Social vulnerability indicators for flooding in Aotearoa New Zealand:

Toolkit for users

2019

He aha te mea nui o te ao? He tāngata, he tāngata, he tāngata.

What is the most important thing in the world?
It is people, it is people, it is people. (Māori whakataukī)

Indicators are the start of the process, not the end.
If they are to be used effectively, they have to be part of a
real, evidence-based and participatory culture of decision-making.
– Dr Maria Poynter

Acknowledgements

Publication details

For more information about this project, see the Environmental Health Indicators (EHI) website:
www.ehinz.ac.nz/our-projects/social-vulnerability-indicators

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Introduction

Purpose

This toolkit gives you information about how to access and use the social vulnerability indicators for flooding. These social vulnerability indicators can help identify areas where population groups who are more vulnerable to the negative impacts of a flood live or work. The indicators can help inform disaster readiness, response and recovery initiatives, as well as help to inform and prioritise risk reduction through land-use planning, infrastructure upgrades, and hazard mitigation works.

What is this toolkit for?

This toolkit can help you to:

- identify population groups who are more vulnerable to the negative impacts of floods on their health and wellbeing
- assess social vulnerability in your area
- apply the indicators for civil defence emergency management (CDEM) activities, health sector emergency preparedness and planning, land use planning, and other related disaster risk reduction (DRR) activities.

The toolkit includes:

- information about social vulnerability to flooding
- a framework for understanding social vulnerability and resilience
- information on how to assess social vulnerability in your area, using:
    - o a national dataset of social vulnerability indicators, by territorial authority, area unit (suburb) and meshblock (the smallest geographic unit available).
    - o other sources of information about social vulnerability in your local area
- an interactive online map (Story Map) for Porirua City Council area, to demonstrate the indicators
- suggestions for how to use the indicators across the 4 Rs of emergency management (risk reduction, readiness, response and recovery).

Who is this toolkit for?

This toolkit is useful for organisations tasked with reducing disaster and health risk posed to our communities, with specific relevance to flood hazard.

Key end-users include:
- CDEM groups and staff in local and regional councils
- the Ministry for Civil Defence & Emergency Management (MCDEM)
- local and regional councils, including policy planners and decision-makers
- emergency planners in the health sector (including District Health Boards, Primary Health Organisations, and ambulance services)
- public health units and district health boards
- Māori iwi and hapū
- the housing sector (particularly social housing providers)
- the education sector (particularly schools and early childhood education (ECE) facilities)
- lifeline organisations (such as water, electricity and communications)
- non-governmental organisations likely to be part of disaster response efforts
- RiskScape users and disaster risk reduction scientists
- local community groups (including ethnic and cultural communities, and groups concerned with health, wellbeing and disaster response).

About social vulnerability indicators

Some people are more vulnerable to flooding

Not everyone in the population is able-bodied, can hear, see, and move themselves, understand the hazard, and carry out what they need to do to prepare or get out of the way of a hazard (Atyia Martin 2015). Some people are more vulnerable to the negative impacts of floods on their health and wellbeing due to their current circumstances.

Negative impacts of floods on people's health and wellbeing include:
- drowning, hypothermia and injuries
- illness due to contact with contaminated water
- worsening of existing health conditions (such as heart disease, diabetes, asthma)
- poorer mental health.

People may also be significantly impacted by disruption to lifeline infrastructure, including transport networks, electricity, telecommunications, safe drinking water, and food supplies. A lack of access to medications and health services can have substantial impacts on people's health. Floodwaters can also damage houses, property, cars, and lead to damp and mouldy housing. These impacts can have long-term impacts on people's health and wellbeing.

Measuring vulnerability with social vulnerability indicators

Social vulnerability indicators are used to identify areas with people who are more vulnerable to these negative impacts of floods. In these areas, people may be less able to anticipate, prepare, cope and recover from a flood.

Understanding the vulnerability of a population allows CDEM and others responsible for disaster risk reduction to consider the specific needs of that population, and prioritise initiatives to reduce vulnerability.

Why do these indicators focus on flooding?

The social vulnerability indicators in this toolkit focus on flooding, as flooding is one of New Zealand's most frequent and costly natural hazards. About two-thirds of the New Zealand population live in flood-prone areas, including in many of New Zealand's main towns and cities. Climate change is expected to increase the intensity and frequency of flooding in New Zealand, due to more heavy rainfall days, and sea-level rise reducing the ability of floodwaters to drain to the sea.

While these indicators have been developed for flooding, they are likely to be useful for other natural hazards.

The relationship between social vulnerability and resilience

It should be noted that social vulnerability is a slightly different concept from resilience (or a lack of resilience).

- *Resilience* focuses on communities' ability to 'bounce back' or 'bounce forward' – that is, to cope with the natural hazard, and be able to recover from it.

- *Social vulnerability* looks more broadly at which population groups are more likely to be vulnerable to the impacts of natural hazards.

Social vulnerability and resilience are not necessarily mutually exclusive concepts – people can be both. People who are socially vulnerable (such as those with a chronic health condition) can also be resilient (such as having enough food and water to cope with shortage).

In this toolkit, the term 'vulnerable populations' refers to people who have a specific vulnerability, as defined by our conceptual framework and social vulnerability indicators. It should be noted that the term 'vulnerability' does not denote that vulnerability is innate or internal to a person, or represents an overarching attribute of an individual. Rather, we identify vulnerabilities that people may be experiencing, that put them at greater risk of harm to their health and wellbeing for a variety of reasons, including social, political and environmental influences.

How were these social vulnerability indicators developed?

This toolkit presents a set of social vulnerability indicators for flooding, that were developed by Massey University, Wellington, New Zealand. These indicators were developed using a robust indicator development process and with input from key stakeholders. For more information about this project, and to access the resources in this toolkit, see the Environmental Health Indicators (EHI) website: www.ehinz.ac.nz/our-projects/social-vulnerability-indicators

Social vulnerability framework and dimensions

This section presents a framework for understanding social vulnerability to flooding based on several well-established frameworks.

A framework for understanding social vulnerability

Social vulnerability is made up of three main components:

- Exposure: being exposed to the hazard (such as flooding)
- Susceptibility: being more susceptible or sensitive to the impacts of the hazard
- Lack of resilience: relating to the capacity to anticipate, cope and recover.

Each of the three components of the social vulnerability framework is made up of one or more dimensions (Figure 1). These dimensions provide a structured way of thinking about and understanding social vulnerability and resilience to flooding.

Exposure to floods includes both direct and indirect impacts (for example, caused by disruptions to lifeline infrastructure). *Susceptible* population groups include the young and old, and people with health and/or disability needs. *Resilience* covers six key dimensions, including housing, money, food and water, social connectedness, knowledge and skills, and decision-making and leadership.

Together, exposure, susceptibility, and a lack of resilience can increase people's vulnerability to negative impacts of floods on health and wellbeing.

Figure 1: Social vulnerability framework and dimensions, relating to flooding in Aotearoa New Zealand
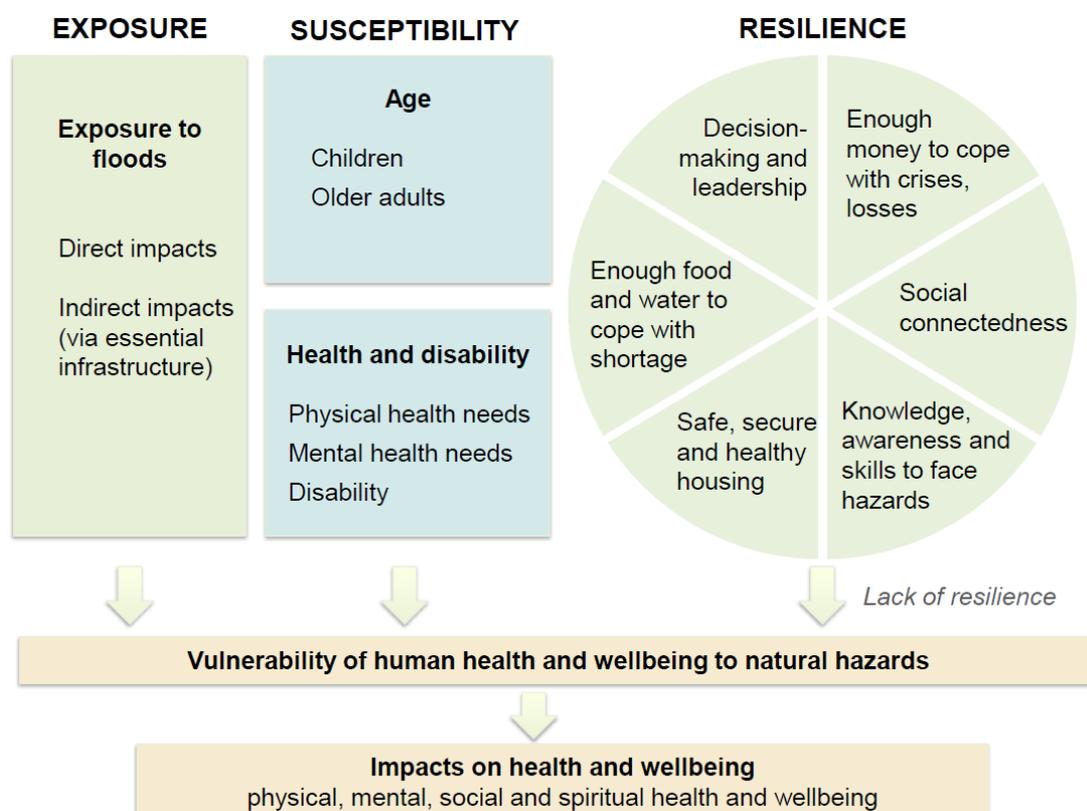
Adapted from Birkmann et al (2013), Wisner et al (2012), USGCRP (2016) and Durie (1985).

The dimensions of social vulnerability to flooding

This section explains the dimensions of social vulnerability to flooding in more detail, and identifies why people are more vulnerable to negative impacts on their health and wellbeing.

Exposure to floods (direct)

People who live in flood hazard zones are at higher risk of experiencing negative impacts from flooding. They are more likely to be exposed to floodwaters, and experience damage to their houses, cars and other property. They are also more likely to be displaced from their homes (temporarily or permanently). People working, studying, or spending time in flood hazard zones may also be affected.

Exposure to floods (indirect via essential lifelines infrastructure)

Flooding can affect people's health and wellbeing through disruptions to essential lifelines infrastructure and services. These services include road networks, public transportation, emergency services, electricity, water, gas, telecommunications, and fuel supplies. People may be cut off or isolated from their house or important services. People may also have difficulty accessing medications and health services that are essential for their health. Having access to safe drinking water is also vital for protecting health and wellbeing, particularly for newborns and young children, pregnant women, the elderly, and people with chronic health conditions. People can also be affected by environmental contamination due to hazardous substances in floodwaters.

Children and youth

Children are more susceptible to the health impacts of flooding, such as gastrointestinal illness from contaminated water. Children (and particularly young children) rely on their caregivers to keep them safe and move them out of the way of danger.

Older adults

Older adults tend to be less mobile and are more likely to have hearing or vision loss. Older adults are also more likely to have chronic health conditions such as heart disease and diabetes, which make them more susceptible to health impacts during and after a flood. They may have limited social networks and be socially isolated, particularly if they live alone. Older adults are more likely to need help to evacuate during a flood, and during the clean-up phase after a flood.

