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Hon Kieran McAnulty, Associate Minister of Local Government

Proactive release of report on vulnerable communities exposed to flood hazard  
11 October 2022

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***August 2022, Report: Vulnerable Communities Exposed to Flood Hazard***

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Te Tari Taiwhenua  
Internal Affairs

# Report: Vulnerable Communities Exposed to Flood Hazard

August 2022

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# 1. Executive summary

This report presents a snapshot of the scale of flood hazard exposure for vulnerable communities in New Zealand. For the purposes for of this report, we define vulnerable communities as communities in areas that have the bottom 10% of most socio-economic vulnerability with significant exposure to flood risk.

The July 2021 flooding of Westport, in the Buller District, revealed the challenging mix of flood hazard and financial limitations the community and councils face.

The Community Resilience work programme focuses on strengthening community resilience to natural hazards and the effects of climate change. The programme focusses on shifting the system from disaster response towards more proactive risk response before disasters occur. DIA has carried out this analysis to provide national level information on the scale of vulnerable communities' exposure to flood hazard. This report provides context to understand the nature and scale of the flood hazard in Westport within a wider national context.

Climate change is expected to exacerbate the impacts of natural hazards such as flooding. More frequent and extreme flooding is expected to disproportionately impact people that have a high level of socio-economic vulnerability. Vulnerable communities have potentially more limited capacity to adapt to the impacts of climate change.

This report identifies 44 communities that have a high level of socio-economic vulnerability and are exposed to flood hazard, are not planning to build flood protection infrastructure according to council LTPs, and communities in the wider district may have limited financial capacity to fund responses to flood risk. The locations of vulnerable communities are presented in figures 1, and in table 1.

Analysis shows there are clusters of vulnerable communities in several regions and that a number of territorial authorities may have a high proportion of their populations in vulnerable communities that are exposed to flood hazard. Northland (particularly Hokianga), Tairāwhiti (East Cape), Waikato, and Bay of Plenty have clusters of vulnerable communities exposed to flood hazard. More than half of the vulnerable communities exposed to flood hazard are in the upper half of the North Island.

As well as regions with clusters of vulnerable communities, seven territorial authorities may also have a significant proportion of their population in vulnerable communities which are potentially exposed to flood hazard. The seven territorial authorities are: South Waikato, Waitomo, Buller, Gisborne, Opotiki, Rotorua, and the Far North.

This report was prepared in a relatively short timeframe using the best available data. We worked with Tonkin+Taylor who incorporated input from NIWA and the Regional Council River Managers Special Interest Group to gather and analyse flood hazard and community socio-economic vulnerability data.

NIWA created a composite flood hazard data set by combining Regional Council surface and river flooding with coastal flooding hazard maps.

Tonkin+Taylor connected NIWA's surface, river, and coastal flood hazard modelling data and incorporated input from the Regional Council River Managers knowledge. Tonkin+Taylor located communities that have a high level of socio-economic vulnerability using the New Zealand Index of Deprivation. Tonkin+Taylor overlaid these two layers of data in mapping software to show the communities that have both a high level of socio-economic vulnerability and exposure to flood hazard.

We removed communities from the scope of the study if they have flood protection infrastructure under construction or planned. We identified which communities have flood protection infrastructure planned or underway by reviewing the COVID-19 shovel-ready flood protection schemes that have been approved and looking at planned investments in council Long Term Plans.

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## 2. Introduction

### Background

- 2.1 The July 2021 flood event had a destructive impact on Westport and a correspondingly severe impact on the Buller District Council's (BDC's) financial position and their ability to manage the flood recovery.
- 2.2 Westport is highly vulnerable to flooding and currently has very limited flood protection in place. BDC and West Coast Regional Council (WCRC) cannot fund this work through rates alone because of Buller district's small rating base of around 7,500 and low median household income of \$54,600 per annum – the lowest in New Zealand. Morrison Low reported in 2021 that half of Buller households' rates payments are at or near 5% of household incomes, the rate commonly accepted in the sector as an upper limit of rates affordability.<sup>1</sup>
- 2.3 In February 2022 the Minister for Local Government invited BDC, WCRC and Ngāti Waewae to submit a business case proposal for co-investment in flood protection as part of a set of solutions to enhance the flood resilience of the Buller District. As part of the work to understand the nature and scale of the flood hazard in Westport, DIA has undertaken this analysis to set the Buller situation within a wider national context.

