ICG/PTWS-XXX

NATIONAL REPORT submitted by:

NEW ZEALAND

BASIC INFORMATION

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2. ICG/PTWS Tsunami Warning Focal Point (TWFP), 24/7 point of contact and NTWC

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3. Tsunami Advisor(s), if applicable

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4. Tsunami Standard Operating Procedures for a Local Tsunami

Local, "near-source" tsunami are generated by large offshore earthquakes, landslides, and volcanic eruptions close to New Zealand. If the tsunami is caused by a local earthquake, the shaking associated with the event may be the only warning people get before this kind of tsunami arrives. Other natural signs could also include loud or unusual noises from the sea or a sudden unexpected change in sea level at the coast. Local-source tsunami could arrive within minutes, so it may not be possible for the NEMA MAR to issue warnings in sufficient time and/or accuracy.

The National Tsunami Advisory and Warning Plan recognises this reality with the following:

> *Local tsunami sources offer very little, if any time for official warnings. In this case, public awareness to be able to recognise and individually respond to natural, felt warnings is vital. Official warnings will be issued (if possible) to reinforce the response to natural warnings. In some cases, local-source tsunami may travel to further regions of the New Zealand coast and therefore travel times to these locations could be greater than 60 minutes and official warnings will still be valuable. In this situation, National Warnings may not include assessments of*

wave amplitude. The assessment of local-source tsunami contained in this appendix must be used to support decision making at local level.

Natural Warnings

'Natural warnings' are personal observations. They can include any of the following:

- Strong earthquakes (it's hard to stand up), or long earthquakes (including weak shaking) lasting for a minute or more; or
- Strange sea behaviour, such as the sea level suddenly rising and falling; or
- Hearing the sea making loud and unusual noises or roaring like a jet engine.

When any of the above observations apply, a Land Threat should be anticipated.

Public education about tsunami awareness, tailored to the specific community is critical in this regard.

This message is a key component of New Zealand's tsunami public education at local, regional and national level. The natural warning signs for tsunami, correct actions to take, and predetermined evacuation zones are communicated frequently and central to public education activities across the country year-round. However, we recognise the challenge of relying on obvious shaking from sources with travel times greater than about 45 minutes for our northern coastlines and are attempting to address the warning "gap" with more rapid instrumental warning products and more thorough educations around indicative ground shaking warning signs for these events.

By the end of 2023, a suite of pre-computed maps will be finalised to be used for local- and Kermadec-source earthquakes. Areas of the New Zealand coastline along the plate boundary have been split into six zones, the maps for which start at the first magnitude where there is an area under land threat, and finish once there is a land threat for the whole New Zealand coastline – all based on database scenarios. The implementation of these maps will include pre-prepared corresponding warning messages and emergency mobile alerts saved in the national warning system platforms. This project will speed up tsunami warnings for local- and Kermadec-source events by cutting out manual steps in getting the first warning message out to stakeholders, the media and the public. Event-specific maps will be developed and follow this initial, pre-computed map and warning. These maps do not replace the natural warning, which remains the primary warning for local source events.

5. Tsunami Standard Operating Procedures

5.1 Responsible organizations

National Emergency Management Agency (NEMA)

NEMA maintains the National Warning System (NWS) for disseminating national warnings to local authorities, government departments, lifeline utilities, the media, and the public. NEMA

also maintains the Emergency Mobile Alert (EMA) system and portal for public alerting. The NEMA Monitoring, Alerting and Reporting (MAR) Centre is a 24/7 capability with a core role of assessing and sending advisories and warnings for tsunami events and administering these systems.

GNS Science

There are multiple functions across GNS Science that contribute to tsunami standard operating procedures.

Opened in December 2018, the National Geohazards Monitoring Centre (NGMC) provides 24/7 monitoring of geohazards in New Zealand including earthquakes, tsunami, volcanoes and landslides. Any potential tsunami threat is assessed immediately and escalated to GNS Duty Officers and the NEMA MAR where necessary. Between these two 24/7 Centres, New Zealand has rapid analysis and response initiation when required.

GNS Science manage and chair the Tsunami Experts Panel (TEP), which is a cross-disciplinary panel of on-call science experts for the provision of bespoke tsunami modelling and advice to GNS Science to support tsunami threat assessment.

5.2 Thresholds and Criteria

Tsunami assessment advisories are issued by the NEMA MAR when earthquake parameters meet or exceed thresholds, or when an event does not meet the thresholds but based on advice received from the NGMC/TEP is considered to hold a potential threat for New Zealand. Once assessed, depending on the initial threat NEMA will send a tsunami warning (land threat >1m), tsunami advisory for beach and marine threat (<1m), or tsunami advisory for no threat. Assessment by the TEP continues and maps issued until there is no threat determined, following which the NEMA MAR issues a cancellation message.

