

# **PATTERNS AND RATES OF SEDIMENTATION WITHIN PORIRUA HARBOUR**



**Dr Jeremy Gibb,  
Coastal Management Consultants Ltd**

Eastern Pauatahanui Inlet - Sept 2009



**HISTORICAL CHARTS DIGITISED**

**Completed Feb-March 2009**

**(MetOcean Solutions Ltd)**

**HYDROGRAPHIC/TOPOGRAPHIC SURVEY**

**Completed 16 March-22 April 2009**

**(Discovery Marine Ltd)**

**DESKTOP ANALYSIS**

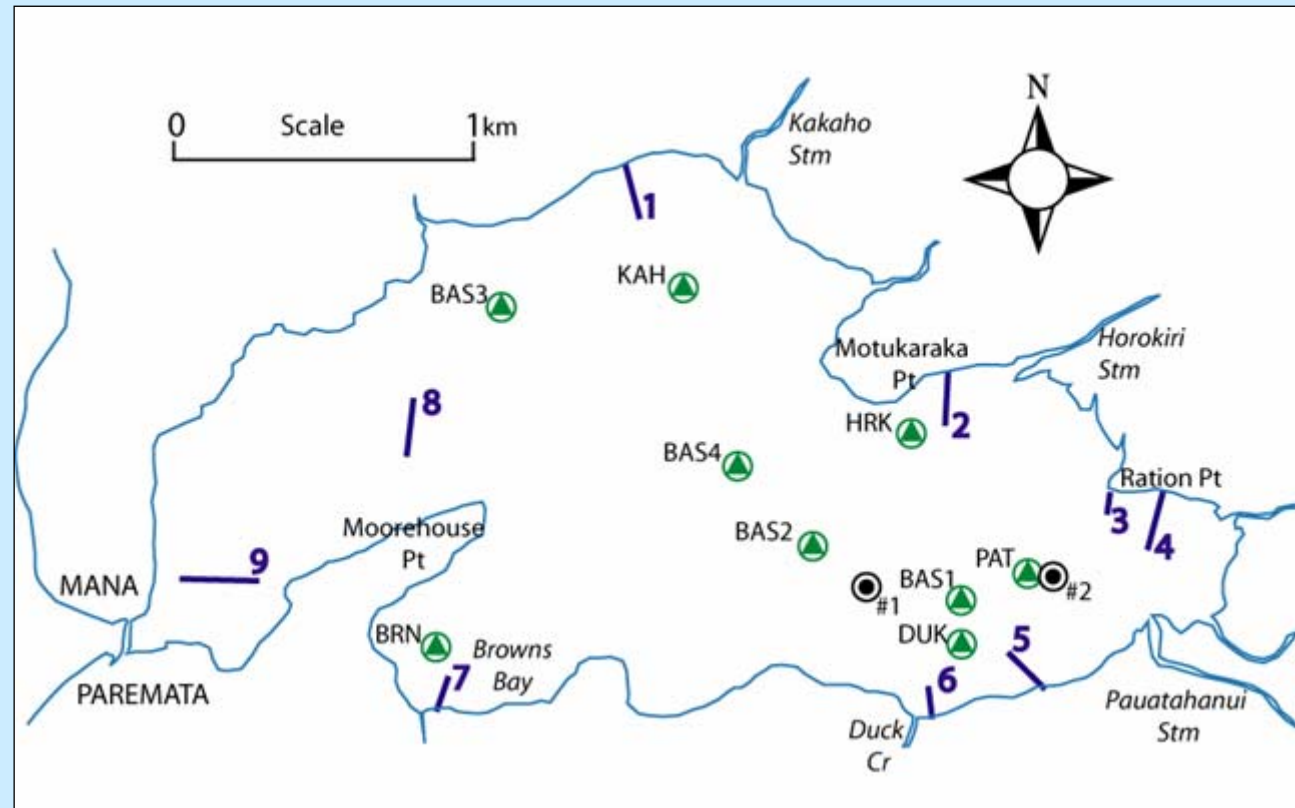
**Completed 15 May-17 August 2009**

**(Coastal Management Consultancy Ltd)**

**for  
PORIRUA CITY COUNCIL**

## PREVIOUS WORK

1976-2004



(source: CMCL Report Fig 7, CR2009/1)

### Geologic Rates

Net Deposition: 1.1m/1000 years (1.1mm/y)

Variability: 0.5-11.7m/1000 years (0.5-11.7mm/y)

### Historic Rates

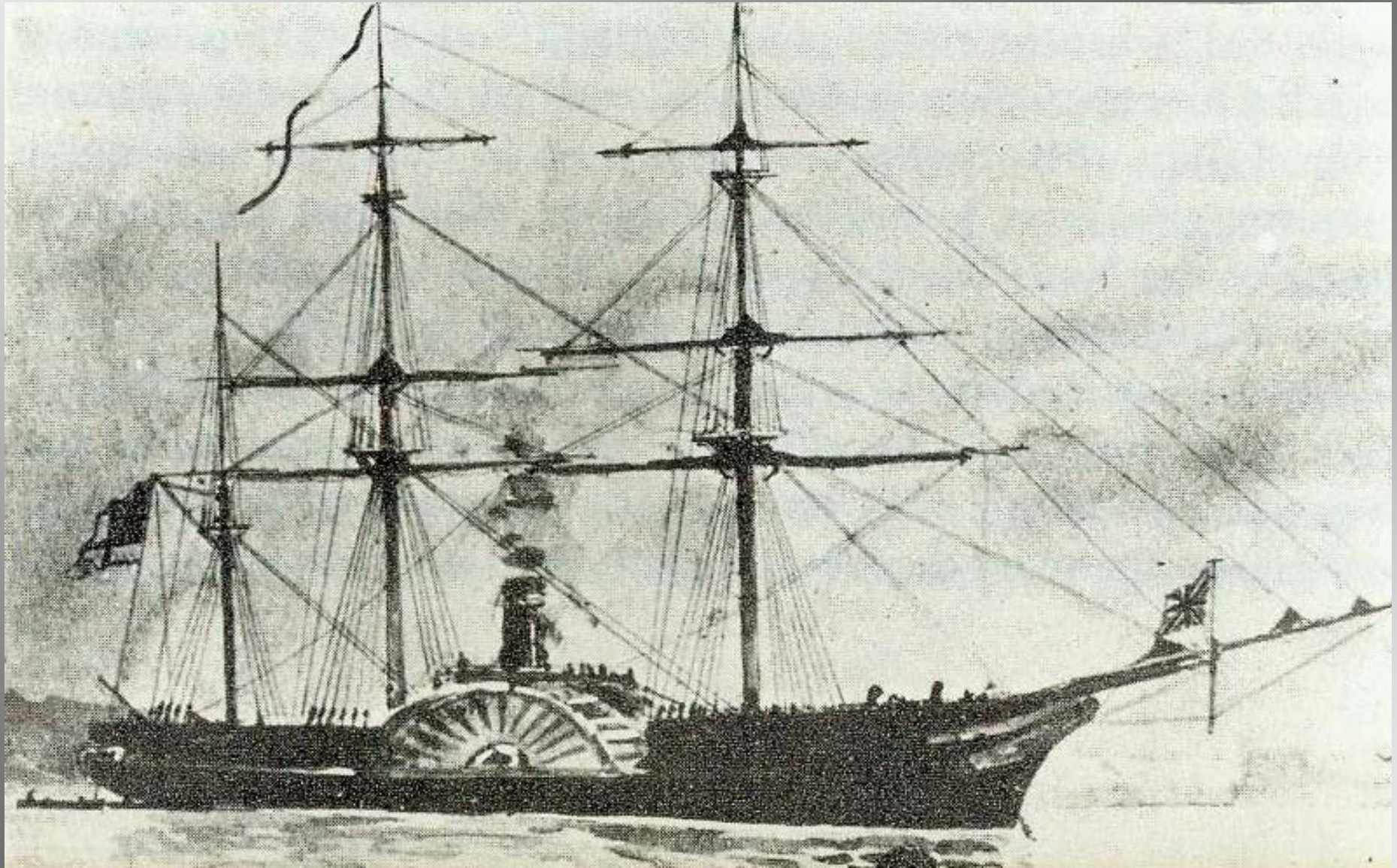
Increase from 2.32mm/year (post 1850) to 4.62mm/year (post 1985)

### Short Term Rates

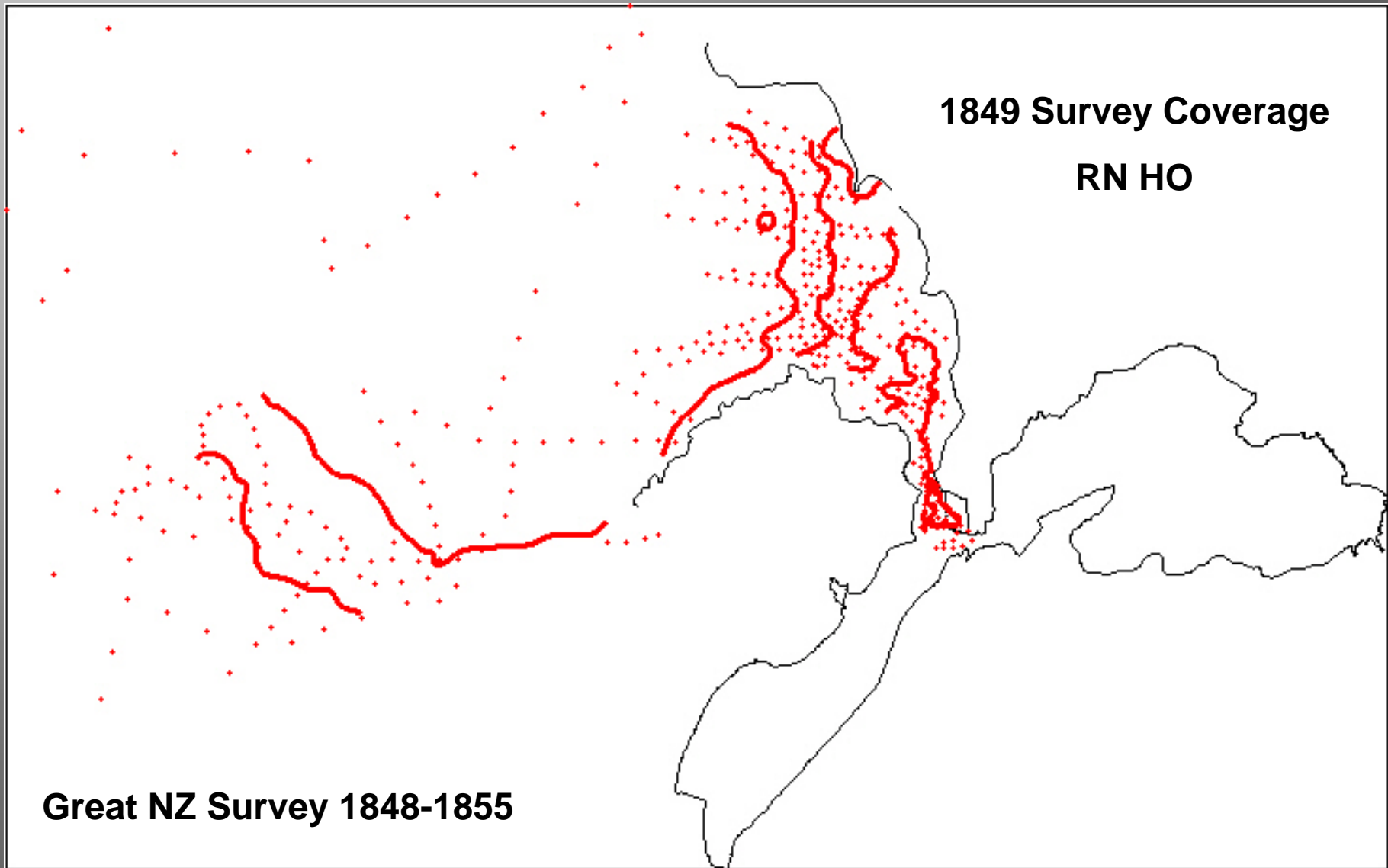
-64 to 47mm/year (15 month period)



