The Treasury

Residential Flood Insurance Issues Information Release

December 2022

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https://www.treasury.govt.nz/news-and-events/reviews-consultation/residential-flood-insurance-issues

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Proprietary and Confidential

A National Flood Risk Assessment of NZ

September 2021

Empower Results®

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Introduction

Aon has been engaged to assist EQC and Treasury in understanding the cost of the flood peril in New Zealand and undertake preliminary analytics around the implications of this risk for establishing insurance premiums. This work has been undertaken to help inform discussions about the affordability or otherwise of flood insurance in New Zealand.

As an extension of this work, we have offered some qualitative and quantitative analyses of potential implications of the Crown assuming this risk, including a preliminary analysis of the impacts of including this risk in the current EQC scheme.

Assessing Flood Risk in New Zealand

Accurately quantifying flood risk consistently across New Zealand has only been recently made possible thanks to significant advancements in national-scale hydrological modelling and computing power. These recent technical advancements allow the development of detailed national flood hazard data and catastrophe loss models which are both beginning to emerge. Examples include the RMS NZ Flood model (which combines river and surface water flooding) and the Ambiental NZ FloodCat model (which relates to river flooding only). s9(2)(b)(ii) and s9(2)(ba)(i) [redacted]

To examine the overall financial implications of flooding across the New Zealand population, we can either utilise the available catastrophe loss models or use the detailed flood hazard maps that cover all sources of flood hazard (river, coastal and surface water flooding). Catastrophe models are useful tools for examining risk at a portfolio level, but for this assessment we've utilised the national hazard maps covering all sources of flooding rather than use catastrophe loss models. The main reasons for using the detailed hazard maps over catastrophe loss models are:

1. We can calculate flood risk at each unique building outline as opposed to an address point location (used by available catastrophe loss models). Flood risk varies considerably over very small geographic distances, it is therefore vital to quantify flood risk at the individual building (i.e. asset) outline over address points which are associated with a land parcel for greater confidence in our risk assessment.

2. Using the detailed hazard maps means we are able to consider all the main sources of flood hazard impacting the New Zealand population whether this be from river, coastal or surface water sources.

3. We can use the most detailed national view of the flood hazard across NZ (5m in urban areas and 8m in rural areas), rather than the coarser resolution used in most catastrophe models.

4. The approach taken allows a consistent assessment of risk on a national basis. This consistency is crucial to ensure regional / study specific nuances do not introduce bias into the comparative risk assessment.

s9(2)(b)(ii) and s9(2)(ba)(i)

[redacted]

s9(2)(b)(ii) and s9(2)(ba)(i)

[redacted]

Risk Calculation Methodology

s9(2)(b)(ii) and s9(2)(ba)(i)

Matching Buildings to Address Data

To assign flood insights at each building outline to all residential addresses across New Zealand, we have been supplied a national address database by EQC that includes 100% of all residential homes across the country (including Kainga Ora). This national database is based on the same raw address dataset that is processed for modelling in EQC's 2021 / 22 reinsurance renewal and totals 1,719,774 homes across New Zealand. Each individual home in this database is represented by a single point location, not a building outline. We therefore spatially match the national address database provided by EQC to the LINZ national 'Building Outline' database that contains building footprints and modelled flood inundation data.

There are limitations to the address matching exercise. The quality of the national address point location for each individual address is vital as we need to select the representative building building footprints.

