The New Zealand Inventory of Stopbanks (NZIS) & application for natural hazard exposure assessments.

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Stopbank failure- Edgecumbe, NZ, 2017 (Te Ara 2017)

Talk Outline

- Context
- Project Objectives
- Approach
- New Zealand Inventory of Stopbanks (NZIS v1.0)
  - current features
  - uncertainties & challenges
- Stopbank exposure to seismic hazards

Northland Flooding, 2007 (MCDEM 2007)

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Northland Flooding in 2007 (MCDEM 2007)

Context

- Flooding is New Zealand's most frequent natural hazard
- Responsible for the highest number of civil defence emergencies
- Flooding is one of NZ's most costly natural hazards
- Severity and frequency of floods increasing

Flooding & forestry debris at Tolaga Bay property, 2018

Property owner amongst flood debris after Ex-cyclone Gita (Stuff 2018)

Context

- "Local risks are a local responsibility" (National CDEM Plan Order 2005)
- Local, regional, city and district councils largely responsible for daily management activities.
- Stopbanks provide a critical role in flood protection in all regions of NZ.
- Physical and engineering attributes **"vary across the country depending on past decisions, community expectations and the risk profile"** (MfE 2008)

Stopbank breach flooding - Edgecumbe, NZ, 2017 (Newshub 2017)

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Project Objectives

- Produce a single, standardised, and spatially-referenced stopbank inventory for New Zealand.
- Characterise the stopbank network (e.g. height, type, geometry, location, design, service levels)
- Inform initial assessments of hazard exposure for the stopbank network.

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Approach

Regional Councils & Unitary Authorities approached through River Managers' Forum

(Data Sources)

Publically available LINZ dataset for NZ

Land Information New Zealand
Toitū te whenua

Council websites & supporting reports

Approach

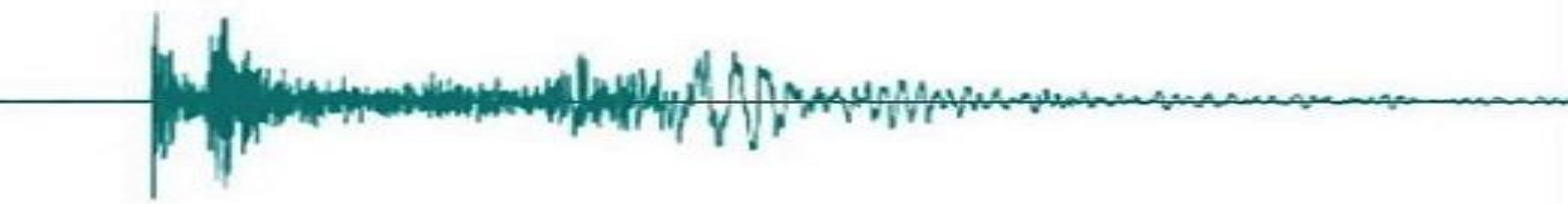
- Assign object identifier to each stopbank feature, maintaining original details
- Assess for different attributes:
  - *physical location*
  - *dimensions*
  - *age and any degradation*
  - *construction type*
  - *foundation material & geology*
  - *design detailing*
  - *intended purpose*
  - *design flood & seismic capacity*

Stopbank – Blenheim, NZ (Daniel Blake 2018)

- Allocate consistent terms to individual stopbank features
- Consider age of obtained data.

Approach – seismic hazard data

- **Known active faults** – GNS Science *(Langridge et al. 2016)*
  - Proximities of 0-5, 5-15, 15-20, 20-50 and 50-100 m considered
- **Ground shaking** – National Seismic Hazard Model & Cybershake NZ v17.9 *(Stirling et al. 2012; Tarbali et al. 2018)*
  - PGA and PGV with a 10% chance of exceedance in any 50 years (i.e. 500 year return period)
- **Liquefaction susceptibility** – global model with 14 proxies *(Zhu et al. 2017)*
- **Landslide susceptibility** – global empirical seismically-induced landslide model *(Jessee et al. 2018)*



