BRANZ

ISSUE 701 BULLETIN

BUILDING ON LAND SUBJECT TO FLOODING AND/OR LANDSLIDES

July 2025

- The risks of rainfall flooding and landslides are forecast to rise in coming years, yet new homes are still being built in areas susceptible to these hazards.
- This bulletin outlines requirements and due diligence for construction in in areas susceptible to flooding and landslides to reduce or mitigate the risk of damage.
- There are some sites where the risk of flooding and/or landslides is so high that the sites should not be built on at all regardless of mitigation efforts.

1 INTRODUCTION

1.0.1 In 2022, NIWA and the University of Auckland reported that 282,395 houses valued at $213 billion have been built in areas of potential flood hazard. (The figure is over 441,000 buildings when all sleepouts, garden sheds and so on are included.) It found that new housing is still being built in these areas where there is a range of risk levels from low to high. In 2024, several local authorities voted to keep flood-risk sites within zones marked for future urban development.

1.0.2 The cost of flood damage has grown enormously in recent decades. Between 2002 and 2018, weather-related insurance claims (mostly for flooding) averaged $123 million per year. From 2019 to 2022, that average jumped to $615 million annually. The figure for 2023 was $3.8 billion. These do not include payments by the Natural Hazards Commission Toka Tū Ake (NHC).

1.0.3 In the 3 years leading up to late 2024, NHC received nearly 10,000 landslide damage claims – almost 10 times the number lodged in the previous 3-year period, which saw just over 1,000 claims. NHC currently receives more claims for damage due to landslides than any other natural hazard, and losses from landslides are much higher than the cost from all other natural hazards combined. (Note that, while some landslides are rainfall-induced, others are triggered by earthquakes.)

1.0.4 Flood damage can also have significant cost consequences for local authorities and therefore homeowners/ratepayers. In early 2025, Bay of Plenty Regional Council said it was anticipating costs of up to $7 million to litigate claims brought against it following the 2017 Edgecumbe flood. Four Edgecumbe residents, one local business and five insurance companies are taking legal action against the council.

1.0.5 NIWA says that rainfall is expected to intensify under climate change, and short intense rainfall is expected to increase the most. The 1-hour duration 1% annual exceedance probability (AEP) rainfall event is expected to increase 14% for every 1°C global temperature increase. (AEP is the chance of an event of a particular size occurring in a single year – 1% AEP means a 1% or 1-in-100 chance of occurring in any one year.) Depending on the path of climate change, one additional degree of warming could occur between 2040–2060, and two additional degrees could occur from 2060 onwards. A separate report jointly published by the Ministry for the Environment and Stats NZ indicated that the total costs from flood are likely to rise. While damage in 2023 (estimated at $9–14 billion, including damage not covered by insurance) was unusually high, more years with extreme costs such as this are possible in future. The report *Our atmosphere and climate 2023* says that 'atmospheric rivers' that carry large volumes of rain from the tropics to cooler regions are projected to get bigger and carry more moisture.

1.0.6 Treasury research found that, on average, around 25% of high-risk homes had flood risk premiums costing at least an extra $250 per year compared to those without flood risk. Other research shows excesses for flood damage of $2,500 upwards are not unusual, with a $10,000 excess imposed on homes in one area before flood mitigation work was completed. Insurers may also replace uncapped reinstatement up to a particular floor area with reinstatement up to a specified sum insured. This happened after the Canterbury earthquakes.