The thresholds for issuing default initial national tsunami advisories and warnings by NEMA are outlined in the National Tsunami Advisory and Warning Plan. For regional and distant source tsunami, thresholds are determined for two regions – the South-West Pacific and the wider Pacific, as shown below:

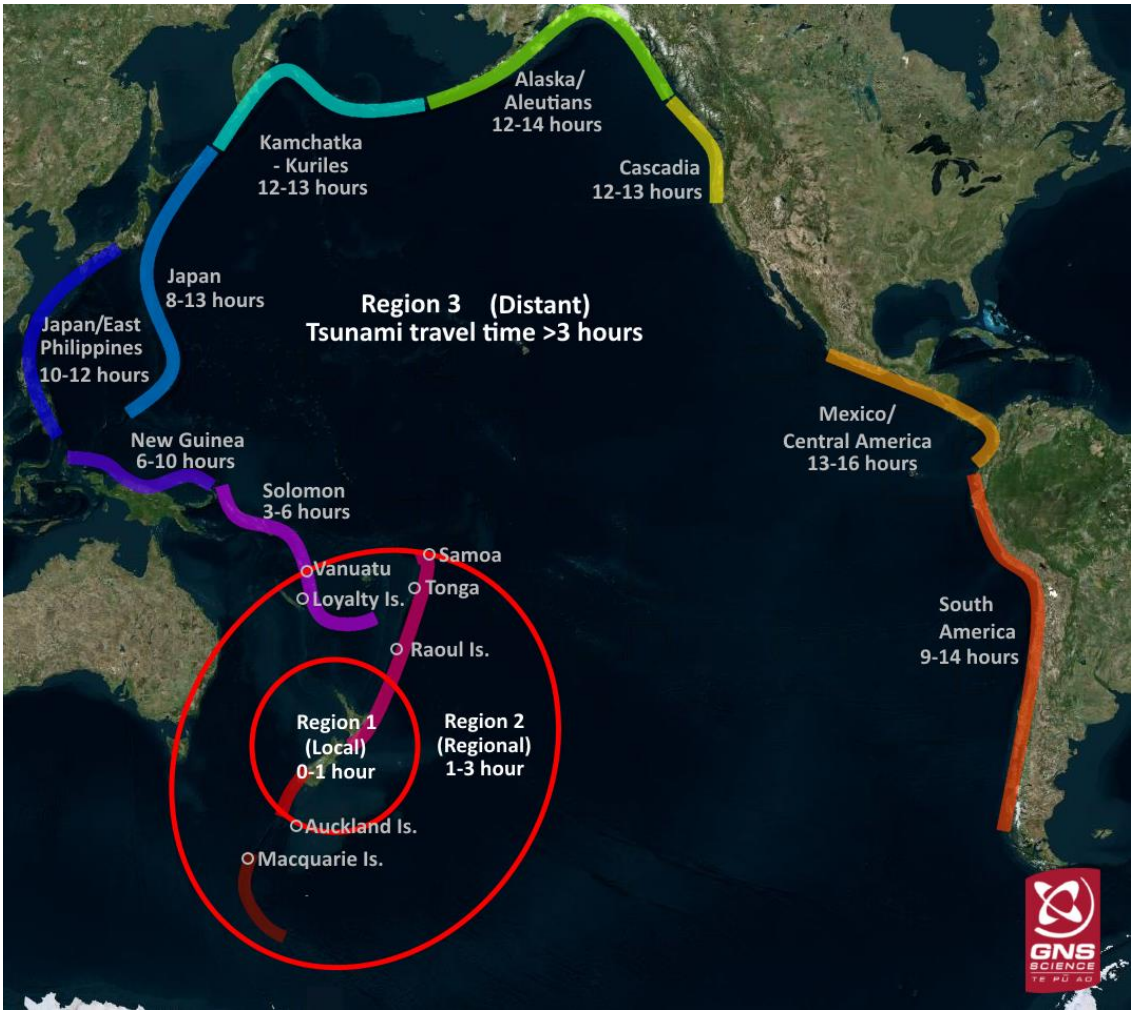


Figure 1: Local (1), regional (2) and distant (3) source regions based on minimal tsunami travel time to New Zealand shores

The thresholds for advisories and warnings are as follows:

Region	Location	Thresholds	Possible notification issued via the National Warning System
1	New Zealand (0-1 hour to nearest coast Local source)	M≥6.5 and <100km depth	**Natural, felt signs are the primary warning for local source tsunami (Region 1).** **If possible and as appropriate,** NEMA will issue one or a sequence of the following Advisories and Warnings: • *National Advisory: Earthquake Being Assessed* ("Long or Strong, Get Gone" holding message) • *National Advisory: Tsunami Activity – Strong Unusual Currents* • *National Warning: Tsunami Threat* • *Emergency Mobile Alert* (to areas where land inundation is forecast) • *National Advisory: No Tsunami Threat* • *National Advisory: Earthquake – No Tsunami Threat*

	Southern Kermadec (<1 hour to nearest coast Local source)	M≥7.9 and <150km depth	**Natural, felt signs are the primary warning for local source tsunami (Region 1), however Southern Kermadec earthquakes located between 25°S and 33°S may not be widely felt in New Zealand.** **If possible and as appropriate,** NEMA will issue one or a sequence of the following Advisories and Warnings: • *National Advisory: Earthquake Being Assessed* (local/regional boundary holding message) • *National Advisory: Tsunami Activity – Strong Unusual Currents* • *National Warning: Tsunami Threat* • *Emergency Mobile Alert* (to areas where land inundation is forecast) • *National Advisory: No Tsunami Threat*
2	South-West Pacific (1-3 hours Regional source)	M≥7.5 and <100km depth	**Initial message:** • *National Advisory: Large Pacific Earthquake Being Assessed* (holding message) **Followed by (as appropriate, once confirmed data and advice received from GNS Science):** • *National Advisory: Tsunami Activity – Strong Unusual Currents* • *National Warning: Tsunami Threat* • *National Advisory: No Tsunami Threat to New Zealand* • *Emergency Mobile Alert* (to areas where land inundation is forecast)
3	Wider Pacific (>3 hours Distant source)	M≥8.0 and <100km depth	

Subsequent national advisories or warnings are issued by NEMA based on the assessment provided by GNS Science and the Tsunami Experts Panel.

For national warnings, further assessment about expected arrival times and threat estimation is included in notifications:

Information about expected arrival times is derived from modeling conducted by the PTWC and moderated by GNS Science. The information is expressed as the estimated time of arrival (ETA) of the first (lead) wave at a given coastal point.

Supplementing PTWC forecasts, GNS Science also applies modeling to provide information about the maximum expected water elevation (amplitude). The amplitude at shore and threat categories that can be assigned for 43 coastal zones across all New Zealand's shores are as follows:

Maximum expected amplitude at shore		Threat definition
	<0.3m	No threat
	0.3-1m	Beach & Marine Tsunami Activity (incl. harbours, estuaries & small boats)
	1-3m	Land & Marine Threat
	3-5m	
	5-8m	
	>8m	

Table 1: Tsunami Threat Categories

Figure 2: Coastal zones for tsunami threat forecasts

5.3 Other Agencies' Response

Following the issue of a national tsunami advisory or warning, local authorities are responsible for local threat assessment and for activating local public alerting mechanisms, following their own procedures, while national agencies activate response plans relevant to their area of business. NEMA maintains a Memorandum of Understanding with key media (radio and TV) for the public broadcasting of warnings.

5.4 Dissemination

National tsunami advisories and warnings are disseminated to all local authorities, key national agencies, the media, and the public. Information is communicated through the National Warning System (NWS) to text, email, phone call, NEMA website, Twitter and Facebook. The processes applied for the NWS are outlined in The Guide to the National CDEM Plan 2015. National warnings for tsunami are followed by an Emergency Mobile Alert (EMA) to areas under land threat instructing people to evacuate. The processes applied for the use of EMA are outlined in the National Tsunami Advisory and Warning Plan.

5.5 Termination

All national tsunami advisories or warnings (except National Advisory – No Threat) are followed up by continuous subsequent advisories/warnings until a formal cancellation is issued via the NWS. Termination is determined by observations from the National Sea Level Network and expert advice from the Tsunami Experts Panel

6. National Sea Level Network

GNS Science and Land Information New Zealand (LINZ) operate a network of real-time tsunami gauges around the New Zealand coasts and on nearby offshore islands as part of GeoNet, New Zealand's geological hazards monitoring system; see http://www.geonet.org.nz). These are owned, designed and operated by New Zealand as part of the LINZ-GNS Science partnership. At each New Zealand station, sea level is measured by two pressure sensors submerged in the ocean. Sea level measurements, sampled at 10 Hz, are transmitted to the GeoNet Data Centres. Data is available to tsunami warning centres in real-time via the GTS as well as over the Internet via Seedlink (a seismic data exchange protocol). An additional two Australian stations at Norfolk Island and Macquarie Island complements the network.

