

# Auckland Council Property-level flood risk assessment framework

## Non-technical Overview

4 March 2024

### Introduction

In response to the severe weather events of January and February 2023, Auckland Council determined that flood-affected properties would be eligible for consideration for buy-out or subsidised risk mitigation where there is a high risk to life to vulnerable people in a flood event that has a 1% probability of occurring or being exceeded in a year.

The Auckland Council Healthy Waters department

developed the Framework for Assessing Flood Risk at the Property-level to enable the categorisation of properties affected by flooding during the severe weather events of January and February 2023. The Framework provides a systematic approach for assessing flood risk on individual residential properties in the Auckland region. This document provides a non-technical overview of that framework.

### Flood Danger Rating

The Framework employs a Flood Danger Rating system, which classifies the flood hazard at a property during peak flood conditions based on water depth, flow velocity, and the combined effect of these factors on the stability of people and buildings.

The Flood Danger Rating describes the perceived hazardousness of flooding on a property:

- **Low Danger:** generally not dangerous for all, including vulnerable people.

- **Moderate Danger:** Whether the situation is dangerous depends primarily on people's decision making. Their choices will determine the level of hazard to which they are exposed.
- **High or Extreme Danger:** Dangerous for vulnerable people, and may be dangerous for all, irrespective of what people decide to do.

The figure on the following page describes several illustrative flooding scenarios.

## Illustrative flooding scenarios and danger ratings

<b>LOW DANGER</b>		<ul style="list-style-type: none"> <li>• Building stability is not at risk.</li> <li>• Flooding may or may not be up to the dwelling footprint. The habitable floor of the dwelling remains dry.</li> <li>• An evacuation route is available which does not require wading or requires low-hazard wading only.</li> <li>• Low danger, including for the mobility impaired.</li> </ul>
<b>MODERATE DANGER</b>		<ul style="list-style-type: none"> <li>• Building stability is not at risk.</li> <li>• The dwelling is surrounded by floodwaters that pose high hazard for children and the elderly and may also be high hazard for adults. The floodwaters could be right up to the dwelling footprint, but the habitable floor remains dry.</li> <li>• There is no safe or low-hazard evacuation route available.</li> <li>• While the safer option would be to shelter in place, some people may choose to evacuate due to uncertainty about the evolving flood situation. This would be dangerous for children and the elderly and may also be dangerous for adults.</li> </ul>
		<ul style="list-style-type: none"> <li>• Building stability is not at risk.</li> <li>• Properties in this zone have a habitable floor subject to minor flooding &lt;0.5m in depth.</li> <li>• A safe or low hazard evacuation route is available but must be accessed from the upper levels of the dwelling.</li> <li>• For able-bodied people who are likely to evacuate or take refuge upstairs, this scenario represents low danger.</li> <li>• For mobility impaired people who may be downstairs, the danger is moderate.</li> </ul>
<b>HIGH DANGER</b>		<ul style="list-style-type: none"> <li>• Building stability is not at risk.</li> <li>• The dwelling is surrounded by floodwaters that are high hazard for children and the elderly and may also be high hazard for adults.</li> <li>• There is no safe or low-hazard evacuation route available.</li> <li>• The floodwaters extend right up to the dwelling footprint and there is flooding over habitable floor, which could be deep.</li> <li>• A significant proportion of people may try to evacuate.</li> <li>• This scenario is dangerous for all.</li> </ul>
		<ul style="list-style-type: none"> <li>• Building stability is not at risk.</li> <li>• Properties in this zone have a lower habitable floor subject to flooding &gt;0.5m in depth that poses high danger for mobility impaired people. At higher levels of flooding (&gt;1.2m) this scenario is dangerous for all, including others in the house who may try to assist those trapped downstairs.</li> </ul>

## Illustrative flooding scenarios and danger ratings

EXTREME DANGER



- The floodwaters extend right up to the dwelling. There may be flooding over habitable floor, which could be deep.
- There are deep and/or fast flowing floodwaters immediately adjacent to the building footprint.
- The building stability may be threatened by erosion of the building foundations or uplift forces causing failure of the walls and foundation slab.
- Even if a safe or low-hazard evacuation route is available, occupants may not be able to access it in the event of building failure.
- This scenario would be dangerous for all.

## Flood Hazard Assessment

The Flood Danger Rating is determined by assessing the observed or predicted flood hazard conditions on the property.

The framework uses flood hazard thresholds grounded in empirical evidence of the stability of people and buildings in flood flows and which align with Australian national guidance. The most dangerous situations are where people or buildings are likely to become unstable in the water.

Auckland's landscape is defined by many small, steep valleys. This topography tends to produce localised flash flooding which can be highly variable at the property-level. It is not uncommon for flooding to affect one property but not neighbouring properties, and it is possible to have dangerous flooding on one side of a house but no flooding on the other side.

