



Mapping Mangawhai Spit¹

Summary prepared by Phil McDermott and Terry Hume

Mangawhai Matters Inc

1. Auckland University (2024) “Topographic mapping of Mangawhai sand spit and development of a draft framework for monitoring future changes” Professor Mark Dickson, Assoc. Prof. Murray Ford, Dr Emma Ryan



1 Study Aims

- Hume Report (2023) identified threats to the spit:
 - Wind deflation
 - Erosion of the harbour coast
 - Erosion of the open coast
 - Inundation by the sea
 - Breaching may result from combined ocean side and harbour-side over-wash
- Topographic Mapping by Auckland University (2024)* commissioned to:
 - Provide mapping of spit morphology and evidence of impacts of storm events and SLR
 - Identify areas of vulnerability
 - Provide a capacity to generate computer maps of alternative outcomes
 - Provide a framework for future monitoring

* Auckland University (2024) “Topographic mapping of Mangawhai sand spit and development of a draft framework for monitoring future changes”
Professor Mark Dickson,, Assoc. Prof. Murray Ford, Dr Emma Ryan for the Mangawhai Harbour Restoration Society.

2 Main results

- Confirms loss of significant volume of sand from the spit
- •Identifies potential for shoal to cause erosion of spit harbour shore
- •Confirms risks from eastern, ocean-side shore
- •Identifies risk of inundation from northern tip of spit
- •Confirms potential for inundation and breach
- •Identifies where its important to focus mitigation efforts

