NEW ZEALAND'S STOPBANK NETWORK: CHARACTERISATION TO IMPROVE RESILIENCE

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Characterising New Zealand's stopbank network to address knowledge gaps, understand current levels of service, determine natural hazard exposure, inform management and policy needs, and guide long-term investment and resilience activities.

Why are stopbanks important to New Zealand?

Floods are the most frequent natural hazard in New Zealand and responsible for the highest number of declared civil defence emergencies and greatest regular economic loss (MfE, 2008). **Stopbanks provide a crucial role in flood protection across the country.**

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).

Damage to stopbanks often have significant economic and societal impacts. Therefore, **a clear understanding of the attributes of this system is needed to be able to assess expected performance and impacts**.

Rangitikei River stopbank failure at Edgecumbe, April 2017 © GNS Science

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 achieved locally; guided by Regional and District Plans in response to local priorities.**

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). Resources and expertise vary widely between 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 **standardised and reliable spatially-referenced inventory, termed the New Zealand 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 nation-wide database (NZIS v1.0), which comprises 4920.96 km of stopbanks.**

The sources of uncertainty in NZIS v1.0, are largely associated with completeness, data quality and terminology and often result from inconsistencies between stopbank feature records in the different source data.

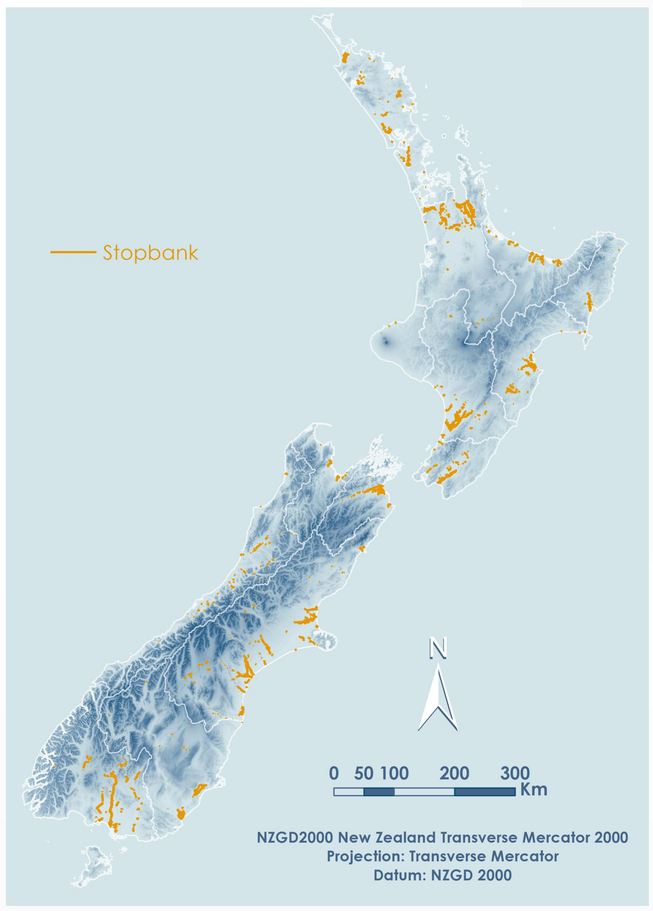
The compilation of this inventory has identified significant knowledge gaps regarding stopbank design, construction and flood risk management attributes. Future work should aim to resolve these gaps so that stopbank performance can be better understood.

Even with limited attribute information however, the inventory will assist with wider flood risk, emergency management planning and resilience activities. For example, it can be used in conjunction with other datasets to:

(1) Assess the consequences of stopbank breaches or failure on populations, agricultural land and critical infrastructure (e.g. roads, electricity);

(2) Conduct exposure assessments of stopbanks to other natural hazards including active fault rupture, seismic shaking and liquefaction.

NZIS v1.0 is an important first step in achieving an improved understanding of the role of stopbanks for flood protection in NZ.



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 councils and unitary authorities 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.

New Zealand stopbank and critical infrastructure (Daniel Blake, August 2018)

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;

(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?

Standardised research on New Zealand's stopbanks will set the stage for improved flood risk and emergency management planning, natural hazard exposure assessments, infrastructure investment decisions, and resilience activities.

- Regulatory authorities (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 future research and allow relevant international collaborations.

Emergency management officials and embankment engineering practitioners can use the NZIS to ensure that:

- Dissemination channels target the full spectrum of stopbank owners and stakeholders.
- Related reduction, readiness, response and recovery activities are appropriately addressed and prioritised.
- Future stopbank engineering requirements are anticipated.

Through long-term research and governance, we hope that ultimately the New Zealand public will benefit by way of improved safety and reliability, and consistent levels of service across the entire stopbank network.

References
MfE (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.
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