### Purpose

- 2.4 The purpose of this report is to provide a snapshot of how many communities are experiencing:
  - i) a relatively high level of socio-economic vulnerability,
  - ii) potential exposure to flood hazard in New Zealand,
  - iii) a lack of flood risk reduction infrastructure, and
  - iv) potential constraints on wider district community ability to fund flood risk reduction.

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<sup>1</sup> Morrison Low (October 2021) Buller District Council: Health Check Report.

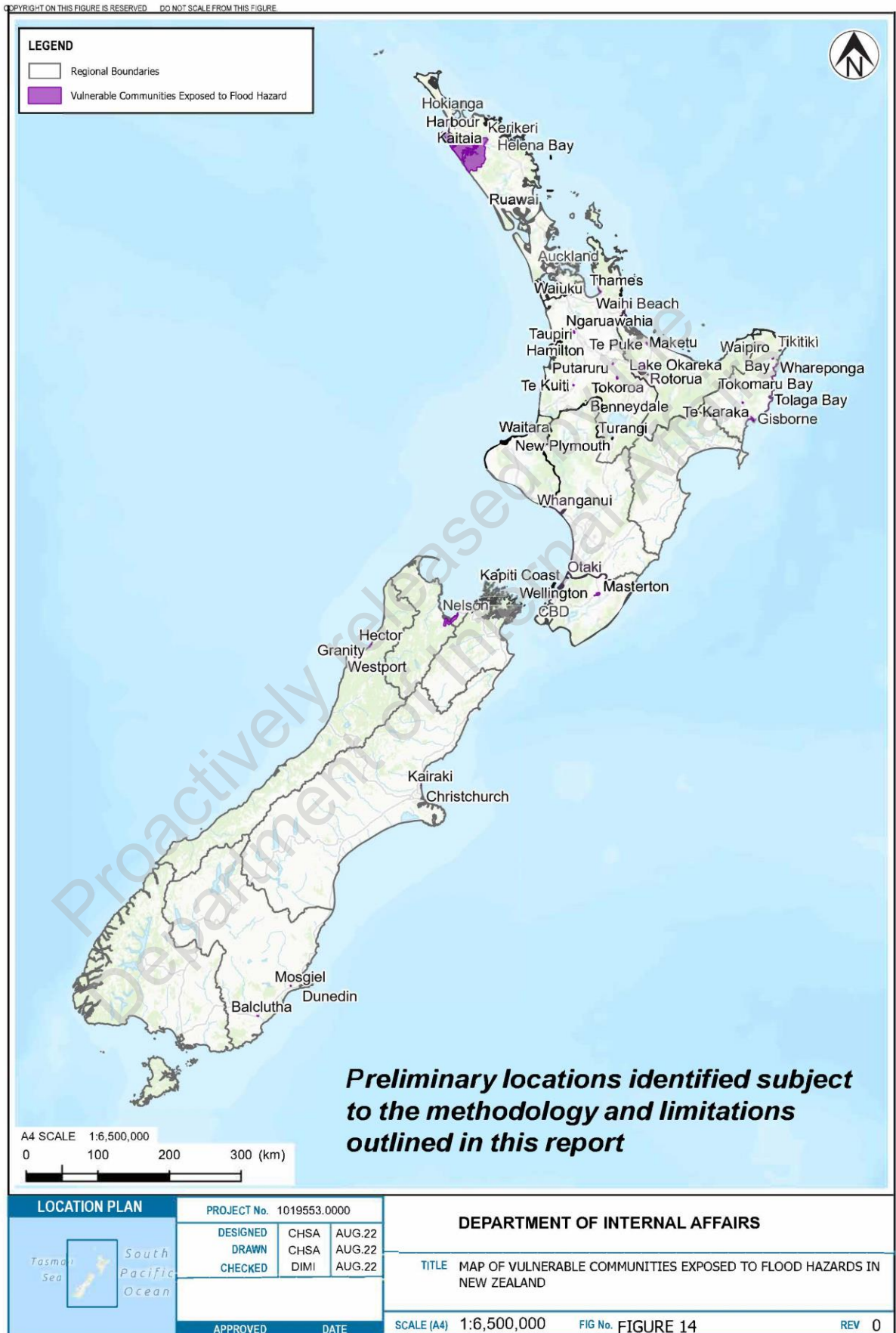


## 3. Results

### Vulnerable communities exposed to flood hazard

- 3.1 We first identified seventy-five communities with relatively high levels of socio-economic vulnerability and exposure to flood hazard in New Zealand.
- 3.2 Thirty-one of these communities were removed from the scope of the study because either flood protection infrastructure is planned for the community or because in depth analysis of surface flooding in heavily urbanised locations was excluded from the scope of this report.
- 3.3 Applying the methodology and data sources described above we identified 44 communities (shown in figures 1 and table 1) that:
- i) have a relatively high level of socio-economic vulnerability,
  - ii) are exposed to a greater potential flood hazard,
  - iii) have no flood protection infrastructure planned to protect the community, and
  - iv) where the wider district community may have limited financial capacity to fund responses to flood risk.
- 3.4 Many of these vulnerable communities are small rural communities located on rivers or on the coast. Several of the communities are situated at the point where a river flows out into the sea, as Westport is.
- 3.5 Northland (particularly Hokianga), Tairāwhiti (East Cape), Waikato, and Bay of Plenty have clusters of vulnerable communities exposed to flood hazard. More than half of the vulnerable communities exposed to flood hazard are in the upper half of the North Island.
- 3.6 As well as regions with clusters of vulnerable communities, analysis indicates that 11 territorial authorities have a relatively high proportion of vulnerable communities exposed to flood hazard. Seven of these territorial authorities have a significant proportion of their population in vulnerable communities which are potentially exposed to flood hazard. The seven territorial authorities are: South Waikato, Waitomo, Buller, Gisborne, Opotiki, Rotorua, and the Far North. Four territorial authorities have relatively less people potentially impacted by flooding when compared to the above in vulnerable communities which are exposed to flood hazard.