## HMS Acheron 1849



(source: Ross 1969)



**Great NZ Survey 1848-1855**

**1849 Survey Coverage  
RN HO**

(source: DML 2009)

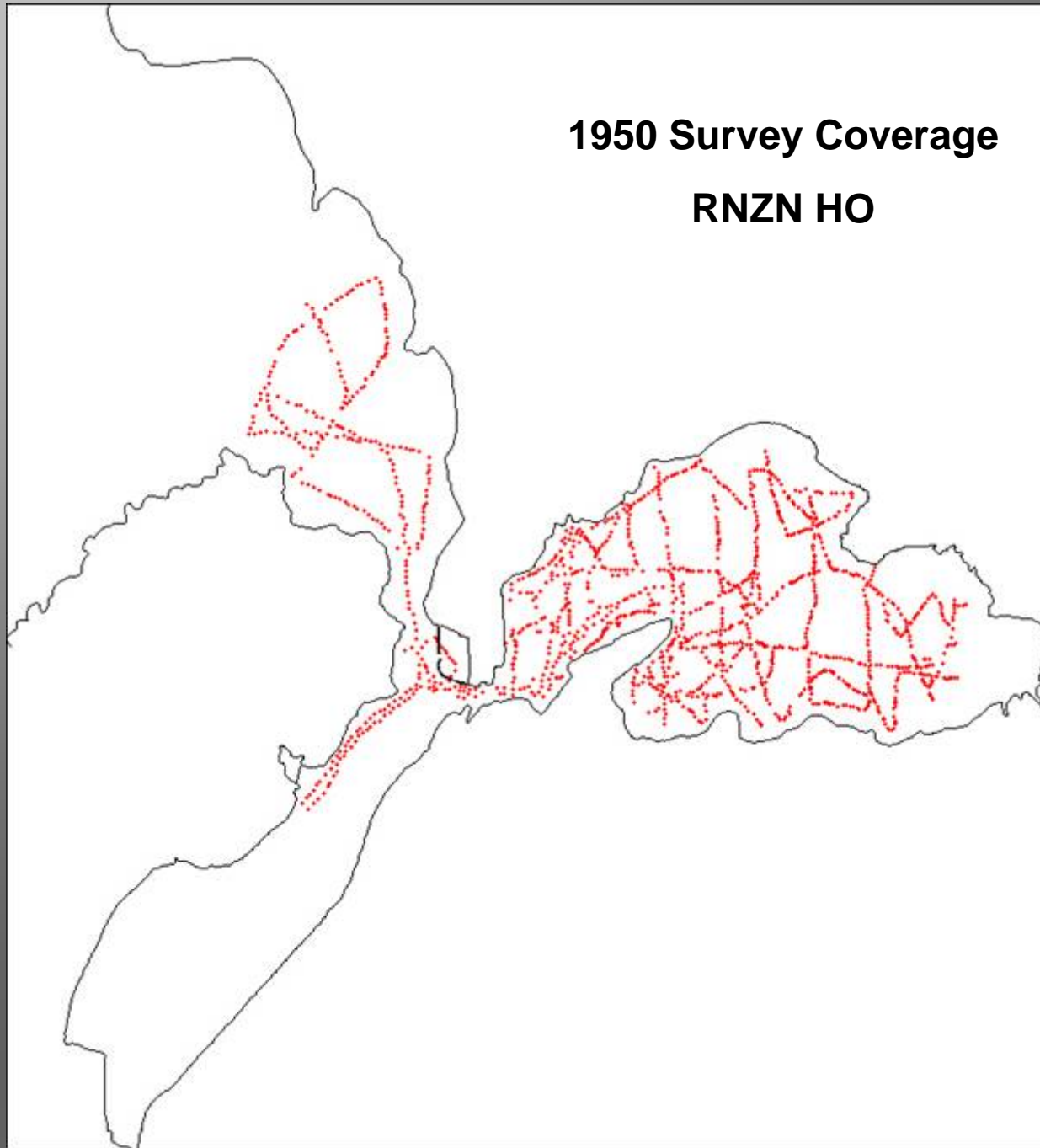


## HMNZS Lachlan 1950-1967



(source: Ross 1969)

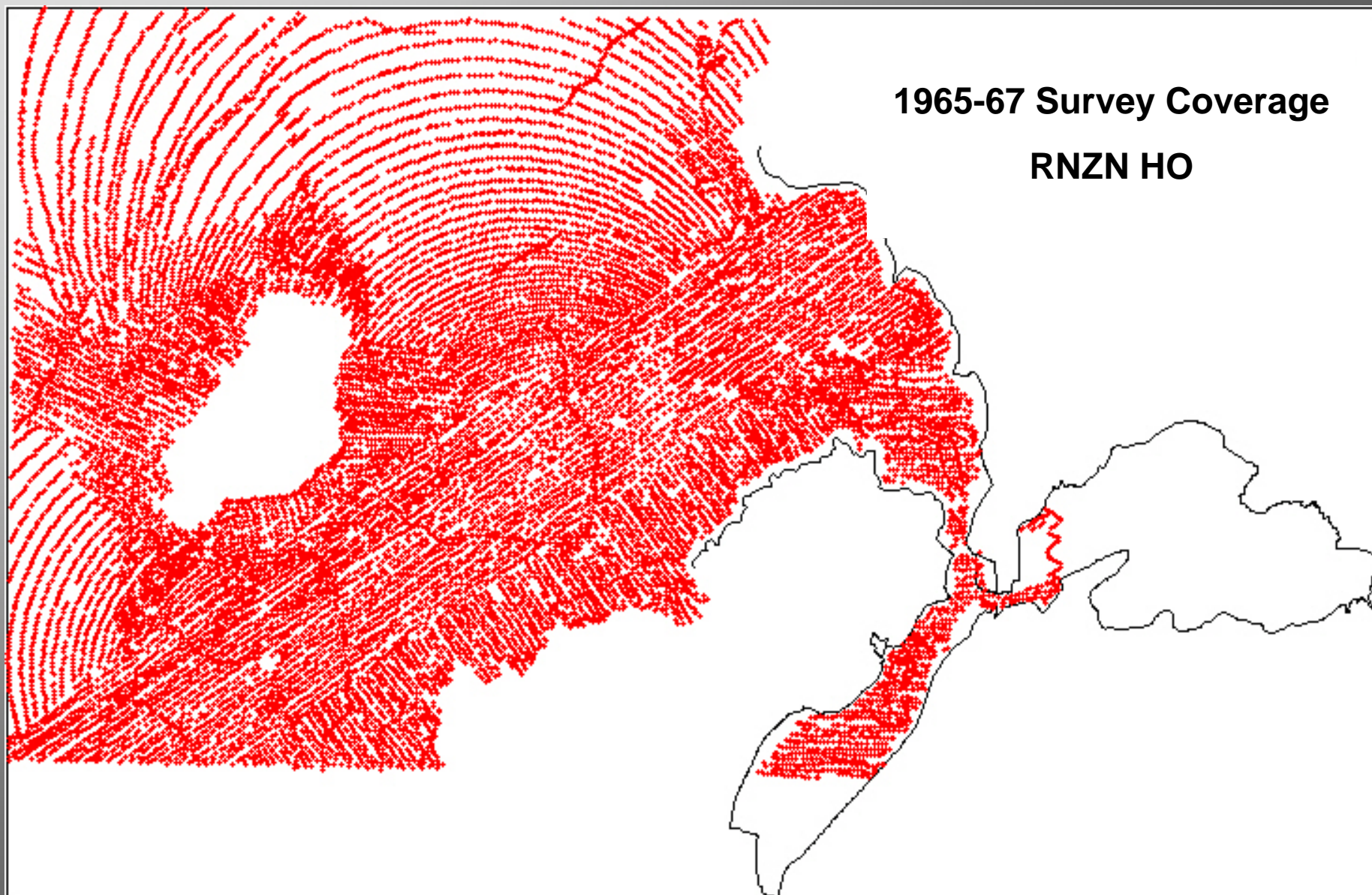
**1950 Survey Coverage  
RNZN HO**



(source: DML 2009)