People with physical health needs

People with chronic health conditions are more susceptible to health impacts during and after a flood event. For example, people with coronary heart disease are at higher risk of a heart attack after a flood, due to stress and excess activity from evacuation and clean-up activities. People with diabetes may need to access insulin in order to live, and they may suffer complications such as diabetic foot as a result of injuries in floodwaters. A range of other chronic health conditions can make people susceptible to health impacts after a flood, including asthma and other respiratory conditions.

During and after a flood, people may have difficulties accessing essential medications and health care. This lack of access to healthcare can have serious (and potentially fatal) consequences for people with chronic health conditions. For example, people may need access to insulin, angina medication, oxygen therapy, and/or dialysis, in order to live.

Pregnant women are also more susceptible to adverse impacts from floods, such as premature birth and pregnancy complications.

People with mental health needs

People with mental health conditions are more susceptible to the impacts of flooding as they may have more difficulties in coping with the stress of flooding.

In particular, those taking medication for mental health conditions may experience significant impacts on their health and wellbeing if they do not have access to these medications. Those affected include people taking medication for depression, anxiety, and psychotic disorders, and opioid substitution treatment. Some of these medications are only dispensed daily or weekly, which means that people are more reliant on being able to access pharmacies or hospitals after a flood event.

People with substance abuse issues (such as alcohol and/or drug use) are at higher risk of increased substance use due to stress.

People with disabilities

People who are restricted in their daily activities by a physical, learning or mental disability may experience problems during and after a flood. They may have difficulty evacuating, moving themselves, and/or understanding hazards and/or directions. They may also depend on caregivers to help them prepare for a flood, and evacuate during a flood. They may have difficulty accessing emergency shelters if these are not accessible for people with mobility issues and/or service dogs.

Having enough money to cope with crises/losses

People or households with low incomes and/or without enough money to cope with crises may not have the money to protect themselves from flooding. They may not be able to afford insurance, flood protection materials or works, or emergency food and supplies.

After a flood, recovery can take a long time for these people. They often end up staying in damp and mouldy houses through an inability to find other accommodation. Financial stress can also lead to mental health impacts.

Social connectedness

Having strong social connections, networks and kinship ties can be beneficial for coping during and after a natural hazard. By contrast, social isolation is an important aspect of vulnerability for people, as it means that people may not have others to help them if needed, including for evacuation, and clean-up.

Knowledge, skills, and awareness of natural hazards

Understanding information is important for being able to prepare, understand early warnings, know where to evacuate to, and how to cope and access services after an emergency. People who have limited English language skills, or who are new to the country, may have difficulties. Additionally, a lack of awareness of local natural hazards is an important cause of vulnerability to flooding. People who are new to the area, or who are tourists, can be vulnerable for this reason.

Safe, secure and healthy housing

Housing quality and safety can have an important impact on people's resilience and/or vulnerability. For example, people may be more vulnerable if their house is located in a flood hazard zone (particularly in areas of deep water or overland flow), if their house is not well constructed, or if floor heights are not high enough to escape floodwaters. People living in crowded houses are also more vulnerable, as they are at risk of infectious diseases, they may not have sufficient emergency supplies, and they are particularly vulnerable if they are displaced

from their home. People living in rental housing are also at risk of displacement if the home-owners need to do repairs. Homeless people are particularly vulnerable.

People living in houses on Māori land are also vulnerable, as they may not have the option of selling their home and moving elsewhere if they are in a flood hazard zone.

Emergency shelters, and in particular marae, can be important sources of resilience for a local community, as they can provide safe shelter for people during a disaster.

Enough food and water (and other essentials) to survive

Having enough food and water is essential for survival. Food insecurity (a lack of access to safe, nutritious and affordable food) before a disaster can increase the risk of people not having sufficient food after a disaster. Having access to safe drinking water is also critically important for protecting health and wellbeing for some vulnerable population groups (especially newborns and young children, pregnant women, the elderly, and people with chronic health conditions). Floods can also affect the ability to produce food from the land, particularly in rural areas and/or isolated communities.

Decision-making and leadership

Decision-making and leadership (including flexible decision-making, access to decision-makers, self-efficacy and autonomy) play an important role in resilience. This includes working closely and partnering with local iwi and hapū in the area. It also includes engaging with vulnerable population groups in an area, to ensure that their needs are listened to and met.

People without access to or involvement in decision-making are likely to be left out of the process, and not have their needs listened to or fully met.

Other individual-level factors of social vulnerability

Other potentially vulnerable population groups include healthcare workers and first responders, who are at higher risk of psychosocial impacts; people who have previously experienced domestic violence, as this is one of the main contributors to experiencing domestic violence again after a natural hazard; and people in institutions, who may rely on others to look after them. People who own or look after animals are also vulnerable, as evacuation may be difficult for them.

How to use the social vulnerability indicators

We have developed a national set of social vulnerability indicators for flooding, based on the social vulnerability framework and dimensions.

You can use these indicators to better understand social vulnerability in your local area. We have also provided ideas for additional information that you could collect, to inform a more detailed social vulnerability assessment. Additionally, we have identified some potential uses for the indicators for a range of sectors, including the CDEM and health sectors.

This section explains the steps for using the social vulnerability indicators and other resources in your local area. This section refers to other resources (in **bold**) which are described in the following pages. Some of these resources are available from the Environmental Health Indicators (EHI) website: www.ehinz.ac.nz/our-projects/social-vulnerability-indicators

Step 1: Understand social vulnerability to flooding and the indicators

The first step is to understand social vulnerability to flooding, the indicators and framework.

- Read this toolkit to learn about the dimensions of social vulnerability and the reasons for these vulnerabilities and the indicators that are available and can be used.

- Explore the **online interactive map (Story Map)** of social vulnerability indicators for the case study area of Porirua, to see an example of the indicators and how they can be used.

- If required, refer to the resource **Social vulnerability indicators for flooding: Rationale, data sources and potential uses** for more information, by social vulnerability dimension, about the reasons for people's vulnerability, potential indicators and data sources, ideas for how to use the indicators, and case studies showing how vulnerability can be reduced. Additionally, a **factsheet** is available that describes how floods can impact on health and wellbeing.

Step 2: Access indicator data for your area

The next step is to access indicator data for your area.

- Explore the **heatmap** in the Excel file for your area. This heatmap shows the area units (suburbs) that have higher vulnerability for the different dimensions of social vulnerability.

- Download the **national indicator dataset** (Excel file) containing nation-wide data for the social vulnerability indicators, by territorial authority, area unit (suburb), and meshblock (the smallest geographic unit available).

- If you have access to a GIS (Geographic Information Systems) analyst, ask them to visualise the indicators on a map.

- If you do not have access to a GIS analyst, you can use the heatmaps and datasets alongside online maps, such as:

    - StatsNZ's StatsMaps, which will show you the area unit and meshblock of specific areas in relation to street maps (https://www.stats.govt.nz/tools/stats-maps

    - the NationalMap Emergency Management Basemap, which contains locations of schools, health services and other locations relevant to emergency management (https://catalogue.data.govt.nz/dataset/emergency-management-basemap)

Step 3: Collate other relevant data

The next step is to collate other relevant data from your local area, to supplement the national indicators. Local knowledge and information can be highly valuable for understanding social vulnerability in your area.

- Identify **point locations** that are related to vulnerability and resilience in your local area.

- Identify **local sources of information** to complement the available indicators. These include other administrative datasets (such as council datasets and primary health organisation datasets), mātauranga Māori from local iwi and hapū, and other local knowledge.

- Access the latest **flood hazard maps** in your local area (these may be available online through your regional or local council). These flood hazard maps should be used alongside the social vulnerability indicators and point locations in order to better understand exposure to flood hazards and vulnerabilities.

- Include additional important information about the **population and societal context**, the **environmental and institutional context**, and **potential future vulnerability relating to climate change**.

The Appendix contains a full list of potential indicators and other sources of data, that could be used in a social vulnerability assessment.

Step 4: Use indicator information to reduce vulnerability

The indicators can only be useful if they inform action. The final step is to use the indicator information to reduce vulnerability.

- Review the **potential uses for the indicators** to identify ways that you could use the indicators in emergency planning and preparedness activities, during a flood response and recovery, and in risk reduction activities (see page 25).

- For further information on the indicators, and ideas for how to use specific indicators, see the resource, **Social vulnerability indicators for flooding: Rationale, data sources and potential uses**.

For GIS analysts

If you have access to a Geographic Information System (GIS) (for example, within local council or in a CDEM group), you can also carry out the following steps.

- Download the **shapefiles** of social vulnerability indicators from the EHI website

- Access **flood hazard maps** (shapefiles) for your area and overlay these onto the social vulnerability indicators. These may be available through your local or regional council.

- Access **local point location data** relevant to your area (such as schools and early childhood education (ECE) facilities).

    a. Councils may hold this data as part of their GIS system.

    b. Other spatial datasets may be available for download on websites such as www.data.govt.nz or koordinates.com.

    c. Relevant point location data may also be available through the National Emergency Management Basemap (https://catalogue.data.govt.nz/dataset/emergency-management-basemap)

- Create maps with flood hazard zones and relevant point locations (similar to the maps that appear in the case study Story Map), to share with others.

- Overlay the social vulnerability indicators onto the flood hazard zones, and use alongside the Excel heatmap to identify vulnerabilities within communities. Use this information to inform emergency planning and preparedness activities.

If you have the time and resource to carry out additional spatial analyses, you can do the following:

- Identify key point locations within flood hazard zones. In particular, identify any locations in areas of deep floodwaters, and/or overland flow zones (where floodwaters will be moving fast). These are important areas in terms of risks to life, health and safety during a flood.

- Estimate the number of people, households, and properties in flood hazard zones.

- Use network analysis to identify areas that will be isolated from emergency service locations, health services, pharmacies and hospitals during a flood event.

For RiskScape users

RiskScape is a risk modelling software that assesses likely impacts from natural hazards. It is a joint programme between NIWA and GNS Science. RiskScape now includes the social vulnerability data as a resource layer, to overlay over other analyses (such as evaluating damage to buildings, infrastructure and people).

If you use RiskScape, or if you are requesting analyses using RiskScape, you can incorporate the social vulnerability indicator data in analyses. For more information, see the RiskScape section (page 23).

For land-use planners

As part of this project, we identified ways that social vulnerability indicators can be included in land use planning and local government processes. We have briefly described these uses in this toolkit (see page 32).

Additionally, you can find more information, and an example of how to include vulnerability in a District Plan, in the resource **Incorporating social vulnerability into local government processes for managing natural hazards and climate change in New Zealand**.

Resources available from this project

This section describes the resources and tools about social vulnerability to flooding that are available from this project. You can access these resources on our website www.ehinz.ac.nz/our-projects/social-vulnerability-indicators

1. Online interactive map (Story Map) for the case study of Porirua

You can access an online interactive map (Story Map) of the social vulnerability indicators and flood hazard zones, for the area covered by Porirua City Council. Porirua was used as a case study for this project, to test the indicators and share them with key stakeholders.