- For 80% of national address points across New Zealand, the address point is geographically located inside a specific building outline and we therefore have a high associated confidence with the flood risk information at these addresses.
- For 14% of national address points, the address point is geographically located outside of the building outline but within 25m and so we have a moderate confidence in the flood risk assessment at these addresses.
- For 6% of national address points, the point locations are geographically located beyond 25m from the building outline and so we have low confidence in the flood risk assessment at these addresses. These low confidence records are geographically dispersed across the country and not concentrated in any particular territory, with less than 200 homes within each territorial authority. Overall, it is not expected that these low confidence locations will skew the findings in any material fashion.

s9(2)(b)(ii) and s9(2)(ba)(i)

[redacted]

s9(2)(b)(ii) and s9(2)(ba)(i)

s9(2)(b)(ii) and s9(2)(ba)(i)

Estimating National Average Annual Loss (AAL)

The damage values calculated above do however represent loss to an individual asset, insensitive to the correlation effects of rainfall and flooding occurring across a catchment and / or multiple catchments. As a result, the sum of these risk level values would likely overstate the risk. As such, we have calculated a national Average Annual Loss (AAL) to estimate the technical premium pool required to support the flood risk in New Zealand.

The ICNZ national ‘Cost of Natural Disasters’ database (ICNZ, 2021) provides reported industry loss data running from 1968 to present and reports major event loss statistics by simplistic natural hazard category definitions (Flood, Storm, Earthquake). These data provide a useful observational record to inform an annualised insurance loss values in recent decades for the insurance market as a whole and offer useful insight to the frequency of major events back to 1968.

We inflate the insured loss values in the ICNZ database into 2021 values and use a time-weighted approach to estimate the annualised cost using the past 20 years of record. We assign the highest weighting to the most recent 5 years of record, the second highest weight to losses occurring between

5-10 years ago, third highest weight to losses occurring 10-15 years ago and finally lowest weight to losses occurring 15-20 years ago. This time-weighted approach is common practice in weather underwriting and takes account of any changing climate patterns over the last 20 years. We ignore loss experience pre-2000 that does include several significant loss events. While use of these event statistics are useful to understand overall event frequency, the normalised loss outputs grow in uncertainty over time with inflationary effects a multiple of actual loss. An example of this methodology is provided in Table 1.

Table 1: Example ICNZ 'Riverine Flood' Loss Calculation

Record Period	Annual Average Loss
Last 5 Years	$99,329,757
6 - 10 years	$78,202,392
11 - 15 Years	$58,594,623
16 - 20 years	$48,723,724
Annual Average	*$71,212,624*

The ICNZ database specifically defines a 'Flood' category that we use to define river flood events. Recognising that the ICNZ loss list considers all classes of business, not simply householders, these values have been discounted. It is estimated that approximately 85% of flood losses are associated with residential policies, resulting in an AAL of approximately $60M for riverine flood losses to residential property.

From a surface water flooding perspective, there is no explicit categorisation and rather these are inherently captured within the overall reported 'Storm' event classification. The majority of property damage in storm events is due to either wind or water ingress damage (typically 70-80% of the total storm event loss). Isolated surface water flooding is typically responsible for 20-30% of the overall storm loss in any given event. We therefore calculate the annualised cost of 'Storm' events from the ICNZ database (similar to 'Flood' events) and assume a 25% proportion of this 'Storm' loss is driven by surface water flooding. The result of this analysis is an AAL of $15m for surface water flooding.

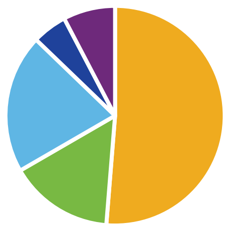
There are no observed coastal flooding events in the ICNZ database, accordingly a subjective AAL of $10m has been applied to account for this risk.

As a result of this analysis, a national AAL is derived to be approximately $85M. Whilst appropriate for a first order assessment of potential costs, the above methodology for developing the AAL should be refined further for application in formally setting premiums.

This AAL can now be disaggregated across the portfolio by normalising the individual risk results generated above, with the logic being that the relative risk presented by a building will be relatively consistent as these have been calculated from a ground up peril basis. The result allows the address-level calculation of mean annual damage at each unique home across New Zealand from river, surface water and coastal sources.

Please note, the ratios in this figure are for illustrative purposes only and do not represent the relativities between

Figure 4 : Constituents of an Insurance Premium



It is important to note here that the technical AAL calculated above is one base component that feeds into creating an insurance premium, rather than the final premium charged to a policy holder. The premium itself will include additional loadings, some of which are illustrated across, with their relative contribution to the overall cost.