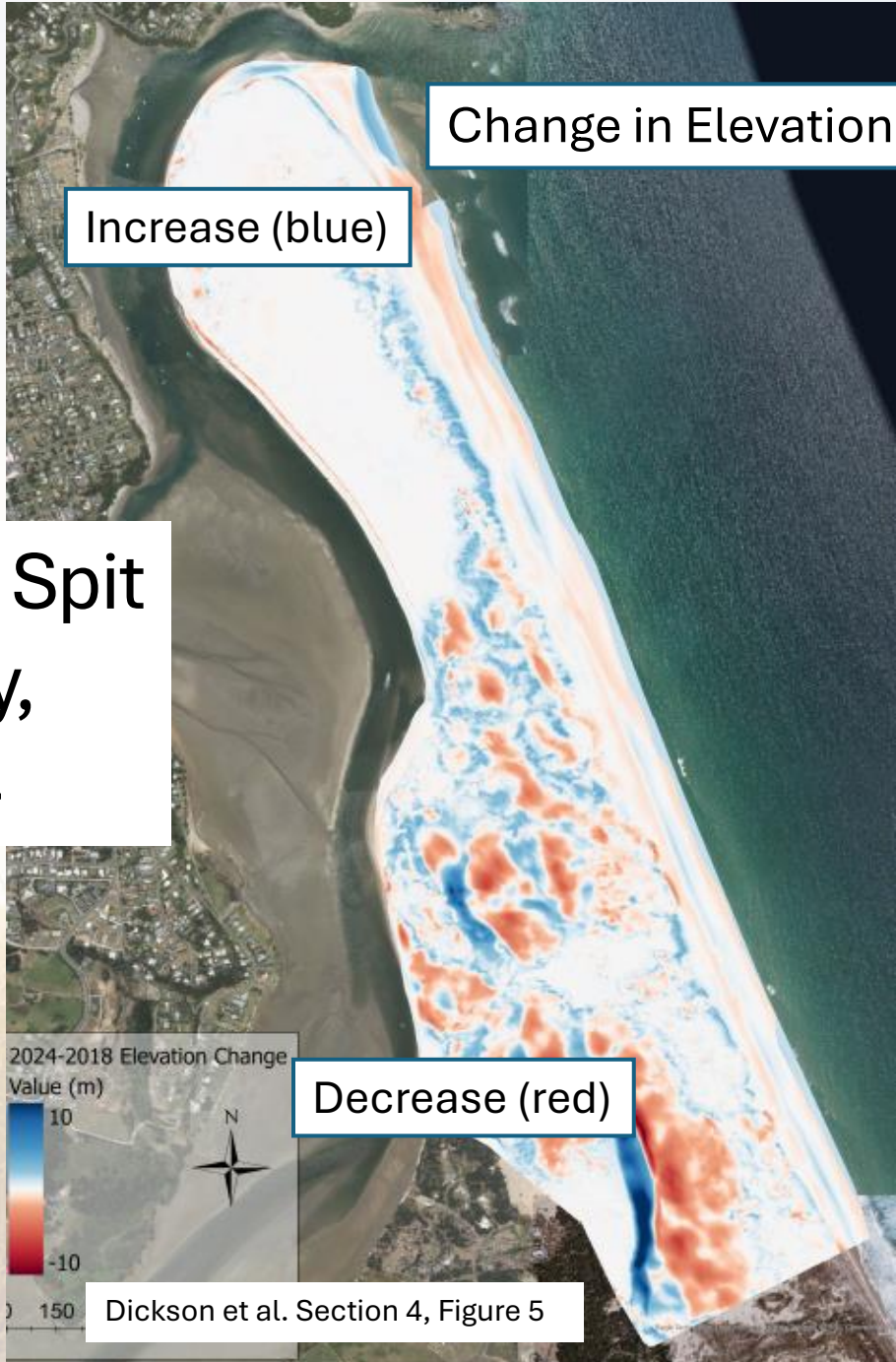
3 Method

- Map spit from 2018 LIDAR aerial imagery (NRC)
- Undertake and map a 2024 high resolution drone LIDAR survey
- Compare 2018 and 2024 spit outline, topography, and volume
- Identify potential water flow paths
- Model inundation under different storm conditions and sea levels
- Test an alternative, cost-effective method for mapping the spit.
- Assess monitoring options
- Generate user friendly GIS maps of outcomes