The Story Map lets you explore interactive maps of Porirua, with flood hazard zones, social vulnerability indicators, and relevant point locations overlaid. You can zoom in to explore suburbs, and investigate aspects of social vulnerability and resilience. You can use this Story Map to give you ideas about how to use the indicators in your local area.

You can access the Story Map on our Massey GIS account.

Figure 2: Screenshot of the Story Map for social vulnerability indicators for flooding, for Porirua, New Zealand
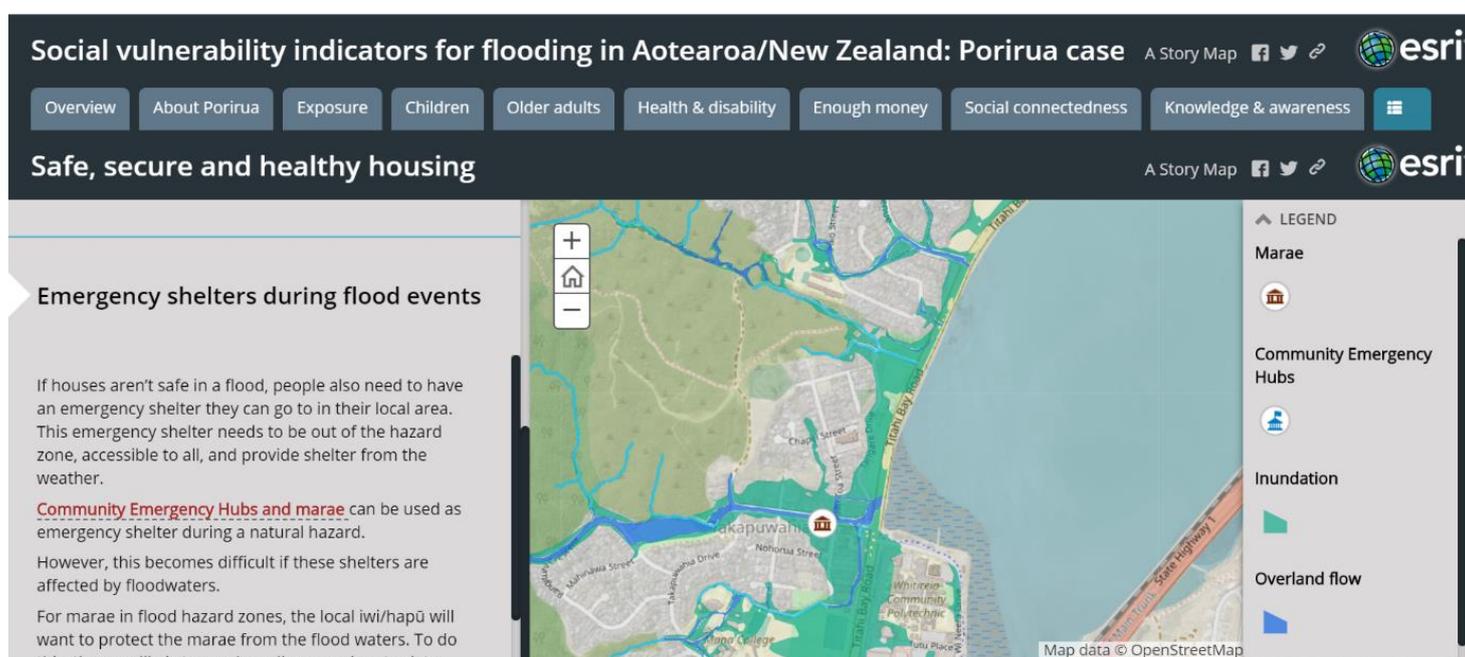
2. National indicator dataset

A national dataset of social vulnerability indicators for New Zealand is available for download. This dataset contains the social vulnerability indicators listed in Table 1.

The dataset is accessible in Excel and contains the indicator data for territorial authorities, area units and, where possible, meshblocks across New Zealand. The data is mostly derived from the 2013 Census.

Table 1: Social vulnerability indicators currently available

Social vulnerability dimension	Social vulnerability indicators (currently available)
Exposure (direct)	Usually resident population Number of households

Social vulnerability dimension	Social vulnerability indicators (currently available)
Exposure (indirect)	People who regularly commute outside of the area
	People who use public transport to get to and from work
	People living in rural or remote communities
Children	Children aged 0-4 years
	Children aged 0-14 years
	Households with at least one child aged 0-4 years
	Households with at least one child aged 0-14 years
	Households with at least one child aged 5-16 years
	Households with at least one child aged 0-16 years
Older adults	Older adults aged 65+ years
	Older adults aged 75+ years
	Older adults aged 85+ years
	Households with an older adult (65+ years) living alone
Physical health needs	Pregnant women
Mental health needs	People with a psychological or psychiatric impairment
Disability	People with a disability
	People with a physical disability
	People with a hearing disability
	People with a vision disability
	People with a psychological or psychiatric impairment
Having enough money to cope with crises/losses	Socioeconomic deprivation (NZDep2013)
	Single-parent households
	Unemployed people
	People who are not in the labour force
	People with minimal education
	Households with no access to a car
	People working in the primary industries
Social connectedness	People who are new to the neighbourhood (within the previous year)
	Households with an older adult (65+ years) living alone
	Single-parent households
	Single-person households
	Households living in rental housing
	Neighbourhoods with fewer households with children
	Recent immigrants
Knowledge, skills, and awareness of natural hazards	People who are new to the neighbourhood (within the previous year)
	Households with no access to the internet
	Households with no access to a mobile phone
	Households with no access to a telephone
	People with limited English proficiency
	Recent immigrants
Safe, secure and healthy housing	Households living in rental housing
	Crowded households
	People living in crowded households
	People who are homeless and/or severely housing deprived
Enough food and water (and other essentials) to survive	*Proxy indicators for lack of emergency preparedness and food insecurity:*
	Households living in rental housing
	Single-parent households
	Socioeconomic deprivation

Social vulnerability dimension	Social vulnerability indicators (currently available)
Decision-making and leadership	Level of voting participation in the community
Other individual-level factors of social vulnerability	Healthcare workers and emergency services workers (ambulance, police, fire)
	Households with one or more healthcare workers and/or first responders
	Registered dog owners (and number of dogs)
Contextual population data	Population by sex (male, female)
	Population by total reseponse ethnic group (Māori, Pacific, Asian, European, MELAA (Middle Eastern, Latin American, African), Other)
	Population counts by language spoken
	Population estimates/projections for 2018, 2023, 2033, 2043 (total, 0-14 years, and 65+ years)

Tips for using the indicator dataset

- Indicator data is mainly sourced from the 2013 Census. Therefore, the data may not accurately reflect current reality, and should be interpreted with caution. However, other data (including data from the 2018 Census) can be used to supplement this data when available.

- These indicators are available at the territorial authority level and, where possible, area unit (suburb) and meshblock level.

- The indicator data are presented as both counts and percentages (of the total population or total households in an area). Counts are useful for understanding the overall number of people (or households) affected. Percentages are useful for understanding the relative impact on an area, and for comparing to other areas.

- Stats NZ has randomly rounded all count data from the 2013 Census to multiples of 3. In some cases, counts and percentages have been suppressed due to low numbers so data will be missing.

- Metadata explaining how the indicators have been defined and created is available in the Excel spreadsheet.

3. Heatmaps

We have created heatmaps to show area units (suburbs) with higher or lower vulnerability to flooding. The heatmaps allow you to see a summary of the indicators across all dimensions of social vulnerability. Figure 3 gives an example of a heatmap, for Porirua City Council.

You can access the heatmaps for the whole of New Zealand, as an Excel file on the EHI website. In this Excel file, you can search for your local council area, and explore the social vulnerability

indicators for the relevant area units. Heatmaps are available for both percentages and count data.

Figure 3: Example of heatmap of social vulnerability indicators for Porirua, by area unit (2013 data)