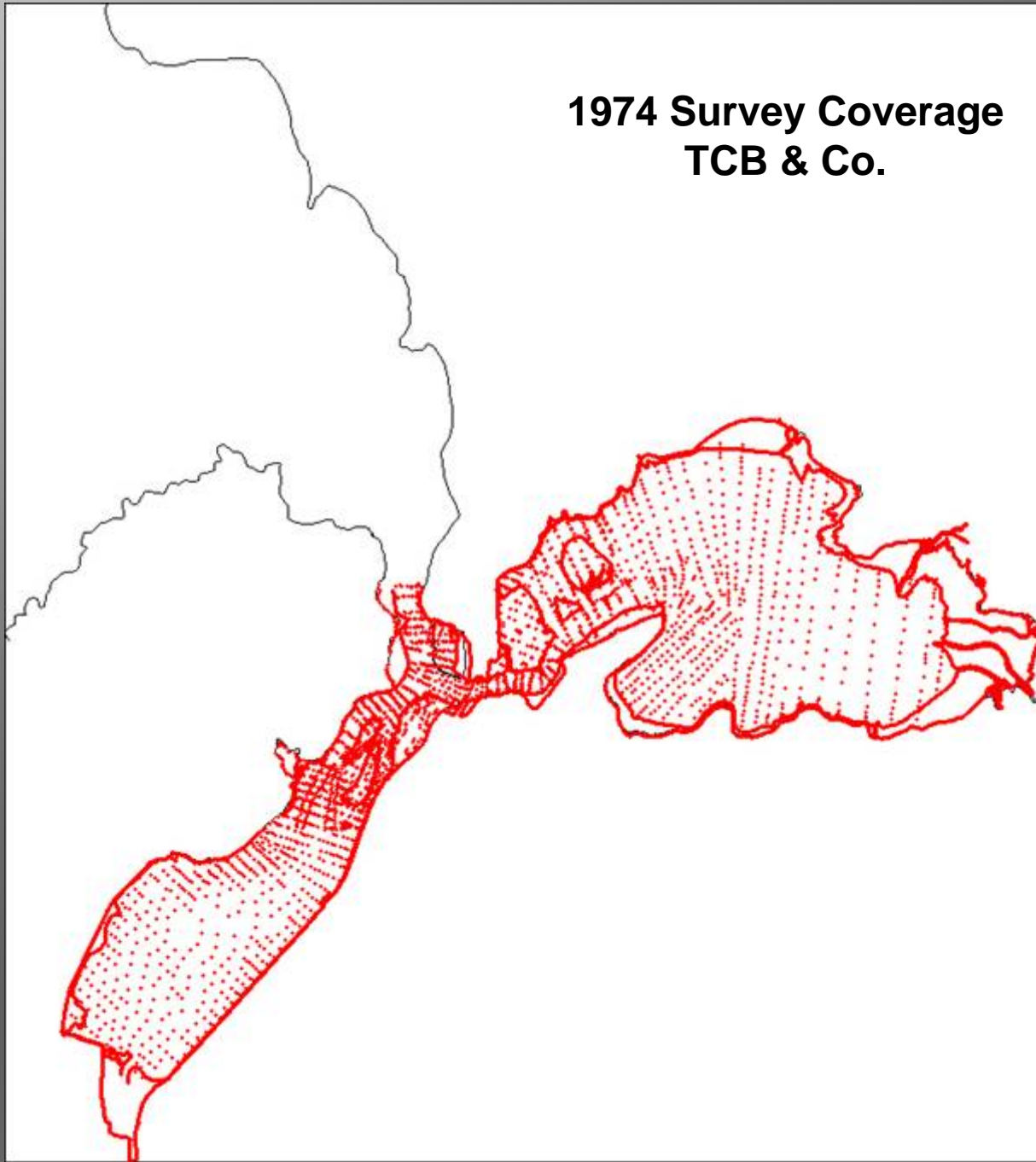




**1965-67 Survey Coverage  
RNZN HO**

(source: DML 2009)

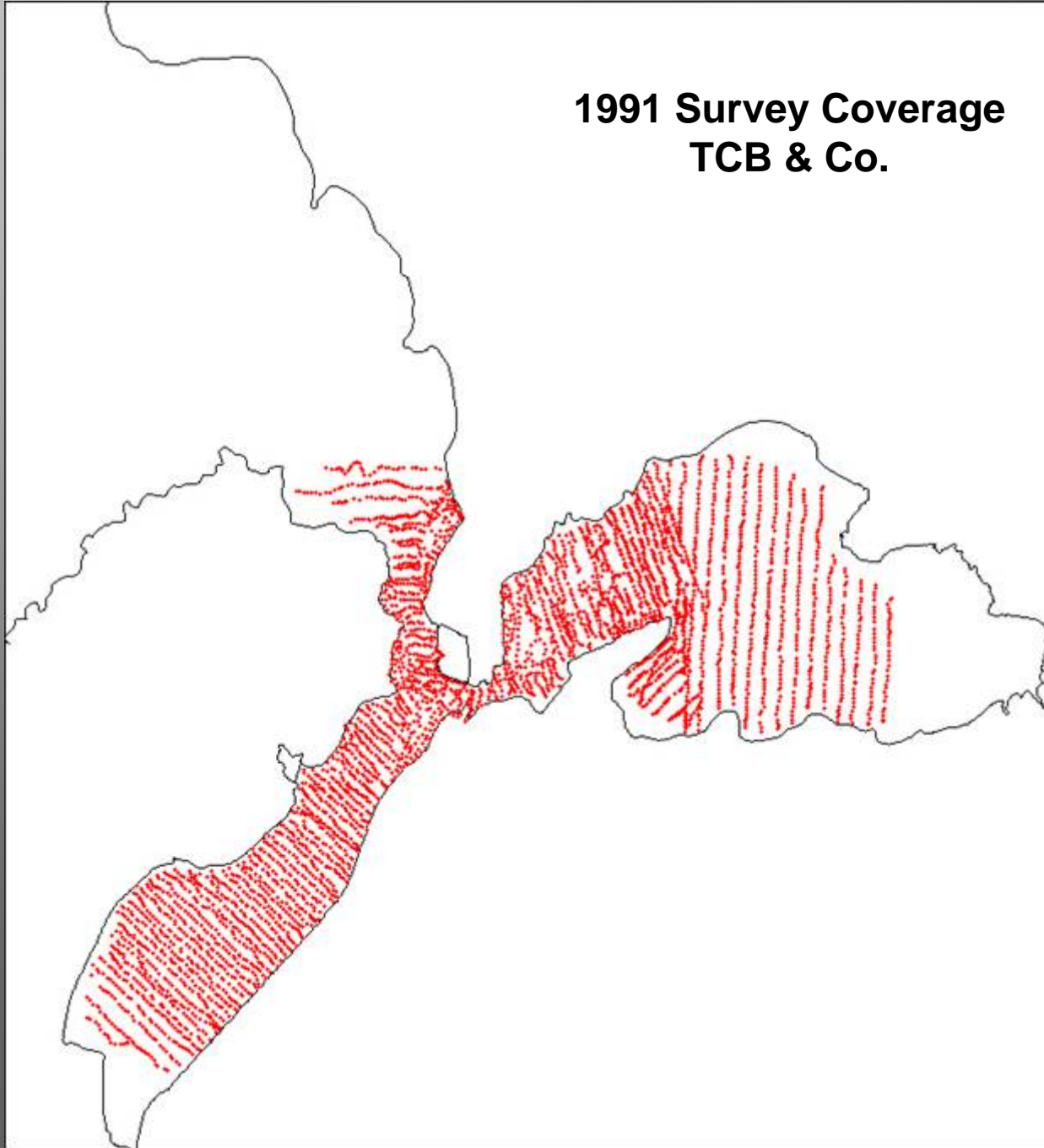
**1974 Survey Coverage  
TCB & Co.**



(source: DML 2009)



**1991 Survey Coverage  
TCB & Co.**



(source: DML 2009)

