Internal Affairs
Te Tari Taiwhenua

45 Pipitea Street
Wellington
Phone 0800 25 78 87
dia.govt.nz

24 April 2026

Joshua Riley
fyi-request-34241-f554e565@requests.fyi.org.nz

Tēnā koe Joshua

Your Official Information Act request, reference OIA 2526-1024

Thank you for your email of 25 March 2026 to the Department of Internal Affairs (Department) requesting the following information under the Official Information Act 1982 (the Act):

> *"My request relates to the report titled "Vulnerable Communities Exposed to Flood Hazard," dated August 2022 and proactively released by the DIA in October 2022. Specifically, I am seeking the underlying data, modeling, and communications used to establish the boundary and classification of the Hokianga Harbour / Hokianga Region as a vulnerable community exposed to flood hazard (as listed in Table 1 and Figure 1 of the report).*
>
> *I am requesting the following specific information referenced in the report's methodology (Section 4):*
>
> *1. NIWA Composite Data (Section 4.7): All specific surface-river flood hazard data and coastal flood hazard data (including the +1.2m sea level rise scenario) that NIWA provided to the DIA or its contractors for the Hokianga area.*
>
> *2. Qualitative "Mural Board" Data (Section 4.8): Copies of the specific notes, comments, and mapping pins that Regional Council River Managers and Tonkin+Taylor flood practitioners placed on the online 'Mural Board' map regarding the Hokianga Harbour area.*
>
> *3. GIS/Riskscape Outputs (Section 4.9 & 4.10): The ARCGIS map layers, shapefiles, or Riskscape outputs that show exactly how the hazard data was overlaid with the NZDep 2018 SA1 unit data to establish the specific geographic boundaries of the "vulnerable community" in Hokianga.*
>
> *4. Historical Validation (Section 4.11): Any specific records from the Historical Weather Events Catalogue (NIWA) or Radio New Zealand archives that were used to validate the flood hazard exposure specifically for the Hokianga area.*
>
> *If this information is held in digital mapping formats (such as GIS shapefiles or KML/KMZ files), I would prefer to receive it in those original formats alongside any standard PDF reports."*

Response to the request

Question 1.

In response to question 1, it is noted by the Department, that NIWA provided surface river flood and coastal flood modelling to Tonkin and Taylor to feed into their summary report. This report is titled *Review of Vulnerable Communities Exposed to Flood Hazard in New Zealand.* This is attached as **Appendix A**.

Please note the limitations and assumptions set out in pages 11-14 of the Tonkin and Taylor report as you read it. Some of the critical limitation about the report includes that:

- the report was a snapshot in time;
- the report was carried out in a short timeframe and requires further checks with stakeholders for accuracy;
- severity of flood hazard at different locations is not known; and
- urban flood hazard has not been investigated at the property level.

With regards to your question, we also refer you to NIWA's *Coastal Flood Layers Viewer* linked here: https://niwa.maps.arcgis.com/apps/instant/slider/index.html?appid=842bf7ef81cf4faaa1d5b0c3013c733f.

This model shows a map of New Zealand Aotearoa, allowing you to navigate anywhere on the map and view sea level rise scenarios of up to 200cm. Information on functions, data and references are found by clicking the icons on the right-hand side of the map.

Specific information on the data used by NIWA to inform the Tonkin and Taylor report, and subsequently the Department's report *Vulnerable Communities Exposed to Flood Hazard,* dated August 2022, may be obtained by contacting NIWA directly.

Question 2.

A link to the *Mural Board* is found on page 4 of the Tonkin and Taylor report attached as **Appendix A**. You can enter the *Mural Board* by logging in as a visitor.

Question 3.

We refer you to NIWA's *Coastal Flood Layers Viewer,* in response to question 1 and NIWA's RiskScape website linked here: https://www.riskscape.org.nz/.

Question 4.

Links to access records from the *Historical Weather Events Catalogue (NIWA*) or *Radio New Zealand archives* can be found on page 11 of the Tonkin and Taylor report attached as **Appendix A**.

Accessing the Ombudsman

You have the right to seek an investigation and review by the Ombudsman of this decision. Information about how to make a complaint is available at https://www.ombudsman.parliament.nz or freephone 0800 802 602.

Nāku noa, nā

Jade Badcock
Manager, Ministerial Services
Water Services Reform Programme

Appendix A

Review of vulnerable communities exposed to a flood hazard in New Zealand

Executive Summary

This report, prepared for the Department of Internal Affairs (DIA), provides maps showing vulnerable communities exposed to a flood hazard (names and locations only). This information forms part of a response to Community Resilience Minister's question around "*How many other 'Westports' are there in New Zealand?".*

Ministers were interested to find out how many communities suffer from ***both*** a high level of socio-economic vulnerability and exposure to a high[1] flood hazard in New Zealand, as Westport does?

In response to a tight deadline the analysis was conducted using the knowledge of flood experts from across New Zealand, including technical experts from Tonkin & Taylor Ltd (T+T) and the River Managers Group[2]. Supplementing this was an analysis completed by the National Institute of Water and Atmospheric research (NIWA).

NIWA was engaged to use their existing composite flood hazard map of New Zealand[3], which consists of existing fluvial and pluvial flood hazard maps produced by various regional and local councils, and coastal flooding data maps. As detailed in this report, this dataset combines historical flood maps with modelled flood maps of a wide range of average recurrence intervals (ARIs) – i.e. from 10 to 500-year ARI, and some flood extents of unknown ARI. The dataset was compiled in 2018 from available flood data and does not include more recent flood modelling information produced around New Zealand. The mapping layer does not contain any information as to the severity of the hazard (i.e. depth, speed or duration of flooding). The composite flood hazard map was intersected with the NZDEP2018 data which is an indication of the socio-economic status of communities in each 'NZ Stats Area 1' (available at: EHINZ)[4]. The dataset classifies communities by socio-economic status into 10 deciles (10% increments) based on nine census variables. NZDEP2018 Decile 10 represents areas with the highest socio-economic needs and was adopted by the DIA for the purposes of this study as representing those communities who are likely to be worst affected by any flood event, all else being equal. For the purposes of this study, these are referred to as "vulnerable" communities, though we note that this term often has a more broad definition with respect to flooding. This first-pass screening approach from NIWA provided useful corroboration and a basis for refinement of the analysis completed by flood experts.

Due to the limitations and assumptions of the adopted approach it is certain that **there will be some vulnerable communities missing from the maps provided in this report and communities included that may not be exposed to a high flood hazard**. Whilst not providing a comprehensive list of vulnerable communities exposed to a flood hazard, what the work does do is provide a sense of the

[1] Due to insufficient data being available at a national scale on the severity of exposure to flood hazards (in a consistent manner), it was not possible to define if communities were exposed to a 'high', 'moderate' or 'low' flood exposure from the NIWA analysis. Flood experts were asked where communities had a high exposure to flooding.

[2] The River Managers Group consists of the lead flood managers from each regional council in New Zealand

[3] Paulik, R., Collins, D., and Craig, H. (2019). New Zealand Fluvial and Pluvial Flood Exposure. Accessed at: (PDF) New Zealand Fluvial and Pluvial Flood Exposure (researchgate.net)

[4] Environmental Health Intelligence New Zealand (2018). Accessed via website. Visit: EHINZ

scale of this kind of exposure across the country and identify key areas for further work (see recommendations in Section 4).

Communities with a **population of 50[5] or more** that sit both within a floodplain as defined within the composite flood hazard maps and score **10 on the NZDEP2018 Decile** (i.e. vulnerable communities) were flagged as the communities exposed to a flood hazard in response to the Ministers' question.

A key limitation with the NIWA analysis is that the individual maps that are included within the composite national data set each use different methods, thresholds and climate change allowances across the country (i.e. for the most part each council uses different methods and parameters to develop their flood hazard maps). There is not a single consistent flood hazard data set for New Zealand. This is currently being developed by NIWA through their project: *Mā te haumaru ō ngā puna wai ō Rākaihautū ka ora mo ake tonu: Increasing flood resilience across Aotearoa*

Without time to subject each council's flood hazard data set to analysis or quality assure (QA) the metadata used within the NIWA analysis, the approach is considered rudimentary and likely leading to wrong identification/non-identification of communities in places. The approach extracted the floodplain extents and captured any communities that are located within the footprint of a 100-year floodplain from the composite flood hazard map. The average recurrence interval (ARI) interval footprint of the floodplain will vary across the regions, further constraining outputs, and it is noted that overland flow paths can often exist outside of the extent of identified/mapped floodplains meaning that they would not be identified in the NIWA analysis. Effectively, communities are either 'in' or 'out' of the floodplain (sometimes referred to as flood prone areas). There are significant limitations with this which are detailed in this report. The socio-economic data was then overlaid to see where NZDEP2018 Decile 10 communities were located within floodplain footprints.

Comments from technical experts from around the country were supplemented by this NIWA data to identify overlaps, gaps, or inconsistencies with the NIWA analysis.

The main output from this work are *indicative* maps of socio-economically vulnerable communities that, based on available information, are likely to be exposed to a flood hazard.

To confirm the exposure to a flood hazard of locations identified in this report site specific analysis would need to be completed. This report is designed to give an overview of the scale of flood exposure for socio-economically vulnerable communities in New Zealand, and as a preliminary investigation to a first phase of work. Recommendations are provided in Section 4 for next steps.

This report is structured in four parts:

1 Methodology
2 Limitations and Assumptions
3 Maps of communities identified through the analysis
4 Recommendations

[5] Community was defined during discussion with DIA and T+T as being a population of over 50 people as it represented a small settlement. Defining communities at a lower population number would have brought up many more locations in the analysis. Ministers were interested in getting an understanding of the scale of the problem so looking at where larger vulnerable populations might be concentrated necessitated a minimum population cut-off for defining 'community'.

Applicability

This report has been prepared for the exclusive use of our client the Department of Internal Affairs for them to report back to Community Resilience Ministers.

1 Methodology

The analysis primarily relied on observations and comments from technical experts, canvassed through the use of an online mural board.

A secondary source of information was provided by NIWA, who developed a methodology for combining existing flood hazard mapping with socio-economic vulnerability mapping to identify communities likely to be both subject to flood hazard and high socio-economic vulnerability.