Porirua City Council		Children		Older adults			Pregnant women	Having enough money to cope with crises/losses						Social connectedness				Knowledge, skills and awareness to face hazards					Housing	Enough food and water to cope with shortage			Healthcare workers	
AU Name	AU	0-4 years	0-14 years	65+ years	75+ years	85+ years	0 years	NZDep2013 deciles	Unemployed	Not in the labour force	Single parent families	Minimal education	No access to a car	New to the neighbourhood	Single parent families	Single person households	Living in rental accommodation	New to the neighbourhood	Don't speak English	No access to the internet	No telephone	No mobile	rented_percent	NZDep2013 deciles	Living in rental accommodation	Single parent families	Healthcare workers and first responders	Workplace of healthcare workers
Pauatahanui	565601	4.2	22.2	9.2	1.9	0.0	0.8	1	3.1	19.8	8.2	10.7	0.0	10.7	8.2	11.0	12.4	10.7	0.6	5.6	4.7	11.2	12.4	1	12.4	8.2	6.9	2.3
Endeavour	565602	6.4	22.3	9.6	3.1	1.1	1.0	1	2.3	23.5	8.3	10.3	1.0	15.5	8.3	8.8	12.1	15.5	1.6	3.0	2.8	7.1	12.1	1	12.1	8.3	8.4	20.6
Resolution	565603	6.7	20.0	4.4	0.0	0.0		1	2.9	21.2	7.1	6.1	0.0	28.6	7.1	0.0	0.0	28.6	0.0	0.0	6.7	13.3	0.0	1	0.0	7.1	3.7	
Adventure	565604	7.3	23.2	13.5	6.6	2.2	1.8	2	3.9	27.7	15.3	14.3	2.5	17.7	15.3	19.0	20.3	17.7	3.4	11.5	7.6	10.8	20.3	2	20.3	15.3	12.4	16.8
Paekakariki Hill	565700	4.1	22.4	0.0	0.0	0.0		2	2.8	14.3	13.3	8.6	0.0	8.3	13.3	11.8	18.8	8.3	0.0	25.0	0.0	56.3	18.8	2	18.8	13.3	3.6	0.0
Titahi Bay North	570400	9.4	24.1	10.4	3.7	1.0	2.0	9	8.0	32.1	26.9	22.1	13.6	19.3	26.9	28.0	45.9	19.3	2.6	27.8	18.3	15.9	45.9	9	45.9	26.9	11.5	15.7
Onepoto	570500	9.3	25.3	9.2	2.8	0.3	1.7	7	5.9	28.9	27.0	22.9	6.3	15.4	27.0	15.4	24.2	15.4	2.5	20.4	11.5	13.6	24.2	7	24.2	27.0	10.5	2.9
Titahi Bay South	570600	10.0	26.5	12.4	5.9	1.6	1.8	9	6.5	37.2	31.7	23.8	16.8	20.0	31.7	25.9	50.5	20.0	3.4	29.2	17.4	15.9	50.5	9	50.5	31.7	13.1	26.5
Elsdon-Takapuwahia	570700	9.0	24.0	9.8	3.3	0.4	1.9	9	9.9	37.0	33.5	29.0	18.6	19.8	33.5	23.6	49.8	19.8	4.4	36.0	21.3	16.9	49.8	9	49.8	33.5	15.9	13.0
Porirua Central	570800	4.7	11.8	6.3	2.4	1.6	0.8	10	10.9	56.5	12.5	33.7	16.7	34.2	12.5	30.8	75.0	34.2	5.3	50.0	33.3	8.3	75.0	10	75.0	12.5	13.5	20.1
Porirua East	570900	7.8	22.6	7.9	2.5	0.4	1.8	10	10.1	39.8	34.3	31.8	19.9	19.7	34.3	21.3	62.2	19.7	6.6	35.4	21.2	20.1	62.2	10	62.2	34.3	12.9	18.6
Ranui Heights	571000	8.6	20.3	11.0	3.5	0.4	2.0	7	5.6	32.6	24.8	24.8	5.8	17.1	24.8	25.3	27.9	17.1	3.8	21.0	10.9	11.6	27.9	7	27.9	24.8	12.1	65.7
Cannons Creek North	571100	10.6	29.7	6.3	2.1	0.4	2.4	10	12.6	49.9	40.0	37.4	29.0	21.8	40.0	16.8	76.8	21.8	9.9	49.0	30.0	21.7	76.8	10	76.8	40.0	13.5	41.3
Cannons Creek South	571200	9.6	29.8	7.3	2.9	0.0	2.0	10	10.7	46.0	41.9	33.0	18.1	21.0	41.9	14.8	66.1	21.0	7.7	43.2	25.6	16.8	66.1	10	66.1	41.9	18.2	7.7
Cannons Creek East	571300	10.1	28.9	8.9	2.6	0.3	1.9	10	11.6	50.5	38.8	36.5	24.3	17.6	38.8	15.2	64.3	17.6	10.0	46.5	22.0	24.1	64.3	10	64.3	38.8	15.6	13.5
Waitangirua	571400	10.6	31.0	7.2	1.9	0.1	1.8	10	12.9	47.4	41.4	38.0	19.9	17.8	41.4	12.9	72.7	17.8	9.8	48.5	26.1	22.4	72.7	10	72.7	41.4	14.9	13.2
Papakowhai North	571501	6.2	19.1	15.9	6.6	2.5	1.2	1	2.8	30.1	11.5	14.1	2.4	15.4	11.5	16.4	17.7	15.4	3.3	7.9	4.3	7.9	17.7	1	17.7	11.5	9.2	8.3
Papakowhai South	571502	11.6	24.7	12.8	7.1	2.2	2.1	1	2.5	28.6	8.4	10.6	6.0	26.1	8.4	19.1	14.8	26.1	3.8	11.3	5.6	11.3	14.8	1	14.8	8.4	7.3	10.5
Ascot Park	571600	9.2	25.5	8.1	2.1	0.1	1.6	8	8.3	31.4	30.0	27.7	9.1	15.5	30.0	13.1	41.0	15.5	4.7	22.8	14.2	13.0	41.0	8	41.0	30.0	11.3	9.5
Pukerua Bay	571800	8.9	24.1	10.3	2.5	0.3	2.2	1	3.2	25.0	11.1	10.7	2.3	16.2	11.1	14.4	18.2	16.2	2.3	9.5	7.2	9.5	18.2	1	18.2	11.1	9.6	6.9
Plimmerton	571900	7.0	19.9	13.9	4.0	1.0	1.3	2	3.2	24.8	12.4	9.8	3.4	18.9	12.4	23.5	25.4	18.9	2.3	11.8	9.1	10.3	25.4	2	25.4	12.4	10.5	4.5
Mana-Camborne	572000	6.9	19.8	13.8	4.8	1.1	1.3	1	2.9	24.8	12.9	10.4	3.8	15.2	12.9	22.0	18.6	15.2	2.2	10.2	5.7	9.2	18.6	1	18.6	12.9	9.4	13.5
Paremata-Postgate	572100	6.2	20.3	11.8	2.7	0.5	1.3	1	2.8	24.4	13.6	11.3	2.3	17.0	13.6	16.3	21.9	17.0	2.4	8.3	7.6	8.6	21.9	1	21.9	13.6	9.2	2.4
Discovery	572200	7.6	23.8	11.2	3.2	0.9	1.4	1	3.4	23.8	11.6	11.2	1.3	14.7	11.6	10.5	16.1	14.7	2.7	5.0	3.0	6.6	16.1	1	16.1	11.6	10.4	8.8

Additionally in this spreadsheet, we have provided a summary table of the social vulnerability indicators by territorial authority, with counts and percentages. This table lets you see a summary of the indicators for your local area (Figure 4).

Figure 4: Example of a territorial authority summary table of social vulnerability indicators

	A	B	AN	AO	AP	AQ	AR	AS	AT
1						Wellington Region CDEM Group			
2	Indicator group	Indicator name	Porirua City	Upper Hutt City	Lower Hutt City	Wellington City	Masterton District	Carterton District	South Wairarapa
56	Social vulnerability indicators (percents)								
57	Social vulnerability dimensions	Indicators	Porirua City	Upper Hutt City	Lower Hutt City	Wellington City	Masterton District	Carterton District	South Wairarap
58	Exposure	Usually resident population (2013 counts)	51,717	40,179	98,238	190,959	23,352	8,235	
59		Number of households (2013 counts)	16,884	15,042	35,988	71,004	9,507	3,297	
60		Uses public transport to get to work (among people who travelled to work)	15.2	13.9	18.3	20.4	2.8	9.3	
61	Children	0-4 years	8.6	6.8	7.4	6.0	6.2	6.6	
62		0-14 years	24.5	20.3	21.4	17.3	20.0	19.9	
63		Households with child(ren) aged 0-4 years	18.9	13.7	14.9	12.2	11.4	11.5	
64		Households with child(ren) aged 0-14 years	37.9	30.2	31.4	26.6	25.6	25.3	
65		Households with child(ren) aged 5-16 years	22.0	19.4	19.4	17.0	17.2	16.4	
66		Households with child(ren) aged 0-16 years	40.9	33.2	34.3	29.2	28.6	27.8	
67	Older adults	65+ years	10.3	14.5	12.8	9.5	19.1	18.8	
68		75+ years	3.5	6.6	5.4	3.9	8.9	6.9	
69		85+ years	0.8	1.9	1.5	1.1	2.6	1.7	
70		Households with an older adult 65+ years living alone	17.0	6.7	11.1	9.9	7.1	14.6	
71	Pregnant women (proxy)	0 years	1.7	1.2	1.4	1.3	1.1	1.1	
72	Disability	People with a disability	23.58	26.51	24.75	19.78	29.18	26.78	
73		People with a physical disability	13.12	14.97	14.52	10.31	17.92	15.74	
74		People with a hearing disability	7.63	9.17	7.79	6.10	10.05	9.65	
75		People with a vision disability	3.39	3.69	3.48	2.86	4.27	3.79	
76		People with a psychological or psychiatric impairment	5.28	6.04	5.55	4.52	5.90	5.36	

TA indicator summary | Heatmap - percents NZ | Heatmap - percents by TA | Heatmap - counts NZ | Heatmap - counts by TA

4. Spatial datasets (shapefiles)

Shapefiles are available with the national indicator data, at the meshblock and area unit level. These shapefiles can be used within a GIS (Geographic Information System).

The shapefiles are available on the EHI website, www.ehinz.ac.nz/our-projects/social-vulnerability-indicators

5. Metadata

Metadata gives information about the indicators, how they were created, the definitions used, and other useful information. Metadata for the national indicators are available in the Excel file.

6. Point locations relating to social vulnerability and resilience

We have identified point locations that are important to include when considering social vulnerability in a local area (Table 2). These locations are where vulnerable populations are likely to be located before or during an event, and/or the locations important for local resilience.

Address information about these point locations is likely to be available through the local council, local agencies (such as infrastructure providers, district health boards, Primary Health Organisations), and/or national agencies.

Table 2: Point indicators relating to social vulnerability and resilience

Dimension of social vulnerability	Point locations
Exposure (direct impacts)	Emergency shelters Important community assets in flood hazard zone (and number of people), such as: • schools • early childhood education services • rest homes • marae • hospitals • health care centres • pharmacies
Exposure (indirect impacts via lifeline infrastructure and services)	Important transport routes likely to be affected during a flood, including main/arterial roads, bus routes, train tracks, train stations and underpasses Emergency service facilities - fire stations, police stations, ambulance stations, hospitals/emergency departments Important utilities in flood hazard zones • Power substations • Water pumping stations • Stormwater pumps • Sewerage pumping stations • Telecommunications infrastructure (including cellphone towers) • Petrol stations Infrastructure vulnerable locations (such as bridges), including: • Hotspots (co-location of critical infrastructure) • Pinchpoints (utility asset or site where a satisfactory alternative route is not available and which is essential to service delivery) Hazardous substances facilities / contaminated sites in flood hazard zones
Children	Early childhood education centres Schools Other facilities for children, such as: • Care and protection residences for children • Youth justice facilities
Older adults	Residential aged care facilities for older adults Retirement villages Social housing for older people
Physical health needs	Primary health care facilities (GP medical centres, A&M emergency clinics) Pharmacies Medical supply depots Hospitals

Dimension of social vulnerability	Point locations
	Other health facilities (note: these may already be included as part of hospitals): • Dialysis units • Birthing units • Long-stay hospitals (including at aged care facilities)
Mental health needs	Mental health facilities (mental health services, in-patient mental health units) Primary health care facilities (GP medical centres) Pharmacies Hospitals
Disability	Facilities for people with disabilities • Community residential homes • Respite care facilities Specialist schools for children with disabilities and high needs
Having enough money to cope with crises/losses	Social housing • Housing NZ homes • Council social housing • Social housing provided by other providers and NGOs (eg Salvation Army) Hazard areas where properties are uninsurable and/or prohibitively expensive to insure
Social connectedness	Marae Schools Early childhood centres Churches Other places of cultural/spiritual significance (such as urupā)
Knowledge, skills, and awareness of natural hazards	Visitor accommodation, including hotels, motels, holiday inns, backpacker accommodation, camping grounds, freedom camping sites, and holiday houses Flood hazard zones that have not experienced a flood in recent times (eg last 10 years) Refugee settlement centres and locations
Safe, secure and healthy housing	Houses in flood hazard zones (by hazard classification zone: stream corridors, overland flow paths, inundation areas; deep floodwater depths) Houses on low-lying land Houses with a floor height below flood depth (particularly houses built in the 1980s–2000s, slab on ground, with no minimum floor height taking into account flood depths) Houses likely to be aggraded during a flood (ie where the river deposits mud, rocks, boulders, and/or erodes land under or around the house) Emergency housing, including night shelters and Women's Refuge centres Temporary accommodation, indulging camping grounds, motor camps, boarding houses, hotels and motels Houses on Māori land in flood hazard zones Safe place for the community to shelter out of flood hazard zone • Civil Defence Centres • Marae
Enough food and water (and other essentials) to survive	Food stores, including supermarkets, dairies and other food stores Food banks Local emergency water supplies (such as water storage tanks, boreholes, and emergency water stations) *Possible proxy indicators:* Rental housing owned by a public landlord (Housing New Zealand Corporation, local authority or city councils, other state landlords)
Decision-making ability and participation	Marae Civil Defence Centres

Dimension of social vulnerability	Point locations	
Other individual-level factors of social vulnerability	Prisons Youth justice facilities Police stations Community corrections centres University dorms Military quarters Rest homes	20

7. List of other sources of information that could be considered

The social vulnerability indicators work best when combined with local knowledge. Local areas are likely to have more detailed, relevant and up-to-date information to supplement the national indicator data.