NAME	CODE	LATITUDE	LONGITUDE
Wellington	WLGT	-41.2846	174.7791
Napier	NAPT	-39.4757	176.9201
Chatham Island	CHIT	-44.0240	-176.3675
Gisborne	GIST	-38.6754	178.0229
Tauranga	TAUT	-37.6411	176.1812
East Cape	LOTT	-37.5504	178.1590
North Cape	NCPT	-34.4148	173.0487
Auckland	AUCT	-36.8314	174.7865
Boat Cove, Raoul Island	RBCT	-29.2800	-177.8944

Fishing Rock, Raoul Island	RFRT	-29.2511	-177.9038
Castlepoint	CPIT	-40.8993	176.2317
Puysegur	PUYT	-46.0848	166.5894
Dunedin	OTAT	-45.8143	170.6294
Kaikoura	KAIT	-42.4129	173.7028
Manukau	MNKT	-37.0466	174.5117
Great Barrier Isl	GBIT	-36.1890	175.4889
Christchurch	SUMT	-43.5701	172.7738
Charleston	CHST	-41.9083	171.4333

Table 2: New Zealand Tsunami Monitoring Network: site names, codes, locations, date opened and deployed sensors. Stations are ordered according to date opened.

NAME	LATITUDE	LONGITUDE
NZA	-42.3707	176.9109
NZB	-40.6003	179.0996
NZC	-38.2001	-179.7978
NZD	-36.0998	178.6037
NZE	-36.0493	-177.708
NZF	-29.6843	-175.0126
NZG	-23.3516	-173.4012
NZH	-20.0896	-171.8599
NZI	-16.8921	-171.1904
NZJ	-26.6672	163.9549
NZK	-24.3093	169.4988
NZL	-19.3096	166.782

Table 3: New Zealand DART Network: Sit Name, Latitude and Longitude

The National Institute of Water and Atmospheric Research (NIWA), port companies, regional and district councils operate various sea-level gauges which complement the operational near real-time monitoring undertaken by GeoNet (New Zealand's geological hazard monitoring system). Real-time raw and de-tided time series are displayed on the GeoNet website: http://www.geonet.org.nz/tsunami/gauges and freely available for download via the GeoNet ftp site: ftp://ftp.geonet.org.nz/tsunami.

7. Information on Tsunami occurrences

During the intersessional period (January 2022 – June 2023):

National Advisory – Tsunami: No Threat to NZ notifications were issued by NEMA for the following events:

29/01/2022	Kermadec Trench	6.6
12/11/2022	Tonga	7.5
24/04/2023	Kermadec Trench	7.3
20/05/2023	Loyalty Islands	7.1

National Advisory – Tsunami activity: Expect Strong and Unusual currents and unpredictable surges at the shore notifications were issued by NEMA for the following events:

15/01/2022	Hunga-Tonga-Hunga-Ha'apai	n/a

16/01/2022	Hunga-Tonga-Hunga-Ha'apai	n/a
19/05/2023	Loyalty Islands	7.7

National Warning – Tsunami Threat to NZ notifications were issued by NEMA for the following events:

16/01/2022	Hunga-Tonga-Hunga-Ha'apai	n/a
19/05/2023	Loyalty Islands	7.7

We note that the Hunga/Tonga-Hunga-Ha'apai event was problematic in that all of our regional TEW protocol are based on earthquake sources. However, the open ocean observations of the tsunami provided by the NZ DART network and the agility provided by analysis and injection of information through the Tsunami Expert Panel allowed us to tailor threat advice though subjective scaling of forecasts based on earthquake sources.

The Loyalty Islands M7.7 tsunami was challenging in that global estimates of Mww7.7 were smaller than Mww7.9 estimates provided by regional wphase inversion and Mwc7.9 (centroid inversion from surface wave data) and Mw7.9 from the analysis of local NZ DART. We used the spread of magnitude estimates to assess uncertainty in our TEW forecasts.

8. Web sites (URLs) of national tsunami-related web sites

- www.civildefence.govt.nz
- www.getready.govt.nz
- www.gns.cri.nz
- www.geonet.org.nz/tsunami
- www.niwa.govt.nz

9. Summary plans of future tsunami warning and mitigation system improvements

Mid-term improvements are focused on the improvement of rapid earthquake and tsunami assessment, and improving the education of the public to empower risk-informed decisions for resilience.

The R-CET endeavour research program is anticipated to be able to solve problems of accuracy and speed of tsunami warning delivery, with the potential for time-based forecasts, reduction of over-conservatism in tsunami warnings, and the delivery of advice faster and with higher confidence than is currently possible in the New Zealand context.

Progress towards national consistency of tsunami evacuation zones will help to improve the translation of tsunami threat into evacuation communications for communities during a tsunami event. This work will be supported by improvements in public education regarding exposure to tsunami. The Toka Tū Ake EQC Natural Hazards Portal will provide better access for the public to access hazard and risk information regarding private property and support better risk-informed choices about property and land.

