

NEW ZEALAND STOPBANK NETWORKS: UNDERSTANDING RESILIENCY CHALLENGES

Dr Kaley Crawford-Flett (Quake Centre), Dr Daniel Blake (University of Canterbury), Mr Eduardo Pascoal (Geospatial Research Institute), Mr Thomas Wallace (University of Canterbury), Dr Matthew Wilson (Geospatial Research Institute), Dr Liam Wotherspoon (University of Auckland), Dr Asaad Shamseldin (University of Auckland)

Characterising New Zealand stopbank networks to inform knowledge gaps, relative service and condition levels, hazard and risk exposure, management and policy needs, and long-term resiliency research.

Why are stopbanks important to New Zealand?

Stopbank networks are a critical distributed infrastructure network, **providing the primary means of flood protection** for people and properties in many New Zealand communities.

The construction of flood protection stopbanks in New Zealand began in the late 1800s, well before the development of modern embankment engineering standards. From 1949 to 1969, more than 2,500 km of stopbanks were constructed in New Zealand (Ericksen, 1986).

Potential damage to a stopbank network is likely to have significant economic and social impacts; therefore, **a clear understanding of the attributes of this system is needed to be able to assess the expected performance and impacts.**



Why is a national perspective needed?

Activities on stopbanks and floodways are generally governed by the Resource Management Act (1991) and maintenance is governed by the Local Government Act (2002). However, **the enactment of stopbank management is entirely local; guided by Regional and District Plans in response to local priorities.**

Just as levels of flood protection vary locally, regionally, and nationally; the physical and engineering attributes of stopbank assets in New Zealand “vary across the country depending on past decisions, community expectations and the hazard and risk profile of each area” (MfE, 2008). Available levels of resource and expertise vary widely among the regions, resulting in inconsistent design, assessment, and maintenance standards.

A 2008 national flood risk management review concluded that **“There are presently no standardised national data sets, indicators or methodologies to assess [flood protection] risk across the country.”** (MfE, 2008).

PART I: NEW ZEALAND INVENTORY OF STOPBANKS (NZIS)

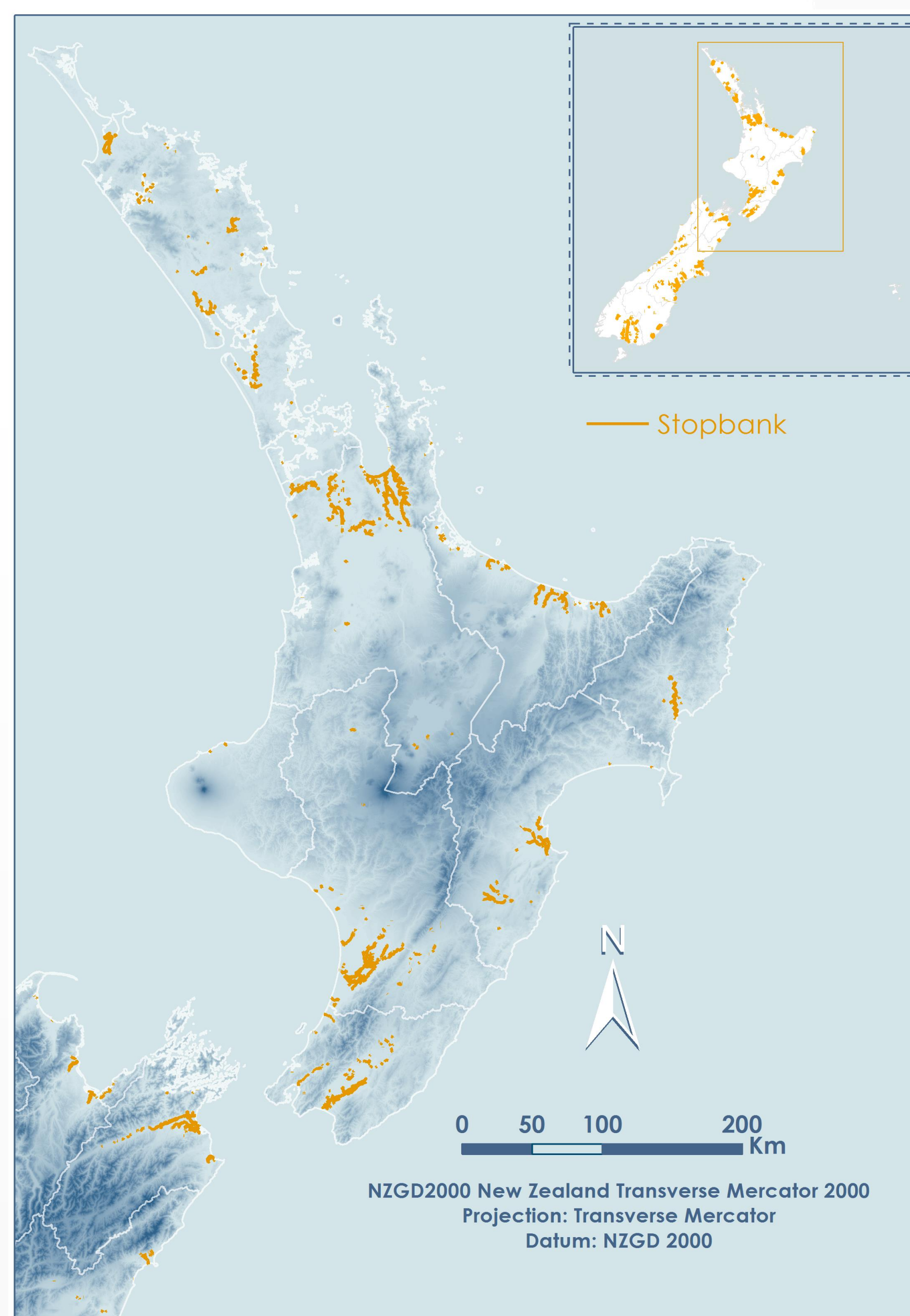
In order to better understand the make-up of stopbank assets in New Zealand, this project sought to compile a **single, standardised, reliable and spatially-referenced inventory in the form of the NZ Inventory of Stopbanks (NZIS).**