You can use data for your local area from the national indicator dataset as a starting point for a social vulnerability assessment, then overlay local data and knowledge. We have provided some suggested additional data sources that you could consider for each dimension. These include local sources of indicator data, lifeline infrastructure, and flood hazard maps.

Local sources of indicator data

You can use local administrative data sources to supplement the national indicator dataset. For example, the following datasets could be included:
- local council datasets, such as registered dog owners
- Primary Health Organisation (PHO) data from patient management systems (PMS), which can be queried to provide an up-to-date snapshot of medically vulnerable people, including those with chronic health conditions, serious mental illness, and/or on essential medication.

You can also include qualitative data, such as information about:
- whether Māori iwi, hapū and marae are included in CDEM planning
- whether population groups with vulnerabilities (such as people with disabilities, people with chronic health conditions) are included in CDEM planning.

Local knowledge from the community can also be valuable. This may include:
- Mātauranga Māori (Māori knowledge)
- local welfare agencies and NGOs
- local knowledge from people in the community
- local knowledge about refugees, seasonal and/or transitory workers, and ethnic communities.

More ideas for local data sources for each dimension of social vulnerability can be found in the resource **Social vulnerability indicators for Aotearoa New Zealand: Rationale, indicators, and potential uses**.

Flood hazard maps

Flood hazard zones are important for assessing and interpreting social vulnerability to flooding, as they show areas that are at risk of flooding.

If possible, you should include the latest maps of flood hazard zones when assessing social vulnerability in your local area. Mapping flood hazard zones allows many insights when combined with social vulnerability indicators and point locations.

When considering flood hazard zones, the following aspects are important to include on the map, if possible:
- fast-flowing water: often in stream corridors and overland flow paths
- deep flood waters
- estimated climate change impacts (see below for more details).

Currently, no national flood hazard zone maps exist. However, flood hazard information may be available through regional councils, and/or through local councils, who may have flood hazard maps to inform District Plan reviews.

Population and societal context

Having contextual information about the population in an area is important for understanding the underlying drivers of vulnerability and population characteristics. The following information could be useful to examine at a regional level, and potentially also the neighbourhood level:

- population characteristics and distribution – by age, sex, ethnic group, urban/rural profile
- population density and growth – including numbers of commuters, tourists, and highly mobile populations
- local economy characteristics – occupations of the local population, characteristics of the local economy (such as single economy, primary industries etc).

In the national dataset, we have included the following population contextual data, to help you:
- population by sex and ethnic group
- languages spoken by people in the community.

Environmental and institutional context

Environmental and institutional contextual factors can influence health outcomes and vulnerability to floods at a larger scale. The following information could be useful to examine:

- land use planning – such as whether development is permitted in vulnerable coastal areas, floodplains and watersheds; whether natural hazards and vulnerable populations are currently considered in land use planning
- flood mitigation systems – such as the extent to which flood mitigation systems currently cope, and/or need upgrades
- emergency management and preparedness – such as the quality and effectiveness of early warning systems and communication to vulnerable populations
- emergency response and disaster relief – such as number of first responders, percent volunteerism, planning of evacuation and accessible shelters, extent to which emergency services are likely to be affected by floods.

Potential future vulnerability relating to climate change

Climate change is expected to increase the severity of flooding (both the intensity and likelihood) in the future, through more heavy rainfall days and impacts of sea-level rise. The following information could be useful to consider:

- flood hazard zones, taking into account 100-year climate change impacts
- population projections for the next 40 years by area unit (suburb), including for vulnerable age groups (0-14 years, 65+ years, 85+ years)
- trends in population ageing
- trends in the number of people living on flood plains
- Māori land, marae and urupā (burial grounds) in areas at risk from climate change impacts
- trends in chronic diseases and underlying drivers of poor health (such as obesity).

In the national dataset, we have included the following data to help you:
- population projections (total population, children, and older adults), for 2018- 2043.

8. Social vulnerability indicators documents

We have produced a number of documents about social vulnerability indicators and their potential uses . To access these documents, see the EHI website: www.ehinz.ac.nz/our-projects/social-vulnerability-indicators

Social vulnerability indicators for flooding: Research report

The research report provides the methodology and rationale used to develop the social vulnerability indicators (Mason et al 2019b). This report includes the process used to develop the conceptual framework, information about end-users, information on Vision Mātauranga, and how the indicators were developed and output. The research report is available for download on the EHI website.

Social vulnerability indicators for flooding: Rationale, data sources and potential uses for New Zealand

In this document, you can find the following information for each dimension of social vulnerability (Mason et al 2019a):
- the rationale for why population groups are vulnerable to the impacts of flooding
- a list of national social vulnerability indicators
- additional point locations and datasets that could be included in a social vulnerability assessment
- ideas for how to use the indicator data in that dimension
- case studies of how vulnerability has been reduced in each social vulnerability dimension.

Factsheet: Health and wellbeing impacts of floods

You can find out about the potential impacts of flooding on health and wellbeing in this factsheet, available on the EHI website.

9. RiskScape

The social vulnerability indicators are available in RiskScape, which is a risk modelling software (https://www.riskscape.org.nz). RiskScape is an open-access tool that lets users assess risk from natural hazards to buildings, infrastructure and people. The tool brings together information about assets (such as houses, infrastructure or people), hazards (such as a flood scenario), and vulnerability functions that estimate damage and loss. The modelled outputs from RiskScape, such as direct damage, reinstatement cost, fatalities and injuries, can be used to inform risk-based decision-making.

End-users of the outputs of RiskScape include:
- central government
- local government
- emergency management
- lifeline/asset managers
- planning or policy
- insurance/reinsurance
- risk consultants
- researchers.

Software development for RiskScape version 2.0 has been underway since May 2018, and involves redeveloping the core engine (see here for more information https://www.gns.cri.nz/Home/News-and-Events/Media-Releases/Riskscape).

As part of this project, we have produced the following:
1. social vulnerability indicators included as a resource layer in RiskScape, so that the data works alongside the existing models
2. a tutorial for how to use the social vulnerability indicators in the command-line interface of RiskScape.

The social vulnerability indicators developed through this project were configured into a shapefile that can be read into RiskScape as a resource layer, to inform analyses about vulnerable populations in the area of interest.

Currently, RiskScape 2.0 is operational by command-line interface (requiring computer coding skills) with a user-interface in development. Users of the command-line interface include risk scientists at NIWA and GNS, PhD students and researchers, as well as current clients such as CDEM Groups who request risk assessments from NIWA and GNS using RiskScape. As such, the social vulnerability indicators are currently only available in RiskScape by using a command-line interface.

Once RiskScape2.0 software is fully developed and released with the new and improved interface, this resource layer will be available on the website, along with a tutorial on how to use the layer.

In the meantime, if you are interested in using the social vulnerability indicators as part of your RiskScape analysis, please contact Ben Popovich (Benjamin.Popovich@niwa.co.nz) or Kristie-Lee Thomas (k.thomas@gns.cri.nz).

10. Guidance for land use planning and other local government processes

As part of this project, a guidance document has been produced that identifies how social vulnerability can be better incorporated into land use planning and other local government processes. In particular, the guidance document identifies:

- mechanisms available to land use planners to include consideration of social vulnerability and/or resilience into local government processes

- two methods for including social vulnerability into District Plans, using adaptations to the risk-based planning approach to natural hazards, through consideration of vulnerable land use activities (such as schools, early childhood education facilities, health services, and aged residential care facilities)

- a case study using Porirua City Council to demonstrate one of the above methods for including social vulnerability into a District Plan

- how social vulnerability information could be used in local council plans, policies and strategies to inform decision-making, particularly around infrastructure upgrades and hazard mititgation works

- tips for the general public on how to make effective submissions, when submitting on local government strategies and plans.

This guidance document, **Incorporating social vulnerability into local government processes for managing natural hazards and climate change in New Zealand** (Beban & Gunnell 2019), is available on the EHI website www.ehinz.ac.nz/our-projects/social-vulnerability-indicators.

Potential uses for the social vulnerability indicators

This section suggests ways in which you could use social vulnerability indicators to help reduce vulnerability to flooding.

The social vulnerability indicators will be particularly helpful for the following end-users:
- Civil Defence and Emergency Management (CDEM)
- health sector, including emergency planners in district health boards (DHBs) and Primary Health Organisations, and Public Health Units
- local councils (including land use planners)
- Māori iwi, hapū and marae
- education sector
- housing sector
- wider social sector.

Some of the uses below relate directly to the indicators themselves, while other uses relate to maps or data visualisations of indicators and flood hazard zones (for example, the Story Map).

You can find further ideas of how to use the indicators and maps, by specific social vulnerability dimension, in the resource **Social vulnerability indicators for flooding: Rationale, data sources and potential uses.**

CDEM

Social vulnerability indicators can help target and prioritise existing CDEM activities, which can help save time and resources. The indicators can inform activities across the 'four Rs' of emergency management (risk reduction, readiness, response and recovery).

As part of risk reduction, the social vulnerability indicators and additional information can be used to inform a social vulnerability assessment. The following section describes further CDEM activities that could make use of social vulnerability information and/or maps of flood zones and vulnerabilities.

1. During the response stage of a flood event

Social vulnerability indicators can be used in an Emergency Operations Centre (EOC) during a response to a flood event (and associated power outages and other service disruptions). In particular, the indicators can:

(i) **Contribute to the development of shared situational awareness**, by contributing in a way that translates beyond the Welfare Function (supporting individuals and communities) to cross the whole response structure (Operations, Logistics, Intelligence and other functions).

(ii) **Help new CDEM staff gain situational awareness:** People new to the EOC can use the Story Map and indicators to quickly understand vulnerabilities in the area.

(iii) **Assist in rapid decision making and prioritisation of response resources:** The indicators can support equitable response during and after a flood event. Indicators can provide immediate intelligence into potentially affected populations and their vulnerability, what assistance they may need for evacuation, as well as where people may be gathering or needing shelter. This information can be used to request intelligence and aid in prioritising resources, as well as where to distribute them.

(iv) **Provide initial information to inform rapid post-disaster needs assessments:** The indicators can be used as intelligence arrives, to estimate whether vulnerable

populations may have been impacted. This may then inform whether more intelligence is required from areas in the days to weeks following disasters, to provide useful assistance to vulnerable and marginalised populations. In particular, the indicators can help counteract the 'squeaky wheel' effect, where areas with people who request help and services get more assistance than areas that do not or are unable to ask for help.

(v) **Assist in response efficiency:** The indicators can be used as a checklist to ensure marginalised and vulnerable population groups are considered, included and communicated with during disaster response.

2. During the recovery phase, after a flood event

Vulnerable population groups are likely to struggle to recover from flood impacts. The social vulnerability indicators can be used during the recovery phase to:

(i) Provide an objective measure of where people are most likely to struggle after a flood: Social vulnerability indicators can provide an objective measure to help you understand where the greatest need is likely to be after a flood event (for example, for evacuation and assistance), and which areas are going to need the most support. In this way, the indicators can help support an equitable response during the recovery stage.