NATIONAL PROGRAMMES AND ACTIVITIES INFORMATION

10. EXECUTIVE SUMMARY

New Zealand tsunami risk management continued to progress in the inter-sessional period, managed across the workstreams of several partner agencies in national and local governments.

The work, as integrated into the National Disaster Resilience Strategy, falls across three major objectives:

- **Managing Risk**
  - Important research programmes have continued to progress with tangible outcomes, including the rapid characterisation of earthquakes and tsunami (R-CET) research programme, and probabilistic tsunami hazard modelling.
  - Toka Tū Ake EQC and GNS Science completed a national exposure assessment for tsunami hazard and risk in 2022.
  - Improved loss modelling continues in order to further develop an evidence base to inform land-use planning decision-making with regard to reducing tsunami risk.

- **Effective Response to, and Recovery from Emergencies**
  - 24/7 tsunami warning operations (transitioning from on-call duty arrangements) were established at NEMA in 2022.
  - Work towards key elements of national consistency regarding tsunami response, including nationally consistent and locally appropriate boundaries for tsunami evacuation zones has progressed.
  - An update of the National Tsunami Advisory and Warning Plan is expected by the end of 2023.

- **Enabling, Empowering and Supporting Community Resilience**
  - Public education campaigns, including a national earthquake and tsunami drill, continue with an increasing level of engagement
  - New Zealand's first National Natural Hazards Portal will launch in 2023. This is a government initiative to improve access to data and information about natural hazards, supporting risk-informed choices about property and land.

11. NARRATIVE

11.1 National Emergency Management Agency Work Programme

11.1.1 24/7 Monitoring, Alerting and Reporting (MAR) Centre

In July 2022, NEMA officially opened a 24/7 awake capability, the Monitoring, Alerting and Reporting (MAR) Centre.

The MAR Centre was established in response to the 2018 Ministerial Review into Better Responses to Natural Disasters and Other Emergencies. The Review made recommendations to establish an integrated 24/7 operation for the monitoring and alerting of emergencies, to increase the speed by which alerts were provided and distributed, particularly regarding providing timely and geographically accurate tsunami warnings.

The MAR Centre works closely with GNS Science's National Geohazards Monitoring Centre (NGMC). The NGMC monitors and measures seismic and other activity to produce

assessments which are fed through to the MAR Centre. MAR Centre staff then use the NGMC information to produce the appropriate advisories and warning messages for NEMA's partners and the public.

11.1.2 DART (Deep-ocean Assessment and Reporting of Tsunami)

In the Hunga Tonga Hunga Ha'apai volcano-tsunami event, the DART Network expediated termination of tsunami warnings and advisories in New Zealand. Detection and observation of first wave arrivals on the network also had a direct role in the issuing of a National Advisory before first arrival at the mainland coastline.

In the 19 March, M7.7 Loyalty Islands earthquake, the DART Network recorded tsunami wave amplitudes consistent with an M7.9 earthquake. This observation, coupled with a regional Mww determination, were used to assess the tsunami potential of this event. In this case, impacts simulated from the DART and regional wphase results (Mww7.9) fit more closely to the measured wave amplitudes than those based on the global Mww 7.7. This highlights the utility of observations of the tsunami source and the challenges of using earthquake estimations as a proxy for tsunami generation.