- 3.7 People in the South Waikato, Waitomo, Buller, Gisborne, Opotiki, Rotorua, and the Far North Districts have the most constrained financial capacity relative to other regions reviewed. The wider community in these regions have relatively high levels of socio-economic vulnerability. For example, approximately half of the Gisborne District appears to be in the bottom 20% of most vulnerable socio-economic communities in New Zealand. This means these communities will have limited capacity to fund responses to flood risk.

Figure 1: Vulnerable communities exposed to flood hazard



**Table 1: Table format showing vulnerable communities exposed to flood hazard**

Community	Region	Community	Region
Kaitaia	Northland Region	Ruatoria	Gisborne Region
Kerikeri	Northland region	Tuparoa	Gisborne Region
Hokianga Harbour / Hokianga Region	Northland region	Whareponga	Gisborne Region
Helena Bay	Northland region	Waipiro Bay	Gisborne Region
Ruawai	Northland region	Tokomaru Bay	Gisborne Region
Waiuku	Auckland Region	Tolaga Bay / Hauti	Gisborne Region
Thames	Waikato Region	Te Karaka	Gisborne Region
Huntly	Waikato Region	Gisborne	Gisborne Region
Ngāruawāhia	Waikato Region	Waitara	Taranaki
Taupiri	Waikato Region	New Plymouth	Taranaki
Putāruru	Waikato Region	Whanganui	Manawatū-Whanganui Region
Tokoroa	Waikato Region	Ōtaki / Ōtaki Beach	Wellington Region
Te Kuiti	Waikato Region	Kapiti Coast (Waikanae to Paekākāriki)	Wellington Region
Benneydale / Maniaiti	Waikato Region	Masterton	Wellington Region
Tūrangi	Waikato Region	Nelson	Nelson Region
Waihi Beach / Bowentown	Bay of Plenty Region	Hector	West Coast Region
Maketu	Bay of Plenty Region	Granity	West Coast Region
Te Puke	Bay of Plenty Region	Westport	West Coast Region
Ōpōtiki	Bay of Plenty Region	Kairaki Beach	Canterbury Region
Rotorua	Bay of Plenty Region	Dunedin* (South Dunedin)	Otago Region
Lake Ōkāreka	Bay of Plenty Region	Mosgiel	Otago Region
Tikitiki	Gisborne Region	Balclutha	Otago Region

## 4. Methodology

4.1 This section describes the data collection methods used for the analysis in this report. The Department worked with Tonkin + Taylor who incorporated input from NIWA and the Regional Council River Managers Special Interest Group to gather and analyse flood hazard and community vulnerability data. The analysis was completed in a relatively quick timeframe using the best available data and information. We note the limitations at section 4 including that this report was completed in a relatively quick timeframe. The analysis requires further checks for accuracy and completeness. We recommend further work to confirm the report's findings at section 5.