# SMB Discovery 2009



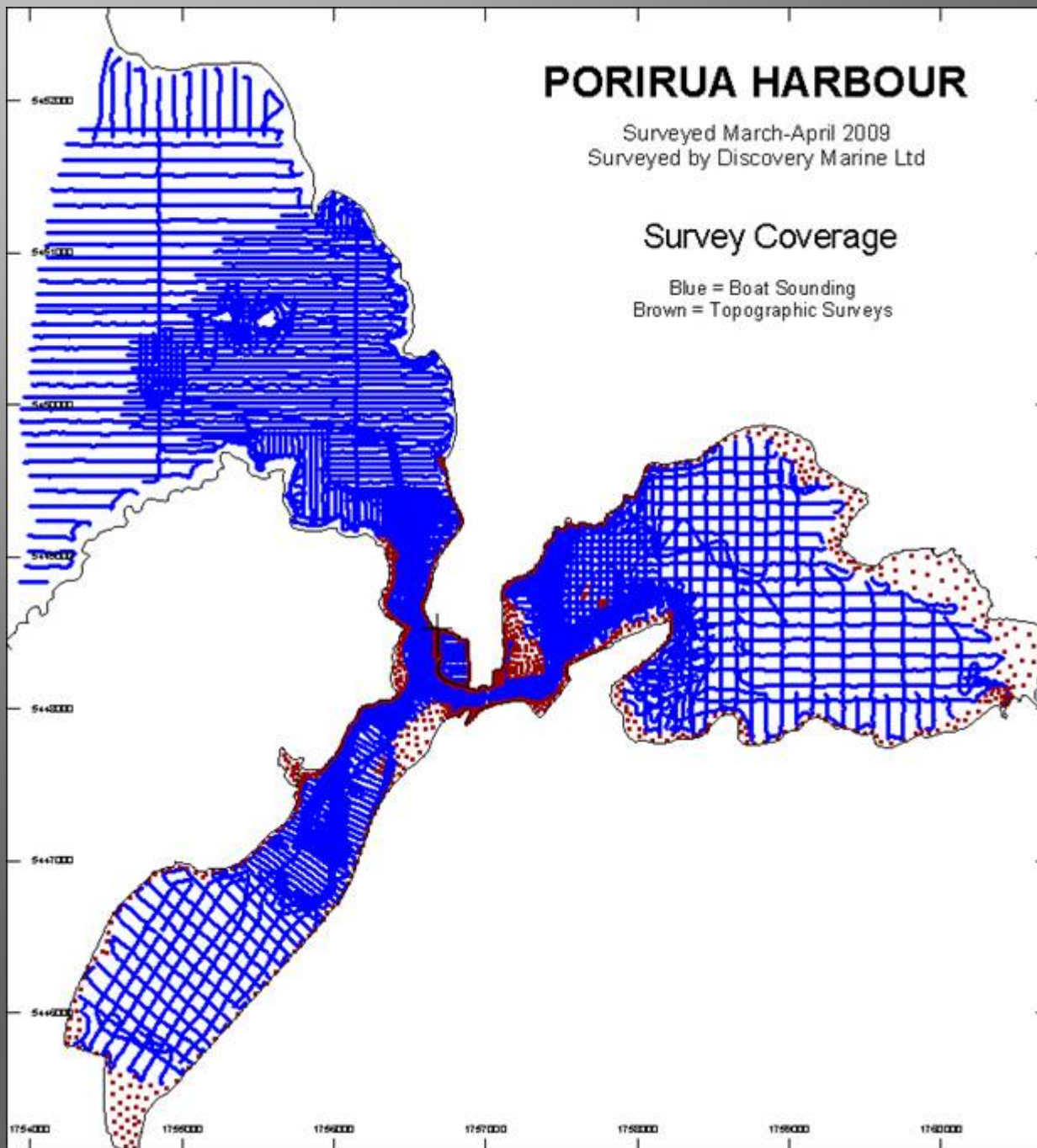


# PORIRUA HARBOUR

Surveyed March-April 2009  
Surveyed by Discovery Marine Ltd

## Survey Coverage

Blue = Boat Sounding  
Brown = Topographic Surveys

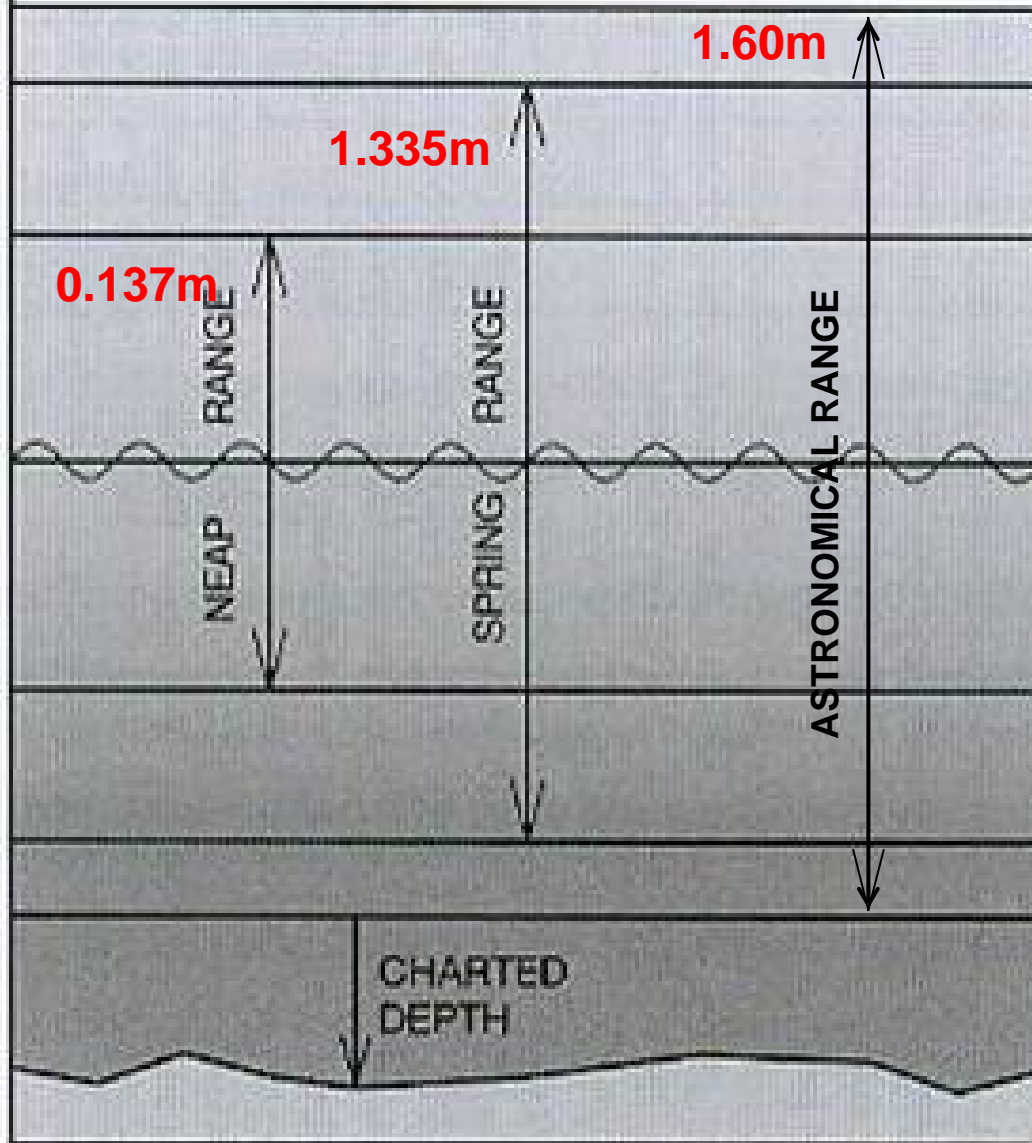


(source: DML 2009)





## 2009 MANA MARINA TIDES



Highest Astronomical Tide (HAT)  
Mean High Water Springs (MHWS)

Mean High Water Neaps (MHWN)

Mean Sea Level (MSL)

Mean Low Water Neaps (MLWN)

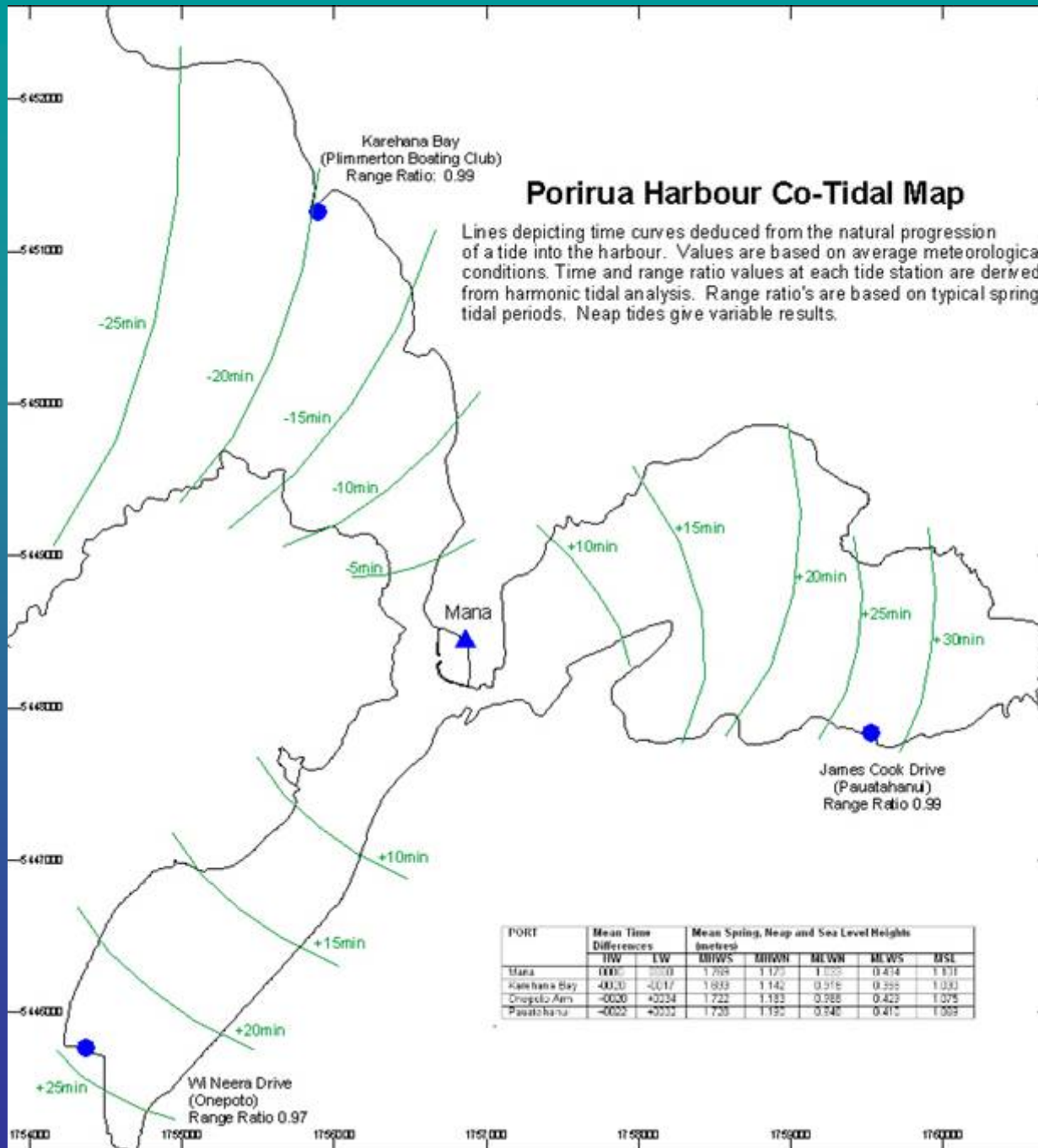
Mean Low Water Springs (MLWS)

Lowest Astronomical Tide (LAT)  
Chart Datum (CD)

(source: CMCL Report Fig 4, CR2009/1)

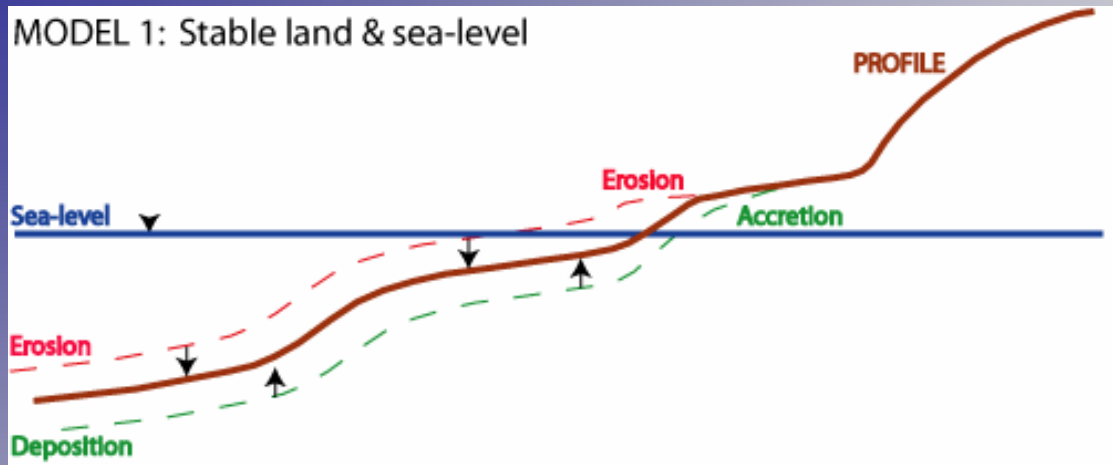
## Porirua Harbour Co-Tidal Map

Lines depicting time curves deduced from the natural progression of a tide into the harbour. Values are based on average meteorological conditions. Time and range ratio values at each tide station are derived from harmonic tidal analysis. Range ratios are based on typical spring tidal periods. Neap tides give variable results.

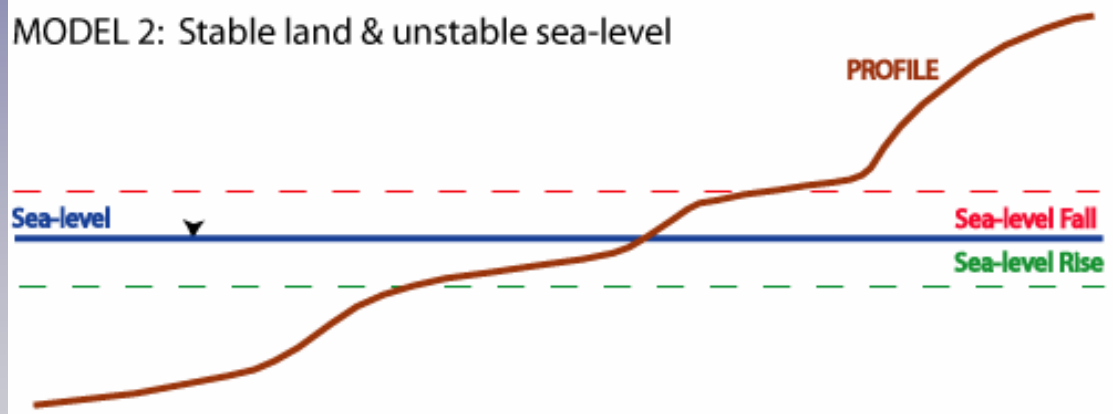


(source: CMCL Report, Fig 5, CR2009/1)