4 Findings – Spit Morphology

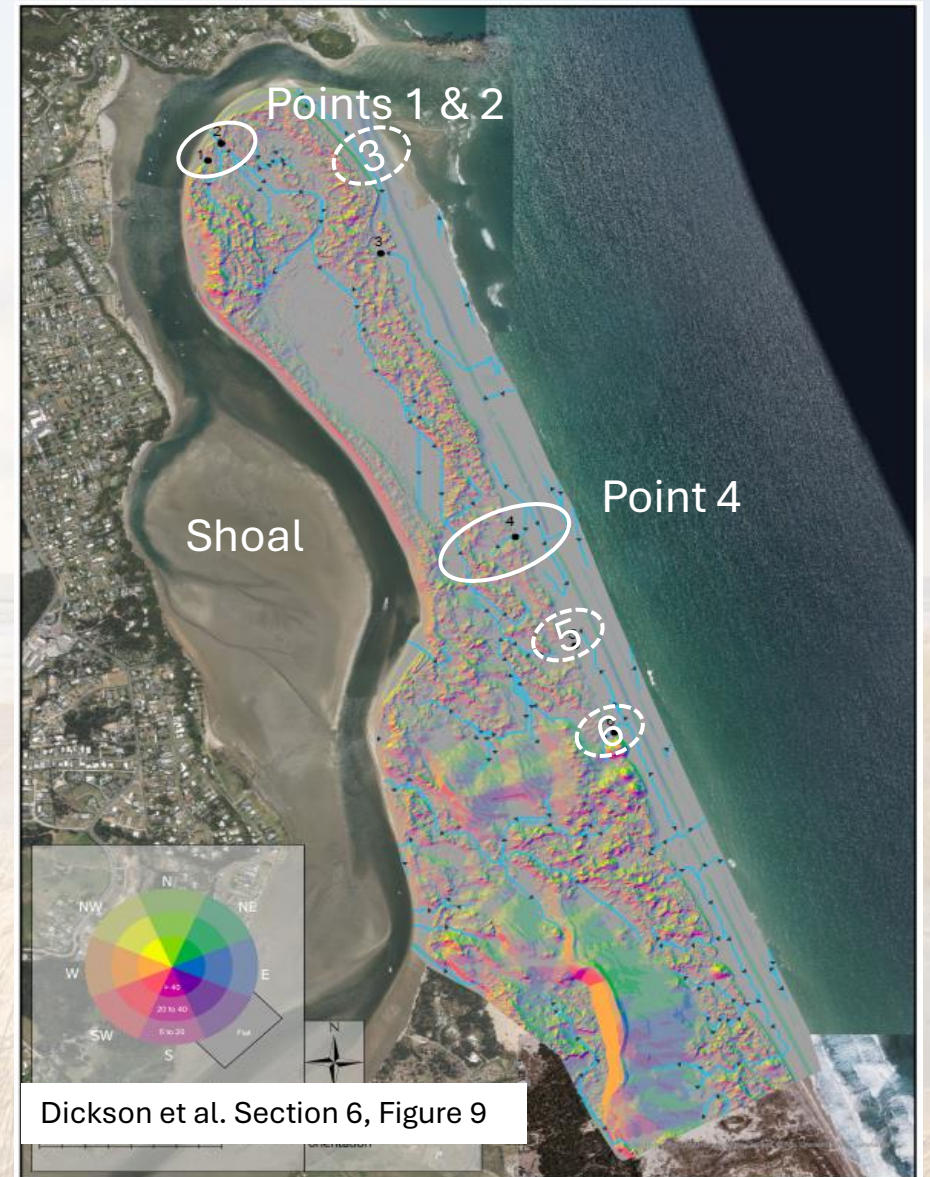
- Changes from 2018 to 2024:
 - The low-lying interior has not changed appreciably
 - Erosion of ocean shore from westward dune movement
 - Big dune has moved west 10-25m and decreased in elevation
 - Harbourside erosion up to 15m in places
- The result:
 - a six year net loss of around 264,700m³ of sand after replenishment by dredging (c.1.8% of total volume)