1.0.7 Building a home in an area susceptible to flooding or landslides can bring a number of complications:

- It may require resource consent in addition to building consent, the timeframe for design, consenting and construction may be longer and costs higher and the process may be more stressful.
- Work is more likely to require specific engineering design, so Building Code compliance cannot be demonstrated just by following Acceptable Solutions – again incurring higher costs.
- Higher floor levels may clash with district plan limits on maximum heights. For example, if the floor level must be lifted by 1 metre and the council height restriction for new homes is around 8 metres, this could limit some two-storey home designs. Subsequent penetration of recession planes may be even more problematic – even single-storey homes may have to reduce their building footprint.
- Higher floor levels may also impact on building accessibility – an issue that is of growing importance with our ageing population.
- Where a higher floor level is to be achieved by raising the surrounding ground level, this may potentially result in an increased flooding risk to adjoining properties, which is a breach of Building Code clause E1 *Surface water*.
- Homes built in zones subject to natural hazards may have a Building Act section 72 notice placed on the title. This may make insurance (and mortgage lending from a bank) harder to find now or in the future and limits the liability of the council and NHC. (Note that insurers often have their own models that they price risk on, so insurance availability or premiums may be driven separately to matters such as section 72 notices.)
- Information about flood or landslide risk on LIM reports available to buyers may make a home less attractive to buyers, potentially reducing its resale value.
- Landslide damage can be extremely expensive to fix and cannot be fixed in some cases. The insurance available for land damaged by landslides is extremely limited or non-existent.
- There have been many cases where flood or landslide damage has been so severe that homes can no longer be lived in. Often, neither insurers nor other agencies (such as councils) will cover the cost of fixing this damage. Note that a home does not need to have even been damaged to be uninhabitable – for example, it may be assessed as having an intolerable risk to life due to landslide risk. In West Auckland coastal communities, owners of some almost brand-new homes will be very unlikely to be able to find house insurance.

1.0.8 Many councils have projects under way to reduce the flood risk to residential properties – for example, Auckland Council is working with central government to reduce risks in Māngere by increasing the capacity of Harania Creek and other waterways.

1.0.9 Councils are also in the process of revising district plans to meet new government requirements. Some have mapped out hazard zones, developing resources such as flood maps and slope hazard (landslide) maps that identify areas at higher risk or susceptibility. Whether or not a proposed building falls within one of these areas is typically considered in building and resource consent processes. Identifying and mapping hazard zones is not a cheap process, so areas covered by some smaller councils may not be mapped to the same level of detail as those by larger urban councils. There may therefore be disparities between councils and regions. Be aware also that the maps are generally indicative – a site-by-site, street-by-street identification of all natural hazards by a territorial authority is not physically practicable.

1.0.10 The issue of construction in areas at risk of natural hazards is likely to be subject to legislative changes in coming years. For example, as this bulletin in being prepared, the Resource Management Act 1991 (RMA) is being amended to clarify and reinforce councils' ability to decline land-use consents or impose conditions when significant natural hazard risks are present. Plan changes that introduce new natural hazards rules will have immediate legal effect. The government has also proposed a new National Policy Statement for Natural Hazards.

1.0.11 While this bulletin focuses on the design and construction of individual homes, many of the best approaches to handling urban floodwaters apply at the development or subdivision level. For example, in late January 2023, Hobsonville Point on the upper Waitematā Harbour recorded over a third of a metre of rain in a single week yet saw less damage to homes than other locations hit by similar downpours. Its resilience stems partly from landscaping features such as large areas of planting that reduce stormwater run-off and ponds or basins in the land that can temporarily hold large volumes of stormwater.

1.0.12 As a general principle, building a new home on flood or landslide hazard ground is not a good idea without obtaining specific engineering/geotech advice for the building site. There are some building sites where the risks are reasonably low and can be managed with appropriate planning, design and construction. There are other sites where the hazard risk is so high that the sites should not be built on at all. (Auckland Council has created a depth/velocity chart that is useful in assessing risk to life and property.)

1.0.13 This bulletin focuses on rainfall flooding rather than coastal flooding, which is affected by storm surges, sea-level rise and land rising/subsiding.

2 BUILDING ACT, BUILDING CODE AND STANDARDS REQUIREMENTS

2.1 BUILDING ACT

2.1.1 Under section 71 of the Building Act, building consent authorities (BCAs) must refuse to grant a building consent for construction of a building (or major alterations to a building) if:

- the land is subject or is likely to be subject to one or more natural hazards – erosion, falling debris, subsidence, inundation (flooding) or slippage
- building work is likely to accelerate, worsen or result in a natural hazard on that land or any other property.

2.1.2 However, BCAs can issue consent if they are satisfied that there is adequate provision:

- to protect the land, building work or other property from the natural hazard or hazards
- to restore any damage to that land or other property as a result of the building work.