(ii) Prioritise distribution of resources and support: The indicators can be used to inform where to locate support services during the recovery phase of the response so that they are accessible to the most vulnerable people.

(iii) Support clean-up efforts: The indicators can be used to identify areas with more vulnerable populations, to target additional assistance during the clean-up phase (such as student armies). Maps of hazardous substance storage facilities and other contaminated sites can also help inform how to best manage health risks of workers during the clean-up phase.

3. Readiness and risk reduction

Social vulnerability indicators can be used during flood risk and impact assessments to inform risk reduction and readiness initiatives.

Indicators can be used to:

(i) **Evaluate potential direct and indirect impacts of floods**: The indicators can be used to evaluate social impacts of floods, or other disaster scenarios to inform CDEM Group Plans and to help identify and prioritise readiness and risk reduction initiatives.

(ii) **Inform Response Plans**: The indicators can be used to help identify where the greatest need for evacuation assistance and welfare help may be during and after a flood (e.g. rest homes, pre-schools, communities that do not speak English).

(iii) **Check that evacuation centres and Civil Defence Centres are located in appropriate locations:** Social vulnerability indicators can be used to evaluate whether centres are accessible to vulnerable populations, and appropriate for their needs (considering language, disabilities, culture, gender).

(iv) **Inform readiness and education campaigns:** The indicators can be used to target engagement with vulnerable populations exposed to natural hazards, to encourage preparedness and resilience. The indicators can also identify areas with a population where standard CDEM engagement activities may not have yet reached.

4. Working with local communities

Social vulnerability indicators combined with flood hazard maps can assist with targeting community engagement, particularly with emergency preparedness and resilience-building. For example, indicators can be used to:

(i) **Identify communities, marae, schools, ECEs, visitor accommodation and vulnerable groups for emergency preparedness activities:** The indicators, combined with hazard information can be used to identify exposed people and community assets. This assessment could be used to target preparedness initiatives with these communities and organisations to check they have suitable emergency plans and/or business continuity plans to cope with flooding impacts. (See page 35 for more information relating to the education sector.)

(i) **Tailor information to people's needs/effective communication:** The indicators can inform the type of emergency preparedness information shared with a community, to ensure that the information is relevant, understandable, useful to them and meets their needs.

(ii) **Inform community resilience-building activities:** The indicators can be used to identify communities where resilience-building activities (for example to help raise awareness and increase social connectedness) could be prioritised.

(iii) **Ensure that community champions are identified in the most vulnerable areas:** The indicators can be used to identify the most vulnerable communities, and to then ensure that any community champions and/or important community leaders are included in civil defence emergency management and planning.

Interactive maps could be used to communicate hazard and risk, as well as to foster participation in emergency planning and risk reduction (such as participatory mapping exercise). This may be a useful approach for working with individuals and households, health services, pharmacies, marae, schools, early childhood education (ECE) centres/services, rest homes and aged care facilities, and visitor accommodation.

5. Welfare coordination

Social vulnerability indicators can help with welfare coordination and preparedness, particularly in the local CDEM welfare network. The indicators can be used to:

(i) **Inform the types of people and organisations** who could be included in the CDEM welfare network for a local area. For example, the network could include representatives of (and agencies working with) vulnerable population groups from across the social vulnerability dimensions, including people with disabilities, people with chronic health needs, older people, people who do not speak English, as well as local Māori/iwi/hapū, Pasifika (eg Pacific leader groups, Pacific churches), Asian groups and other ethnic communities.

(ii) **Check that there are appropriate representatives** in the CDEM welfare network. This includes:
   a. socially vulnerable population groups (or people working with these groups), such as people with disabilities, people with chronic health needs and older people
   b. local iwi/hapū
   c. ethnic communities
   d. local community leaders and community champions
   e. representatives from key agencies involved in welfare services.

(iii) **Promote relationship-building** between agencies, and also with local iwi/hapū, before a flood event, so that the relationships and communication pathways are already established.

(iv) **Promote information-sharing and working collaboratively** between agencies after a flood, to ensure that vulnerable communities can access welfare services in an integrated way.

(v) **Prompt agencies to consider vulnerable clients** living in flood hazard zones, and to help them plan for potential disruption feasibly for that person.

Sharing the social vulnerability indicators and interactive map within the CDEM welfare network may help to prompt further discussion, and encourage people to share local knowledge.

6. Building and strengthening relationships between CDEM and Māori iwi and hapū

The Treaty of Waitangi is an important foundational policy context for risk reduction for natural hazards in New Zealand. In particular, we note the three principles of *protection, partnership* and *participation*.

Māori communities play an important role in response and recovery, and operate important resources including Māori welfare and support services, wide social networks, and marae that may be able to operate as emergency shelters during a disaster (MCDEM 2008). Strengthening relationships and building partnerships with local iwi and hapū can help to increase resilience for iwi, as well as for the entire local community if the iwi is well supported with resources to do so.

The CDEM sector can apply the social vulnerability framework, indicators and maps through the following activities:

(i) **Building relationships and partnerships with local iwi/hapū**, for example through iwi liaison officers, can ensure that iwi/hapū are involved in CDEM planning and decision-making, which strengthens resilience.

(ii) **Assisting iwi and hapū to identify flood risk to Māori-owned assets** with Māori communities can assist with their planning.

(iii) **Facilitating the development of marae emergency preparedness planning** can help ensure that local iwi are well resourced, with systems and processes to support communities during emergencies, if they are prepared to do so.

(iv) **Understanding the capacity and capability** of local marae with iwi and hapū, and identifying potential vulnerabilities, can help to evaluate how to best support them to increase their capacity and capability, to increase resilience.

One of the biggest challenges during an event is ensuring that marae are well resourced for an emergency. There is significant opportunity for government to establish a process that recognises the role of marae in emergency planning, and explores ways in which these challenges can be addressed in an on-going partnership with Māori.

Health sector

Social vulnerability indicators can help inform emergency planning and preparedness in the health sector, including emergency planners in district health boards (DHBs) and primary health organisations (PHOs), and the Ministry of Health. The indicators may also be useful for public health units.

Social vulnerability indicators can provide additional information to support emergency management planning and response in the health sector. In broad terms, social vulnerability indicators may have the following applications in the health sector:

(i) **Enhance the community planning for health needs undertaken by DHBs and PHOs**, by adding another element when building community profiles

(ii) **Provide another tool for the emergency management planning and response** undertaken in conjunction with CDEM Welfare Groups

(iii) **Provide further 'red flags' when looking at the need for assisted evacuation** of DHB patients being cared for in the community. DHBs generally maintain a list of the especially vulnerable people who may need rapid and assisted evacuation in a range of emergency situations.

The following section describes some more specific uses of the social vulnerability indicators in the health sector.

1. Planning for medically vulnerable people

People with high medical needs are a key vulnerable population group. Indicators and/or local information about medically vulnerable people can be valuable for planning for these people during a flood. These people are also a high priority for accessing safe drinking water after a flood.

These medically vulnerable people may include:
- young children, particularly newborns
- pregnant women
- the elderly
- people on medication such as insulin, angina medication, inhalers for asthma and other lung conditions, epilepsy medication, immunosuppressant drugs, anti-HIV medication, anti-depressants, anti-psychotics, opioid substitution treatment
- people on home oxygen therapy
- people on dialysis (home-based or at dialysis units).

Emergency planners DHBs and PHOs are responsible for planning for the health needs of their population. The social vulnerability indicators and information could be used to inform the following specific activities:

(i) **Identify areas of high health need:** Use the indicators to identify areas with vulnerable populations and/or high levels of health need, that are likely be affected by flooding (either through floodwaters or by being isolated). This information can be used to plan how to best reach these populations during and after a flood, such as identifying where to send mobile health centres.

(ii) **Identify contingency plans for getting safe drinking water to vulnerable people:** Use indicators to identify areas where there will be vulnerable people (such as the very young, elderly, and people with chronic health conditions) with potentially no access to

safe drinking water. This information can inform planning for getting safe drinking water to these people.

(iii) **Query patient management systems (PMS) to identify vulnerable patients:** During a response to a flood event, the PMS within a PHO or GP clinic could be queried to identify individual vulnerable patients who may need additional assistance or support.

(iv) **Develop regional emergency plans for people on opioid substitution treatments and other restricted medications:** People who are prescribed medications that are restricted to daily or weekly dispensing are particularly vulnerable to disruptions to access to medication. For example, people on opioid substitution treatment are likely to turn up to hospitals in a natural hazard. Developing a plan for ensuring that people can get treatment can help reduce the vulnerability of this group of people.

2. Emergency preparedness and business continuity planning for health services

It is important that health services can continue operating shortly after a flood has occurred. Emergency planners in DHBs and PHOs can use maps of flood hazard zones and health services (GP clinics and pharmacies) to help with business continuity planning.

In particular, flood hazard maps and the locations of health services, pharmacies, aged care facilities and disability care services can be used to:

(i) **Identify health services in flood hazard zones:** Maps of flood hazard zones and locations of health services can be used to identify health services (such as GP centres and pharmacies) in flood hazard zones.

(ii) **Identify potential disruptions to the road network, electricity and safe drinking water:** Maps of flood hazard zones and locations of GP centres and pharmacies can be used, in conjunction with lifelines organisations, to identify potential disruptions to the road network (and potentially other utilities) in a flood. These potential disruptions can help to inform business continuity planning for health services.

(iii) **Develop contingency plans for relocating health services located in flood hazard zones:** Flood hazard maps and locations of vulnerable populations can be used to inform contingency plans during a flood, such as temporarily relocating health services.

(iv) **Identify contingency plans for getting safe drinking water in pharmacies:** The indicators can be used to identify pharmacies likely to be affected in a flood, so they can develop contingency plans for getting safe drinking water to mix medications.

3. Informing public health messages

Flooding can have a number of impacts on health and wellbeing, including drowning, injuries, and gastrointestinal illness from contact with contaminated water. Some people are more susceptible to these impacts than others, including newborn babies, children and young people, older people, people with chronic health conditions and people needing essential medication and/or health services.

Public health units are responsible for communicating public health messages to the public during a flood. Social vulnerability indicators could be used to inform these messages, for example through the following activities:

(i) **Developing standard public health messaging for flooding:** Information on vulnerable populations in an area can be used to help develop standard public health messaging for floods. These could be based on the Ministry of Health guidelines.[1]

(ii) **Tailoring public health messaging:** Social vulnerability indicators could be used to inform types of public health messaging that are shared with the public, depending on the profile of the population.

(iii) **Translating public health messaging into other languages**: Information on other languages spoken in the area could be used to inform whether key public health messages need to be translated for those populations.

4. Reminding others about vulnerable population groups and equity focus

Public health units play an important role in supporting the health of the population in their local area. In this capacity, they can use the social vulnerability indicators to remind other agencies about considering vulnerable population groups, and supporting equity in all activities during preparedness, response and recovery.

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[1] See: https://www.health.govt.nz/your-health/healthy-living/emergency-management/protecting-your-health-emergency/floods-and-health

Local councils

Local councils can use the social vulnerability indicators, flood hazard maps, and point locations information to inform a wide range of activities in their local council area.