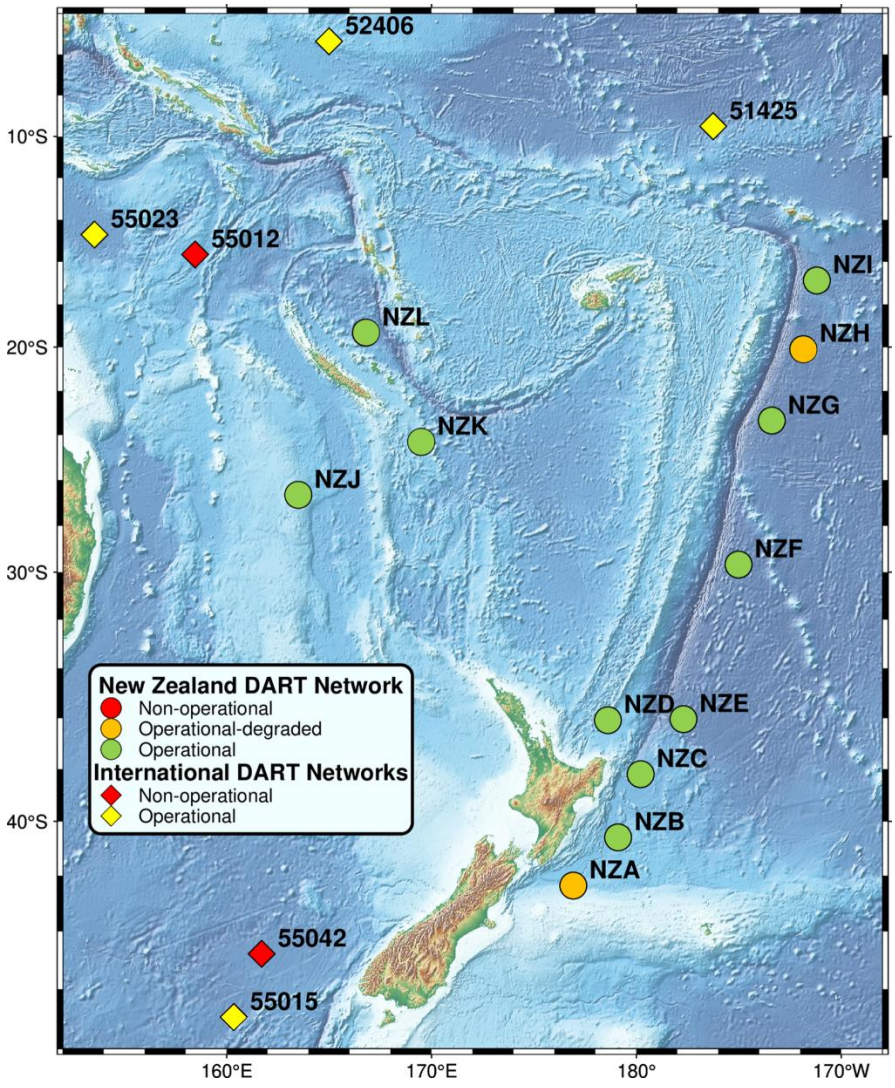


Figure 3: DART Map June 2023

11.1.3 National Tsunami Strategy and Work Programme

NEMA is coordinating the development of a National Tsunami Strategy in collaboration with the National Tsunami Working Group (NTWG). The purpose of the Strategy is to outline best practice for strengthening the resilience of coastal communities through action and advocacy across all 4R's – risk reduction, readiness, response and recovery.

This strategy uses the National Disaster Resilience Strategy (NDRS) as a foundation document. The NDRS is focused on wider disaster resilience for all New Zealanders, and all those who live, work, or visit here. The objectives of the NDRS underpin this strategy.

This strategy provides a common agenda for national agencies and organisations, regional and local government, the science and research community, and community champions with an interest and role in tsunami risk reduction, readiness, response and/or recovery, to create a collective impact.

Following publishing of the National Tsunami Strategy, the NTWG will collaborate on a shared National Tsunami Work Programme to coordinate the implementation of the Strategy.

11.1.4 Coastal Breakpoints

New Zealand's coastal breakpoints mark the beginning and end of each of the 43 coastal zones (Figure 2), determined based on tsunami modelling. These are used in maps and warning messages to show/explain the areas that need to evacuate in a tsunami land threat. The suite of these breakpoint names was updated earlier this year to improve the accuracy of these locations based on how they relate to the physical breakpoint itself. Previously, some breakpoints were named after populated areas quite some distance from the physical breakpoint, so referring to this location in maps and warnings may lead to over- or under-evacuation depending on which coastal zones were under threat.

This was an important step in the development of the pre-computed maps which is a key project for speeding up tsunami warnings.