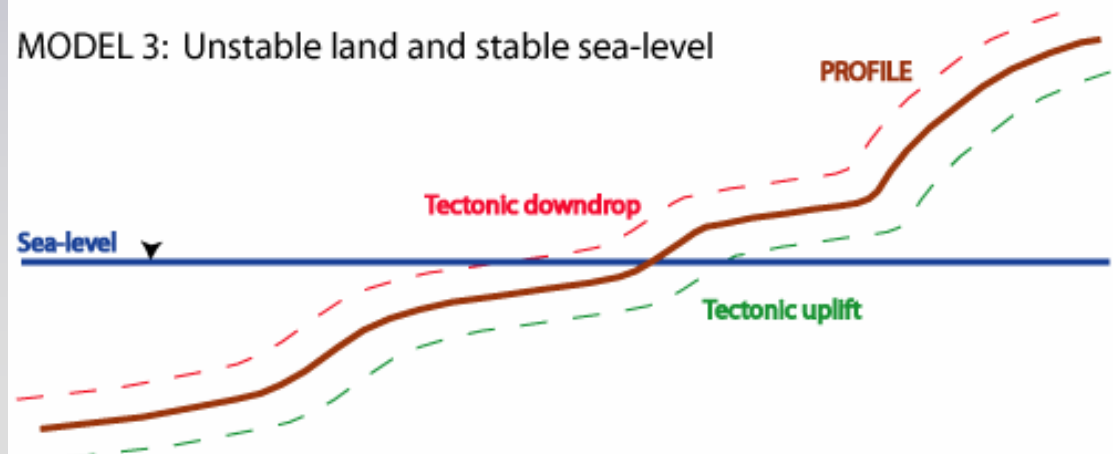
MODEL 1: Stable land & sea-level



MODEL 2: Stable land & unstable sea-level



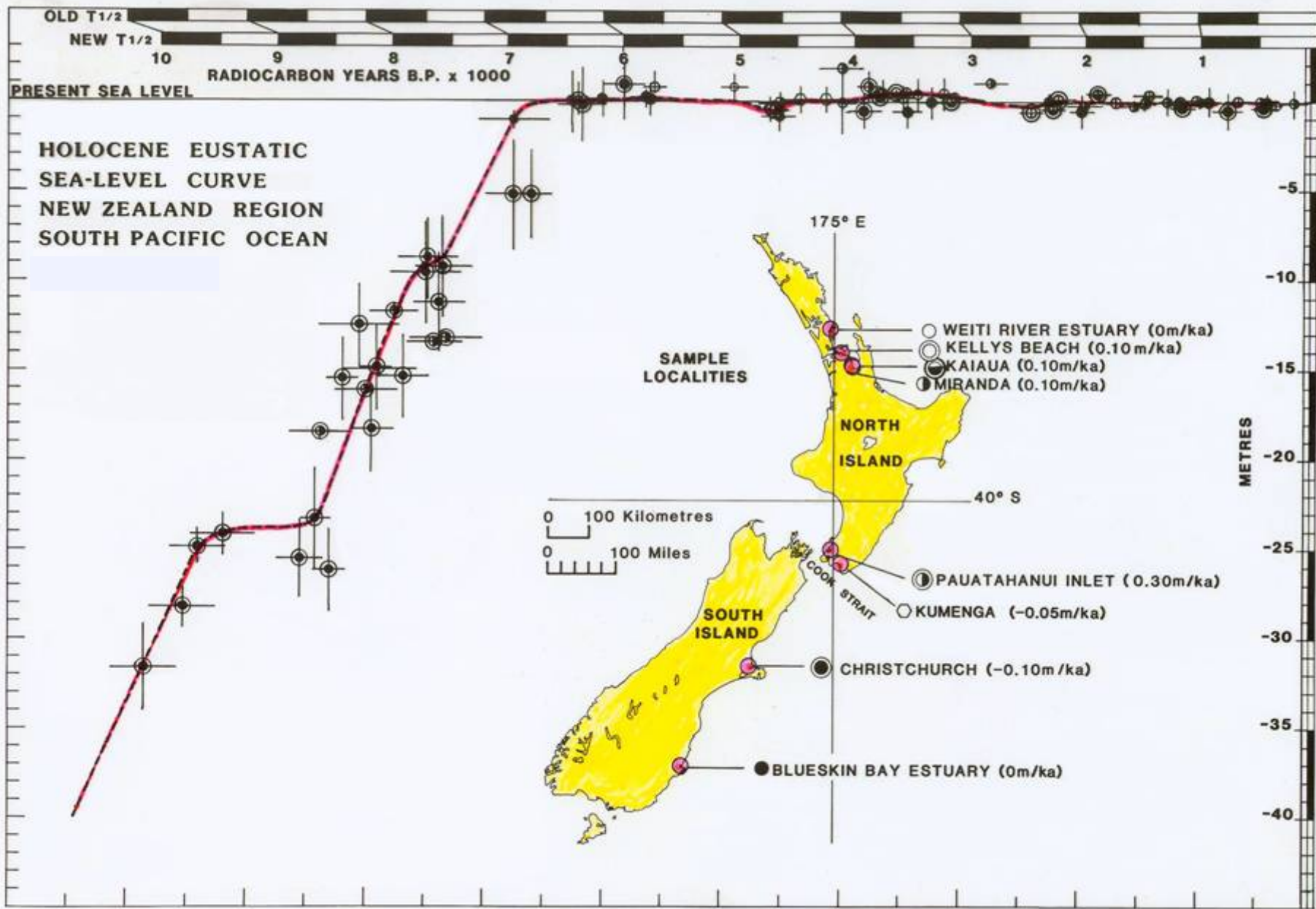
MODEL 3: Unstable land and stable sea-level



# Conceptual Framework

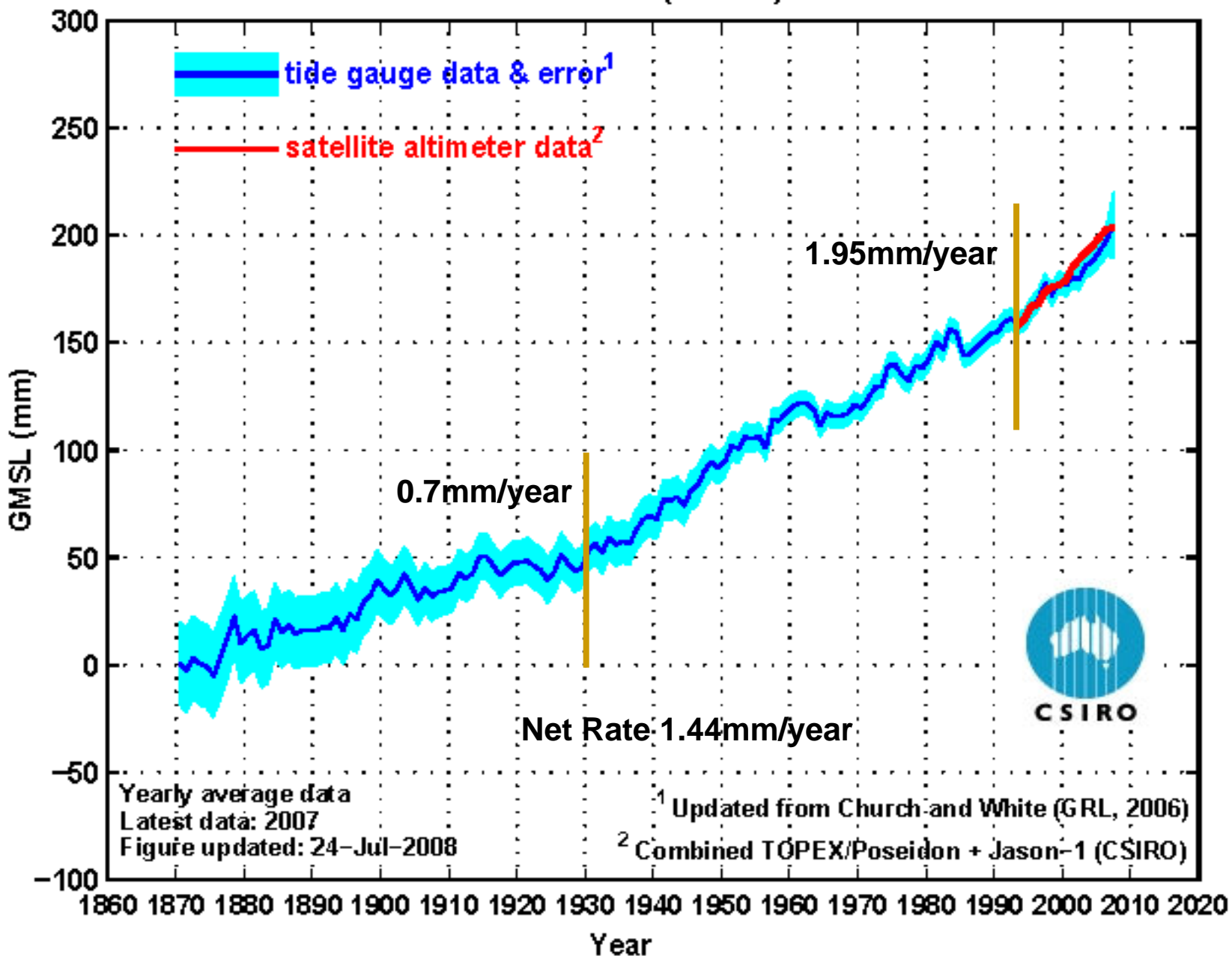
Which model or combination thereof applies?