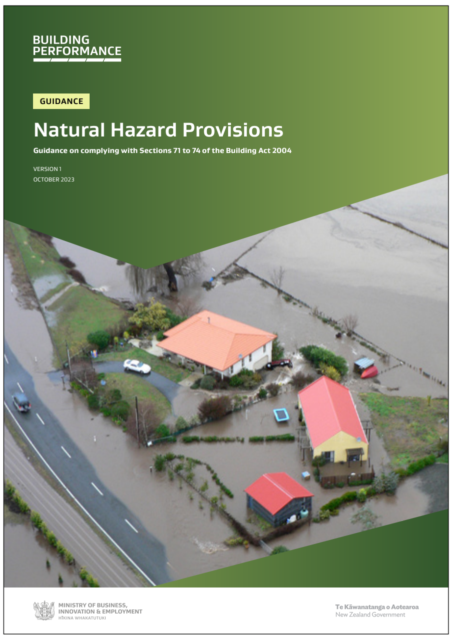
2.1.3 BCAs must issue a consent for building on land subject to one or more natural hazards if they consider that the work will not worsen the hazard on the land or any other property and they believe "it is reasonable to grant a waiver or modification of the Building Code in respect of the natural hazard concerned" (section 72). Many homes have been given consent in locations that some people would consider inappropriate.

2.1.4 If consent is given for building on land subject to natural hazard, a note will be added to the record of title that a building consent was granted under section 72, identifying the natural hazard concerned. Prospective purchasers should check for a section 72 notice. (The Building Act also has a process in section 74 for removing a notice.)

2.1.5 Where a land title has a section 72 note on it:

- the BCA is exempted from liability for damage arising from the natural hazard (under section 392)
- NHC can legally decline to provide cover, depending on the nature of the hazard
- insurance companies may decline to cover or may exclude cover for the relevant hazard.

2.1.6 MBIE has produced a guidance document on the natural hazard provisions of the Building Act. Although the guidance focuses on flooding, it can also be used for other natural hazards listed in the Act such as slippage.



2.1.7 The guidance includes a flow chart that outlines the general process set out in sections 71–74 of the Building Act (Figure 1).

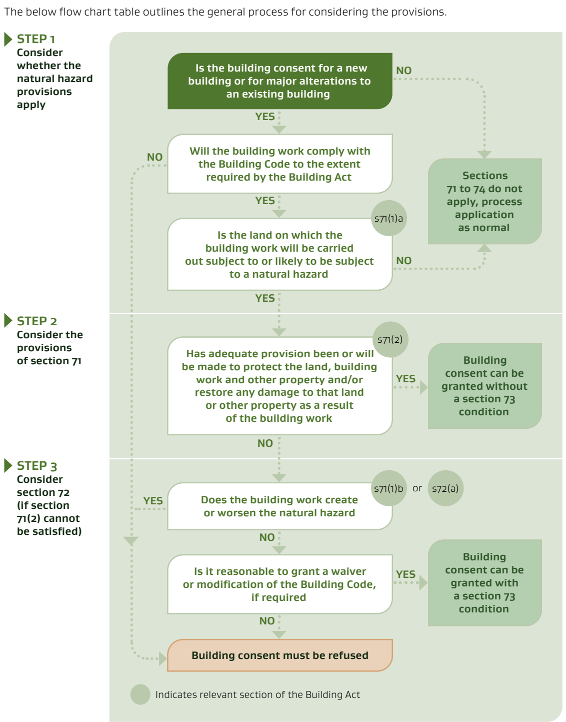


Figure 1. MBIE flow chart outlining the general process for considering natural hazard provisions in the Building Act. (Source: MBIE, *Natural hazard provisions*, 2023, p. 14)

2.1.8 Councils also have the power to grant building consent subject to Building Code waivers or modifications. The waiver or modification may be subject to conditions the council thinks appropriate. Determinations have found that there must be compelling reasons for a waiver, and they must only be granted when it is reasonable to do so.

2.1.9 Houses built in flood zones may require both resource consent and building consent. If resource consent has not been given when building consent is granted, building consent may be issued subject to section 37 of the Building Act. Usually, building work cannot begin until the resource consent is received. After the resource consent is granted, the section 37 restriction will usually be removed, allowing building work to start.