The outputs from the NIWA analysis were then used to sense check against the information provided by flood experts. This section provides an overview of the approach taken to generate each data set. Limitations and assumptions of this approach are then set out in the subsequent section.

1.1 Observations/comments from flood practitioners (Mural Board)

A qualitative task was completed to draw on the expertise of flood practitioners from around the country as to their knowledge of communities exposed to flooding. To access this knowledge a mural board was shared with flood experts from T+T and the River Managers Group. Both groups were asked to identify where socio-economically vulnerable communities were believed to be exposed to high coastal, fluvial, and/or pluvial flood hazard (though noting that flood hazard experts are not likely to also be experts on socio-economic data sets). Information was also received via email and added to the mural board. The results of this exercise are presented in **Figure 1**.

A limitation with this qualitative form of analysis is that experts had extensive knowledge of flood hazards but relatively less knowledge of socio-economic data. As a result, a number of locations which do not suffer from a high level of socio-economic vulnerability were flagged through the exercise. For example, locations such as Queenstown and Wanaka were noted on the mural board, despite not having NZDEP2018 Decile 10 units identified within the towns. All qualitative results were cross-checked against the NIWA analysis (see below) prior to their inclusion or exclusion from of the maps provided in Section 3.

The results from the mural board were exported to a .csv file and then converted to .shp files. These are presented in **Figure 2** (North Island) and **Figure 3** (South Island).

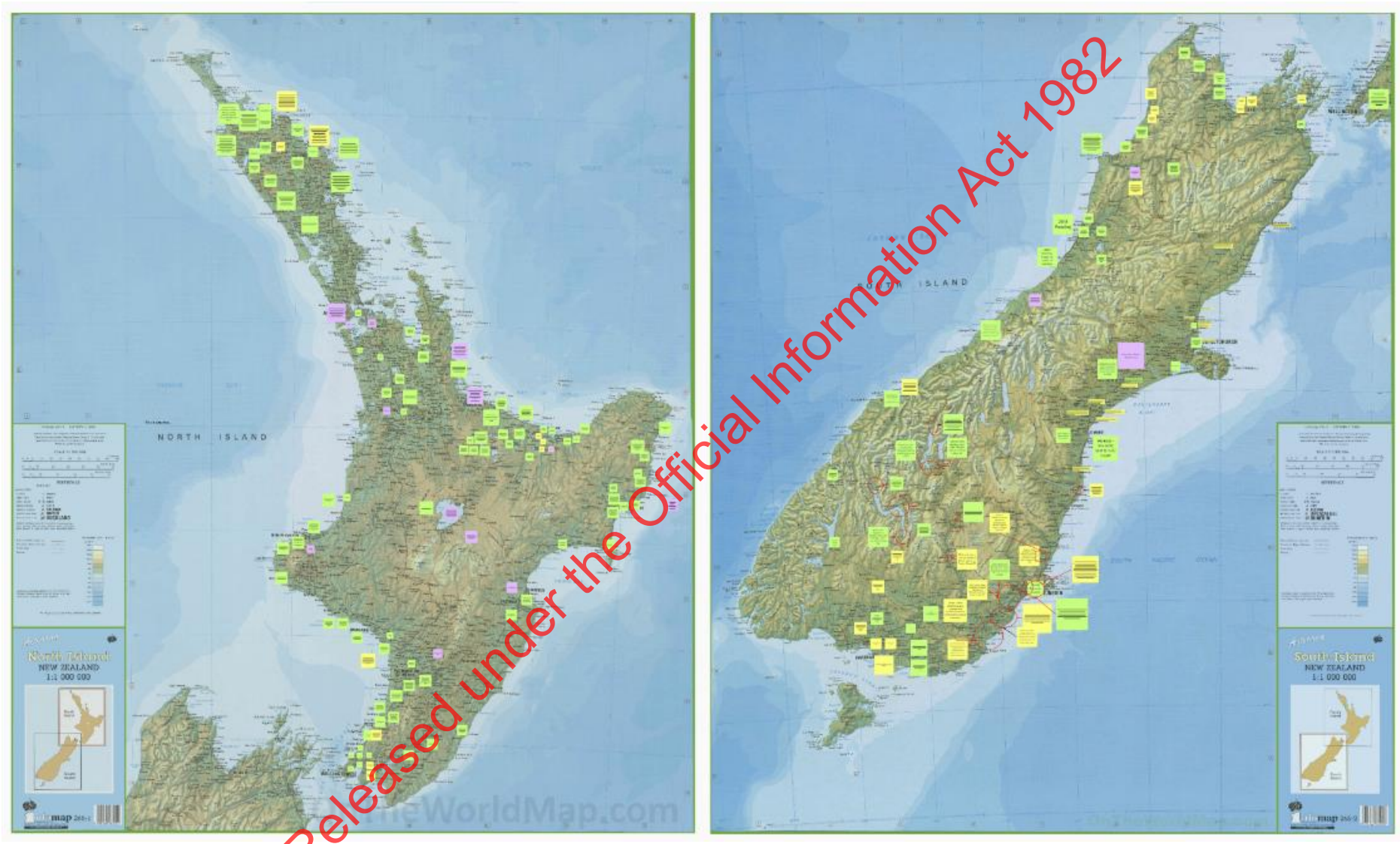

Figure 1: *Final mural board with notes added by T+T specialists and the River Managers Group*

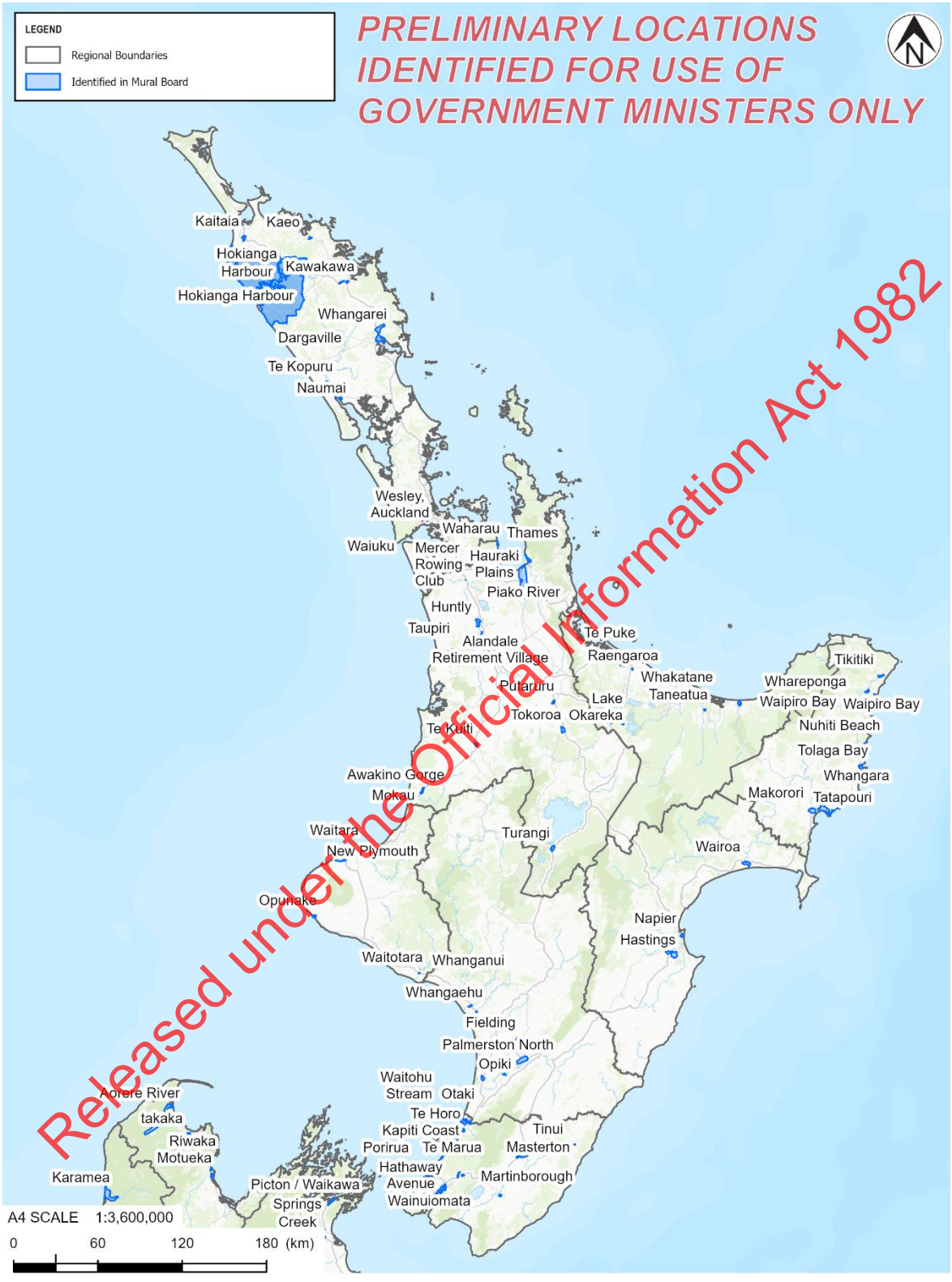

***Figure 2**: Map of the North Island showing areas identified by flood practitioners as having high flood hazard and likely high socio-economic vulnerability.*

***Figure 3**: Map of the South Island showing areas identified by flood practitioners as having high flood hazard and likely high socio-economic vulnerability.*

1.2 NIWA Analysis

NIWA used their RiskScape tool to identify NZDep2018 Statistical Area 1 (SA1) unit boundaries that intersect with floodplain areal extents derived from a national composite flood hazard data set which was developed using their methodology below.

The first step was to prepare the national composite flood hazard data set which includes:

1) A composite fluvial-pluvial flood hazard area map from public sources; and
2) Coastal flood hazard area maps based on 100-year average recurrence interval (ARI) sea level events for both the present-day scenario and including +1.2m sea level rise (SLR) (i.e. NZ RCP8.5 H+ SLR projection for 2123, as adopted by NIWA)

NIWA's metadata information on this dataset is provided **Appendix A**. Following the preparation of the 'national composite flood hazard layer' the NZDEP 2018 SA1 units were imported into RiskScape and intersected with the composite flood hazard layer. Any SA1 units with a Decile score of 10 (i.e. most vulnerable according to socio-economic metrics) that were located within a floodplain extent were identified as socio-economically vulnerable communities potentially exposed to a flood hazard and taken forward for further analysis.