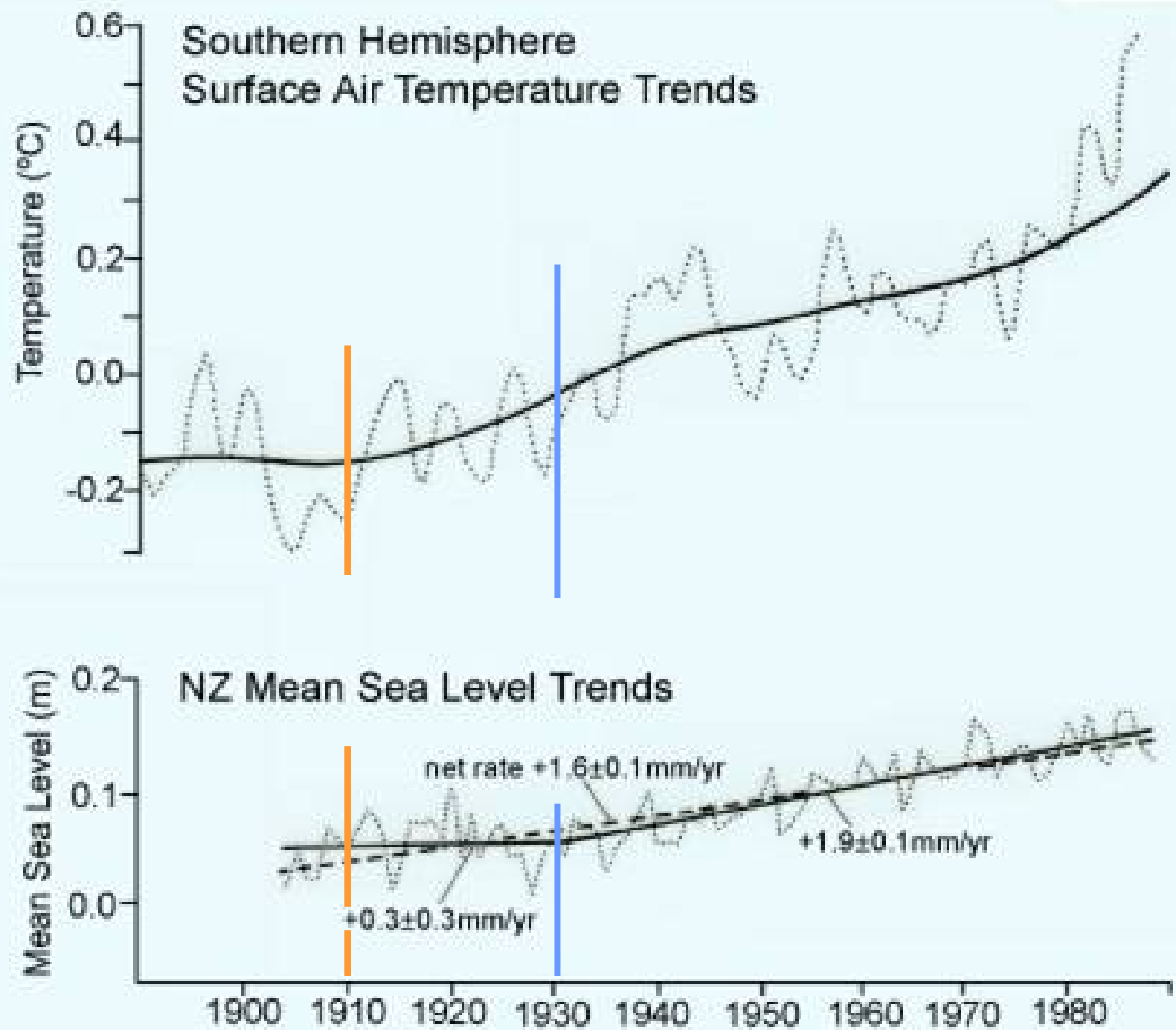


(source: Gibb 1986)

# Global Mean Sea Level (GMSL) – 1870 to 2007



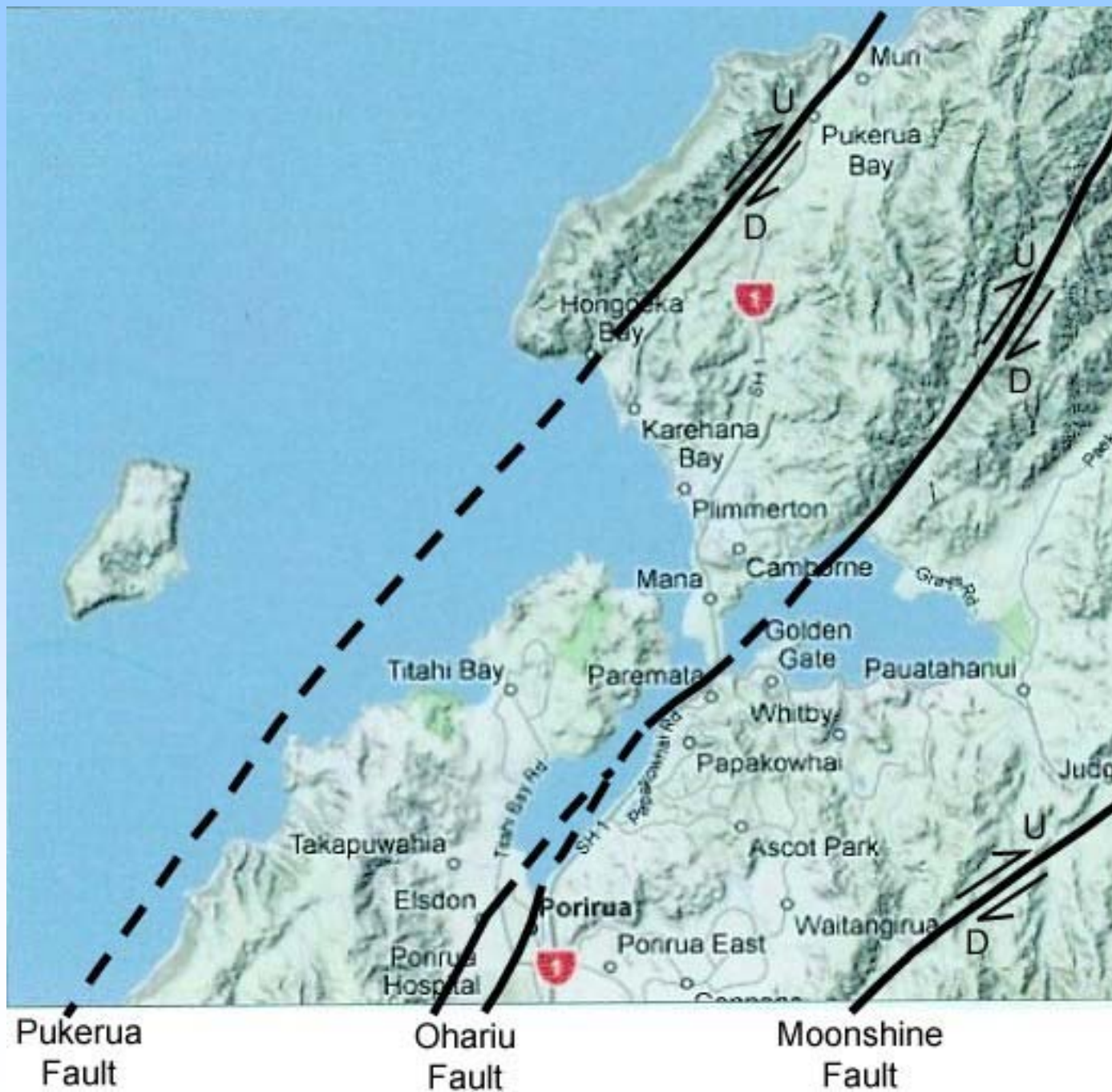
(source: Church et al. 2008)



(source: Gibb 1991)

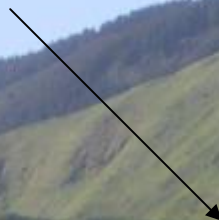


# Tectonics



(source: CMCL Report, Fig 2, CR2009/1)

**Ohariu Fault**



**Kakaho Valley – Sept 2009**





# Ohariu Fault

0.5m/1000yrs

Up

Down

0.0m/1000yrs

Grays Rd

Paekakariki Hill Rd

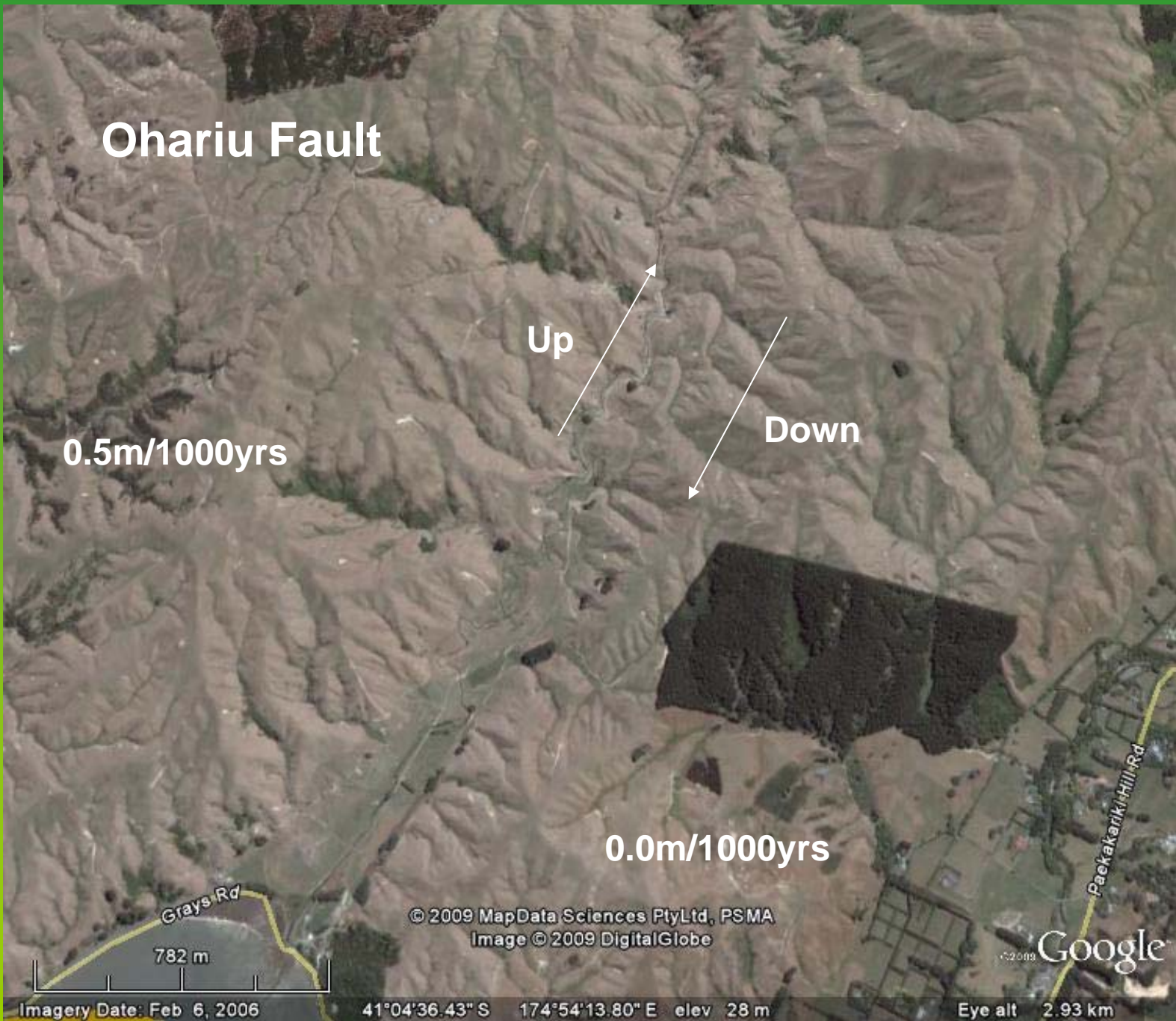
© 2009 MapData Sciences PtyLtd, PSMA  
Image © 2009 DigitalGlobe