When creating premiums for distribution to policy holders, insurers often mitigate the impacts of extremes in the technical flood rate, employing strategies such as 'capping and cupping'. Capping sets a maximum amount that premiums can increase at renewal for a given policy. For example, an insurer may set a cap of 20% for home and contents product premium increases overall, even if a change in the technical premium, or a premium adjustment would otherwise generate a far greater increase. Capping is often used as a way of reducing price shock to customers from year to year and smooths premium increases over time. Cupping (or collaring) on the other hand is a limit on the amount of premium reduction. These strategies have not been employed in the current analysis, however, may skew the results shown herein when compared to open market pricing.

s9(2)(b)(ii) and s9(2)(ba)(i)

How Many Homes are Exposed to Flooding?

Using the risk-level flood hazard, we calculate national aggregate values of exposure for New Zealand. We can calculate these national aggregate totals individually for each separate source (river, coastal and surface water) and collectively as a whole. This combined view is provided below in Table 2 and covers the aggregate risk-level exposure to modelled floodplains at multiple return periods (expressed in years). The aggregate risk counts for each individual peril is provided in Appendix 1.

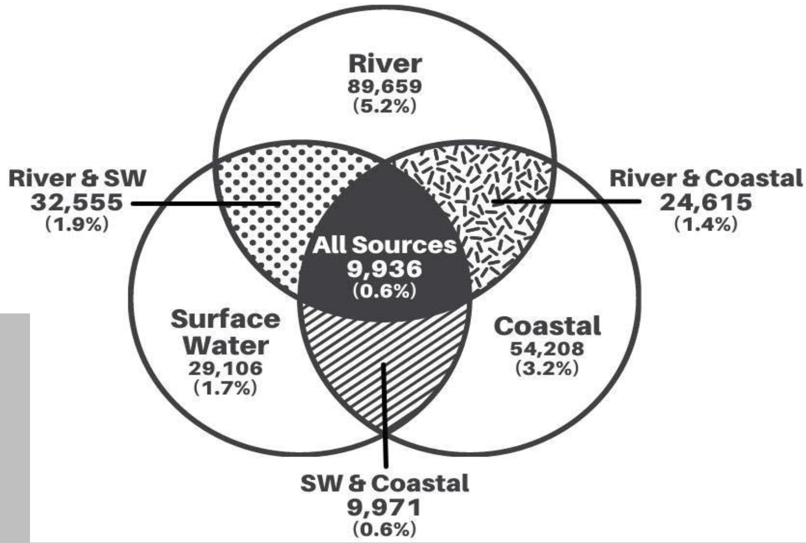
Table *2* finds there are 250,050 homes exposed to flooding (14.5% of all homes). We find that 8% of homes (137,499) are particularly exposed to flooding (within the modelled 1% floodplain, or 100-year return period). We find 5% of homes (88,647) are extremely exposed to flooding (and within the 5% floodplain, or 20-year return period). The sum insured listed below is taken from the data provided by EQC.

Table 2: Flood Exposure Counts: All Residential Property (including NZHC)

Return Period (Years)	Home Exposure Count	Home Exposure (%)	Total Sum Insured	Total Sum Insured (Average)
<= 20	88,647	5.2%	$36,162,721,249	$407,941
<= 50	109,909	6.4%	$44,756,675,815	$407,216
<= 100	137,499	8.0%	$55,596,522,520	$404,341
<= 200	163,924	9.5%	$66,418,278,718	$405,177
<= 500	185,324	10.8%	$75,128,699,716	$405,391
<= 1,000	201,811	11.7%	$82,100,222,810	$406,817
<= 10,000	250,050	14.5%	$101,999,485,278	$407,916
Total National	***1,719,774***		***$751,450,300,974***	***$436,947***

The diagram across illustrates the contribution to flood exposed properties from each form of flooding. This illustration clearly shows the dominance of riverine flooding risk. Interestingly, almost 10k locations are exposed to all three flood mechanisms.