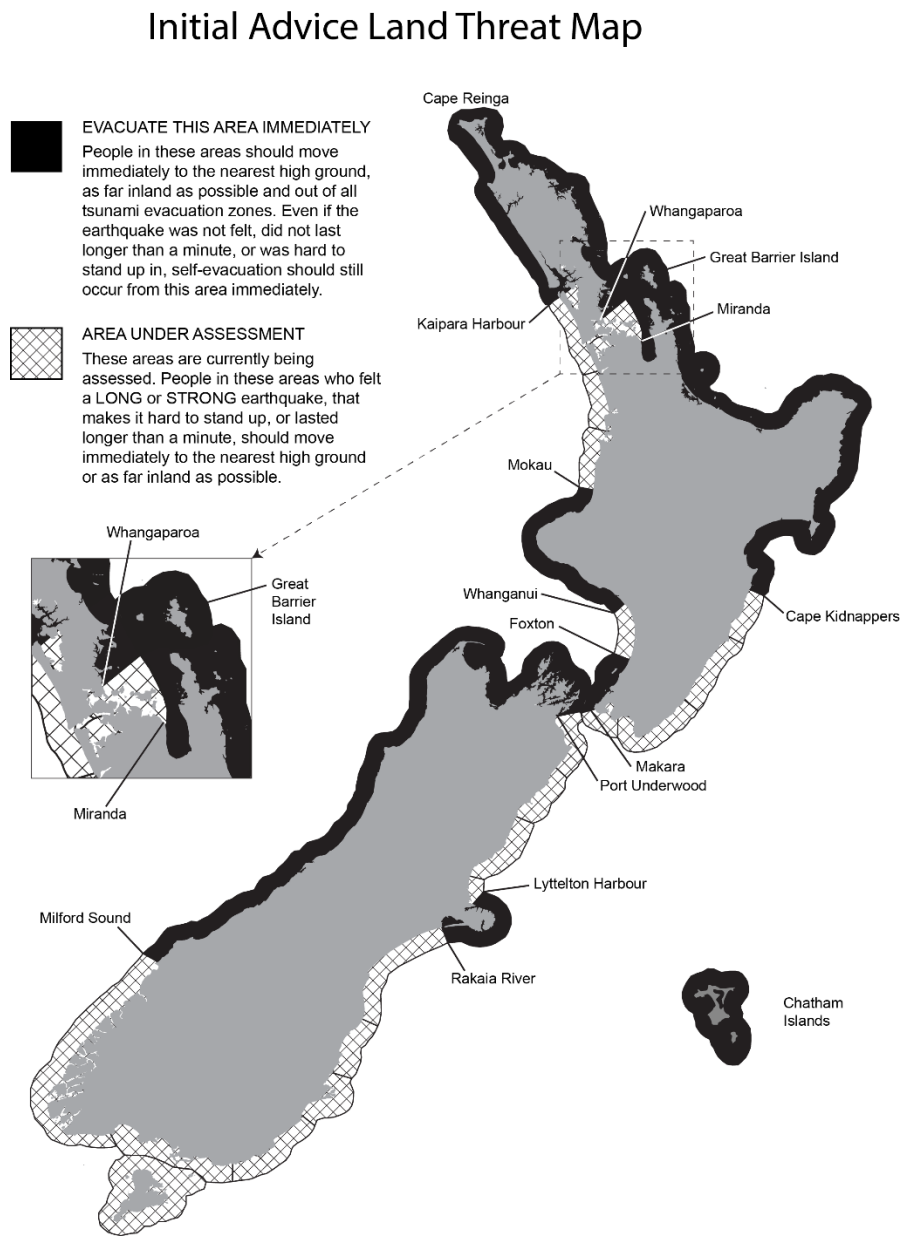


Figure 4: Example from current pre-computed Kermadec map showing coastal breakpoints

11.1.5 Public Education

NEMA's public education programme includes a large component dedicated to tsunami. NEMA run large tsunami awareness campaigns over the summer holidays (Long or Strong, Get Gone) and promote tsunami hīkoi (evacuation walk) as part of New Zealand ShakeOut every year. In 2022, 700,714 people signed up for New Zealand ShakeOut. As of 12 July, over 207,000 people have already registered for New Zealand ShakeOut 2023 since sign ups opened on 27 June.

A key channel for public education is the Get Ready website, which includes information for the public on what to do before, during and after emergencies. There are dedicated webpages for all hazards, including tsunami, and these have been translated into 15 languages (to date).

11.1.6 National Tsunami Advisory and Warning Plan

The National Tsunami Advisory and Warning Plan will be updated by NEMA by the end of 2023 to reflect the role of the MAR Centre and the new pre-computed maps for local- and Kermadec-source events. The Plan states the following:

- Responsibilities (agencies) regarding tsunami advisories and warnings
- Processes for tsunami advisories and warnings
- Types of tsunami advisories and warnings
- Action guidelines
- Tsunami categories and threat

The current version of the Plan is available on the NEMA website.

11.1.7 Nationally Consistent Tsunami Evacuation Zones

NEMA's Hazard Risk Management (HRM) team is leading the updates of two key national tsunami risk management documents: the Director's Guideline for Tsunami Evacuation Zones and the National Tsunami Signage Technical Standard.

There are several components of the Director's Guideline that require work for the update. One of the critical elements is guidance (number and definitions of zones) for tsunami evacuation zones. There is a mutual desire from NEMA and regional Civil Defence Emergency Management (CDEM) Groups to have a consistent approach to tsunami evacuation zones across Aotearoa New Zealand. At present, there are various tsunami evacuation zone approaches implemented by CDEM Groups in their regions. The difference in approaches has resulted in a lack of consistency, which has flow-on effects for public education and tsunami warnings, communication, and behaviour during events.