2.2 BUILDING CODE

2.2.1 Building Code clause E1 *Surface water* has the functional requirement that "Buildings shall be constructed in a way that protects people and other property from the adverse effects of surface water." There are three performance requirements:

- Except as required under the RMA for the protection of other property, surface water resulting from an event having a 10% probability of occurring annually and that is collected or concentrated by buildings or sitework must be disposed of in a way that avoids the likelihood of damage or nuisance to other property (E1.3.1).
- Surface water resulting from an event having a 2% probability of occurring annually must not enter buildings. Appendix A in E1/AS1 gives 10% and 2% AEP intensities in mm/hour for locations in New Zealand. Clause E1.3.2 applies only to classified uses Housing, Communal Residential and Communal Non-residential (defined in Building Code clause A1). Carports, domestic garages or sheds are not covered.
- Specific requirements for drainage systems are given in E1.3.3.

2.2.2 MBIE says that a flooding event with 1% AEP is considered the threshold for flooding that amounts to inundation (Figure 2). If the inundation risk does not exceed 1% AEP, the land is not likely to be subject to the hazard for the purposes of Building Act section 71. (The resource consent process also typically uses 1% AEP in assessment and decision making.)

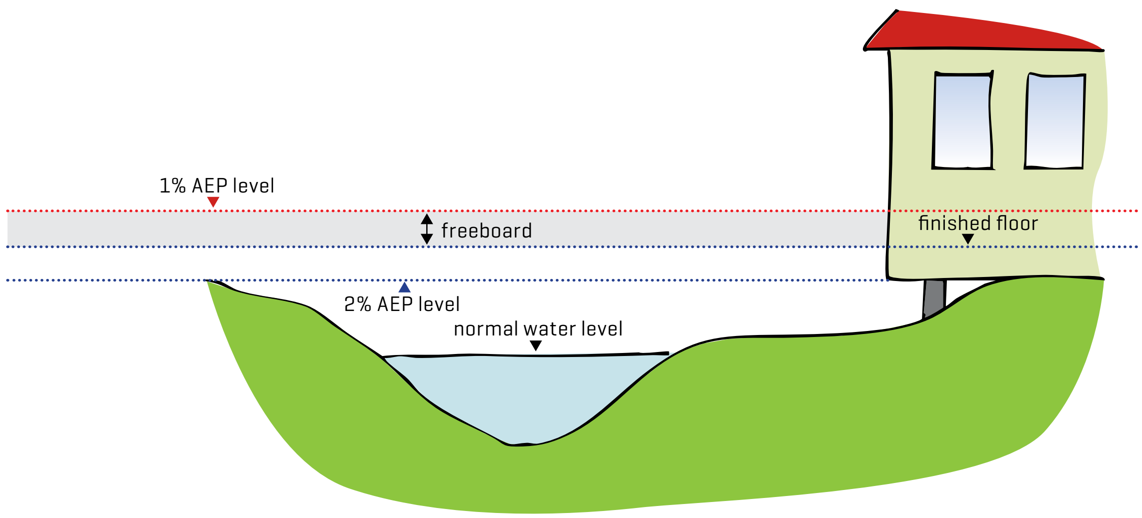


Figure 2. Normal water level, flood levels, freeboard and floor level.

2.2.3 The compliance pathway E1/AS1 (in 2.0 and Figures 1 and 2) sets out a minimum acceptable floor level of at least 150 mm above the finished level of the surrounding ground immediately adjacent to the building. However, the Acceptable Solution only applies to properties with no history of flooding and that are not beside a stream or river and not in a low-lying area or secondary flow path (the route that floodwater will follow if the primary drainage system is blocked or overwhelmed).

2.2.4 For practical purposes, freeboard is an allowance used when setting minimum floor levels (Figure 2). This takes account of uncertainties in flood modelling, potential wave action and other issues. Applying a requirement for freeboard gives higher confidence of water levels not being exceeded. Freeboard requirements of 400 mm or 500 mm are common around the country.