Geospatial stopbank data was sourced from thirteen of the sixteen regional councils and unitary authorities in the North and South Islands of New Zealand. Supplementary data was sourced from the Land Information New Zealand (LINZ) embankment dataset. Following data checking and processing, the data was aggregated into a **standardised nationwide database (NZIS v1.0), which comprises 5092.13 linear km of stopbanks.**

The sources of uncertainty in NZIS v1.0, are largely associated with completeness, data quality and terminology. **The compilation of this inventory has identified significant knowledge-gaps regarding design and construction characteristics of stopbank networks.** Future work should aim to resolve data gaps such that stopbank performance characteristics can be better understood.

However, even with limited design and construction information, the spatial analysis framework can be extended to assess the impact of potential levee failure on other infrastructure, in terms of both (1) flood hazard, and (2) the cascading effect of other natural hazard events, using geospatial properties of the network in relation to other infrastructure, land-use, geology, and hazard datasets.

The NZIS v1.0 is an important first step in creating an improved understanding of the role of stopbanks for flood protection in New Zealand. It will also assist with wider flood risk and emergency management planning, natural hazard exposure assessments, infrastructure investment decisions, and resilience activities across the country.



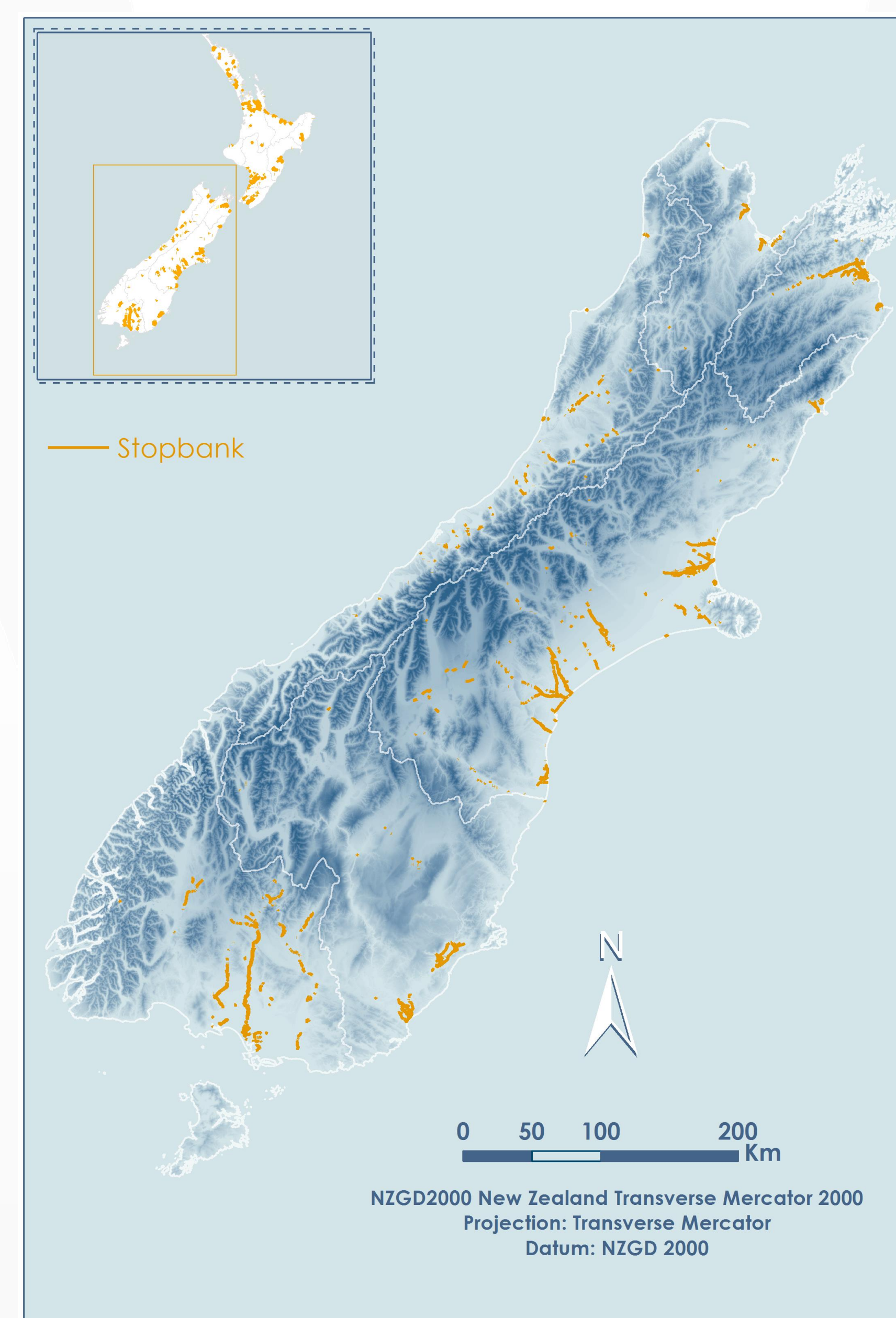
NZIS v1.0: Documented stopbanks in New Zealand (Eduardo Pascoal and Daniel Blake)