Further to the above, an estimate of usually resident populations within SA1 units exposed to a flood hazard was completed by NIWA to understand the proportion of the population flagged as being exposed to a flood hazard. This was done using their recommended approach below:

- Broadly identifying what 'objects' from the Land Information New Zealand (LINZ) building outlines dataset may represent a habitable building (i.e. assumed these are objects with an outline area between 70m2 and 1000m^2);
- Estimate the number and outline area of defined habitable buildings within SA1 units;
- Calculate a m^2 population rate for SA1 units (i.e. outline area of defined habitable buildings/usually resident population);
- Estimate the number and outline area of defined habitable buildings within SA1 units exposed to fluvial, pluvial and/or coastal flooding; and
- Join the above information to SA1 units that had a NZDEP2018 Decile 10 score.

For the purposes of this analysis, a **community was defined as a location (i.e. small settlement, town, city, but not the sum of isolated rural properties over a large area) with a population of more than 50 people** (as per DIA/T+T discussion and agreement).

It should be noted due to the method employed there is **low confidence in the population estimates** derived from the analysis above and population counts of exposure to flood hazard is not provided in this report. This aligns with the scope which was to identify **locations only**. Refer to Section 2 for further details about the limitations associated with the population estimates.

Following the processing of the datasets the RiskScape model was run, and outputs generated. Outputs were reviewed by NIWA and provided in spatial (.shp) and tabular (.csv) formats. These are presented in **Figure 4** (North Island) and **Figure 5** (South Island).

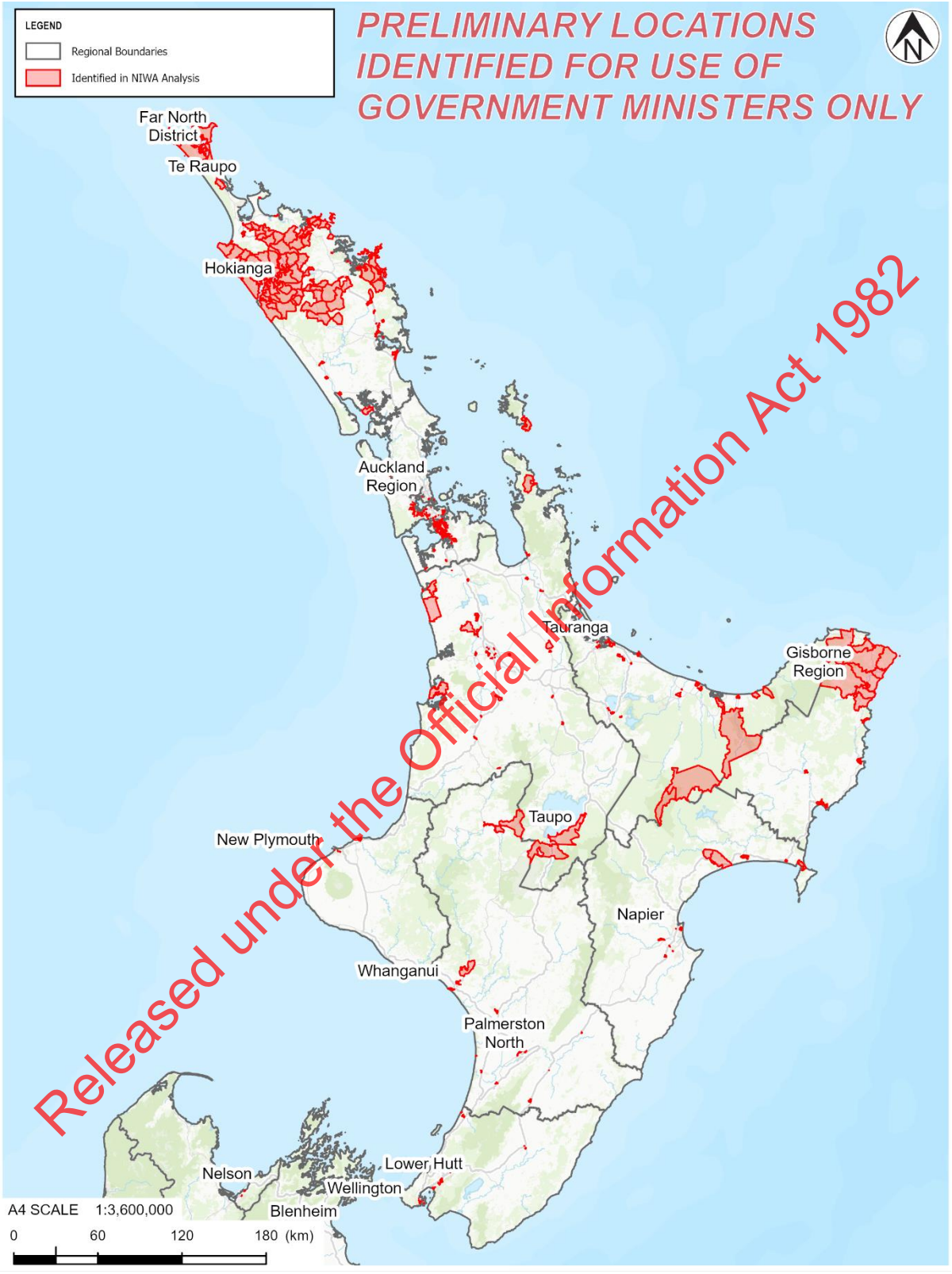

***Figure 4**: Map of the North Island showing areas identified from the NIWA analysis as being exposed to flood hazard and a high socio-economic vulnerability score (i.e. NZDEP2018 Decile 10)*

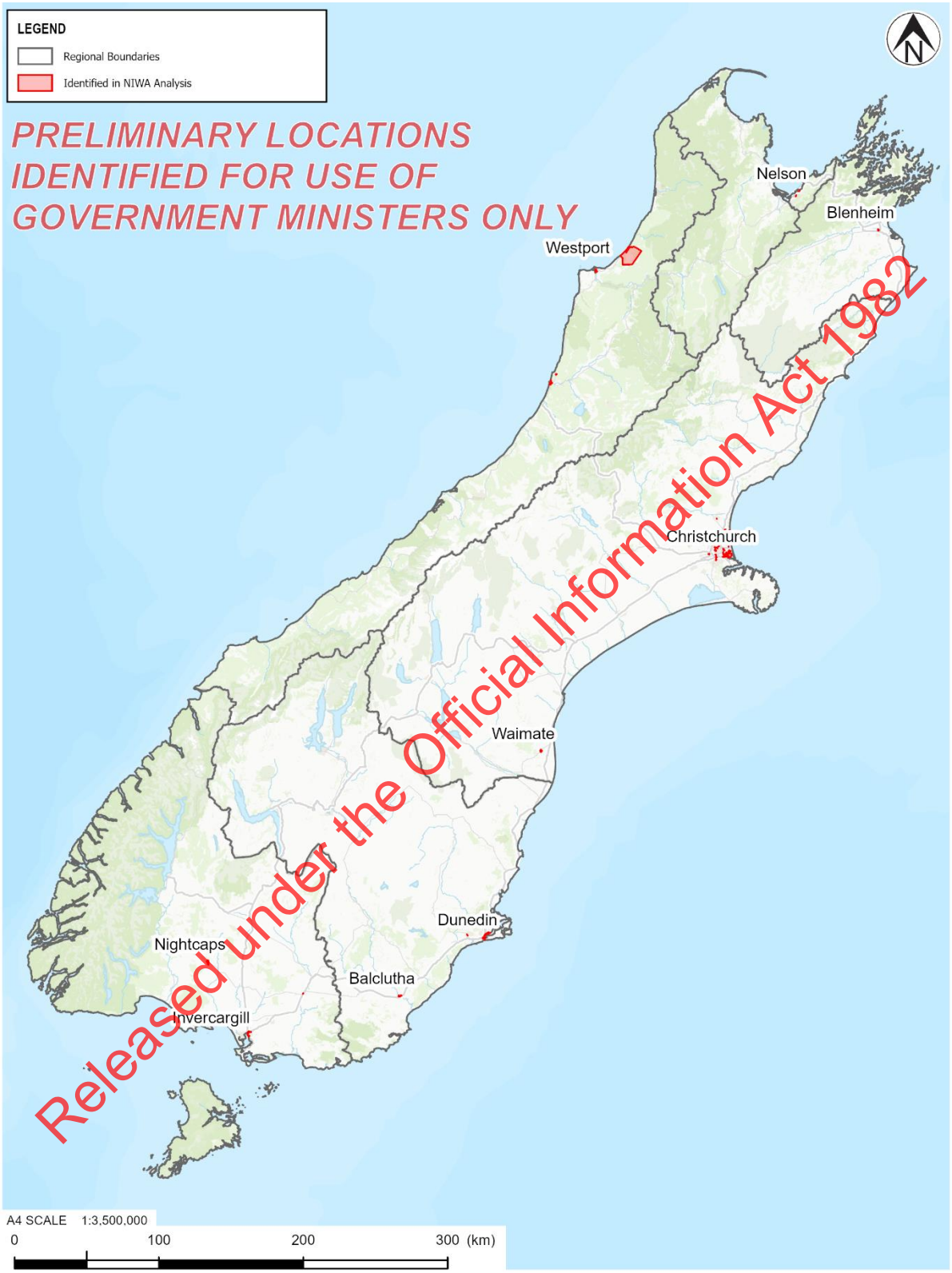

***Figure 5**: Map of the South Island showing areas identified from the NIWA analysis as being exposed to flood hazard and high socio-economic vulnerability (i.e. NZDEP2018 Decile 10)*

1.3 Combining the datasets

GIS layers were created from both the NIWA data and flood practitioner (Mural Board) data sets, uploaded to ArcPro, and overlaid to identify areas where the two datasets intersected. These areas were then reviewed against the Historical Weather Events Catalogue (NIWA) and the new archive on Radio New Zealand (RNZ) to review historical flood events for areas identified in the analysis. This cross-check helped build confidence that the areas identified are exposed to a flood hazard. It should be noted that schemes currently proposed, being implemented, or recently finished which may reduce exposure to flood hazard were not captured as part of this screening – see the 'flood barriers assumed effective' assumption in Section 2.