### Vulnerable communities

- 4.2 Vulnerability can arise for a number of reasons. In this report we focus on two aspects of vulnerability: socio-economic vulnerability, and susceptibility to flood hazard.
- 4.3 Vulnerable communities were identified using the New Zealand Index of Deprivation (NZDep 2018). The NZDep is an area-based measure of socioeconomic vulnerability in New Zealand. It measures the level of socio-economic vulnerability for people in each small area (statistical area 1).
- 4.4 NZDep is displayed as deciles. Decile 1 represents areas with the least vulnerability, while decile 10 represents areas with the most vulnerability. NZDep is produced by Massey University using census data.<sup>2</sup>
- 4.5 This report focussed only on decile 10 areas that are exposed to flood hazard. This means the analysis focussed on areas that represent the bottom 10% of most vulnerable socio-economic communities in New Zealand.
- 4.6 Community is defined as a location (i.e., small settlement, town, city, but not the sum of isolated rural properties over a large area) with a population of more than 50 people. This means only groups of more than 50 people in a flood hazard area were identified and not isolated dwellings in flood hazard areas.

### Flood hazard

4.7 Surface, river and coastal flood hazard data was provided by NIWA. NIWA have created a composite surface-river flood hazard area map from public sources (local government flood data). Coastal flood hazard data is based on 100-year average recurrence interval (ARI) sea level events for both the present-day scenario and including +1.2m sea level rise.

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<sup>2</sup> Environmental Health Intelligence New Zealand – Massey University, Socioeconomic deprivation profile, Available at <https://www.ehinz.ac.nz/indicators/population-vulnerability/socioeconomic-deprivation-profile/>

- 4.8 Regional Council River Managers and Tonkin + Taylor flood practitioners participated in a qualitative data exercise. The exercise involved flood practitioners using their expert knowledge to identify socio-economically vulnerable communities exposed to flood hazards by attaching notes to an online 'Mural Board' map.

## Combining vulnerable community and flood hazard data<sup>3</sup>

- 4.9 NIWA used their Riskscape tool to combine flood hazard data and the NZDEP 2018 SA1 unit vulnerable community data. The data was then uploaded into ARCGIS (map software).
- 4.10 At this stage of the analysis, Tonkin + Taylor identified an initial list of communities potentially exposed to flood hazard and with a comparatively high level of socio-economic vulnerability.

### *Data quality assurance checks*

- 4.11 Flood hazard areas were reviewed against the Historical Weather Events Catalogue (NIWA) and the news archive on Radio New Zealand (RNZ). This crosscheck helped build confidence that the areas identified are exposed to flood hazard.
- 4.12 The community was included if it was clear the community identified had a population of more than 50 people (checked against satellite imagery and census data), was identified within an Index 10 unit in the NZDEP2018 data and had some history of flooding or were otherwise believed to be flood-prone (e.g., through past modelling or assessment known to flood practitioners and/or included in NIWA's composite flood layer).

## Flood protection infrastructure

- 4.13 We have removed communities from the scope of the study where we know the community has work underway on flood protection infrastructure. We identified which communities have flood protection infrastructure underway or planned by reviewing the COVID-19 shovel-ready flood protection schemes that have been approved and looking at planned investments in council Long Term Plans.
- 4.14 Through the COVID-19 Response and Recovery Fund Government funded a range of climate resilience and flood protection infrastructure projects across New Zealand. A total of \$217 million was provided for flood protection infrastructure in 2020 and many of the projects have been completed.
- 4.15 This step of the project only counted new flood protection infrastructure, or improvements to levels of service by improving existing flood infrastructure. Projects that would only deliver maintenance of existing projects were not counted as these projects are not expected to further reduce flood risk.

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<sup>3</sup> Data quality assurance information is available in Appendix A.

## Proportion of people in district impacted by flooding

4.16 The report estimates the relative scale of the flood hazard within territorial authority areas. The scale of the flood hazard can be understood by defining the percentage of people in a territorial authority area that are in a vulnerable community and impacted by flood hazard. This data was gathered from Statistics NZ.

## Community ability to pay

4.17 The report considers the financial capacity of the wider community within each territorial authority boundary as a proxy for ability of that community to pay for responses to flood risk. Local communities, for the most part fund the operations of a council mainly through rates, and through fees and charges associated with council activities.