2.3 NZS 3604:2011 *TIMBER-FRAMED BUILDINGS*

2.3.1 Before any design approach is considered, architects/designers should ensure that the scope of relevant standards is not limited by natural hazards. In NZS 3604:2011, the height of piles above cleared ground level (6.4.1.1) can be no more than:

- 600 mm for ordinary piles directly supporting jack studs
- 1.2 m for cantilevered piles
- 600 mm to the highest connection for anchor piles
- 1.5 m for all other concrete or concrete masonry braced or ordinary piles
- 3.0 m for timber ordinary piles and braced piles when they directly support bearers.

2.3.2 While this gives some opportunities for raising floor levels, there will be many cases where a high floor height is required where the standard cannot be used to demonstrate Building Code compliance and specific engineering design will be required.

2.3.3 The structural elements and bracing of pole houses, a construction option suited to steep sites, are outside the scope of NZS 3604:2011 and require specific engineering design. Test boreholes to determine soil properties will generally be necessary, and the engineer may need to engage geotechnical specialists.

3 MBIE DETERMINATIONS

3.0.1 For several decades, there has been a regular flow of relevant MBIE determinations. Many have produced findings that can be applied more widely:

- 2024/069: "Clause E1.3.1 is limited to surface water collected or concentrated by buildings or sitework. However, creating impervious surfaces that don't fall under regulations as buildings or sitework may still require consideration to minimize the effects on other property."
- 2024/067: "protection of 'other property' is not limited to the protection of buildings but the land itself must also be protected ... Not all surface water needs to be disposed of; only surface water resulting from an event with 'a 10% probability of occurring annually' or put another way, a storm or rainfall event of such severity that it only occurs once in every 10 years."
- 2024/050: "The objective of clause E1 concerns injury or illness of people and protection of buildings and other property, not the amenity of the owner."
- 2024/025: "The [Building] Act does not specify any minimum level or magnitude for each hazard listed to be considered a 'natural hazard'...before an event can be considered a 'natural hazard' for the purposes of the Act, it must be more than minimal or trivial."
- 2021/013: It is not sufficient for the property in general to be subject to a natural hazard. "Instead, the land affected by the hazard must be that where the building work is being carried out ..."
- 2016/034: "Life safety is a fundamental principle that underlies the Act and should be taken into account when determining if it is reasonable to grant a section 72 waiver."

4 THE RESOURCE MANAGEMENT ACT AND DISTRICT PLANS

4.0.1 Building or altering a house in a flood zone or areas subject to land instability may require resource consent as well as building consent. While the government is in the process of replacing the RMA with new legislation, the current Act still applies at the time this bulletin is published. Territorial authorities have specific functions under the RMA.

4.0.2 Resource consent may be issued subject to certain conditions being met. This may include, for example:

- earthworks that change the landform and drainage patterns to reduce the risk to the site and neighbouring properties
- relocation of an overland flow path (subject to approval from the council and affected parties)
- setting a minimum floor level for buildings
- mitigation works to remove flooding from a site
- for land instability, requiring works to be undertaken in accordance with geotechnical recommendations.

4.0.3 In the case of subdivision consents where consent notices have been imposed under section 221, a certificate with the details of this must be lodged with the Registrar-General of Land (section 224(c)). Councils will place a flood memo, geotechnical reports and so on in the property file of properties where a section 224(c) certificate has been lodged, which will be available to anyone seeking a LIM report for the property.

4.0.4 Some local authorities apply their own requirements around floor levels and construction in flood zones:

- Auckland Council's Stormwater Code of Practice (in the Auckland Design Manual) sets out freeboard requirements.
- Christchurch City Council has established required minimum floor levels in some areas and specified these in the district plan. This is referred to as the Fixed Minimum Floor Level Overlay area. In other areas, the floor levels may require further assessment and a Minimum Floor Level Certificate must be obtained from the council for all new buildings and additions to existing buildings that increase the ground floor area of the building.

- In the Wellington region, new subdivisions on the Ōtaki and Waikanae floodplains must be sited above the 100-year flood level. Floor levels are given to the bottom of floor joists or concrete floor slab.
- An Inundation Practice Note for Nelson City Council and Tasman District Council explains the methodology for determining minimum ground and/or floor levels for subdivision, new buildings and alterations in areas identified as being subject to inundation.