©2009 Google

Imagery Date: Feb 6, 2006

41°04'36.43" S 174°54'13.80" E elev 28 m

Eye alt 2.93 km





# Tectonic uplift



Whitireia Park – Sept 2009



# Tectonic uplift



Whitireia Park – Sept 2009



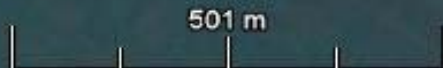
0.2m/1000 yrs

3.2ka

4.2ka

0.5m/1000 yrs

Plimmerton, New Zealand



Imagery Date: Feb 6, 2006

41°04'43.69" S 174°52'15.06" E elev 6 m

Image © 2009 DigitalGlobe

©2009 Google

Eye alt 1.91 km





0.0m/1000 yrs

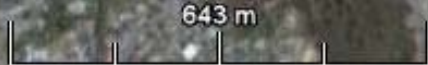


Image © 2009 DigitalGlobe

©2009 Google

Imagery Date: Feb 6, 2006

41°05'48.42" S 174°54'25.81" E

Eye alt 2.38 km

## Wairarapa Fault, Pigeon Bush

1855 Wairarapa Earthquake – Magnitude 8.2-8.3

Maximum coseismic strike-slip offset 15-19m

Maximum coseismic vertical uplift 4-6m

Up

Down

© 2009 MapData Sciences PtyLtd, PSMA  
Image © 2009 DigitalGlobe

©2009 Google™

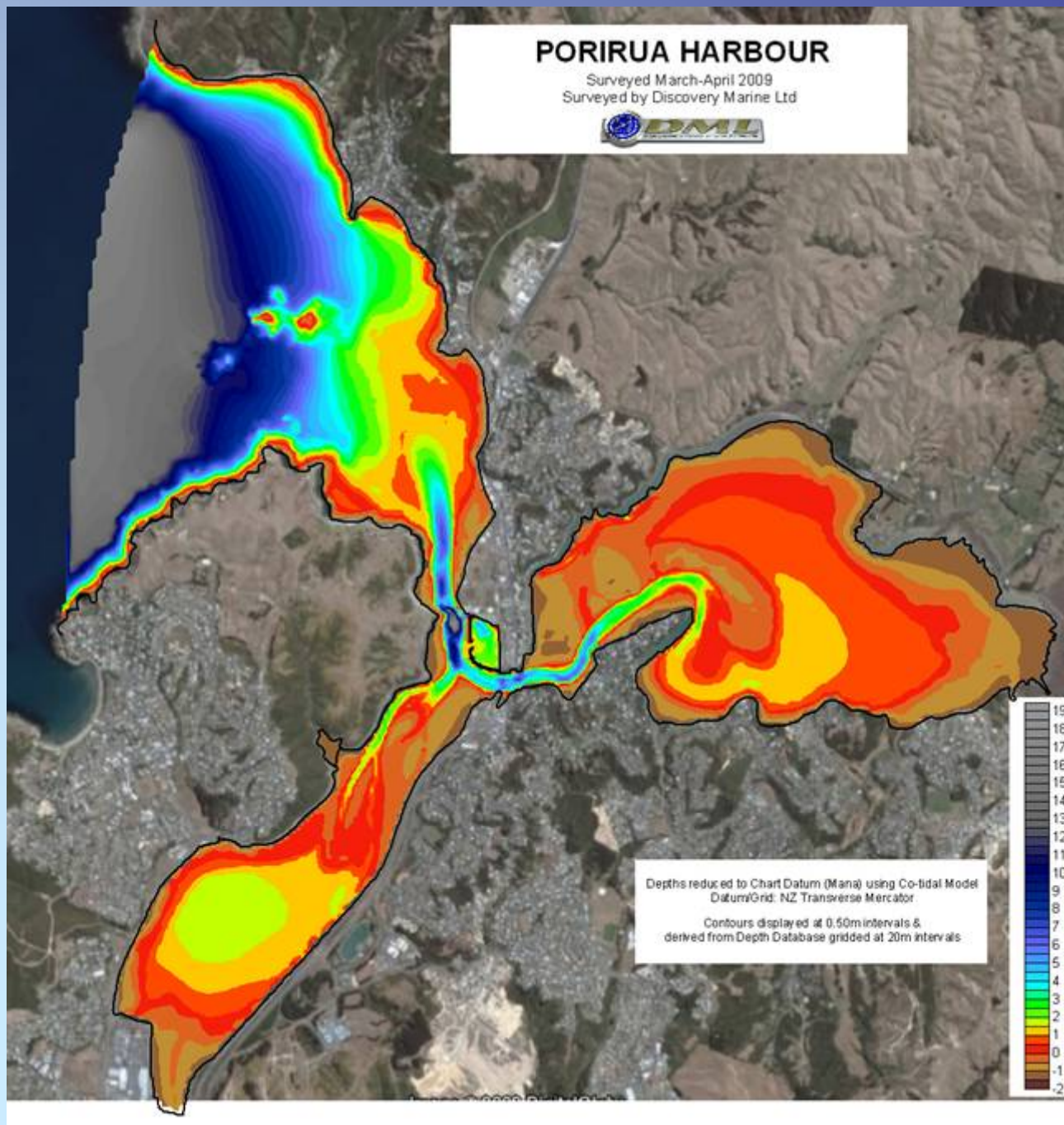
123 m

Imagery Date: Apr 17, 2002

41°08'18.96" S 175°16'52.41" E elev 21 m

Eye alt 492 m

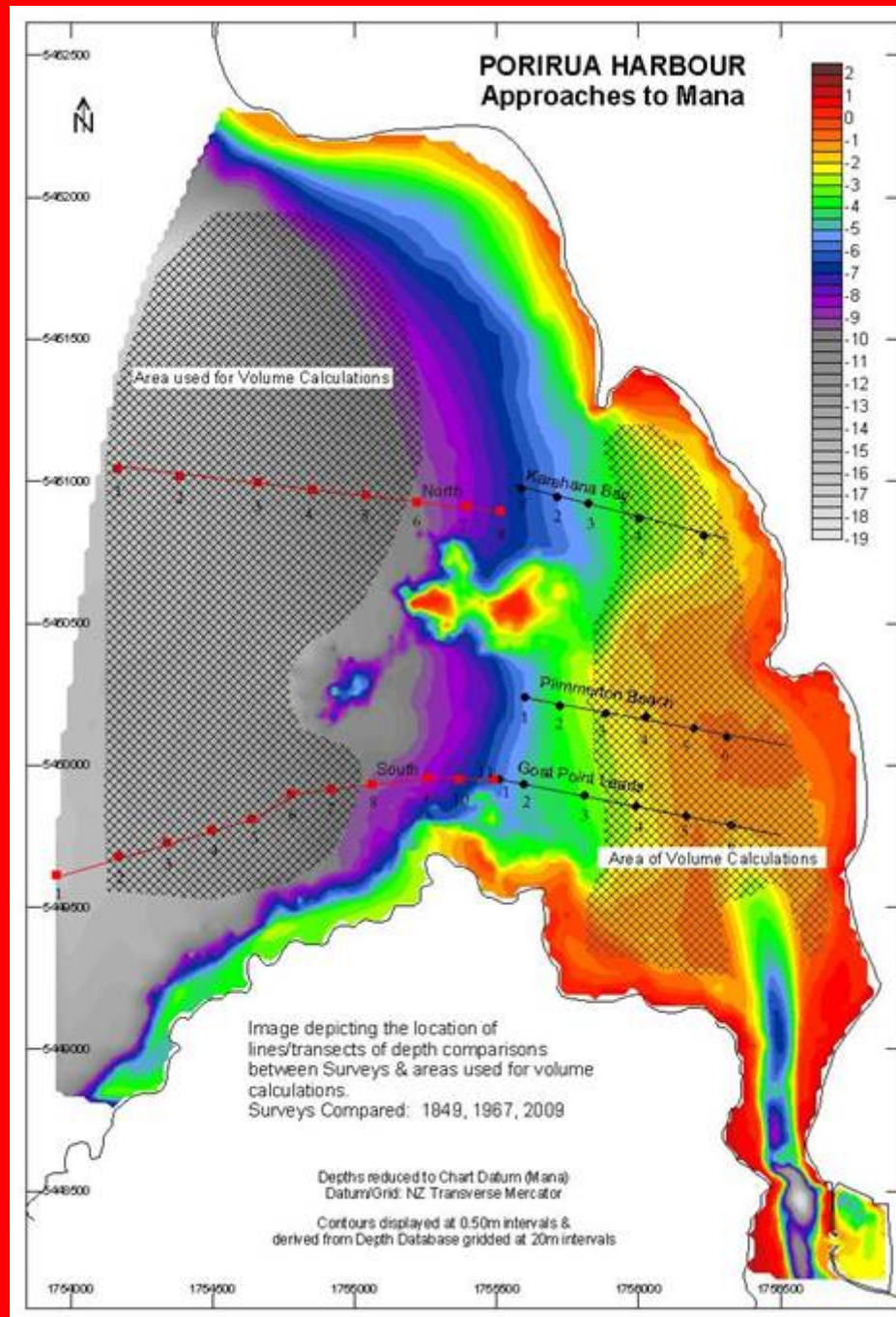




# SEABED MORPHOLOGY 2009

(source: CMCL Report, Fig 6, CR2009/1)