PART II: ASSESSING THE IMPACT OF UNDOCUMENTED STOPBANKS (Thomas Wallace, ME Candidate)

This project (ongoing) seeks to address a key knowledge gap identified in the Part I NZIS project, concerning stopbank dataset completeness. Regional and Unitary Councils typically hold internal records of council-owned stopbank assets; however, the council catchment management mandate is complicated in some regions by a proliferation of **privately-owned, undocumented, or unconsented embankment structures that may have significant impacts on flood routing and downstream flood risk.** A complete understanding of formal and informal flood routing measures is crucial to understand the resulting risk profile for peripheral and downstream communities.

This project aims to address the presently-unknown impact of undocumented and private stopbank structures on flood routing and resultant risks to people and property. This aim will be achieved through a case-study concerning a river catchment in the Tasman Region, including field surveying, geospatial analysis and hydraulic flood modelling. A geospatial stopbank model will be developed for the case-study catchment, comprising: (1) council-administered stopbank networks, and (2) “undocumented” privately-owned stopbanks. The study will characterise the catchment and integrated stopbank network using a range of hydrologic and geotechnical attributes to allow for the assessment of relative flood routing performance across a number of hazards (including, but not limited to, seismic hazards).

The project will provide an initial spatial analysis and integration framework that can be extended to assess the impact of undocumented stopbank structures on wider catchment performance in other regions, both in terms of flood hazard and the cascading effect of other natural hazard events



What does this mean for New Zealand? Who will benefit?

Nation-wide research on New Zealand’s flood protection embankments will set the stage for **improved stopbank risk management** in coming decades.

- **Regulatory authorities** (both national and regional) will gain an improved nation-wide understanding of stopbank assets to help inform appropriate and consistent risk management measures and policy.
- Outputs from analysis of the NZIS will inform the **academic community**, refine future research needs, and help identify relevant international collaborations.
- The **New Zealand hazard and embankment engineering communities** can use the NZIS to ensure that:
 - Dissemination channels target the full cross-section of stopbank owners and stakeholders.
 - Event response actions are appropriately prioritised.
 - Future stopbank engineering needs are anticipated.
- Through long-term research and governance, we hope that the **New Zealand public** will benefit by way of improved reliability of flood protection networks, consistent levels of service, and safer embankment networks.

[1] Ericksen, N.J. (1986). *Creating flood disasters? New Zealand’s need for a new approach to urban flooding*. National Water and Soil Conservation Authority.

[2] Ministry for the Environment (2008). *Meeting the challenges of future flooding in New Zealand*. Ministry for the Environment and the Flood Risk Management and River Control Review Steering Group. August 2008. ISBN: 978-0-478-33126-4

Acknowledgements

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