The intersected areas were confirmed and included in the maps presented in Section 3.

Further to the above locations, areas identified in the NIWA analysis but not flagged by comments on the mural board were reviewed using the historical weather events catalogue and RNZ archive. If it was clear the community identified had a population of more than 50 people (checked against satellite imagery and census data), was identified within a Decile 10 unit in the NZDEP2018 data, and had some history of flooding or were otherwise believed to be flood-prone (e.g. through past modelling or assessment known to flood practitioners and/or included in NIWA's composite flood layer), the location was included in the final map. If the areas in the NIWA list did not have any communities with a population of more than 50 people, then the area was removed from the final maps. See 'Defining Community' assumption in Section 2.

A similar process was completed for the qualitative data that was not identified within the NIWA data. Once completed any remaining locations were added to the final maps. As stated earlier, a number of locations identified through the qualitative task were removed from the final maps as they did not meet the socio-economic threshold.

It is noted that due to limitations with this approach (see Section 2), mainly associated with the tight timeframe, the communities identified on the maps in Section 3 are not exhaustive. What the approach does allow for is an *indicative* view of locations around the country providing a rough number of highly vulnerable communities that are exposed to a flood hazard. Although acknowledged as not being a comprehensive list, what the work does is provide a sense of the scale of this issue in New Zealand.

2 Limitations and Assumptions

- **DEFINING COMMUNITY:** Community is defined as a NZ Stats Area 1 (SA1) (or collection of areas) with a population greater than 50 in 2018. Refer to Section 1.2 as to how the population count was derived – it is noted that there is low confidence in the method used. Adjacent areas in urban / built up areas were reviewed and included (i.e. an SA1 area of 25 adjacent to a SA1 area of 60 giving a total population of 85 for a single town would have been included in the analysis). A way to refine this process would be to set a higher population threshold and subject the selected areas to more detailed analysis. For example, the population of Westport is approximately 4,500 whereas there are many communities identified on the mural board that have a population of only a few hundred. Whilst this approach could focus investigations, the risk is large regions that consist of multiple small communities could be missed (see Hokianga / Smaller Communities limitation below).
- **DEFINING SOCIO-ECONOMIC VULNERABILITY:** Communities included are those categorised as Decile 10 communities within the NZDEP2018 Decile dataset (available at EHINZ). Communities with a lower score than 10 (or containing no Decile 10 units) have been excluded from the analysis. It is noted that in future analysis the Decile threshold could be broadened to incorporate more communities. Decile 10 locations are generally neighboured by Decile 8 and 9 communities, however there were exceptions. An example of a community that was excluded is Karamea on the West Coast of the South Island which is known to have flooding issues and is Decile 9.
- **SNAPSHOT IN TIME:** The information is based on a snapshot in time and is not likely to be reflective of the current or future situations within the towns identified. For example, the NZDEP2018 data is a snapshot of socio-economic data from 2018 and will not incorporate economic changes to communities as a result of Covid-19 and subsequent impacts of high inflation. The regional flood hazard maps compiled within the NIWA analysis have been created at different times, meaning the timing of the NZDEP2018 data and flood hazard data is unlikely to match in the majority (if not all) locations submitted to analysis.
- **FLOOD BARRIERS ASSUMED EFFECTIVE:** The analysis does not account for the failure of flood defences in most places (i.e. assumes defences operate effectively to their designed level of service). See 'Stopbank / Dam Failure' for more information as some council data incorporates flood defence breach modelling. It is also noted that in some areas of the country flood schemes are in the process of being built so historical events may not be an effective proxy for future hazard.
- **NO CLIMATE CHANGE EFFECTS INCLUDED FOR FLUIVAL AND PLUVIAL FLOODING (MOSTLY):** The composite flood hazard maps used for this analysis incorporates present-day pluvial and fluvial hazard for most locations (i.e. does not incorporate increased exposure to pluvial and fluvial flood hazards due to climate change). This is due to the different modelling work done by different councils. There are some exceptions such as the Auckland Region and Nelson, which include climate change scenarios within their flood hazard maps. As a result, mixed probabilities are represented within the NIWA data set. This is another way that the data is inconsistent across the country and could have potentially resulted in overstating or understating the floodplain extents in different locations. Refer NIWA's metadata information on the composite flood layer in **Appendix A** for more information.

- **STOPBANK / DAM FAILURE**: Council flood hazard maps may or may not represent the risk from a breach or failure of a stopbank. This will be dependent on the modelling completed for each region. For example, in some locations such as Lower Hutt there is flooding from stopbank breach / overtopping. In other locations with residual flood risk (e.g. Napier City from Tutaekuri River) this is not represented. Dam failure is also not captured within the composite flood map.
- **BASED ON THE 100 YEAR ARI COASTAL FLOOD EVENT:** The analysis is based on 100-year ARI coastal flood hazard layers as a national dataset. Analysis of more frequent (e.g. 10-year or 20-year ARI) coastal flooding should be undertaken to understand which communities are likely to be affected more frequently, but this is not included in this analysis.
- **VERTICAL LAND MOVEMENT AT THE COAST:** The coastal flood hazard layers include an allowance for climate change. This is represented by a 1.2m increase in sea levels above present-day levels. The analysis doesn't explicitly represent vertical land movement (i.e. subsidence or uplift) which will vary around the coast and would alter the level of the land relative to the sea level. The analysis is based on a total relative increase in coastal depths (i.e. the combined net effect of sea level rise and vertical land movement). Some areas of the coastline will experience a total relative increase of 1.2m sooner than others.
- **NO GROUNDWATER FLOODING:** Flood hazard includes exposure to fluvial, pluvial, and coastal flooding. It excludes groundwater flooding, but this is captured to a certain extent within the antecedent conditions of the fluvial models (i.e. a high groundwater table / soil saturation will result in more rapid flooding from fluvial sources). Groundwater flooding has been subject to less modelling meaning the datasets are less complete relative to fluvial and coastal flooding. There is a current NIWA project 'Future Coast Aotearoa' that is looking into groundwater hazards from coastal flooding. It would be useful to examine this data set once available.
- **EXISTING INEQUALITY:** It is assumed that there is an existing inequality between the flood hazard mapping available, in that those communities better able to fund flood hazard mapping are likely to have more information available about exposure to flood hazards (i.e. Auckland Council). Whereas regions with a smaller rating base are less able to define flood hazard exposure and as a result there may be socio-economically vulnerable communities missed from some of the regional council data sets.
- **FLOODPLAIN 'IN OR OUT':** The flood maps used for this project only provide areal extents of floodplains which show locations 'in or out' of flood hazard exposure zones – they do not provide other hazard severity information, such as depth, velocity or duration. For example, a community in a floodplain extent could be subject to flooding of 1.5m depth during the 100-year ARI event, but there is nothing distinguishing this exposure from another community in the same floodplain extent being exposed to 0.1m depth of flooding during the same event. **The analysis is on the exposure of communities to flood hazard and does not provide information as to the level of damages or consequences (I.e. risk to life) that may result from this exposure.** In reality, some flooding presents lower hazard or risk to people and property. A key recommendation further detailed in Section 4 is that depth and velocity information is reviewed for the locations identified in the maps in Section 3.

- **CAMPSITES EXLUDED:** Due to the delineation of populated areas exposed to flood hazards being based on buildings, the analysis does not account for individuals and/or communities exposed to a flood hazard who reside in campground (I.e. in caravans).
- **BASED ON AVAILABLE DATA:** The analysis is based on available flood hazard maps published by councils. Flood hazard modelling/mapping is an ongoing process for most councils. We are aware of councils who have recently updated their flood mapping but have not yet published the maps. Please refer to the metadata provided by NIWA and included as **Appendix A** for the versions of the flood hazard maps used for this study.
- **POPULATION ASSUMPTIONS:** Due to the way the population was derived, it is possible that some buildings such as woolsheds or other storage units were classified as 'habitable'. Also refer to the 'CAMPSITES EXCLUDED' limitation. This would also not account for seasonal populations and temporarily occupied buildings such as baches. A manual check of areas showed that there was a low level of confidence in the population estimates derived using the methodology outlined in Section 1.2.
- **QUALITATIVE COMMENTS:** Notes on the mural board are a form of qualitative analysis and are subjective. For example, comments could provide an example of known flooding in a certain location, but it may not capture flooding of all impacted areas (e.g. Mataura floods 2020 affected communities between Gore and Invercargill. However, only Mataura was identified on the Mural Board). A number of affluent areas were included on the mural board but were excluded from the maps in Section 3 (i.e. if a location did not have any NZDEP2018 Decile 10 units the location was removed from the maps).
- **SOCIO-ECONOMIC VULNERABILITY IS NOT A PROXY FOR HAZARD:** It should be noted that there are other communities outside the analysis that may face more severe hazards due to flooding, including the potential for loss of life, but are not identified in this assessment as they do not meet the socio-economic criteria required for this assessment (i.e. NZDEP 2018 Decile 10). An example of this is Karamea on the West Coast of the South Island (Decile 9 community).
- **HEAVILY URBANISED AREAS:** Pluvial flooding in urban areas is generally associated with more rapid flooding and a higher level of certainty due to factors such as the capacity of stormwater networks, blockages impacting overland flow paths, and changes in impervious land use cover. These areas generally tend to be subject to more modelling. The qualitative assessment identified broad urban areas susceptible to flooding and suffering socio-economic deprivation in urban areas (e.g. South Dunedin). The NIWA analysis provided an indication of SA1 units in certain urban areas (e.g. Mangere in Auckland), but without reviewing the individual area specific flood models within each region there is a very high level of uncertainty as to the most vulnerable urban areas to flooding. The review of detailed urban modelling available for most urban centres around the country is a key recommendation in Section 4. Specific locations within urban areas have not been provided as part of this project and should be incorporated later when sufficient time is available to review urban flood models from around the country.
- **HOKIANGA / SMALLER COMMUNITIES:** Through the qualitative assessment isolated houses and smaller communities were flagged by the River Managers Group. For example, **Figure 6** was provided by Northland Regional Council as an example of a flood event near a vulnerable property in Waimamaku (Hokianga). Hokianga was considered an exception

because the entire region is classified as Decile 10 **and** consists of multiple small communities. Another similar region was the East Cape, but in this area, communities were clearly identified within the mural board. By flagging the Hokianga region further analysis can be done in this area to identify the locations exposed to a flood hazard. This type of regional analysis could also be completed in other areas of the country such as the West Coast of the South Island if the socio-economic vulnerability threshold was adjusted (i.e. broaden to include lower decile communities). However, around the country there will be isolated properties and very small communities that are exposed to a flood hazard that have not been identified in this project.