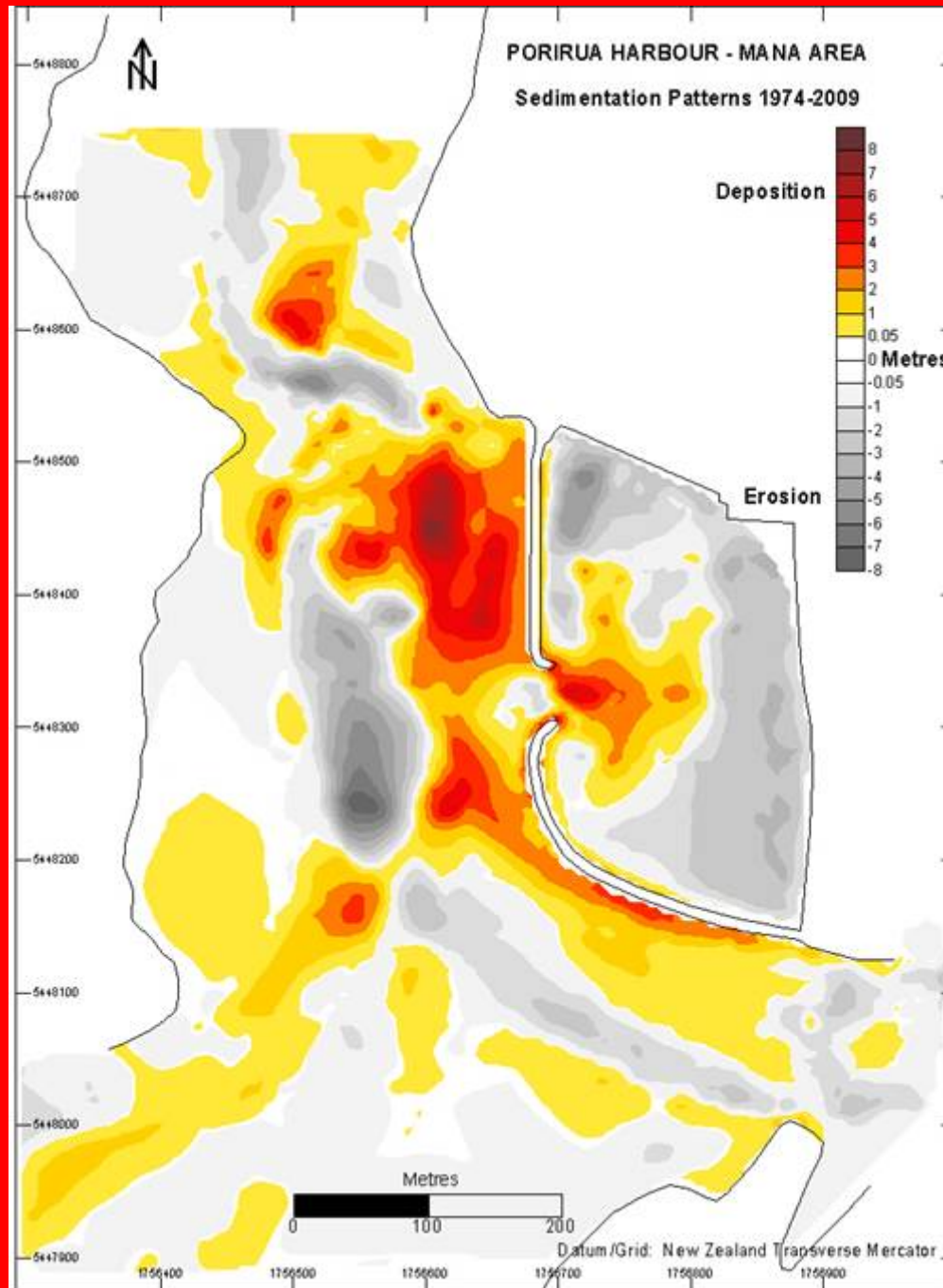
# SEDIMENTATION RATES

1967-2009

Approaches:  
-24.4mm/year erosion

Entrance Bar:  
-1.3mm/year erosion

(Source: Fig 8, CR2009/1)

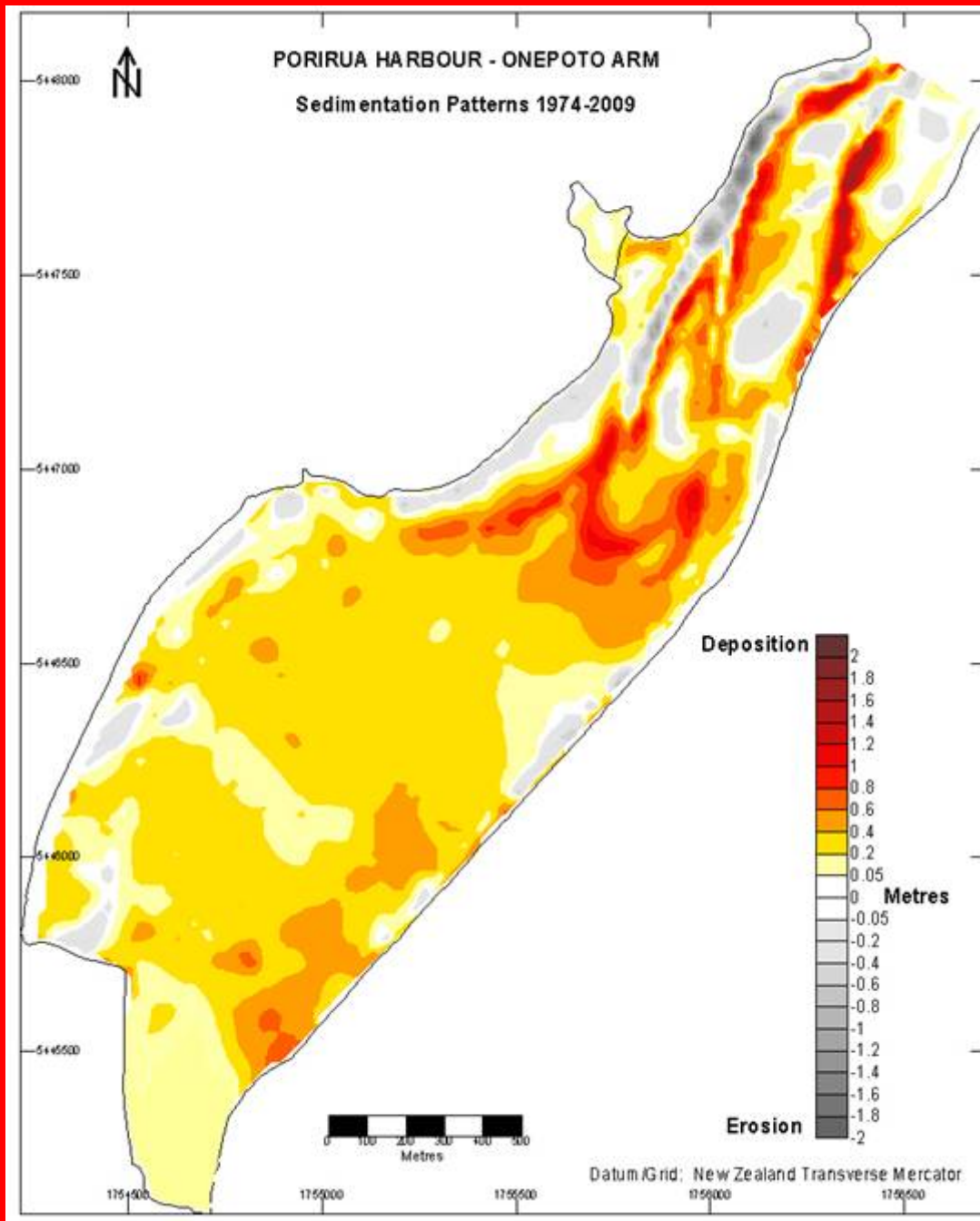


# SEDIMENTATION RATES 1974-2009

**Net deposition: 27.9mm/year**

(Source: Fig 9, CR2009/1)





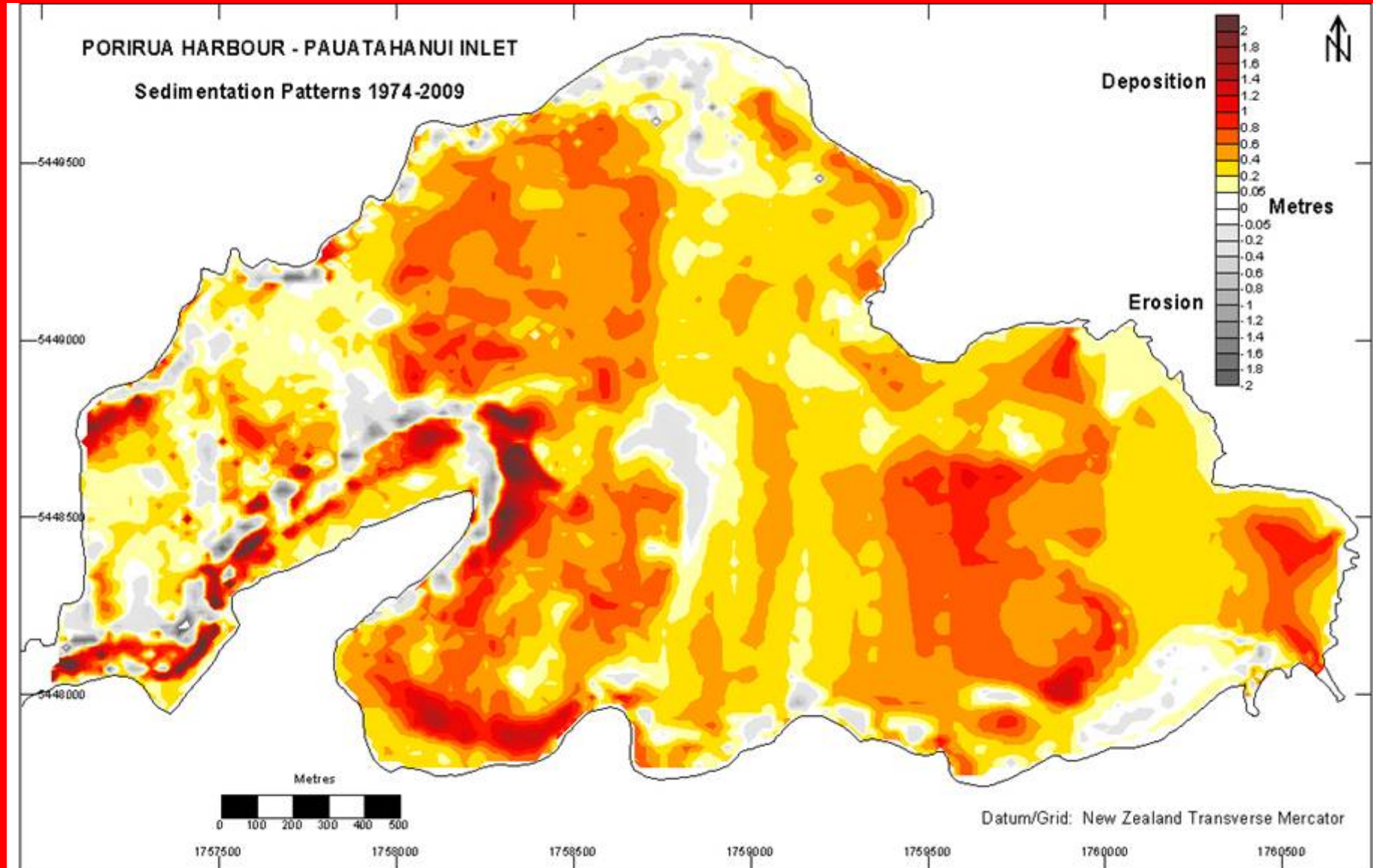
# SEDIMENTATION RATES 1974-2009

Net deposition: 5.7mm/year

(Source: Fig 10, CR2009/1)

# SEDIMENTATION RATES 1974-2009

Net deposition: 9.1mm/year



(Source: Fig 11, CR2009/1)





## TIDAL PRISM REDUCTIONS 1974-2009

Pauatahanui Inlet -8.7%

Onepoto Arm -1.7%



# FORECAST

(Projecting 1974-2009 deposition rates)

Saline swamp by  
 $2180 \pm 25$

Saline swamp by  
 $2350 \pm 50$

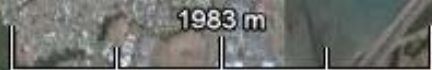


Image © 2009 DigitalGlobe  
Image © 2009 TerraMetrics

©2009 Google

Imagery Date: Feb 6, 2006

41°05'58.19" S 174°52'11.61" E

Eye alt 7.02 km



# Study Recommendations

***“It is recommended that PCC after due consideration of this report:***

- 1. Take appropriate steps immediately to reduce the current net average rates of deposition of sand and mud from 5-10mm/year in both the Onepoto Arm and Pauatahanui Inlet, to the geologic rate of 1.0-1.5mm/year, to preserve both estuarine arms of Porirua Harbour.***
- 2. Ensure that all sand dredged from areas of Porirua Harbour, especially around Mana Marina, is explicitly designated for the restoration of both the natural character and amenity of beaches within the Porirua Harbour area including its approaches.”***

(source: CMCL Report CR 2009/1)