4.0.5 Councils may also have specific requirements around overland flow paths. They will typically want to consider where minor overland flow paths (with a contributing catchment of less than 2 hectares) enter and leave the site. Ideally, these will remain unchanged, but any application must address potential impacts due to any changes and how these will be managed. Potential erosion could be managed by site vegetation and/or slope stabilisation.

4.0.6 If a major overland flow path (typically with a contributing catchment of 2 hectares or more) is being rerouted, there should be documentation from an engineer available that the new path has been designed to accommodate potential flow rates. Floodwater movement must not be obstructed and floodwaters must not impact other properties.

5 FINDING INFORMATION ABOUT FLOODING AND LANDSLIDE HAZARDS

5.0.1 Recent decades have seen enormous growth in the amount of national and local information available about flooding and landslide hazards. Much of this has been in readily accessible digital resources such as online maps. In many cases, new resources have been driven by legal obligations on local authorities to provide information on individual hazards or natural hazards more broadly. BRANZ Bulletin BU700 *Natural hazard information for building sites* provides more detail.

6 DESIGNING AND BUILDING HOUSES ON SITES AT RISK OF FLOODING

6.0.1 The Building Code is primarily concerned with life safety and does not necessarily require anything additional specific to buildings subject to natural hazard risks.

6.0.2 In addition to meeting national and local requirements about building sites and floor levels, there is a considerable amount that can be done to reduce risk or make future relocation of a building possible. There are very different implications behind the various big-picture options. For example, in Figure 3, the first two options – avoidance and protection – protect both the building and land against flooding. The third option – mitigation – does not and so building consent would be granted under Building Act section 72. (Some properties are protected by stopbanks – the middle image in Figure 3 – but infill housing in these locations is not advised as it will increase the residual risk in the case of an overdesign event.)

6.0.3 Identify and then build away from natural drainage paths or channels. Locate the building on a higher part of the site whenever practicable. Note that this may significantly increase the engineering and construction costs of a new build, which needs to be weighed when considering building on potentially vulnerable sites.

6.0.4 Any structure designed to protect a building or property should:
- be located within the property boundaries or on an adjoining property only with legal permission (such as an easement)
- meet all requirements, including building/resource consents if necessary
- be designed to protect the building for its intended lifespan
- require little or no maintenance.

6.0.5 Retain existing vegetation on site as far as possible, especially mature trees, but take the fire risk into consideration in rural areas. Mature trees can play a significant role in stormwater management. They catch rainwater in their canopies and allow it to gradually evaporate from there, reducing the volume of water reaching the ground. In one American research project that studied 14 storms, this 'canopy interception' for urban areas with relatively high canopy cover was found to average around one-fifth of the total rainfall.

6.0.6 Adopt flood-resilient design in the building itself. This uses materials, construction systems and house design types that can withstand substantial and multiple floods. Flood-resilient design lets homeowners remove and store belongings before a flood event and then clean up and repair after floodwaters recede with less disruption.

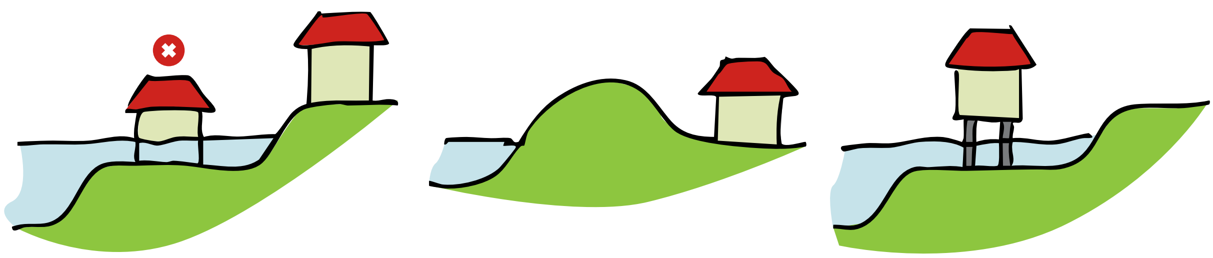


Figure 3. Three approaches – avoidance of flood risk, protection against flood risk and mitigation of flood risk.