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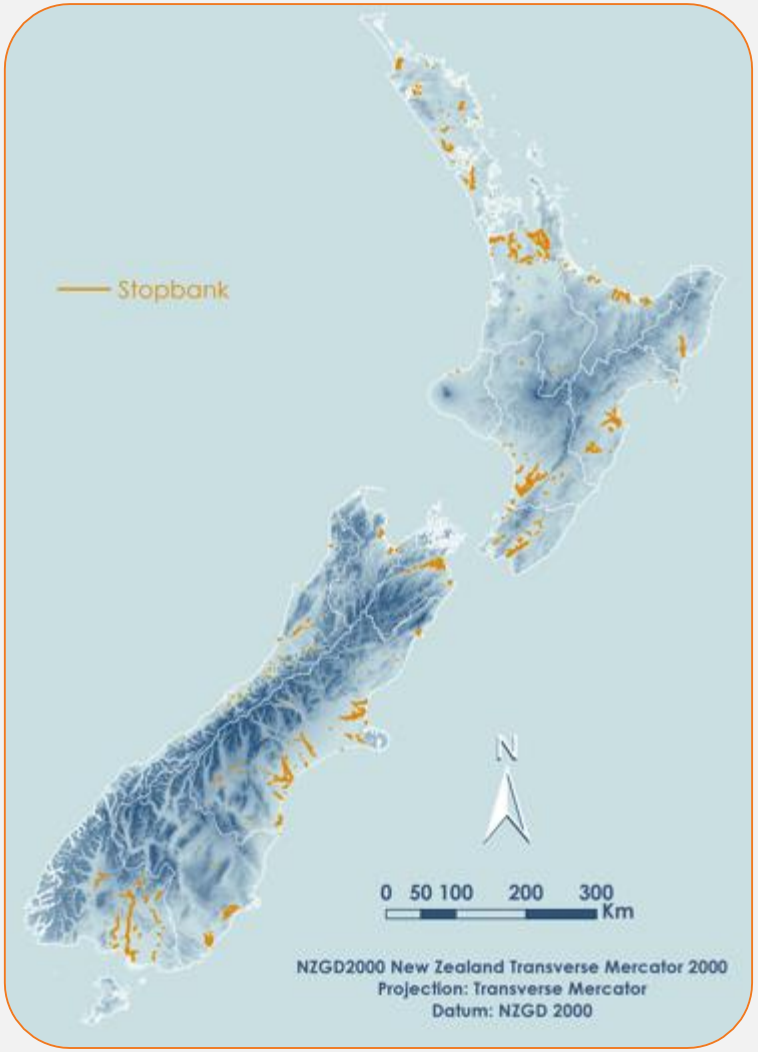
- **New Zealand Inventory of Stopbanks (NZIS v1.0)**
  - **current features**
  - **uncertainties & challenges**
- Stopbank exposure to seismic hazards

Northland Flooding in 2007 (MCDEM 2007)

New Zealand Inventory of Stopbanks: NZIS (v1.0)