***Figure 6**: Isolated property in Waimamaku sent through by Northland Regional Council. Property in proximity of a debris flow causing the nearby river to find a new path.*

3 Maps of identified communities

Refer to the methodology in Section 1 as to how **Figure 7** (North Island) and **Figure 8** (South Island) were created.

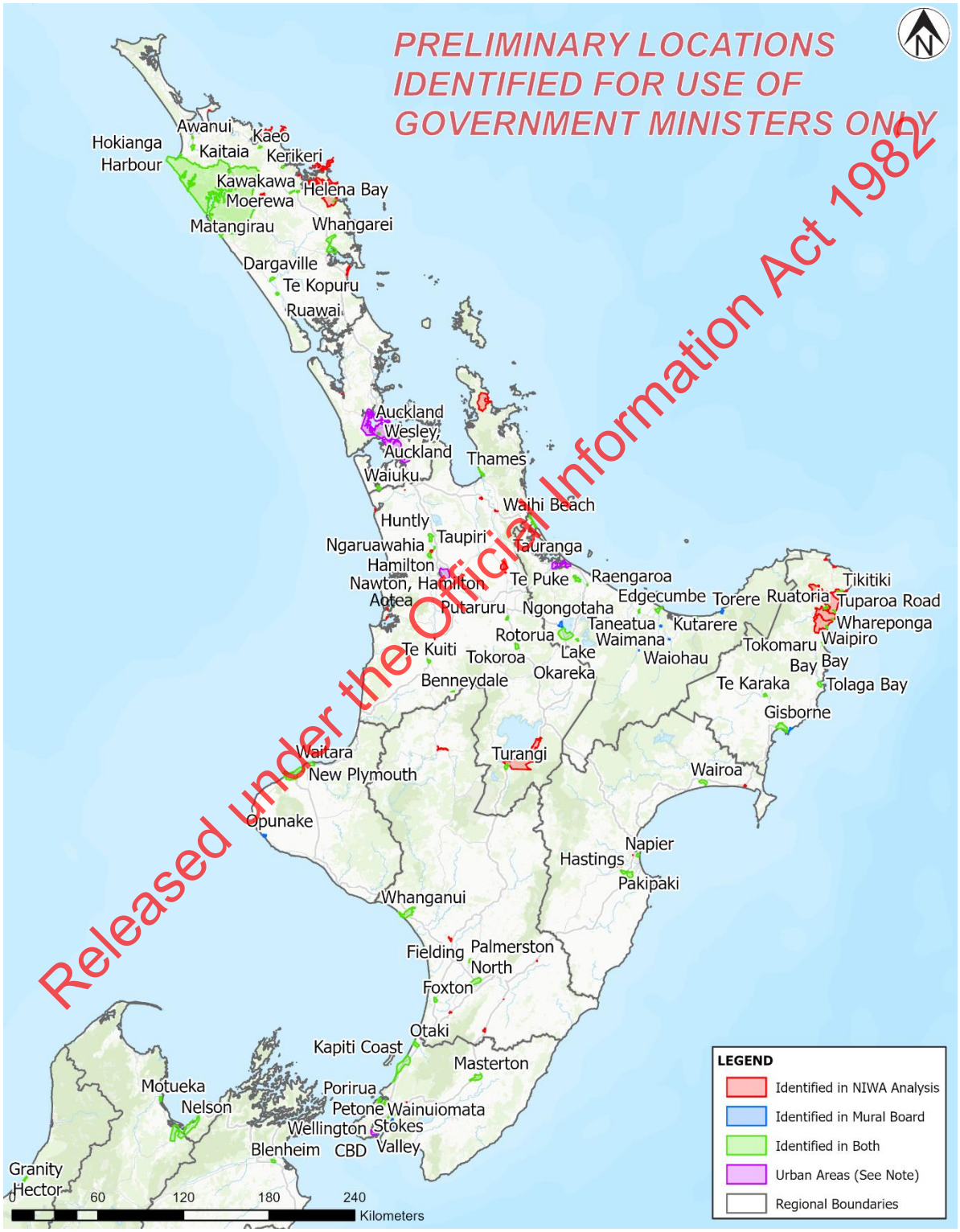

***Figure 7**: Final locations (North Island) identified from both the NIWA analysis and mural board (please note urban areas require further analysis – see recommendation in Section 2)*

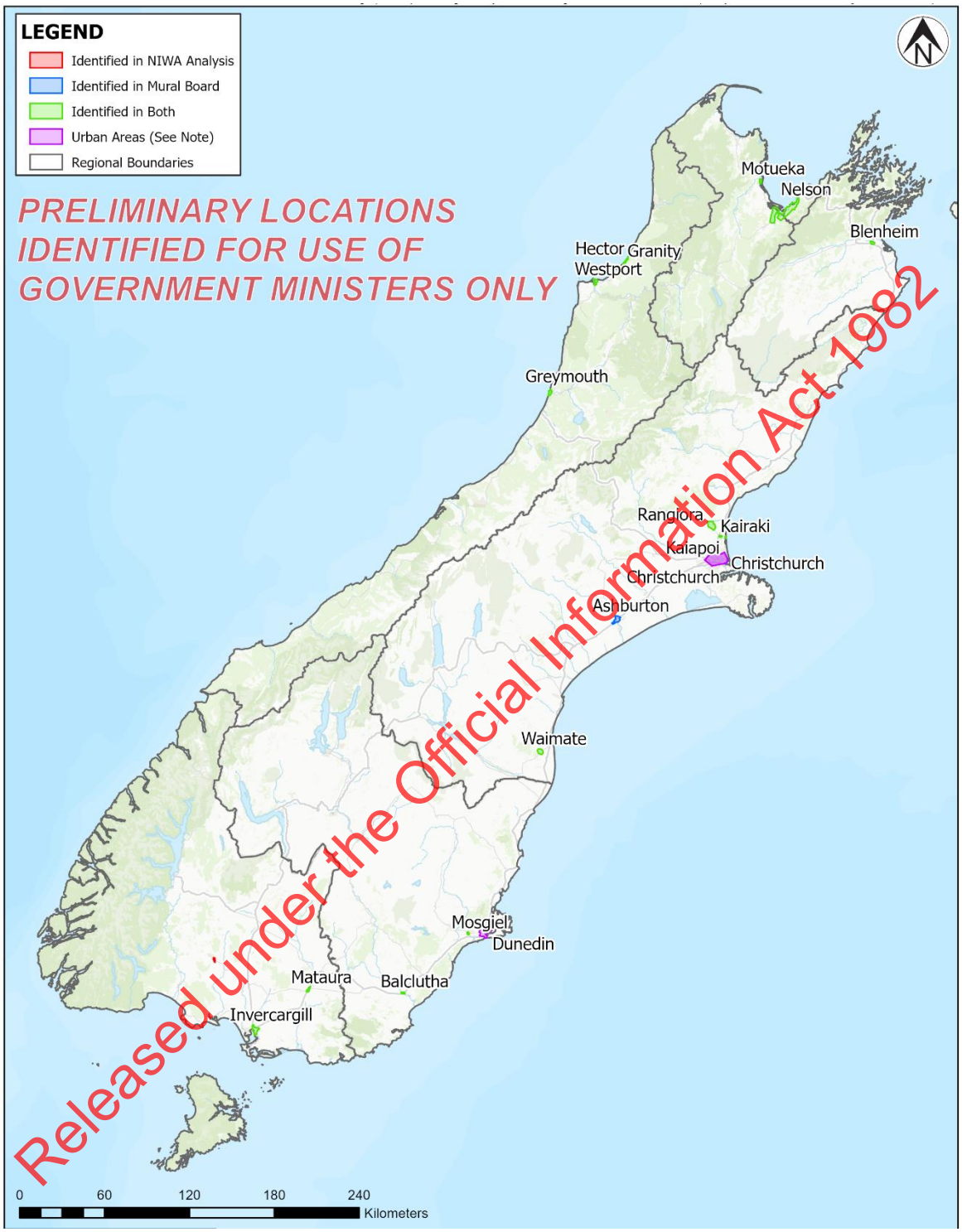

Figure 8: *Final locations (South Island) identified from both the NIWA analysis and mural board (please note urban areas require further analysis – see recommendation in Section 2)*

4 Recommendations – Next Steps

As was discussed in Section 2 there are a number of limitations and assumptions with the maps presented in Section 3 due to the tight timeframe to provide an answer to the Minister's question. What has been provided are *indicative* maps of locations exposed to a flood hazard and suffering from high socio-economic vulnerability.

The work done provides a basis for future work that could examine in greater detail the severity of hazard faced by communities identified in this report. As per earlier comments, this report only identifies exposure to hazard (not the severity of the hazard). It must also be restated that **there will be communities exposed to a flood hazard that will have been missed from the maps provided, and some included who do not face exposure to a hazard**. The intention of this work is to provide a sense of the scale of the number of NZDEP2018 Decile 10 communities around the country that are exposed to a flood hazard and use this a basis for a more comprehensive study in the future.

It may be useful to revisit the question when the flood hazard dataset from NIWA is available in the next 1-2 years. This could potentially make it easier to complete this type of assessment. Alternatively the question could be further explored now using the available flood hazard data sets from different regional councils around the country.