For this reason, the assessment considers flood hazard at three locations on the property. At each location, the Flood Danger Ratings reflect the threat to those who are vulnerable:

- **The hazard to people inside:** this represents the threat to people from flooding inside the building and is assessed as the maximum flood depth over the lowest affected habitable floor. Inside the dwelling the most vulnerable people are the mobility impaired who could not evacuate unassisted even if they wanted to. Around 14 per cent of the adult population in New Zealand and 46 per cent of those aged over 65 are mobility impaired.

- **The hazard to people outside:** This represents the threat to people if they try to evacuate and is assessed at the location/s of maximum flood depth and velocity along the most likely evacuation route. Outside the dwelling, the stability of people in floodwaters is a function of their height, weight, and physical ability relative to the depth and velocity of flow. The most vulnerable are children and the elderly who are less stable in floodwaters.
- **The hazard to building stability:** this represents the threat to the structural stability of the building from flooding and is assessed at the location/s of maximum flood depth and velocity immediately adjacent to the building. Very deep and/or fast flowing waters can damage the structural integrity of the building and pose a risk that the building might collapse. Everyone is vulnerable in this situation as people inside the building may not have time to evacuate to safety if the building were to collapse. This scenario would be dangerous for all and therefore has the highest danger rating of extreme.

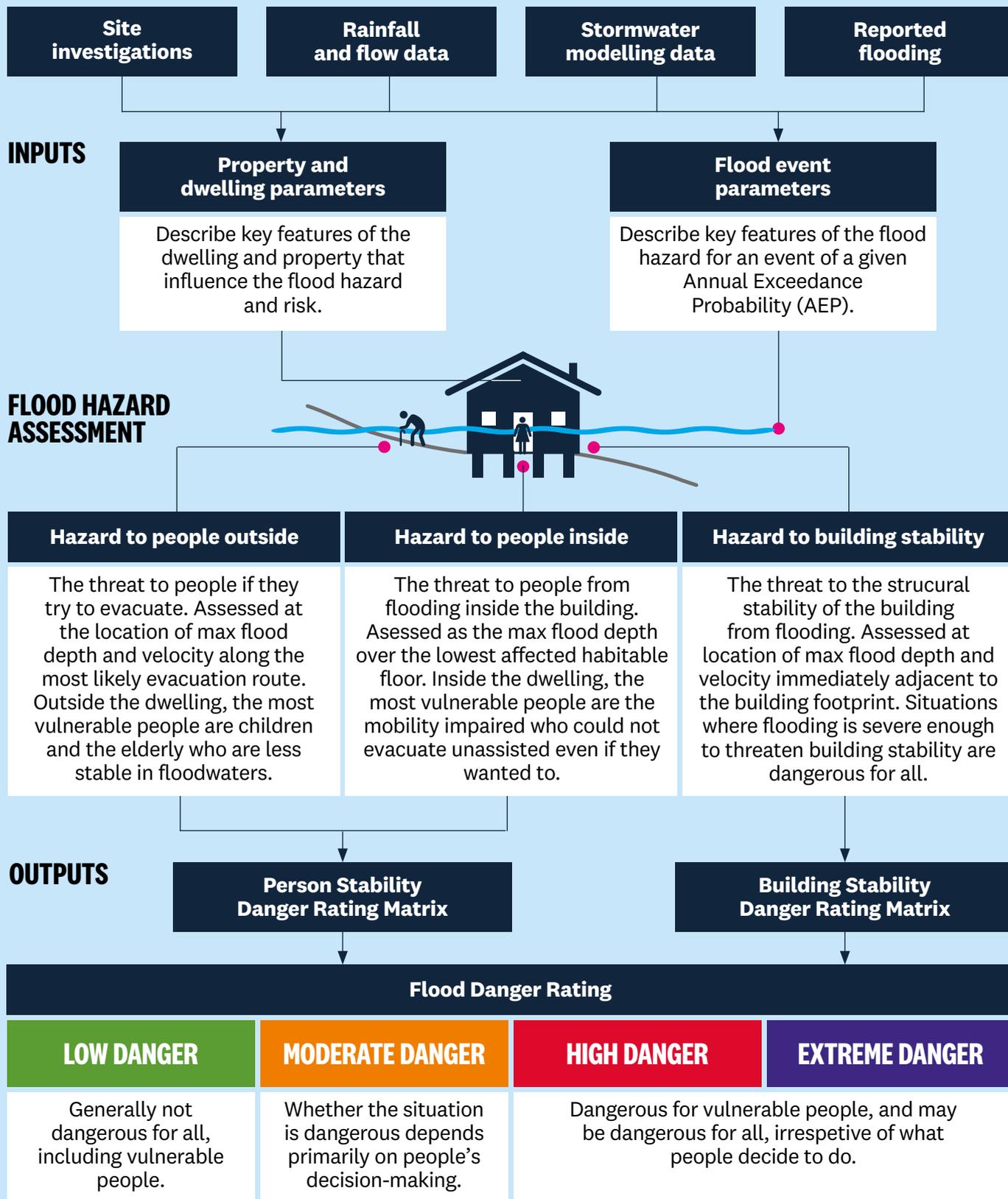
The inputs to the flood hazard assessment are generated from detailed desktop and site investigations.