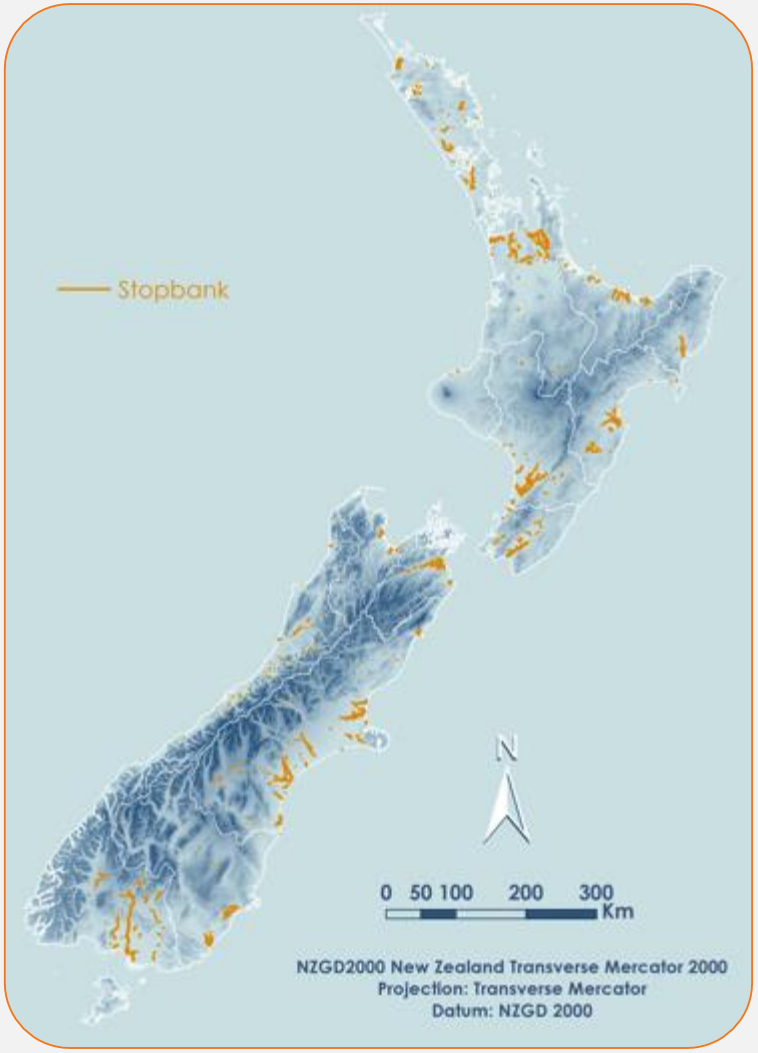
- Data provided by 13 (out of 16) regional councils / unitary authorities

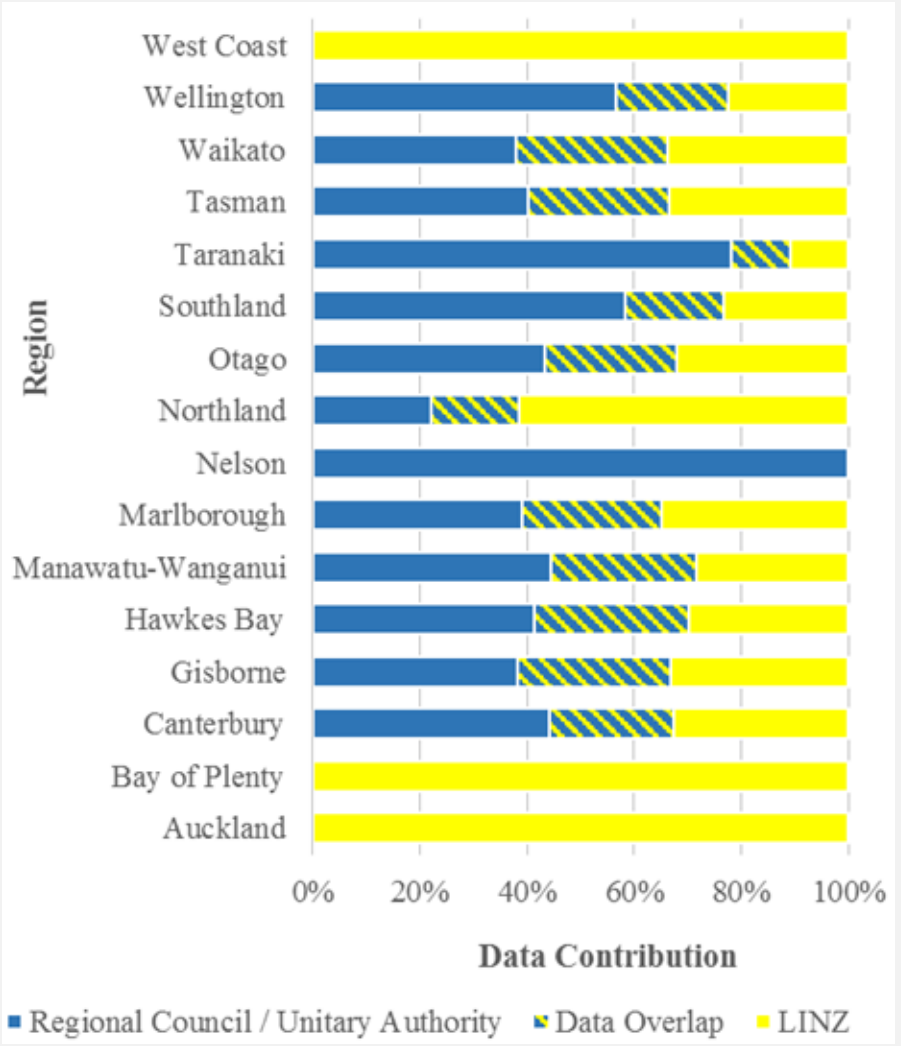
- Total records: 5,978
- Total length of stopbank data: 6,700 km