The following recommendations are provided:

- Further analysis of heavily urbanised areas. Specifically, Auckland, Hamilton, Tauranga, Wellington, Christchurch, and Dunedin. Communities within these cities would need to be reviewed via the area specific flood hazard models for these locations. Following this, analysis could be broadened to include even smaller urban centres such as, but not limited to Nelson, Rotorua, Whangarei, and Gisborne.
- Analysis of a broader range of ARI events (i.e. higher frequency events such as 10-year, 20-year ARI intervals) alongside a review of lower frequency events (i.e. 100-year ARI and greater). The July 2021 flood in Westport was estimated between a 50 to 100-year ARI[6].
- For the locations identified on the maps in Section 3 review the depth and velocity information available from the existing flood models to understand the severity of hazard.
- Timing has not allowed the River Managers Group to review the maps in this report to confirm they accurately represent the comments left on the mural board.
- Further to a review from the River Managers Group in future, the indicative locations could also be reviewed by government organisations such as Civil Defence and the EQC to broaden the pool of flood hazard experts commenting on the communities identified through this project.
- Analysis of ratepayer data for locations identified to understand what communities would struggle to fund flood resilience schemes. It may be the case that urban areas in Auckland and Christchurch may be less vulnerable in the future as they are assumed to have a greater ability to fund flood schemes compared to smaller towns such as Wairoa or Westport.

[6] LandRiverSea (2022). The science behind the Buller floods, rainfall events and river modelling. Community PowerPoint Presentation. June, 2022.

- Review insurance coverage of private properties for locations identified (and any further locations identified in subsequent analysis) to further understand the economic vulnerability of communities.
- Review the flood schemes currently planned or being implemented around the country to review if any of the locations identified are or will be benefiting from flood defences.
- Because flood hazard and associated natural hazard data sets (e.g. Tsunami impact assessments) are constantly being reviewed and updated via independent studies across the country, it may be useful to consider a live dashboard / data portal with a live status of hazard exposure for communities. The status of communities could be updated when new data is available. Currently the volume of material and ongoing work being done by regional councils, local authorities, EQC, NIWA and Civil Defence means any form of analysis will only provide a very limited temporal snapshot of flood exposure.

Appendix A – NIWA Metadata

Input data for the composite flood hazard map produced by NIWA.

Table 1: GIS RESTful Services

Organisation	Url
Auckland Council	https://mapspublic.aklc.govt.nz/arcgis3/rest/services/
Bay of Plenty Regional Council	http://gis.boplass.govt.nz/arcgis/rest/services/
Environment Canterbury	https://gis.ecan.govt.nz/arcgis/rest/services/
Gisborne District Council	http://maps.gdc.govt.nz/H5V2_7/Index.html?viewer=TairawhitiDownload
Greater Wellington Regional Council	http://mapping.gw.govt.nz/arcgis/rest/services
Hawkes Bay Regional Council	https://opendata-hbrc.opendata.arcgis.com/datasets/
Horizons Regional Council	https://gisdmz.horizons.govt.nz/arcgis/rest/services/
Marlborough District Council	http://maps.marlborough.govt.nz/arcgis/rest/services/
Nelson City Council	https://www.topofthesouthmaps.co.nz/arcgis/rest/services/
Northland Regional Council	http://hilltop.nrc.govt.nz/nrcwebmap/rest/services/
Otago Regional Council	https://gis.cluthadc.govt.nz/arcgis/rest/services/DistrictPlan/MapServer/
Environment Southland	http://gis.es.govt.nz/arcgis/rest/services/Public/
Tasman District Council	https://www.topofthesouthmaps.co.nz/arcgis/rest/services/
Christchurch City Council	https://opendata.ccc.govt.nz/DistrictPlan/service.svc/get
Clutha District Council	https://gis.cluthadc.govt.nz/arcgis/rest/services
Dunedin City Council	http://apps.dunedin.govt.nz/arcgis/rest/services/
Hamilton City Council	http://gisviewer.hcc.govt.nz/arcgis/rest/services/
Kapiti Coast District Council	http://maps.cera.govt.nz/arcgis/rest/services/KCDC
MacKenzie District Council	https://maps.mackenzie.govt.nz/arcgis/rest/services/
New Plymouth District Council	http://maps.npdc.govt.nz/arcgis/rest/services
Queenstown Lakes District Council	http://qldcmaps.qldc.govt.nz/arcgis/rest/services
Rotorua Lakes Council	http://geo.rdc.govt.nz/arcgis/rest/services/BOPLASS
Taupo District Council	https://gis.taupodc.govt.nz/arcgis/rest/services
Tauranga City Council	http://gismob.tauranga.govt.nz/arcgis/rest/services
Thames Coromandel District Council	https://services5.arcgis.com/MYtLmLEStmKgdmln/ArcGIS/rest/
Waimate District Council	http://gis.waimatedc.govt.nz/arcgis/rest/services
Western Bay of Plenty District Council	http://arcgis.westernbay.govt.nz/arcgis/rest/services
Whakatane District Council	http://maps.whakatane.govt.nz/arcgis/rest/services/ArcGISOnline

Table 2: Flood Map Metadata (for national composite flood hazard data set)

Owner	Name	Year	Max. ARI	Method	Climate change
Auckland Council	Overland flow paths 2000 to 4000 sq m	2013	100	DEM and 'fill' tool used to identify depressions, then flow direction tool to identify upstream catchments and calculate the catchment area, overland flow paths were then calculated if between 2000 and 4000 sq m (ArcGIS)	None
Auckland Council	Overland flow paths 4000m sq m to 3ha	2013	100	DEM and 'fill' tool used to identify depressions, then flow direction tool to identify upstream catchments and calculate the catchment area, overland flow paths were then calculated if between 4000 sq m and 3ha (ArcGIS)	None
Auckland Council	Overland flow paths 3ha and above	2013	100	DEM and 'fill' tool used to identify depressions, then flow direction tool to identify upstream catchments and calculate the catchment area, overland flow paths were then calculated if greater than 3ha (ArcGIS)	None
Auckland Council	Flood prone areas	2014	100	Flood prone areas defined as "the extent of land within a topographical depression that water will pond on in a 1% flood event, assuming any outlet to the depression is blocked" (AC Memo 19/12/2014). Layer generated using LiDAR and GIS techniques.	HIRDS to 100 years

Auckland Council (AECOM, DHI, MWH, URS, T&T, OPUS, Jacobs, GHD, URS modelling)	Flood plains	2014	100	Flood plains defined as "the area of land that is inundated by water during a specific flood event" (AC Memo 19/12/2014 www.aupihp.govt.nz/documents/docs/aupihpmemohearingtopic026att220141219.pdf). Multiple modelling techniques - 1D (MOUSE) and 2D (MIKE FLOOD & MIKE 21).	Various (none or a 16.8% increase in rainfall)
Bay of Plenty Regional Council (Harrison Grierson modelling)	Opotiki 1% AEP flood model	2016	100	Numeric modelling	None
Bay of Plenty Regional Council (Harrison Grierson modelling)	Opotiki 1% AEP with climate change	2016	100	Numeric modelling	1m SLR
Bay of Plenty Regional Council	Bay of Plenty 2004 flood	2004	>100	Aerial photography, field mapping, and surveyed information from the 2004 flood	NA (event mapping)
Rotorua Lakes Council	Rotorua inundation	2016	50	Lake Rotorua (RL 281.18m) and Rotoiti (RL 280.46m) levels - bathtub over LiDAR	None
Tauranga City Council	Tauranga overland flow path extent	2014	100	LiDAR data, GIS methods	None
Tauranga City Council	Tauranga flood hazard city plan area	2013	100	Mapped flood plains (primarily based on LiDAR) in areas where further development possible (brown and greenfield development)	None
Tauranga City Council	Tauranga flood hazard (extreme rainfall)	2013	100	2D catchment model of extreme rainfall event	None
Tauranga City Council (DHI modelling)	Matua 100 year flood depths	2014	100	Numeric modelling - 2D (MIKE FLOOD)	100 year in line with 2014 recommendations

Western Bay of Plenty District Council (DHI modelling)	Wairoa (WBOP) floodable area	2016	100	Numeric modelling (MIKE 21 and MIKE URBAN) (http://www.westernbay.govt.nz/our-services/property/natural-hazards/Documents/DHI%20Wairoa%20Stormwater%20Catchment%20Modelling%202016_web.pdf)	None
Western Bay of Plenty District Council (Duffill Watts and King, Opus, T & T)	Western Bays floodable area	2004-2012	100	Various from numeric modelling (MIKE 21 and MIKE URBAN) of maximum probable development to LiDAR catchment mapping. Flood maps shown on DP.	Various
Western Bay of Plenty District Council (T & T modelling)	Waihi Beach (WBOP) floodable area	2017	100	Numeric modelling (MIKE 21 and MIKE URBAN) of maximum probable development (http://www.westernbay.govt.nz/our-services/property/natural-hazards/Documents/Tonkin%20and%20Taylor%20Waihi%20Beach%20Stormwater%20Model%20Report%202017.pdf)	16.8% increase in rainfall + 20 year ARI SL
Whakatane District Council	Whakatane inundation risk zone	-	Unknown	Assessment using LiDAR, areas below RL 103.6m in risk zone	None
Ashburton District Council (Environment Canterbury mapping)	Ashburton flood map	2014	200	Various methodologies including previous events, LiDAR, numeric modelling	None
Christchurch City Council	Christchurch fixed floor level area	2016	~200	Numeric 2D modelling showing areas where fixed floor levels must be applied in development	Not specified, but considered
Christchurch City Council	Lake Ellesmere management area	2016	-	Historic event mapping	None

Christchurch City Council	Christchurch flood management area	2016	-	Various methodologies including previous events, LiDAR, numeric modelling	None
Christchurch City Council	Christchurch flood ponding	2016	-	LiDAR mapping	None
Christchurch City Council	Waimakariri River flood plain high hazard	2016	50	Numeric modelling showing areas where flood depth multiplied by velocity is ?1 or depths are >1m	2016 guidance values for Canterbury used
Christchurch City Council	Waimakariri River stopbank floodplain	1950s	500 (protection level of stopbank)	Floodplain protected by stopbanks, mapped with LiDAR data	None
MacKenzie District Council	Canal breach area	2004	-	1D numeric modelling of Ohau-Pukaki Canal breach	None
MacKenzie District Council	Kimbell flood area	-	~50	Mapped extent of previous events	None
MacKenzie District Council	MacKenzie potential flooding areas	2004	200	Various methodologies including previous events, LiDAR, numeric modelling	None
Selwyn District Council (Environment Canterbury mapping)	Selwyn Ecan defined flood zones	2016	200	Various methodologies including previous events, LiDAR, numeric modelling	None
Waimakariri District Council	Flood depth (North of Waimakariri River)	2016	200	Numeric modelling (MIKE 21 and MIKE URBAN) (https://www.waimakariri.govt.nz/__data/assets/pdf_file/0017/19313/Waimakariri-District-Localised-Flood-Hazard-Assessment-July-2015.pdf)	2016 guidance values for Canterbury used
Waimate District Council	Waimate flood region	2014	200	Various methodologies including previous events, LiDAR, numeric modelling	None