5 Changes in Spit Morphology, 2018-2024



6 Areas of Vulnerability

- Water flow pathways defined by low points and slope
- Shoal expansion will increase these vulnerabilities
- Spit today is wider than 1978
- Dredging and replenishment has reduced vulnerability to recent storms



7 Low Points, Pathways, & Areas at Risk

- Greatest potential for breaching Point 4 where spit is narrowest
- Northern part of spit (points 1 and 2) are vulnerable
- Northern portion of spit – site of previous breach – at significant risk



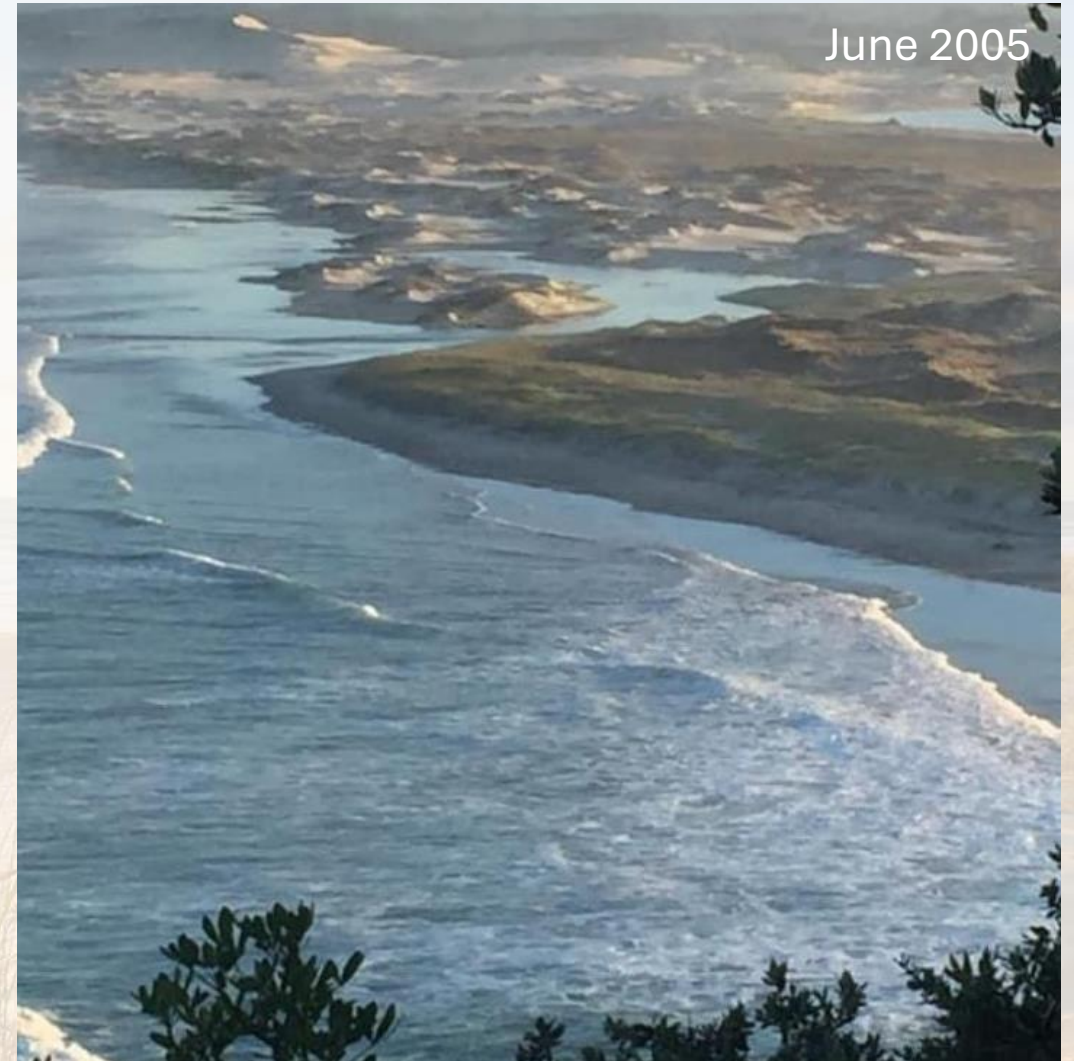
8 Potential for Inundation

Bathtub modelling – floods areas of the spit based on slopes and elevation

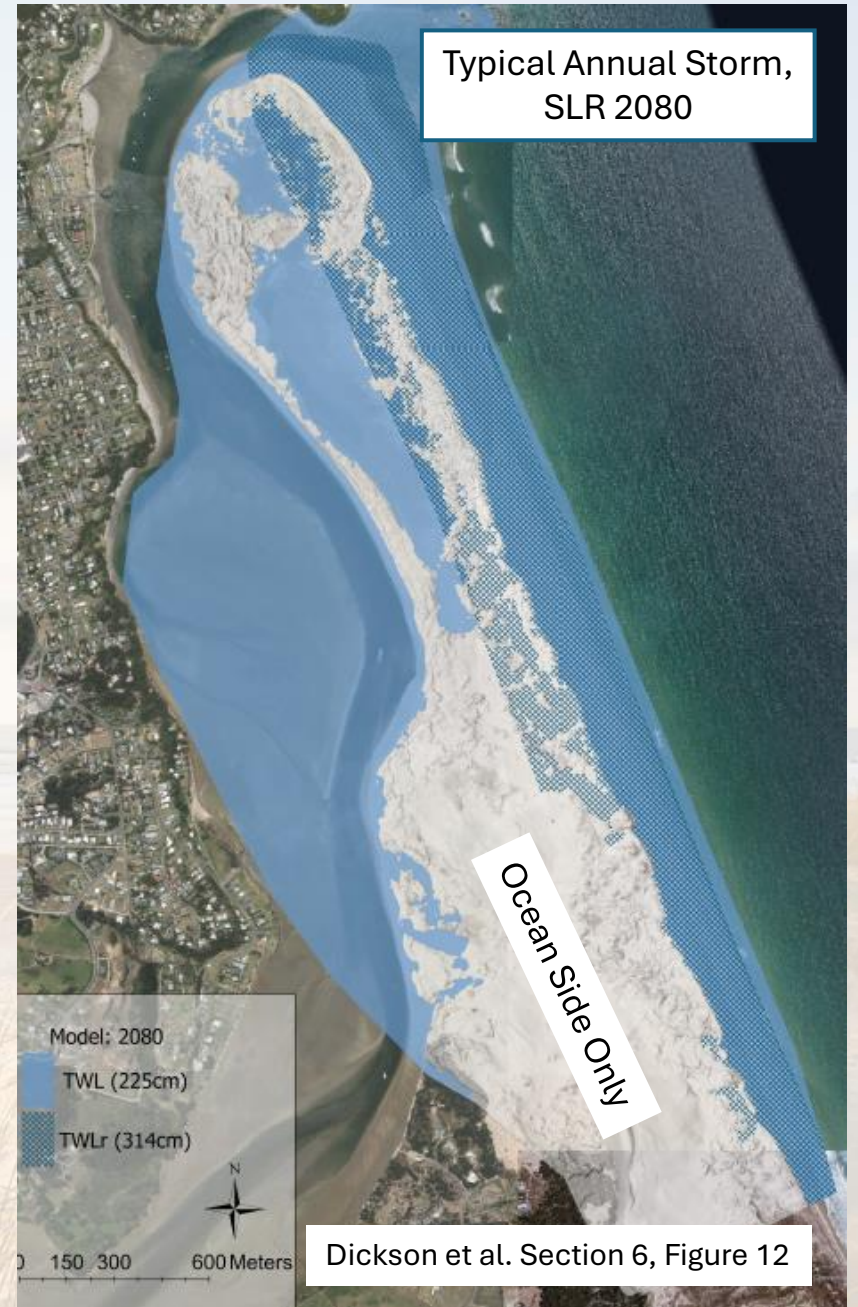
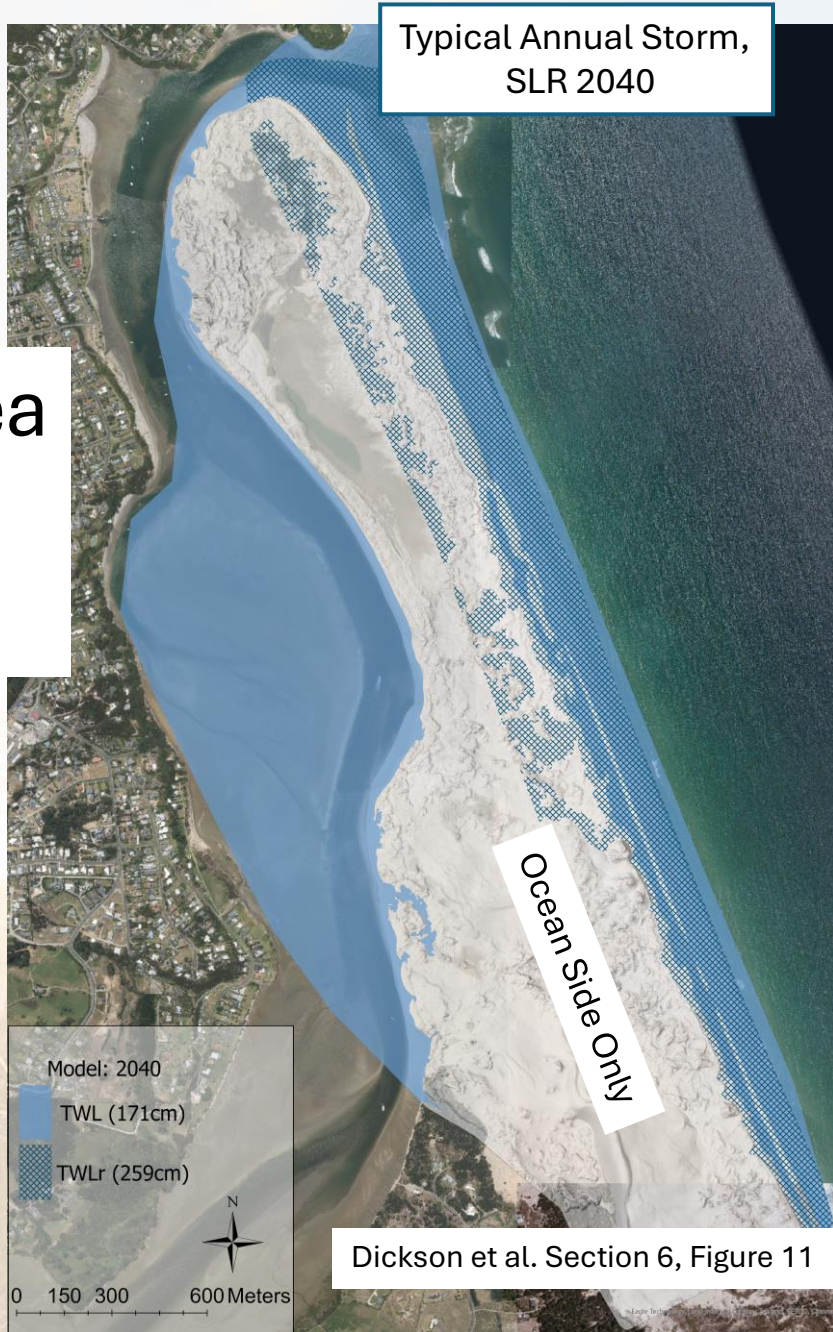
Based on current spit morphology, two sets of flooding scenarios:

Sea Level Rise: Typical annual storm unlikely to inundate the interior with SLR projections to 2040 but likely to do so by 2080.

Extreme storms: 1% Annual Return Interval conditions (cf 1978) see large portions of the spit inundated and breaching a prospect.



9 Impact of Sea Level Rise, 2040, 2080



10 What will determine if breaching occurs?

- Condition of the spit:
 - Erosional state of the ocean beach;
 - Height and continuity of coastal dunes;
 - Height & continuity of harbour shore dunes & bund
 - Eastern extent of harbour shoal
 - Shoal and shoreline interaction in the north
 - Location of low points and pathways

[Mangawhai aerial viewer](#)

- Nature of climate event:
 - Duration and frequency of storms
 - Elevation of harbour waters -catchment run-off, storm surge, tide state
 - Elevation of ocean waters – storm surge, storm tide, wave runup and setup
- Sea Level
 - Seasonal, decadal (El Niño and La Niña), and long term (climate change) variations

11 Inundation from the Ocean, 2005

Volunteering Pingao reforming primary dune

Bund wall





1978 Storm Surge

Ocean Side Only

Present Day TWL Raised to Projected 2040 Level (1.28m)
1978 Storm Surge (448cm)



Based on Dickson et al. Section 7, Figure 13



1% ARI Storm

Ocean Side Only

Present Day TWL Raised to Projected 2040 Level (1.28m)
1% ARI 2100 (698cm)



Based on Dickson et al. Section 7, Figure 14

12 Impact of Severe Weather Events & SLR, 2040

13 Our Conclusions

- The report shows
 - Loss of significant sand from the spit
 - Potential for shoal to erode harbour shore
 - Impact of erosion from eastern, ocean-side shore
 - Risk of inundation from northern tip of spit
- It identifies paths and low points to focus mitigation efforts
- It confirms prospect of another breach within 50 years is high
- Our conclusions
 - Bund wall has been effective in limiting damage from recent storm activity
 - Possibility of a breach within 15 years justifies increasingly active management of the harbour and spit
 - Active management calls for reviewing options and ongoing monitoring of the spit shorelines, topography, and volume

14 Critical Actions

- Manage the harbour continue dredging (NRC/MHRS)
 - Prioritise dredging efforts on shoals to direct flow away from:
 - (1) the middle estuary and
 - (2) the northern tip of spit
- Manage the spit (DOC/MHRS)
 - Maintain harbour-side sand replenishment
 - Prioritise sand replenishment on low spots of oceanside dunes
 - Maintain fencing and planting to limit sand loss
- Address land use issues that exacerbate storm runoff, sedimentation, and elevated harbour water levels. (KDC/NRC)

15 A Framework for Monitoring

- Annual mapping of ocean coast and harbour shoreline and shoals using:
 - Free aerial imagery and/or ground surveys; or
 - LIDAR imagery and professional interpretation,
- Community/MHRS observation and photographic record of vulnerable areas
- Monitor and map sand placement
- Regular (4-5 yearly) drone LIDAR surveys of spit topography and volume to compare Digital Elevation Models
- One-off LIDAR surveys following extreme events

16. Next Steps – Sustainable Mangawhai Project

- Stage 2A – Complete physical risk assessment
 - Review & refine catchment inundation prospects and outcomes (Tonkin & Taylor)
 - Identify and document existing harbour and spit habitats (NIWA Proposal)
 - Prepare storm-based scenarios covering events, probabilities, and physical outcomes (workshop)
- Stage 2 B – Impact assessment
 - Environmental assessment – marine, terrestrial, and avian biodiversity
 - Cultural assessment – impact on waahi tapu, taonga, heritage
 - Economic assessment – impact on property, visitor business, public assets