- **Total length of stopbanks: 4921 km**

- Limited information on attributes
  - *Width known for 25% of records*
  - *Height known for 19% of records*
  - *Other attributes much more limited*

New Zealand Inventory of Stopbanks: NZIS (v1.0)





New Zealand Inventory of Stopbanks: NZIS (v1.0)

Uncertainties and challenges

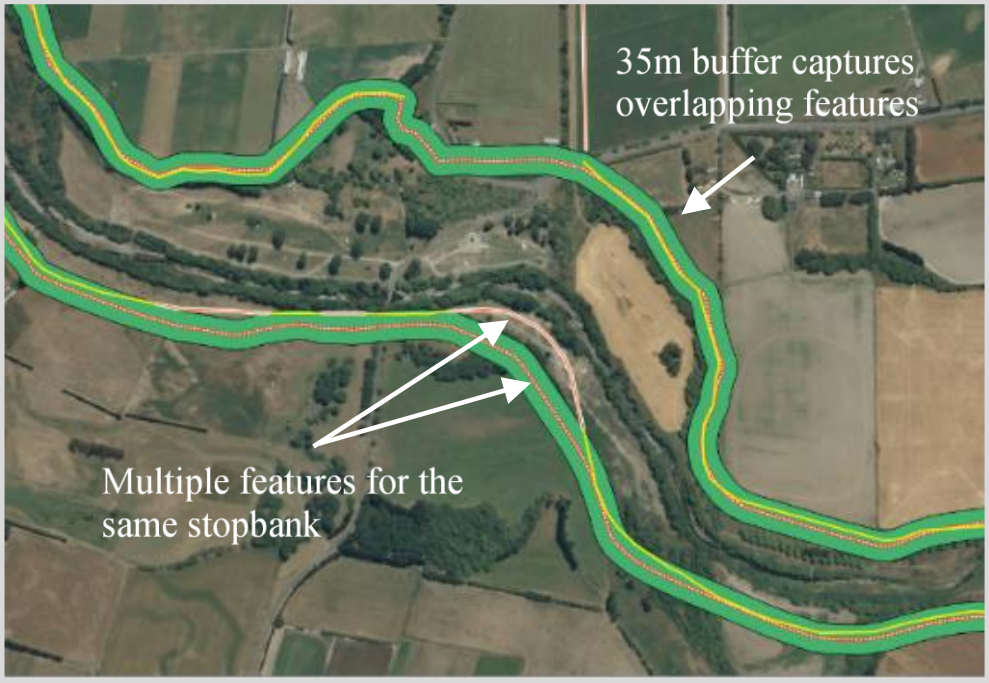

(Scott Olson / Getty Images 2011)

- Completeness
  - *inconsistencies in data – incomplete*
  - *privately-owned stopbanks not considered: Thomas Wallace (ME candidate)*
- Quality
  - *errors identified and corrected where possible*
  - *relevance to current time (old data)*
- Terminology
  - *Missing metadata and inconsistencies in terminology between councils.*

New Zealand Inventory of Stopbanks: NZIS (v1.0)

Uncertainties and challenges *(continued)*

- Example of duplicated and overlapping stopbank features:



Solution:

- 35m buffer distance for identification
- Comparison to satellite imagery
- Prioritisation of features with greater geospatial information

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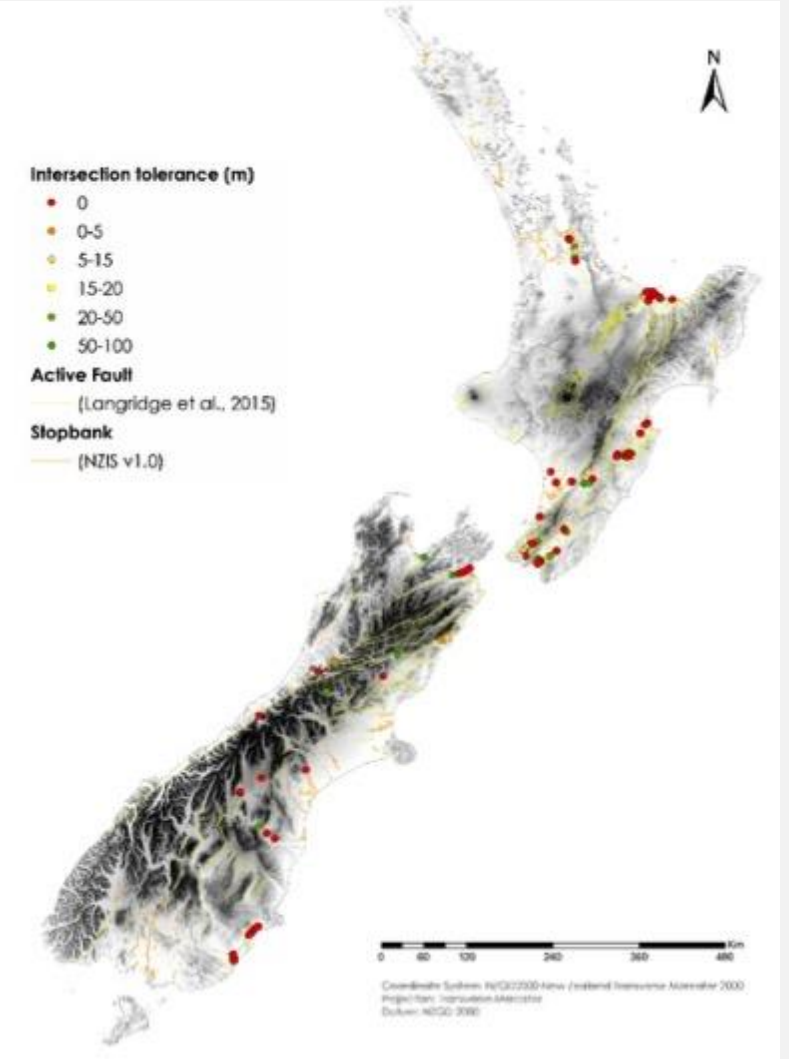
Northland Flooding in 2007 (MCDEM 2007)