Figure 5 : Risk Count by Flood Peril



s9(2)(b)(ii) and s9(2)(ba)(i)

[redacted]

s9(2)(b)(ii) and s9(2)(ba)(i)

[redacted]

s9(2)(b)(ii) and s9(2)(ba)(i)

Is there a change in flood prone risks through time?

The data provided include information related to the year a property was constructed, with data grouped into 5-year bands. Using these data, we have extracted a flood prone risk count, by each 5-year period, which is shown in Table 3.

Table 3 : Flood exposed risk count by age band

Year	Home Risk Count
2020	8,991
2015	190,606
2005	223,119
1995	191,979
1985	174,754
1975	238,115
1970	39,242
1965	200,093

Recognising that the 2020 band is incomplete, there does not appear to be a strong migration to or away from flood risk through time.

s9(2)(b)(ii) and s9(2)(ba)(i)

s9(2)(b)(ii) and s9(2)(ba)(i)

[redacted]

What are the National Costs Associated with Flood Risk?

At a national aggregate level, we calculate the market residential AAL from flooding to be NZD 85m. This national aggregate total is driven mostly by the river flood peril (NZD 60m) with surface water flooding (NZD 15m) and coastal flooding (NZD 10m) making up the remainder.

s9(2)(b)(ii) and s9(2)(ba)(i)

[redacted]

s9(2)(b)(ii) and s9(2)(ba)(i)

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s9(2)(b)(ii) and s9(2)(ba)(i)

s9(2)(b)(ii) and s9(2)(ba)(i)

Financial Impacts on the Crown

We have assessed the financial impacts of the Crown providing insurance coverage for the flood peril across all NZ homes. The section below outlines the implications of some of these for decision making, as well as introduces some other considerations regarding any Crown involvement in helping alleviate affordability concerns regarding flood insurance.

The implications of Crown protecting Flood risk

The work undertaken in the previous section creates a solid foundation upon which to assess the implications of incorporating flood risk into EQC or an alternative Crown own mechanism.

Very simply, the AAL, or risk cost associated with flood is approximately $85m, or $46 per household, or $340 per flood exposed household. This value may be distributed between EQC, the Private Market and reinsurers, however any distribution does not lessen the total risk cost. In fact, any method for distributing this risk beyond the Crown will incur increased cost as all external risk carriers apply margins on the risk. The question then becomes what qualitative considerations need to be made in order to manage such a change in the distribution of the risk.

s9(2)(f)(iv)

[redacted]

s9(2)(f)(iv)

s9(2)(f)(iv)

s9(2)(f)(iv)

[redacted]

s9(2)(f)(iv), s9(2)(b)(ii) and s9(2)(ba)(i)

[redacted]

s9(2)(f)(iv)

[redacted]

s9(2)(b)(ii) and s9(2)(ba)(i)

[redacted]

s9(2)(b)(ii) and s9(2)(ba)(i)

Concluding Thoughts

We have undertaken an analysis of flood risk in New Zealand using per risk flood height data, coupled with industry loss information. The result is that for every house in New Zealand an estimated cost of risk can be developed.

Following this analysis, various high-level observations can be made, most notably:

- The Average Annual cost of flooding to New Zeeland is estimated to be approximately $85m, coming from riverine, surface water and coastal inundation.
- 250k risks (14% of national housing stock) are exposed to some type of flooding in New Zealand, with 88k risks (5% of national housing stock) exposed to extreme flood risk (i.e. < 20-year return period).
- When accounting for population, the flood risk in New Zealand is most severe in rural areas.
- 67% of flood exposed risks are expected to have a technical flood premium below $250.
- s9(2)(b)(ii) and s9(2)(ba)(i)

s9(2)(b)(ii) and s9(2)(ba)(i)

s9(2)(b)(ii) and s9(2)(ba)(i)

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s9(2)(b)(ii) and s9(2)(ba)(i)

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