(Environment Canterbury mapping)					
Gisborne District Council	Gisborne District flood zones	2006 (updat-ed 2016)	~100	Some numeric modelling but primarily LiDAR and previous event mapping of areas (river and flood way, high/med/low hazard, ponding, old river loops, urban stormwater ponding, etc.). Included in District Plan	Various
Gisborne District Council	Gisborne flood hazard areas	2007 (updat-ed 2016)	~100	Some numeric modelling but primarily LiDAR and previous event mapping of areas (river and flood way, high/med/low hazard, ponding, old river loops, urban stormwater ponding, etc.). Not included in District Plan	Various
Hawkes Bay Regional Council	Hawkes Bay flood risk areas	2017	50-100	Numeric modelling - variety of methods, local scale models joined to give risk areas	None
Horizons Regional Council	Cloverlea 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Cloverlea area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	Feilding 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Fielding area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	Herbertville 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Herbertville area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	Mangatainoka 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Mangatainoka area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	Ohakune 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Ohakune area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	Oroua Mangaone 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Oroua Mangaone area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	Pahiatua 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Pahiatua area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	Pohangina 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Pohangina area	None assumed that 0.5% current will be 1% by 2090

Horizons Regional Council	Taumarunui 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Taumarunui area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	Turakina 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Turakina area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	Tutaenui 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Tutaenui area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	Upper Gorge 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Upper Gorge area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	Upper Mangaone 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Upper Mangaone area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	Waikawa-Manakau 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Waikawa-Manakau area	None
Horizons Regional Council	Whakarongo 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Whakarongo area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	Whangaehu 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Whangaehu area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	Whanganui 200yr wet extent	2008	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event of Whanganui area	None assumed that 0.5% current will be 1% by 2090
Horizons Regional Council	1976 flood extent	-	-	Aerial photography mapping and digitising, including internal ponding	NA (event mapping)
Horizons Regional Council	1988 flood extent	-	-	Aerial photography mapping and digitising, including internal ponding	NA (event mapping)
Horizons Regional Council	Mangatainoka October 2000 flood	2000	~100	Aerial photography mapping and digitising, including internal ponding	NA (event mapping)
Horizons Regional Council	Mana January 2005 flood	2005	~50	Aerial photography mapping and digitising, including internal ponding	NA (event mapping)
Horizons Regional Council	SH57a October 2005 flood	2005	-	Aerial photography mapping and digitising, including internal ponding	NA (event mapping)
Horizons Regional Council	Waikawa-Manakau January 2008 flood	2008	-	Aerial photography mapping and digitising, including internal ponding	NA (event mapping)

Horizons Regional Council	Mangahao SH2 September 2010 flood	2010	-	Aerial photography mapping and digitising, including internal ponding	NA (event mapping)
Horizons Regional Council	Makowhai Stream September 2010 flood	2010	-	Aerial photography mapping and digitising, including internal ponding	NA (event mapping)
Horizons Regional Council	October 2010 flood	2010	-	Aerial photography mapping and digitising, including internal ponding	NA (event mapping)
Horizons Regional Council	October 2013 flood	2013	-	Aerial photography mapping and digitising, including internal ponding	NA (event mapping)
Horizons Regional Council	Whanganui flood (June 2015)	2015	100	Aerial photography mapping and digitising, including internal ponding	NA (event mapping)
Horizons Regional Council	Observed flood extent February 2004	2004	100	Aerial photography mapping and digitising, including internal ponding	NA (event mapping)
Horizons Regional Council	FPM modelled 200yr wet extent	2013	200	Numeric modelling using MIKE11 and MIKE21 of 0.5% AEP event (not complete - some areas of region missing)	None - have assumed that a 0.5% AEP current event will be a 1% event by 2090
Horizons Regional Council	Indicative flooding affected area	1990s	~200	Coarse scale flood mapping using a variety of sources (previous events, topographic data, field surveys, etc)	None
Marlborough District Council	Marlborough Environment Plan flood hazard plan	2017	50	Land defined into 4 levels - L1 shallow, low-velocity flooding 2% AEP; L2 depth/velocity not well understood but affected by 2% AEP flood or within 8m of lake; L3 deep, fast flowing water in 2% AEP event; L4 land that could be affected by deep, fast flowing water if flood defences overwhelmed	None
Nelson City Council (T&T modelling)	Nelson flood 2100	2016	100	Numeric modelling of flood extent - 2D (MIKE 21 and MIKEFLOOD)	1m SLR, 15.5% increase in rainfall
Nelson City Council (T&T modelling)	Nelson flood 2100 depth	2016	100	Numeric modelling of flood depth - 2D (MIKE 21 and MIKEFLOOD)	1m SLR, 15.5% increase in rainfall

Nelson City Council (T&T, Opus, MWH modelling)	Nelson flood present day	2016	100	Numeric modelling of flood extent - 2D (MIKE 21 and MIKEFLOOD)	None
Northland Regional Council	Northland 100 year flood extent	2013	100	Various methodologies including previous events, LiDAR, numeric modelling	None
Northland Regional Council	Northland 10 year flood extent	2013	10	Various methodologies including previous events, LiDAR, numeric modelling	None
Northland Regional Council (GHD modelling)	Far North District MPD floodplain (10 year)	2012	10	Numerical modelling of runoff and channel flow assuming Maximum Probable Development using MOUSE and MIKE 11 (https://www.fndc.govt.nz/services/fndc-maps/Stormwater-Model-Build-Report.pdf)	None
Northland Regional Council (GHD modelling)	Far North District MPD floodplain (100 year)	2013	100	Numerical modelling of runoff and channel flow assuming Maximum Probable Development using MOUSE and MIKE 11 (https://www.fndc.govt.nz/services/fndc-maps/Stormwater-Model-Build-Report.pdf)	20.1% increase in rainfall
Whangarei District Council	WDC District Plan - flood susceptibility	2001	50	Numeric modelling - 1D catchment mapping (http://www.wdc.govt.nz/BuildingandProperty/Land-Hazards/Documents/Flood%20Zone%20Reports/Flood-susceptibility-mapping-report.pdf)	Current climate only
Clutha District Council	Clutha flood prone land	1998	~100	Based on Otago flood hazard area layer (ORC data) with some additions based on previous local-scale events	None
Clutha District Council (Otago Regional Council modelling)	Clutha deep floodway corridors	2012	-	Overland flow pathways identified from LiDAR and previous events, usually 1-2m deep	None

Clutha District Council (Otago Regional Council modelling)	Clutha rural and semi-rural floodway corridors	2012	-	Overland flow pathways identified from LiDAR and previous events	None
Clutha District Council (Otago Regional Council modelling)	Clutha urban floodway corridors	2012	-	Overland flow pathways identified from LiDAR and previous events	None
Clutha District Council (Otago Regional Council modelling)	Tokomairiro floodway corridor	2012	-	Floodplain area that will be flooded by the north and west branches of the Tokomairiro River (historic and topographic information). Area 1A - https://www.orc.govt.nz/media/3796/milton-2060-strategy.pdf	None
Clutha District Council (Otago Regional Council modelling)	Tokomairiro floodplain	2012	-	Wider floodplain area where flows of the Tokomairiro Riveare still deep and fast to cause a safety risk (historic and topographic information). Area 1B - https://www.orc.govt.nz/media/3796/milton-2060-strategy.pdf	None
Clutha District Council (Otago Regional Council modelling)	Clutha ponding areas 2A	2012	-	Ponding areas (identified using historic and topographic information) to the N and W of SH1	None
Clutha District Council (Otago Regional Council modelling)	Clutha ponding areas 2B	2012	-	Ponding areas (identified using historic and topographic information) to the S and E of SH2	None

Clutha District Council (Otago Regional Council modelling)	Clutha urban ponding areas (outside of 2A, 2B)	2012	-	Ponding areas (identified using historic and topographic information) in urban areas	None
Dunedin City Council	Minimum flood level area - Waitati and Karitane	2015	~100	Observational methodology using terrain and historic flood extent analysis	None
Dunedin City Council	Minumum flood level area - Dunedin	2015	~100	Numerical modelling of hill catchment run-off and rain on grid	2.5 degree increase in temperature, providing a 20% increase in rainfall intensity
Dunedin City Council	Dunedin hazard 1 - flood	2006	<100	Very high hazard. Various approaches combined - including historic event mapping, LiDAR inspection, and some 2D numeric modelling	Various - assume that hazard zones 2 and 3 will become 1 with climate change
Dunedin City Council	Dunedin hazard 1 (flood) overlay zone	2014	<100	Very high hazard. Various approaches combined - including historic event mapping, LiDAR inspection, and some 2D numeric modelling	Various - assume that hazard zones 2 and 3 will become 1 with climate change
Dunedin City Council	Dunedin hazard 1A (flood) overlay zone	2014	<100	Very high hazard. Various approaches combined - including historic event mapping, LiDAR inspection, and some 2D numeric modelling	Various - assume that hazard zones 2 and 3 will become 1 with climate change
Dunedin City Council	Dunedin hazard 2 - flood	2006	>100	High hazard. Various approaches combined - including historic event mapping, LiDAR inspection, and some 2D numeric modelling	Various - assume that hazard zones 2 and 3 will become 1 with climate change
Dunedin City Council	Dunedin hazard 2 (flood) overlay zone	2014	>100	High hazard. Various approaches combined - including historic event mapping, LiDAR inspection, and some 2D numeric modelling	Various - assume that hazard zones 2 and 3 will

					become 1 with climate change
Dunedin City Council	Dunedin hazard 3 - flood	2006	>200	Moderate hazard. Various approaches combined - including historic event mapping, LiDAR inspection, and some 2D numeric modelling	Various - assume that hazard zones 2 and 3 will become 1 with climate change
Dunedin City Council	Dunedin hazard 3 (flood) overlay zone	2014	>200	Moderate hazard. Various approaches combined - including historic event mapping, LiDAR inspection, and some 2D numeric modelling	Various - assume that hazard zones 2 and 3 will become 1 with climate change
Otago Regional Council	Otago flood hazard area	2015	-	Variety of sources - primarily LiDAR and past event (aerial photography and surveys) with occasional numerical modelling	None
Queenstown Lakes District Council	Queenstown flood map - dam break	2006	-	Numeric modelling - 2D of a dam burst scenario	None
Queenstown Lakes District Council	Queenstown flood map - rainfall	2006	100	Numeric modelling - using WaterRide software for rainfall event	None
Environment Southland	Southland Floodplains	2016	-	Various - primarily mapping of previous events and topological information	None
New Plymouth District Council	Flood detention area spillway	1990s	-	Areas identified from LiDAR and previous events that would potentially act as a spillway during a flood event	None
New Plymouth District Council	New Plymouth flood plain	-	-	Topographic information primarily - township areas only	None
NIWA	Waitara 3200 cumec water level	2014	100	Gerris numeric modelling	18% uncertainty
NIWA	Waitara 3780 cumec water level	2014	200	Gerris numeric modelling	20% uncertainty
NIWA	Waitara 4540 cumec water level	2014	200	Gerris numeric modelling	22% uncertainty and 20% for climate change