6.0.7 Specific design ideas that can make a home more resilient to flooding:

- Ideally, a suitably qualified professional should assess the flood mechanism and then determine specific resilience or resistance measures appropriate for the property.
- Design piled foundations rather than a raft slab with polystyrene in the voids, which can increase buoyancy in extreme cases. Apart from ensuring a higher floor level, piles also allow a home to be more easily relocated at a future date. Bear in mind that a house with a raft slab foundation in Hawkes Bay's Esk Valley was moved 600 m by sediment-dense floodwaters during the 2023 Cyclone Gabrielle floods.
- Set electrical plugs and switches a metre above the floor.
- In multi-storey homes, consider whether the ground and upper floors can have separate electrical circuits with breakers.
- Install utilities such as water heating cylinders on a raised platform rather than on the floor.
- Specify flooring materials with high resilience.
- Specify floor insulation materials with high resilience.
- Specify flood-resilient skirtings.
- Specify solid doors rather than hollowcore doors for exterior entry.
- If there are staircases, make the bottom riser of stairs removable for easy cleaning and drying out.
- Use flood-resilient cabinetry in kitchens and bathrooms.
- Where a home has a basement, ensure the design helps to avoid the risk of basement flooding caused by overland water entering the home. Understanding drainage and drainage paths is key to this. Avoid putting living spaces in the basement and repair cracks in basement walls without delay. Specify a sump pump and position at a low point to aid pumping out water.
- With construction such as brick masonry, ensure homeowners know that ventilation and drainage holes must always be kept clear. Consider whether additional weep holes would be a good idea.
- Ensure gutters and downpipes are sufficiently sized and recommend that homeowners keep them cleared of leaves and other debris.
- Ensure that wall penetrations for pipes and cables are properly sealed.
- Consider whether proprietary flood barriers are appropriate. These can be installed by homeowners to protect a home from flooding if and when the first warnings are issued. Some barriers are slotted into channels that remain permanently installed either side of doors.

6.0.8 Specific design ideas that can make the site more resilient to flooding:

- For homes on sloping ground, try to avoid sealed driveways directing surface water towards the house.
- Specify permeable paving where practicable.
- Ensure that paved and unpaved surfaces within 2 m of a home direct stormwater away from the home.
- Recommend that homeowners keep drainage ditches clear of vegetation and debris.
- When identifying how a site will be set out, design car parking for areas of higher ground rather than lower ground.
- Specify swales, ponds or detention tanks to hold stormwater.
- Homeowners should be made aware of where the overland flow paths are on their site and make sure the flow paths remain protected.

6.0.9 The design ideas above assume houses may be flooded and provide ways of reducing the costs of remediation or refurbishment. While mitigation measures such as a raised floor level may mean that a house will be less damaged by a flood, there could still be life safety issues if people attempted to leave the house. Critical to the early assessment of a site is to make sure that flooding anticipated on the property does not cause risk to life. Areas that are identified as risk to life – both in floodwater depth and velocity – should not be built on.

6.0.10 When building goes ahead in an area susceptible to flooding, potential evacuation routes during flood events should be considered. If the floor could be inundated in an extreme event, the house occupants will have difficulty evacuating.

7 MORE INFORMATION

AUCKLAND COUNCIL

- Building on land at risk of a natural hazard
- Creating a flood resilient home
- Preparing your property for flooding

BRANZ

- BU702 *Construction work after an emergency*
- BU700 *Natural hazard information for building sites*
- BU597 *Timber pole house construction*

CRESA

- Selecting a site for your home

GNS SCIENCE

- Natural hazards and risks – Landslides
- Landslide planning guidance

MBIE

- Step-by-step guide: Natural hazard decision making process
- Managing stormwater
- Natural hazard provisions
- Resilient homes – flooding

MINISTRY FOR THE ENVIRONMENT

- Climate Projections Map
- Coastal hazards and climate change guidance
- Our atmosphere and climate 2023

NATURAL HAZARDS COMMISSION TOKA TŪ AKE

- Natural Hazards Portal
- Slopes and retaining walls

NIWA

- High Intensity Rainfall Design System (HIRDS)

OTHER

- Landslides NZ (including NZ Open Landslides Database)

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