These include flood event parameters, which describe key features of the flood hazard, and dwelling parameters, which describe key features of the dwelling and property that influence the flood hazard and risk.

The figure on the following page shows the inputs and components of the flood hazard assessment and how these are combined to generate the Flood Danger Rating.

# How the Flood Danger Rating is determined

## DATA AND ANALYSIS



The Person Stability Danger Rating Matrix is below. This matrix shows how the assessed flood hazards to people inside and outside the dwelling are combined to generate the Flood Danger Rating.

# Person Stability Danger Rating Matrix

HAZARD Show the danger rating based on the assessed hazard inside and hazard outside.				HAZARD TO PEOPLE OUTSIDE				
				Assess flood hazard along the most likely evacuation route using DxV Chart 2 (Flood hazard thresholds for person stability). Select the most appropriate hazard outside rating between very low to high.				
<b>Danger rating key</b>  <b>LOW DANGER</b>  <b>MODERATE DANGER</b>  <b>HIGH DANGER</b>	<b>Conditions</b>	<b>Hazard rating</b>	<b>D&amp;V thresholds</b>	<b>HAZARD TO PEOPLE OUTSIDE</b>				
				Very low	Low hazard for all except infants and very young children.	Low hazard for adults / High for children and elderly.	Moderate hazard for adults.	High hazard for all.
				n/a	Refer DV Chart 2	Refer DV Chart 2.	Refer DV Chart 2.	Refer DV Chart 2.
<b>HAZARD TO PEOPLE INSIDE</b>  <b>Step 3.</b> Assess flood hazard inside the dwelling based on depth over habitable floor (assuming V = 0 inside the building).  For assessing hazard Inside, vulnerable people includes children, the elderly, and the mobility-impaired.	Habitable floor remains dry.	Very low	Floodwaters are NOT touching the building footprint. Nil depth over habitable floor.	Very low	Low hazard for all except infants and very young children.	Low hazard for adults / High for children and elderly.	Moderate hazard for adults.	High hazard for all.
			Floodwaters are touching the building footprint. Nil depth over habitable floor.	Very low	Low hazard for all except infants and very young children.	Low hazard for adults / High for children and elderly.	Moderate hazard for adults.	High hazard for all.
	Habitable floor is wet.	Low hazard for all except infants and very young children.	Depth (D) over habitable floor: $0 \leq D < 0.5\text{m}$ .	Moderate hazard for able-bodied adults.	Moderate hazard for adults.	High hazard for all.	High hazard for all.	High hazard for all.
			Depth (D) over habitable floor: $0.5 \leq D < 0.85\text{m}$ .	High hazard for all.	High hazard for all.	High hazard for all.	High hazard for all.	High hazard for all.
			Depth (D) over habitable floor: $0.85 \leq D < 1.2\text{m}$ .	High hazard for all.	High hazard for all.	High hazard for all.	High hazard for all.	High hazard for all.
			Depth (D) over habitable floor: $D \geq 1.2\text{m}$ .	High hazard for all.	High hazard for all.	High hazard for all.	High hazard for all.	High hazard for all.

Intolerable Risk Threshold @ 1% AEP

# Flood risk

The Flood Danger Rating represents the threat to life to vulnerable people in a given flood event.

For the purposes of property categorisation, Danger Ratings of Extreme or High are considered to be intolerable if the flood event has a probability of 1% or more of occurring or being exceeded in a year. This is referred to as the Annual Exceedance Probability or AEP.

A flood with an AEP of 1% would be expected to occur, on average over the long-term, once every 100 years, but may occur more frequently than that. There is a 55% chance of a 1% AEP flood occurring at

least once in any 80-year period, and a 19% chance of it occurring at least twice in that period.

The selection of the 1% AEP as the threshold for intolerable risk is consistent with the standards for urban planning and development in Auckland. Situations classified as High or Extreme Danger are dangerous, particularly for vulnerable people. Properties where these situations are expected to occur with an annual probability of 1% or greater should be considered unsafe for long-term residential occupation.

# Existing risk

This is the flood risk which currently exists, based on recorded rainfall, the existing level of development in the catchment, and the current state of the property and dwelling at the time of the assessment.

Properties which are assessed to have High or Extreme Danger Ratings in the existing 1% AEP

flood become candidates for property buyout or subsidised risk mitigation works. Properties which are assessed to have Low or Moderate Danger Ratings in the existing 1% AEP flood receive a Category 1 classification.

# Future risk

This is the flood risk that is anticipated to exist in the future assuming heavier rainfall due to climate change, the maximum development of the catchment (which increases runoff), and the future state of stormwater infrastructure and the property and dwelling assuming any proposed community or private risk mitigation works have been completed.

The final property categorisation (as in Category 3, Category 2P or 2C) depends on an assessment of the potential private and community solutions to mitigate the flood risk at the property. Since flood risk in the future will be greater than the existing risk due to climate change and the effects of development, future risk must be considered in this evaluation to determine whether the proposed property-level or community-level interventions will be effective at mitigating the future risk.