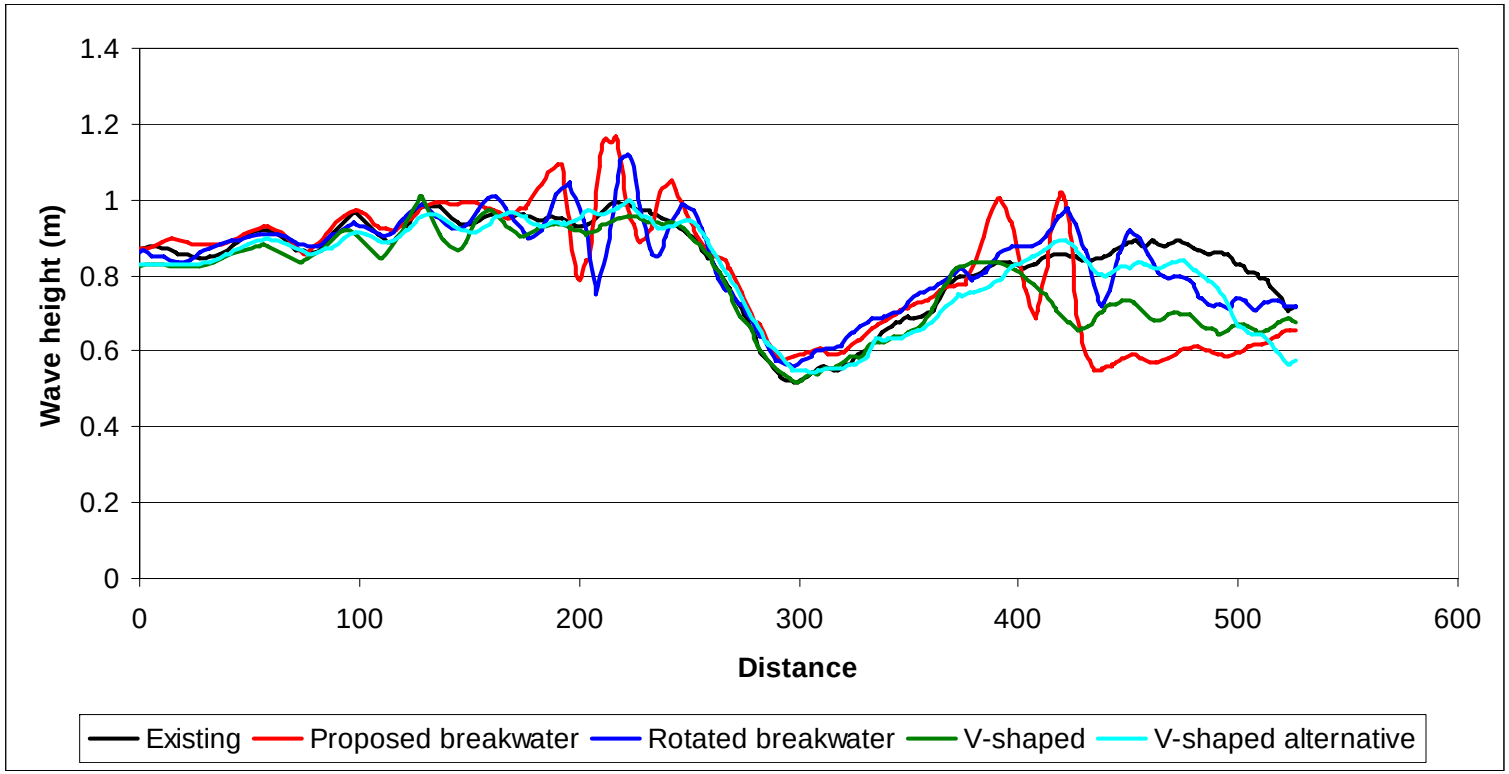


V-shaped

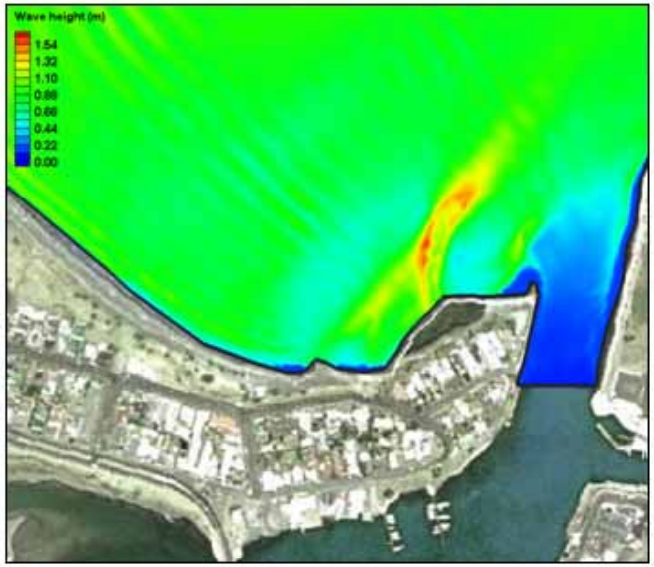


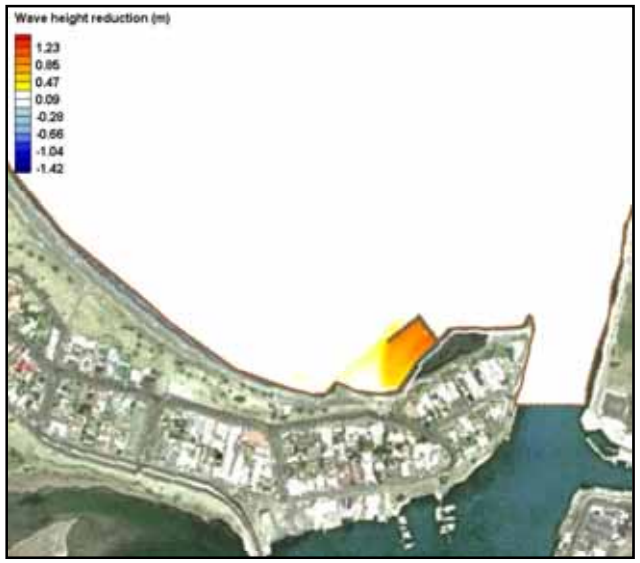
V-shaped alternative

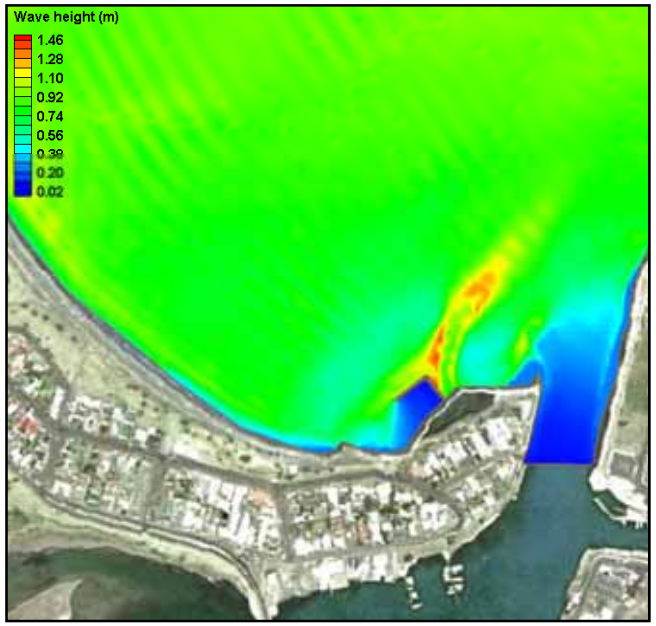
Comparison of the seawalls

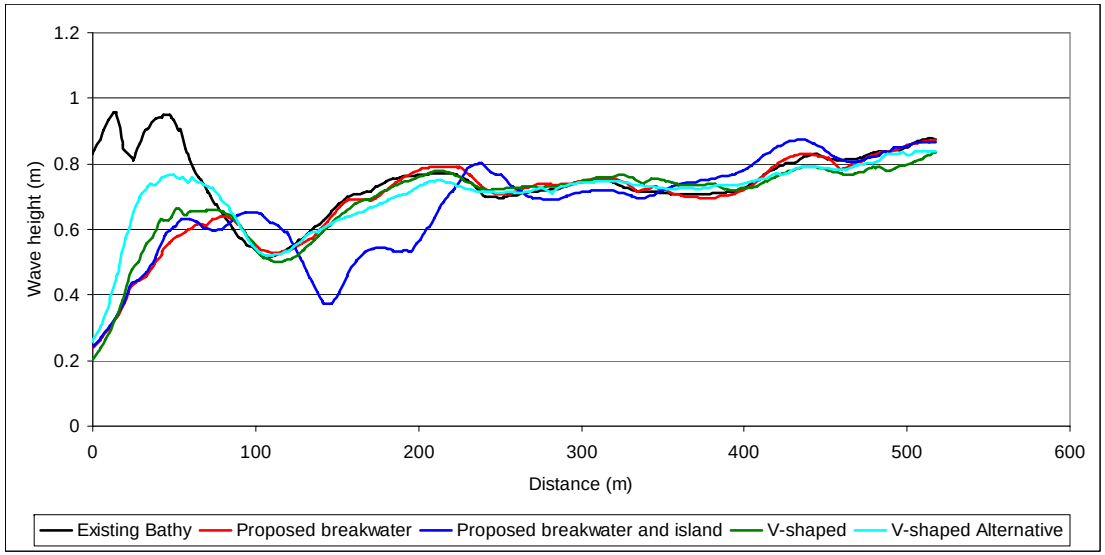


Wave sheltering effects

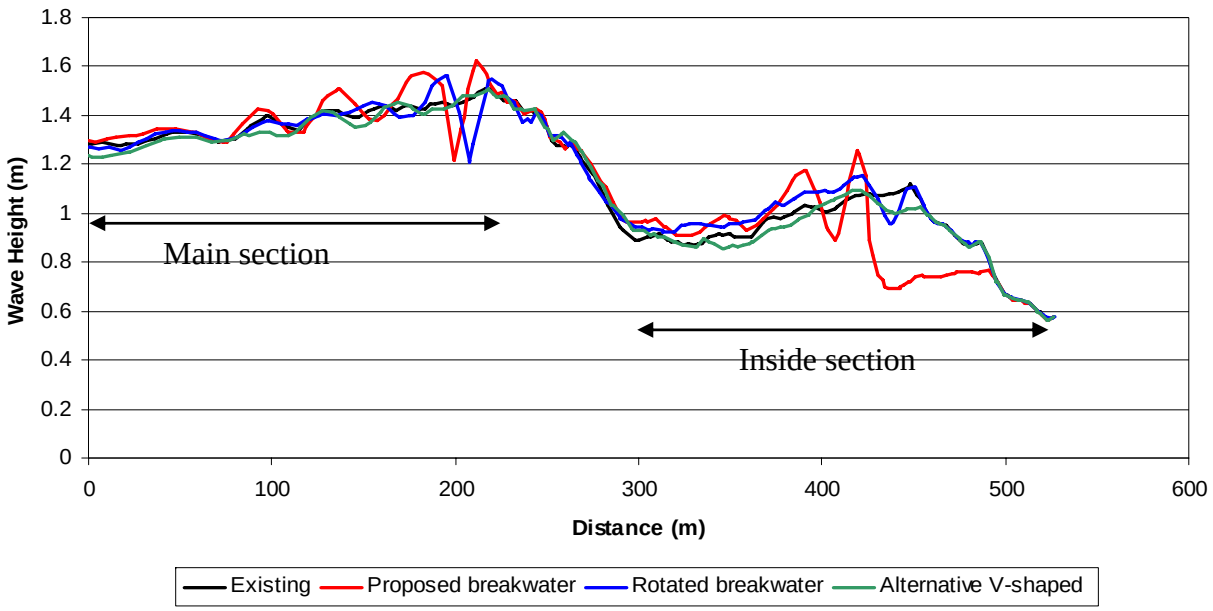








Wave effects on the surf of 19 June 2007



Summary

The original seawall option would reduce the surf quality at the break. The primary effects would be due to wave reflections, likely to be manifest as backwash on the inside section of the ride, and wave crest interference patterns on the outer section and at the takeoff zone.

The effects would be greatest under high tide / low wave height conditions, but will be partially evident under most of the typical surf conditions.

Rotation of the seawall orientation to increase the angle of incidence to the incident wave crests reduces (but not eliminates) the negative effects on the surf quality. However, rotation reduces the area and utility of the tranquil zone behind the structure.

Summary

The V-shaped seawall alternatives exhibit the least impact on the surf quality, by reducing the amount of reflected wave energy back into the surfing region. Two options have been tested; one that follows the native seabed shape and a design that that is as close to the shore as possible.

All the seawall options that were tested in this study are effective in creating a tranquil zone on the leeward side, although the Alternative V-shaped structure was the least effective.

At present the waves are focussed into the western corner of the beach, exacerbating the local erosion issues. A sheltered zone with a smooth transition to the open beach is expected to be conducive to the establishment and maintenance of a low-energy beach (i.e. directly in the lee and immediately adjacent to it).