4.18 We identified a range of potential criteria that can help understand the potential ability of the wider district community to fund any increase in payments to a council.<sup>4</sup> The criteria we used to understand community financial capacity include:

- i) median household income,
- ii) percentage of people over the age of 65 as these are often superannuants and may be more likely to operate on fixed incomes, and
- iii) percentage of people in the New Zealand Index of Deprivation decile 9 and 10 (most vulnerable). We chose to include decile 9 as these communities are still likely to be under significant financial duress.

4.19 This analysis considers only the socio-economic vulnerability of communities. It does not consider the economic impact of flooding on communities, or the ability of a council to continue to collect rates.

## This report does not analyse local authorities' ability to fund flood protection infrastructure

4.20 The report uses the financial capacity of Territorial Authorities as a proxy for indicating wider community ability to pay for flood risk reduction measures. Territorial Authority financial information was used only to supplement the community financial capacity information.

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<sup>4</sup> Data used to understand community financial capacity was gathered from Statistics NZ (deprivation is not a Statistics NZ measure, it is created using their data but compiled by Massey University).

- 4.21 Further analysis is required to understand the capacity of the relevant local authorities to fund sufficient flood protection in the areas identified in this report. Territorial authorities and regional councils have different roles and responsibilities for flood protection infrastructure. Regional Councils fund flood protection infrastructure and Territorial Authorities fund stormwater management, land use planning, and emergency management in relation to managing flood risk.
- 4.22 There is no simple or single measure of the financial capacity of a council. Councils vary significantly in this respect. The full methodology for assessing council financial capacity is outlined at Appendix A.

### ***Roles and responsibilities for funding and regulating flood risk management***

- 4.23 The most significant investment in flood risk management tends to involve river protection works which are administered and funded by regional councils. In urban areas district and unitary councils fund stormwater management, emergency management, and land use planning as part of flood protection within their territorial authority boundary. In some larger urban areas stormwater management schemes can also involve large-scale works such as water retention basins and pumping stations (eg for the Heathcote River in Christchurch).
- 4.24 The RMA requires regional authorities to control the use of land for the avoidance or mitigation of natural hazards. Territorial authorities are required to control the actual or potential effects of the use, development or protection of land, including for the purpose of avoiding or remedying natural hazards. The Resource Management (Energy and Climate Change) Amendment Act 2004 further requires local authorities to have particular regard to the effects of climate change.<sup>5</sup>

## **Summary of criteria for identifying vulnerable communities**

<b>Criteria</b>	<b>The measurement</b>	<b>Does community meet the criterion?</b>
Socio-economic vulnerability	A score of decile 10 (most vulnerable) in the New Zealand Index of Deprivation (NZDep 2018)	✓
Flood hazard	Exposed to flood hazard	✓
Flood protection infrastructure	No planned flood protection infrastructure for the community	✓
Community ability to pay	Council financial (TA) capacity and wider district socio-economic data	✓

<sup>5</sup> Ministry for the Environment (2010) *Preparing for future flooding: A guide for local government in New Zealand*, Available from: <https://environment.govt.nz/publications/preparing-for-future-flooding-a-guide-for-local-government-in-new-zealand/part-four-managing-flood-risk/>

## 5. Limitations

5.1 This section describes limitations of the data. Available flood risk mapping in New Zealand has some limitations. The key limitations are:

- i) Variation in the recurrence intervals used across the regions (from 10 to 500-year ARI). This means some flood maps identify floods across a 10-year time period, while other maps take a longer time period. This also means in some parts of the country flood hazard may not have been identified.
- ii) The extent of flooding is not identified. This means that the depth, speed, and duration of flooding is not known at the national level. Communities may be exposed to 20cm of flooding or 1.5 meters of flooding. The five-year NIWA-led research programme is in the process of developing a system to map flood hazard consistently across the whole country which will provide the ability to better understand flood hazard at the national level in future.<sup>6</sup>
- iii) Unlike coastal flooding, existing surface and river flooding data does not account for the impacts of climate change.
- iv) This analysis was completed in a relatively quick timeframe and requires further checks for accuracy and completeness. In particular, analysis of surface flooding in heavily urbanised areas was not carried out. An in-depth analysis of each urban location would be required to identify surface flooding given the high of level variability that exists.
- v) An assumption was made that planned new flood protection infrastructure would significantly reduce flood risk for vulnerable communities. On this basis a number of communities were excluded from the study. If the new flood protection infrastructure provides less protection from flooding than expected, this may mean there are more communities potentially exposed to flood risk than we have described in this report.
- vi) The analysis has not included an assessment of Regional Council financial capacity for funding flood protection infrastructure. The most significant investment in flood risk management tends to involve river protection works which are administered and funded by regional councils. Further analysis is required to understand the capacity of the relevant local authorities to fund sufficient flood protection in the areas identified in this report.