1. District Plan reviews and land use planning

Land use planning has a vital role to play in the reduction of social vulnerability and the strengthened resilience of our communities. There are a number of mechanisms available to land use planners to include social vulnerability thinking into land use planning, including:

(i) **Restricting development** in areas subject to natural hazards, either by reducing existing risk (eg managed retreat), avoiding future development, or mitigating the potential effects (eg raised floor levels in areas of flood inundation).

(ii) **Restricting the location of critical buildings** (eg hospitals) **and vulnerable land uses** (eg daycares, schools, rest homes) in areas subject to natural hazards.

(iii) **Protecting natural flood buffers during the planning process,** for example requiring esplanade strips to protect riparian margins, under section 229(a)(v) of the Resource Management Act 1991.

(iv) **Requiring urban design that promotes resilience** (for example connectivity of routes for evacuation, installation of emergency rainwater tanks, and communal open space areas to encourage social connectedness).

(v) **Recovery planning to promote resilience** in rebuilding after an event has occurred.

(vi) **Ensuring policies facilitate emergency/temporary housing solutions**, for example at schools, marae and public places.

Additionally, we have produced a resource for land use planners on how social vulnerability can be incorporated into District Plans through adapting a risk-based approach to natural hazards, using a case study of Porirua City Council to demonstrate how this can be achieved.

For more information, see the resource: **Incorporating social vulnerability into local government processes for managing natural hazards and climate change in New Zealand.**

2. Infrastructure upgrades and hazard mitigation works

For many areas with socially vulnerable people and/or activities, infrastructure upgrades and hazard mitigation works are the main way that risk from natural hazards can be reduced, as the cost of relocation is often too significant.

Social vulnerability indicators can be used to prioritise infrastructure upgrades (such as stormwater, electricity, communications and transport) in areas with high numbers of socially vulnerable people. Floods in these areas will have disproportionately high impacts on these vulnerable people, and recovery may take a long time for these people. Upgrading or retrofitting infrastructure to be resilient to flooding in areas where vulnerable populations live can help increase resilience and reduce people's vulnerability.

In particular, council decision-makers can use information about the vulnerability of the people in an area, as well as information about the vulnerability of the stormwater pipes, to make informed decisions about where to upgrade and/or retrofit infrastructure. Decision-making about infrastructure upgrades and hazard mitigation works occurs through the Annual Plan and Long-term Plan processes. The upgrading of infrastructure is generally based on the vulnerability of the infrastructure itself, rather than the vulnerability of the community it services. These plans go through a public submission phase, where vulnerable communities and activities are often poorly represented.

To get a better representation of vulnerable communities in terms of infrastructure upgrades and hazard mitigation works, the following may help:

- **(For council) Incorporate a weighting factor for social vulnerability** of the community and/or activities into the priority ranking for infrastructure renewal.

- **(For people outside of council) Prepare a submission** as part of the consultation period to help better represent vulnerable communities in decision-making processes.

Additionally, during a response, social vulnerability indicators can be used to prioritise infrastructure repair and restoration, to ensure that areas with vulnerable populations are not attended to last.

Some tips for people wanting to make submissions on local government processes are included on page 37. For more information about including social vulnerability into local government processes, see the resource: **Incorporating social vulnerability into local government processes for managing natural hazards and climate change in New Zealand** (Beban & Gunnell 2019).

3. Planning for climate change

Councils can use social vulnerability indicators for flooding to start planning for climate change. For example, through the Long-Term Plan process, climate change can be integrated into future transport and infrastructure planning, which will help to build resilience.

More broadly, climate change can be considered in the context of the social vulnerability indicators by:
- including climate change impacts into flood hazard mapping
- examining current patterns of social vulnerability, and the projected population in at-risk areas
- considering the locations of sites with vulnerable people.

Māori iwi, hapū and marae

The social vulnerability indicators, framework and interactive map could be useful for helping Māori, iwi, hapū, and marae to build their resilience to floods.

Social vulnerability indicators and flood maps may be useful to support the following resilience-building activities:

(i) **Identify flood hazard zones** and risks to marae, iwi-owned assets, urupā, and local communities to inform iwi management plans, strategic plans and emergency plans.

(ii) **Inform emergency response planning** within iwi/hapū and in the local community.

(iii) **Identify the need for and develop a marae emergency preparedness plan** to ensure that there are processes and systems in place to respond to flooding and other natural hazards.

(iv) **Identify vulnerabilities and vulnerable locations that may be reduced through preparedness,** for example, sourcing sandbags to protect marae in flood hazard zones, and ensuring that people know how to properly use sandbags.

(v) **Work with local CDEM groups and local council** on emergency preparedness, including having a shared understanding of social vulnerability and resilience.

(vi) **Inform the design of iwi-led housing developments** to ensure resilience to flooding (see page 36 for more information about housing).

(vii) **Inform iwi/hapū management plans and strategic plans,** for example with regards to natural hazards and the 4 Rs of risk reduction, readiness, response and recovery.

Education sector

Children are particularly vulnerable to the impacts of floods. CDEM groups can work with local schools and Early Childhood Education (ECE) services to check they have emergency plans for floods. These emergency plans can help schools and ECEs to provide a safe environment for the children in their care in the event of a flood.

Business continuity planning is also important for schools and ECE services. After a flood, these facilities would ideally open soon after the event, so that children could get back into regular routines, and their parents and caregivers are able to clean-up and return to work.

Flood hazard maps, the location of schools and ECEs, and indicator information about children in the local area can be used to inform the following activities to reduce vulnerability to flooding:

(i) **Check that schools and ECEs within flood hazard zones have emergency plans that address flood hazards:** The flood hazard maps and locations of schools and ECEs can be used to identify those located in flood hazard zones. These schools and ECEs could check that their emergency plans are up-to-date and address the flood hazard.

(ii) **Identify potential disruptions to the road network:** Identifying potential disruptions to the road networks around schools and ECEs can help to identify any potential issues that may occur with parents collecting children from the facility during a flood.

(iii) **Identify travel routes used by children to walk to school** that might be impacted by flooding, and develop plans to address this.

(iv) **Develop contingency plans for temporary relocation of schools located in flood hazard zones:** Flood hazard maps and locations of vulnerable populations can be useful to inform contingency plans for temporarily relocating schools and/or ECEs in flood hazard zones after a flood, while they are being cleaned and disinfected.

(v) **Work with civil defence** to assess if the school is an appropriate community meeting point during a disaster.

Housing sector

Good quality housing is an essential part of resilience. Without safe, secure and healthy housing, people are vulnerable to long-lasting impacts of floods, including displacement.

The housing sector can contribute to resilience to natural hazards in a number of ways.

1. Incorporating resilience-thinking into new social housing developments

Social housing, by nature, houses vulnerable population groups. This means it is particularly important to have social housing that promotes resilience, rather than contributing to vulnerability. The development of new social housing is a good opportunity to ensure that the housing will be resilient to natural hazards.

Resilience-thinking can be incorporated into new social housing developments in the following ways:

(i) **Consider the natural hazard profile of land before redevelopment:** Check that any potential redevelopment and/or intensification of social housing is appropriate given the natural hazard profile of the area.

(ii) **Minimum floor heights above flood levels:** Check that minimum floor heights are sufficiently high enough that houses are unlikely to be inundated with water during a flood.

(iii) **Adequate housing for peoples' needs:** Work towards providing adequate housing, so that people are not homeless and are not living in overcrowded homes. This may mean building larger homes to accommodate larger families.

(iv) **Accessible housing for people with disabilities:** Aim for all social housing to be accessible to people with mobility issues.

(v) **Rainwater tanks:** Install emergency rainwater tanks, so that houses (or blocks of housing) have emergency water stored away. A similar approach may be taken to other aspects of resilience (such as solar power to provide electricity during outages).

Applying actions such as these will help reduce vulnerability and build resilience in the local area.

2. Considering the social housing arrangements of vulnerable people

Within the social housing sector, information about natural hazards could be incorporated into decisions about where people live. For example, people with mobility issues and/or other disabilities ideally would not live in high-hazard zones.

Wider social sector

For many of the social vulnerability dimensions identified, there are underlying upstream factors that impact (or exacerbate) vulnerability. Social vulnerability indicators can provide evidence about vulnerabilities in the local community, to support important risk reduction strategies.

(i) **Employment initiatives** to reduce unemployment, if this is a notable vulnerability in the local community.

(ii) **Identify and address issues contributing to poverty** in a local community.

(iii) **Provide a health-promoting environment**, to help reduce the levels of chronic diseases (such as heart disease and diabetes) in the community.

Being involved in local government processes

The resilience of vulnerable groups can be improved through access to political power in local government processes. Being involved in local government processes can help ensure that the needs and concerns of the local community, and in particular people with vulnerabilities, are heard and addressed.

As part of this project, we have identified a range of ways that vulnerability could be considered in local government plans, policies and strategies. For more information, see the resource **Incorporating social vulnerability into local government processes for managing natural hazards and climate change in New Zealand** (Beban & Gunnell 2019).

This section outlines ways in which people interested in improving outcomes for vulnerable communities can be involved in the local government processes. This includes opportunities for involvement in local government processes and submitting on plans, policies and strategies.

Opportunities for involvement in local government processes

There are several ways that you can be involved in local government processes, if you wish to help improve outcomes for vulnerable population groups.

- **Be on a steering group or focus group:** If there is a chance to be on a steering or focus group on an issue, then take the opportunity. It is easier to change outcomes and get results working directly with council officers, than going through the submission process.

- **Be on your council's list of interested parties:** Most councils have lists of parties who wish to be consulted on plans and strategies. If you can get your organisation on one of these lists, then you will be advised when documents have been released for public comment.

- **Keep watch:** Keep a weekly watch on key council websites to see what plans, policies and strategies are being consulted on. This is as simple as having their consultation pages saved as bookmarks and spending five minutes each week checking these pages to see whether there is anything worth commenting on.

- **Make a submission:** Submit on local government strategies and plans during the public consultation period (see below for more details).

Submitting on plans, policies and strategies

There are opportunities to encourage a vulnerability and resilience perspective on local government plans, policies and strategies. The vast majority of local government strategies and plans go through a public submission process. The period for public submission is generally four

weeks (20 working days), and therefore, there is limited time for submissions to influence the content of plans and policies. Vulnerable communities and activities are often poorly represented during the submission phase of these processes, and as a result can be overlooked or lose funding.

This section provides some general tips for submitting on a plan, policy or strategy.

- Concentrate your efforts on the six documents that have the greatest influence on the local council and can include measures to protect vulnerable activities. These six documents are Annual Plans, Long Term Plans, District Plans (and relevant plan changes), Regional Policy Statements, Urban Growth Strategies, and CDEM Group Plans.

- These plans have differing timeframes for consultation for renewal. Typical timeframes include:
  - Annual Plans – annually
  - Long Term Plans – every three years
  - Urban Growth Strategies – every five years
  - District Plans – every 10 years
  - Regional Policy Statements – every 10 years
  - CDEM Group Plans – every 10 years.

  Given these timeframes, if the submission phase is missed, it can take a long time before the issue can be readdressed within these documents.

- When submitting on a plan, policy or strategy, make sure the submission is relevant to the topic being consulted on.

- Be factual in the submissions. If you can, support points raised in the submission with evidence; this will hold more weight than emotional arguments with no evidence.