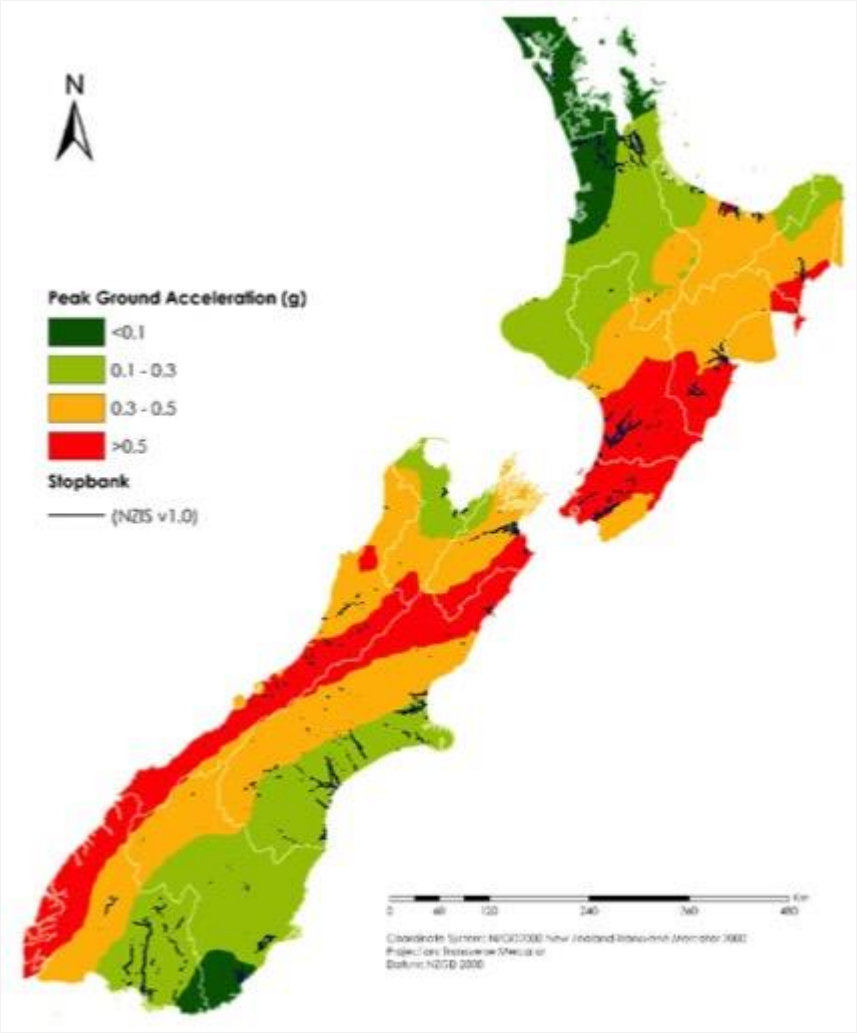
Exposure to seismic hazards – active faults

- **186 km of catalogued stopbank length <5 m from known active faults**
- 1100 km within 100 m
- 73% of these faults with a very high to moderate potential for surface rupture are within Southland
- 16% of stopbanks within 100 m of active faults are in Wellington.