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<sup>6</sup> Mā te haumarū ō nga puna wai ō Rākahautū ka ora mo ake tonu: Increasing flood resilience across Aotearoa - <https://niwa.co.nz/natural-hazards/research-projects/m%C4%81-te-haumarū-%C5%8D-te-wai-increasing-flood-resilience-across-aotearoa-0#assessment>



## Further work

5.2 Further work could be carried out to refine the list of vulnerable communities exposed to flood hazard including:

- i) Assessing the financial position of Regional Councils and their capacity to fund flood protection infrastructure,
- ii) Analysing Regional Council planned investments for further flood protection infrastructure,
- iii) Verifying the list of vulnerable communities with Regional Council River Managers,
- iv) Further analysis of the communities most at risk within Tairāwhiti (East Cape) and Hokianga, Waikato, and Bay of Plenty geographic areas where there are relatively high concentrations of vulnerable communities exposed to flood hazard, and
- v) Conducting a separate analysis of large urban areas to identify pockets of vulnerability in highest flood risk areas.

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## 6. Appendix A: Council financial capability methodology

- 6.1 The report uses the financial capacity of Territorial Authorities as a proxy for indicating wider community ability to pay for flood risk reduction measures. Territorial Authority financial information was used only to supplement the community financial capacity information.
- 6.2 Further analysis is required to understand the capacity of the relevant local authorities to fund sufficient flood protection in the areas identified in this report. Territorial authorities and regional councils have different roles and responsibilities for flood protection infrastructure. Regional Councils fund flood protection infrastructure and Territorial Authorities fund stormwater management, land use planning, and emergency management in relation to managing flood risk.
- 6.3 There is no simple or single measure of the financial capacity of a council. Councils vary significantly in this respect. The full methodology for assessing council financial capacity is outlined at Appendix B. Constraint on the financial capacity of a council include (but are not limited to), the land area and scale of infrastructure that needs to be maintained, the size and composition of the ratepayer base, the presence of historical investment funds. To get a sense of those councils that might have limited capacity, we used a range of simple criteria<sup>7</sup>. These criteria were considered relative to one another. The Initial set of criteria included consideration of:
- i) Rates revenue: This is the main source of income for most council. If communities are impacted by a flood this may have downstream impact on their ability to pay rates. This may limit the immediate ability of a council to increase funding, particularly if people are not able to live on their property. The measures we considered are rates as a percentage of operating revenue – indicating reliance on the rates revenue stream. We also considered rates per rating unit to understand the relative burden on ratepayers in comparison to councils with similar characteristics.
  - ii) Debt: Most councils use debt to fund capital works. If a council already carries a significant amount of debt, this may impact on their ability to fund any additional projects associated with risk reduction and recovery. Councils carry different levels of debt depending on their infrastructure needs and the risk associated with using this funding sources. There is no simple measure of the relative risk of levels of debt and each council needs to be considered on their individual merits. As with the above measures for rates, we applied an external debt per rating unit to compare councils with similar characteristics. We also looked at the debt servicing component of the financial prudence regulations.

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<sup>7</sup> Data used to assess Territorial Authorities against these criteria was gathered from Territorial Authority Annual Financial Reports.

- iii) Capital Expenditure: While not an indication of the ability of a council to raise funds, the relative size of a council capital programme is a way to understand the potential capacity of a council to manage significant capital expenditure associated with risk reduction infrastructure.
  - iv) Balance sheet assets: This includes assets such as investment in council-controlled organisations, and cash and other financial assets. These could in theory be used to offset the need to raise debt. The reality is that these funds are also used to offset rates. In addition, some councils may have covenants on how some of the financial assets can be used.
- 6.4 While these measures give an indication of the potential ability of a council to fund an unexpected event, the diversity of council, and their communities means that this method only gives an indication of potential risk and needs to be carefully considered in this context.
- 6.5 Consideration of community financial capacity indicates in a relative sense the communities that would have more difficulty in funding flood protection infrastructure as much of the infrastructure is funded through targeted rates on the community.

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