NIWA	Waitara 4660 cumec water level	2014	500	Gerris numeric modelling	26% uncertainty
NIWA	Waitara 5590 cumec water level	2014	500	Gerris numeric modelling	26% uncertainty and 20% for climate change
Tasman District Council	Tasman District flood zones	2014	-	Variety of sources - primarily LiDAR and past event (aerial photography and surveys) with occasional numerical modelling	None
Tasman District Council	Aorere December 2010 flood	2010	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Aorere January 1985 flood	1985	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Brooklyn Riwaka 1976 flood	1976	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Ellis Creek and Pohara December 2011 flood	2011	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Ewes Valley and Redwood Valley June 1980 flood	1980	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Ewes Valley and Redwood Valley June 1982 flood	1982	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Kaituna 1974 flood	1974	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Mill Stream 1986 flood	1986	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Motueka August 1990 flood	1990	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Motueka July 1983 flood	1983	-	Aerial photography mapping and digitising	NA (event mapping)

Tasman District Council	Moutere July 1983 flood	1981	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Orinoco Creek March 1986 flood	1986	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Pitfure June 1980 flood	1980	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Pitfure June 1982 flood	1982	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Riwaka August 1980 flood	1980	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Takaka July 1983 flood	1983	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Upper Motueka April 1974 flood	1974	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Waiiti July 1983 flood	1983	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Wairoa December 1983 flood	1983	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Wairoa January 1986 flood	1986	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Wangapeka November 1997 flood	1997	-	Aerial photography mapping and digitising	NA (event mapping)
Tasman District Council	Takaka Q200 with no McK bank	2011	200	Numeric modelling - 2D (LiDAR and WaterRide) without informal stopbank	None - assume that a 200yr event today will become a 100yr by 2090, 100yr become a 60yr, 50yr become a 30yr
Tasman District Council	Takaka Q200 with McK bank	2011	200	Numeric modelling - 2D (LiDAR and WaterRide) with informal stopbank	None - assume that a 200yr event today will become a 100yr by 2090, 100yr

					become a 60yr, 50yr become a 30yr
Tasman District Council	Takaka Q100 with no McK bank	2011	100	Numeric modelling - 2D (LiDAR and WaterRide) without informal stopbank	None - assume that a 200yr event today will become a 100yr by 2090, 100yr become a 60yr, 50yr become a 30yr
Tasman District Council	Takaka Q100 with McK bank	2011	100	Numeric modelling - 2D (LiDAR and WaterRide) with informal stopbank	None - assume that a 200yr event today will become a 100yr by 2090, 100yr become a 60yr, 50yr become a 30yr
Tasman District Council	Takaka Q50 with no McK bank	2011	50	Numeric modelling - 2D (LiDAR and WaterRide) without informal stopbank	None - assume that a 200yr event today will become a 100yr by 2090, 100yr become a 60yr, 50yr become a 30yr
Tasman District Council	Takaka Q50 with McK bank	2011	50	Numeric modelling - 2D (LiDAR and WaterRide) with informal stopbank	None - assume that a 200yr event today will become a 100yr by 2090, 100yr become a 60yr, 50yr become a 30yr
Tasman District Council	Takaka Q20 with no McK bank	2011	20	Numeric modelling - 2D (LiDAR and WaterRide) without informal stopbank	None - assume that a 200yr event today will become a 100yr by 2090, 100yr become a 60yr, 50yr become a 30yr
Tasman District Council	Takaka Q20 with McK bank	2018	20	Numeric modelling - 2D (LiDAR and WaterRide) with informal stopbank	None - assume that a 200yr event today will become a 100yr by 2090, 100yr

					become a 60yr, 50yr become a 30yr
Tasman District Council (Sinclair Knight Merz modelling)	Brightwater-Wakefield flood map	2013	500	Numeric modelling - 2D, 2m grid (MIKE 21)	Used 500 year event as CC proxy - not a significant increase from current 100 year event due to defences and floodplain morphology
Tasman District Council (Sinclair Knight Merz modelling)	Q500 depth BW (Brightwater)	2013	500	Numeric modelling - 2D, 2m grid (MIKE 21)	None - used 500 year event as CC proxy - not a significant increase from current 100 year event due to defences and floodplain morphology
Tasman District Council (Sinclair Knight Merz modelling)	Q500 depth WF (Wakefield)	2013	500	Numeric modelling - 2D, 2m grid (MIKE 21)	None - used 500 year event as CC proxy - not a significant increase from current 100 year event due to defences and floodplain morphology
Tasman District Council (Sinclair Knight Merz modelling)	Q200 depth BW (Brightwater)	2013	200	Numeric modelling - 2D, 2m grid (MIKE 21)	None - used 500 year event as CC proxy - not a significant increase from current 100 year event due to defences and floodplain morphology
Tasman District Council (Sinclair Knight Merz modelling)	Q200 depth WF (Wakefield)	2013	200	Numeric modelling - 2D, 2m grid (MIKE 21)	None - used 500 year event as CC proxy - not a significant increase from current 100 year event due

					to defences and floodplain morphology
Tasman District Council (Sinclair Knight Merz modelling)	Q100 depth BW (Brightwater)	2013	100	Numeric modelling - 2D, 2m grid (MIKE 21)	None
Tasman District Council (Sinclair Knight Merz modelling)	Q100 depth WF (Wakefield)	2013	100	Numeric modelling - 2D, 2m grid (MIKE 21)	None - used 500 year event as CC proxy - not a significant increase from current 100 year event due to defences and floodplain morphology
Tasman District Council (Sinclair Knight Merz modelling)	Q50 depth BW (Brightwater)	2013	50	Numeric modelling - 2D, 2m grid (MIKE 21)	None - used 500 year event as CC proxy - not a significant increase from current 100 year event due to defences and floodplain morphology
Tasman District Council (Sinclair Knight Merz modelling)	Q50 depth WF (Wakefield)	2013	50	Numeric modelling - 2D, 2m grid (MIKE 21)	None - used 500 year event as CC proxy - not a significant increase from current 100 year event due to defences and floodplain morphology
Tasman District Council (Sinclair Knight Merz modelling)	Q20 depth BW (Brightwater)	2013	20	Numeric modelling - 2D, 2m grid (MIKE 21)	None - used 500 year event as CC proxy - not a significant increase from current 100 year event due to defences and floodplain morphology

Tasman District Council (Sinclair Knight Merz modelling)	Q20 depth WF (Wakefield)	2013	20	Numeric modelling - 2D, 2m grid (MIKE 21)	None - used 500 year event as CC proxy - not a significant increase from current 100 year event due to defences and floodplain morphology
Hamilton City Council	Hamilton surface water flooding	2012	100	Numeric modelling (MIKE FLOOD) of catchment surface flooding	2.08 degree warming (HIRDS)
Hamilton City Council	Hamilton culvert block flooding	2012	100	Numeric modelling (MIKE FLOOD) of flooding due to completely blocked culverts, catchpits, etc.	2.08 degree warming (HIRDS)
Taupo District Council	Taupo defended area	2015	100	Numeric modelling using a "banks down" approach	2 degree warming (HIRDS)
Taupo District Council (Opus model)	Taupo flood hazard extent	2012-2014	100	Numeric modelling of Hinemaiaia River, Kuratau River, Tauranga-Taupo River, Tokaanu Stream, Tongariro River, and Whareroa Stream	2 degree warming (HIRDS)
Thames Coromandel District Council (Waikato Regional Council model)	Thames Coromandel flood hazard area	2011-2016	100	Numeric modelling of Taruru River, Te Puru River, Waiomu River, Pohue River, Tapu River, Karaka Stream, Hape Stream, Whangarahi Stream (MIKE 11) with 0.5m SLR	0.5 m SLR, 2 degree warming
Waikato Regional Council	Waikato RACS (river & catchment services) flood hazard	1990s to present	-	Variety of sources - primarily LiDAR and past event (aerial photography and surveys) with occasional numerical modelling	None
Waikato Regional Council	Waikato River 1% AEP flood model	2016	100	WaterRide 1D modelling of river from Horotiu to Port Waikato	None
Greater Wellington Regional Council	Flood hazard areas for the Greater Wellington Region	2018	430 (0.23% AEP - Hutt River); 100 (1% - Otaki,	Numeric modelling from various sources. Mostly 2D.	Various

			Porirua, Mangaroa, Wainuiomata, Waiohine, Waikanae, Waiwhetu. Kaipiti Coast, Te Kauru); 50 (2% - Wairarapa)		
Kapiti Coast District Council	Kapiti Coast flood maps	2012	100	Numeric modelling - 2D of Kapiti Coast catchments	None
NIWA	Westport 1% AEP flood	2011	100	Gerris numeric modelling - including stopbanks	None