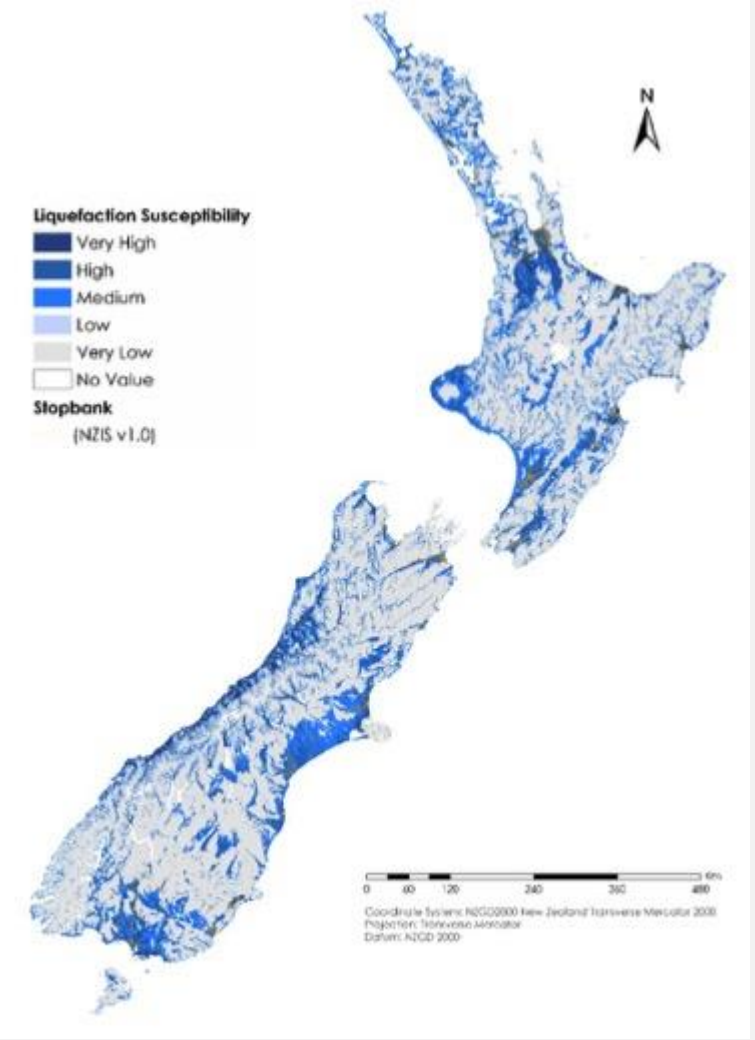
Exposure to seismic hazards – PGA & PGV

- **27% of all catalogued stopbanks are exposed to PGAs > 0.5 g for 500 year return period ground shaking**
- **8% exposed to PGVs > 50 m/s**
- Regions with greatest length of stopbanks exposed to strongest ground shaking are Manawatu-Wanganui, Wellington and Hawkes Bay.



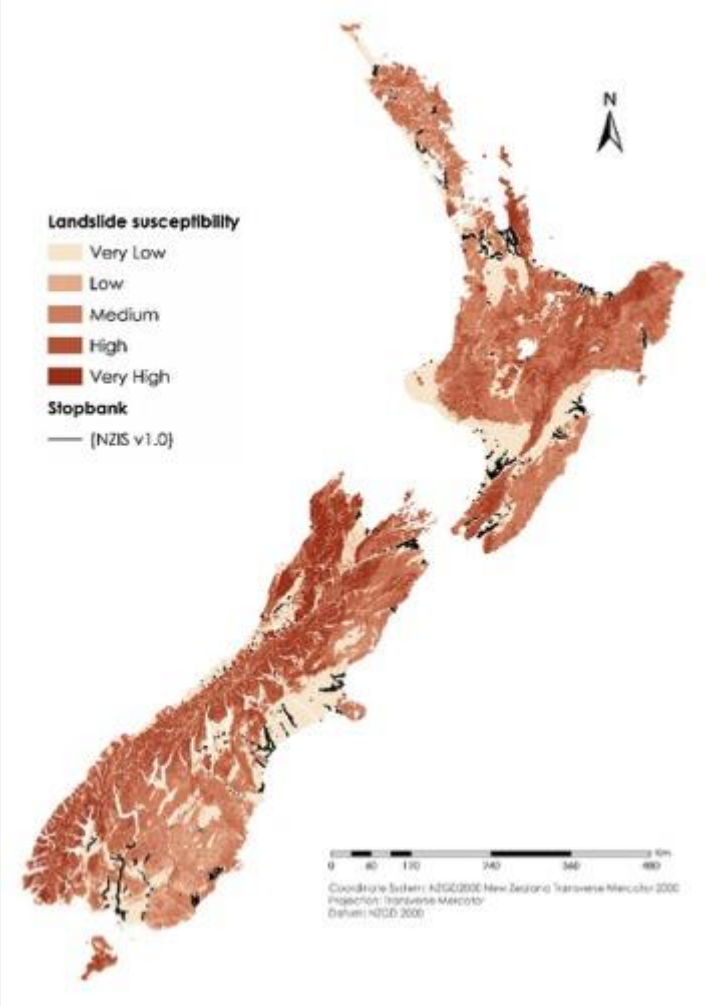
Exposure to seismic hazards – Liquefaction

- **80% of all catalogued stopbanks in areas of either ‘very high’ or ‘high’ liquefaction susceptibility.**
- More evenly distributed across different regions



Exposure to seismic hazards – Landslides

- **<0.2% stopbanks located in areas of 'very high' or 'high' landslide susceptibility**
- **2.5% located in areas of medium landslide susceptibility**
- Mostly in Bay of Plenty and Waikato



Summary

- NZIS v1.0 formed by combining LINZ and regional data – 4921 km
- Uncertainties associated with completeness, quality & terminology
- Many attribute fields but very limited data available
- Preliminary seismic hazard exposure assessment conducted

- Assists wider flood risk and emergency management planning, infrastructure investment decisions and resilience activities.