- Write your submissions in plain English. When you are identifying a problem, make sure you identify acceptable solutions to the problem. Submissions that are solution-focused have a greater uptake.

- Verbally present the submission at the hearing, as these submissions are generally more effective. Ensure that you present and summarise the main points of the submission within the allocated time (which may be between 2 minutes and 30 minutes, depending on the committee). It is possible to request the presenting times in advance of attending the hearing so the verbal submission can be tailored to the hearing.

- Requests for changes to an issue will need to appear to be reasonable. This may not be a best-practice outcome, but it is better to get some improvement and recognition to an issue or outcome through a reasonable response, rather than getting nothing from being unreasonable. Normally, changes to an issue occur through numerous small incremental changes as opposed to one large step change.

- Acknowledge good points or positives in a plan, policy or strategy when they exist. This makes the submission appear balanced, and will provide greater weighting towards the issues and solutions raised in the submission.

- In some instances, expert support may be required to support a submission, particularly in relation to Regional Policy Statements, District Plans, and CDEM Group Plans. Experts who know their way through the legislation and what matters can be included in submissions. This is likely to result in more uptake on the matters raised in submissions.

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Appendix: Full list of potential indicators and point locations

Social vulnerability indicators for flooding

Table 3 presents a full list of potential social vulnerability indicators for flooding. The indicators in **bold** have nation-wide data available in an Excel file, at the territorial authority, area unit (suburb) and meshblock level (where possible). The other indicators are included as a prompt, to help you think about other information that might be useful to include for your local area.

Table 3: Dimensions of social vulnerability for flooding and potential social vulnerability indicators (indicators in **bold** are available nationally)

Social vulnerability dimensions	Social vulnerability indicators (indicators in **bold** are available nationally)
Exposure (direct impacts)	**Usually resident population** **Number of households** People working in the local area Land area in flood hazard zone Estimated number of people living in flood hazard zone Estimated number of buildings / dwellings in flood hazard zone Estimated number of people working (or studying at educational facilities) in flood hazard zone Estimated number of children and youth attending ECEs / schools in flood hazard zone
Exposure (indirect impacts via lifeline infrastructure and services)	**People who work outside of the territorial authority** **People who use public transport to get to work** **People living in rural and/or remote communities** People living in an area likely to be isolated during a flood due to impacts on the transportation network (eg isolated from emergency services, health services, central business district, food stores) People living in an area likely to experience water and/or electricity loss during a flood People living in an area likely to experience telecommunications outages during a flood People living in an area likely to be contaminated during a flood (eg by fuel or sewerage pipe leakage, or due to floodwaters affecting hazardous substances facilities or contaminated sites)
Children	**Children aged 0–4 years** **Children aged 0–14 years** **Households with children aged 0–4 years** **Households with children aged 0–14 years** **Households with children aged 5–16 years** **Households with children aged 0–16 years**
Older adults	**Older adults aged 65+ years** **Older adults aged 75+ years** **Older adults aged 85+ years** **Households with an older adult (65+ years) living alone**
Physical health needs	**Pregnant women** People with a pre-existing health condition, who are at risk of worsening health due to a flood, such as: • People with coronary heart disease • People with diabetes • People with chronic respiratory diseases (such as asthma, COPD) • People with compromised immune systems (such as those on immunosuppressant drugs, having cancer treatment, or with HIV/AIDS) • People with other chronic health conditions (such as tuberculosis, cystic fibrosis, sickle cell disease) People requiring essential medication (within 1–3 days of the flood), such as: • People on angina medication • People with insulin-dependent diabetes • People needing inhalers (and/or other medications) for chronic lung conditions

Social vulnerability dimensions	Social vulnerability indicators (indicators in **bold** are available nationally)
	• People taking medication for epilepsy • People taking immunosuppressant drugs • People on anti-HIV drugs People requiring electricity and/or health services for medical purposes (within 1–3 days of the flood), such as: • People on dialysis (haemodialysis or peritoneal; at home or at a dialysis unit) • People using home oxygen therapy for lung conditions • People receiving cancer treatment
Mental health needs	**People with a psychological or psychiatric impairment** People with pre-existing mental health issues, who are at risk of worsening of mental health status due to a flood, such as: • People with a diagnosed serious and persistent mental illness • People with a psychological or psychiatric impairment People requiring essential medications (within 1–3 days of flood), such as: • People on antidepressants and/or anti-anxiety medication • People on anti-psychotic medication • People on opioid substitution treatment (OST) People with substance abuse issues
Disability	**People with a disability (physical, hearing, vision, psychological or psychiatric impairment)** • **People with a physical disability** • **People with a hearing disability** • **People with a vision disability** • **People with a psychological or psychiatric impairment** People with a service dog
Having enough money to cope with crises / losses	**Socioeconomic deprivation** **Single-parent households** **Unemployed people** **People who are not in the labour force** **People with minimal education** **Households with no access to car** **People working in the primary industries** People living in low income households Households with no home or contents insurance
Social connectedness	**People who are new to the neighbourhood (within previous year)** **Households with an older adult (65+ years) living alone** **Single-parent households** **Single person households** **Households living in rental housing** **Neighbourhoods with fewer households with children** **Recent immigrants** Refugees
Knowledge, skills, and awareness of natural hazards	**People who are new to the neighbourhood (within previous year)** **Households with no access to the internet** **Households with no access to a telephone** **Households with no access to a mobile phone** **People with limited English proficiency** **Recent immigrants** Refugees Seasonal or transitory workers (such as fruit pickers, truck drivers) Tourists
Safe, secure and healthy housing	**Households living in rental housing** **Crowded households**

Social vulnerability dimensions	Social vulnerability indicators (indicators in **bold** are available nationally)
	People living in crowded households **People who are homeless or severely housing deprived** People living in houses on Māori land People living in low-lying properties in flood hazard zones People in single-storey properties (or on the bottom floor of multi-storey buildings) in flood hazard zones People living in damp and mouldy housing People who do not have house insurance
Enough food and water (and other essentials) to survive	Households without emergency water supplies for X days Households without emergency food supplies for X days Households without an emergency plan Households without better levels of emergency preparedness (torch, portable radio, spare batteries, essential first aid, medication) Households experiencing food insecurity (ie adequate and nutritious food is often not readily available in the household) Use of local food banks *Possible proxy indicators:* **Households living in rental housing** **Single parent households** **Socioeconomic deprivation** People living in low income households Receiving a means-tested benefit
Decision-making ability and participation	**Level of voting participation in the community** Inclusion of Māori, iwi, and hapū in civil defence emergency management planning and decision-making Inclusion of vulnerable population groups (such as those with health needs and/or disabilities) in civil defence emergency management and decision-making Inclusion of marae committees, and committees of other important assets (such as schools) in flood hazard zones, in CDEM response communications
Other individual-level factors of social vulnerability	**Healthcare workers and first responders** **Households with a healthcare worker and/or first responder** People who have previously experienced domestic violence People who are serving community sentences (such as home detention, community work) or who are on parole Households with one or more pets **Number of currently registered dog owners** **Number of currently registered dogs** People who own or manage livestock

Point locations

Table 4 presents a list of point locations to consider alongside the social vulnerability indicators for flooding. These point locations are included as a prompt, to help you think about the type of locations that might be useful to include in a social vulnerability assessment for your local area.

Table 4: Point locations

Dimension of social vulnerability	Point locations
Exposure (direct impacts)	Flood hazard zones Emergency hubs, including: • Civil Defence Centres • Marae Important community assets in flood hazard zone (and the number of people), such as: • schools • early childhood education services • rest homes • marae • hospitals • health care centres • pharmacies
Exposure (indirect impacts via lifeline infrastructure and services)	Important transport routes likely to be affected during a flood • Main/arterial roads • Bus routes • Trains tracks and train stations (including underpasses) Emergency service facilities • Fire station • Police station • Ambulance station • Hospital / Emergency Department Important utilities in flood hazard zones • Power substations • Water pumping stations • Stormwater pumps • Sewerage pumping stations • Telecommunications infrastructure (including cellphone towers) • Petrol stations Infrastructure vulnerable locations (such as bridges), including: • Hotspots (co-location of critical infrastructure) • Pinchpoints (utility asset or site where a satisfactory alternative route is not available and which is essential to service delivery) Hazardous substances facilities / contaminated sites in flood hazard zones
Children	Early childhood education centres, • Daycares • Kindergartens • kohanga reo • Playcentre and playgroups Schools • Primary schools • Secondary schools • Kura Kaupapa schools • Specialist schools (eg schools for high needs children) Other facilities for children, such as: • Care and protection residences for children • Youth justice facilities
Older adults	Residential facilities for older adults

Dimension of social vulnerability	Point locations
	• Residential care facilities, for people who need a higher level of daily assistance (which include rest homes, long-stay hospitals, and dementia/psychogeriatric units) • Retirement villages (independent living) Social housing for older people
Physical health needs	Primary health care facilities (GP medical centres, A&M emergency clinics) Pharmacies Medical supply depots Hospitals Other health facilities (note: these may be already included as part of hospitals): • Dialysis units • Birthing units • Long-stay hospitals (including at aged care facilities)
Mental health needs	Mental health facilities (mental health services, in-patient mental health units) Primary health care facilities (GP medical centres) Pharmacies Hospitals
Disability	Facilities for people with disabilities • Community residential homes • Respite care facilities Specialist schools for children with disabilities and high needs
Having enough money to cope with crises/losses	Social housing • Housing NZ homes • Council social housing • Social housing provided by other providers and NGOs (eg Salvation Army) Hazard areas where properties are uninsurable and/or prohibitively expensive to insure
Social connectedness	Marae Schools Early childhood centres Churches Other places of cultural/spiritual significance (such as urupā)
Knowledge, skills, and awareness of natural hazards	Visitor accommodation • Hotels • Motels • Holiday inns • Backpacker accommodation • Camping grounds • Freedom camping sites • Holiday houses Flood hazard zones that have not experienced a flood in recent times (eg last 10 years) Refugee settlement centres and locations ** For the accommodation locations, it is useful to include the likely number of people at each site, and any other relevant details about the people that might influence vulnerability*
Safe, secure and healthy housing	Houses in flood hazard zones (by hazard classification zone: stream corridors, overland flow paths, inundation areas; deep floodwater depths) Houses on low-lying land Houses with a floor height below flood depth (particularly houses built in the 1980s–2000s, slab on ground, with no minimum floor height taking into account flood depths) Houses likely to be aggraded during a flood (ie where the river deposits mud, rocks, boulders, and/or erodes land under or around the house)

Dimension of social vulnerability	Point locations
	emergency housing, such as • Night shelter • Women's refuge Temporary accommodation • Camping grounds and motor camps • Boarding houses, hotels, motels Houses on Māori land in flood hazard zones Safe places for the community to shelter out of flood hazard zone, such as local marae
Enough food and water (and other essentials) to survive	Food stores • Supermarkets • Dairies • Other food stores Food banks Local emergency water supplies (such as water storage tanks, boreholes) *Possible proxy indicators:* Rental housing owned by a public landlord (Housing New Zealand Corporation, local authority or city councils, other state landlords)
Decision-making ability and participation	Marae Civil Defence Centres
Other individual-level factors of social vulnerability	Prisons Youth justice facilities Police stations Community corrections centres University dorms Military quarters Rest homes