In addition, community preparedness is being furthered by creating national guidelines for the tsunami blue lines initiative started in some communities. This involves painting blue lines across roads in tsunami prone areas to indicate where the community should evacuate beyond if they feel a strong or long earthquake (i.e., those possible to generate tsunami).

11.1.8 Aotearoa Tsunami Evacuation Map

In late 2022, NEMA launched the first version of the Aotearoa Tsunami Evacuation Map. This is an interactive map tool that allows people to search their home, work or school address to find out if it's in a tsunami zone.

The map is informed by data provided by CDEM Groups and councils, including tsunami zone areas and advice specific to each region. NEMA does not provide information about current tsunami warnings on this map.

NEMA is working in collaboration with CDEM Groups and councils to determine what features may be included in future versions of this map, including discussions about use of the map for tsunami advisories/warnings, providing information about evacuation routes, and more.

11.1.9 Tsunami Ready

NEMA is currently considering how it might support regional communities to implement the Tsunami Ready Recognition Programme in support of the Ocean Decade Goal of 100% of all at risk communities prepared for and resilient to tsunami. This would be undertaken using near-to existing reporting requirements and governance structures.

This approach will also enable New Zealand to report to ICG/PTWS on progress towards the goal, without requiring formal recognition in addition to national requirements, where this may present an administration burden to regional communities.

One CDEM Group has already used the Tsunami Ready Recognition Programme to inform the design of a regional tsunami work programme. This resulted in the work program being structured in a similar manner to TRRP, and also consistent with national standards and culturally appropriate for the community. Four additional indicators were added in support of quality management and recovery.

11.2 Regional Work Programme

In September 2022, Civil Defence Emergency Management (CDEM) Groups, who coordinate tsunami across New Zealand's 16 regions, completed a stocktake of their tsunami work programmes to inform a snapshot of all major components of tsunami work being undertaken across New Zealand. The stocktake asked about a range of specific tools and resources used across all 4Rs (risk reduction, readiness, response, recovery) that are common in CDEM Groups tsunami work programmes.

Future tsunami plans and priorities outlined by CDEM Groups span across all aspects of tsunami work programmes and all 4Rs – risk reduction, readiness, response, and recovery. Updating tsunami evacuation zone modelling/maps and planning are the most common priorities amongst the CDEM Groups for both the immediate future and looking to the next five-years. Readiness and public education, updating signage and public information, recovery considerations, and relationships with science and research programmes are also common priorities.

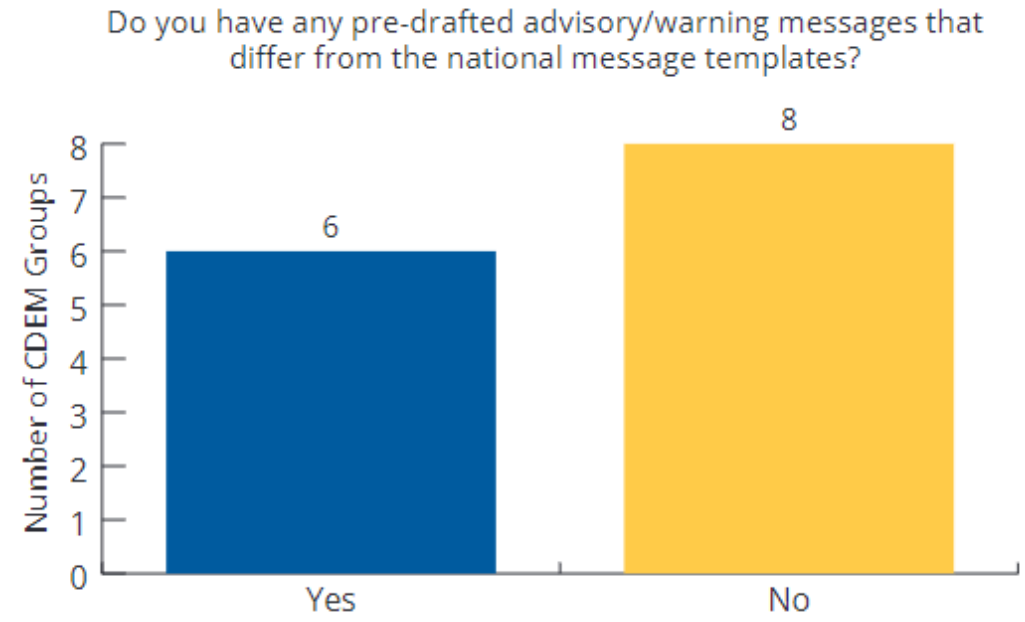
While tsunami is a priority for many CDEM Groups, there are some clear challenges and barriers to meeting regional and/or national consistency for tsunami readiness and resilience.

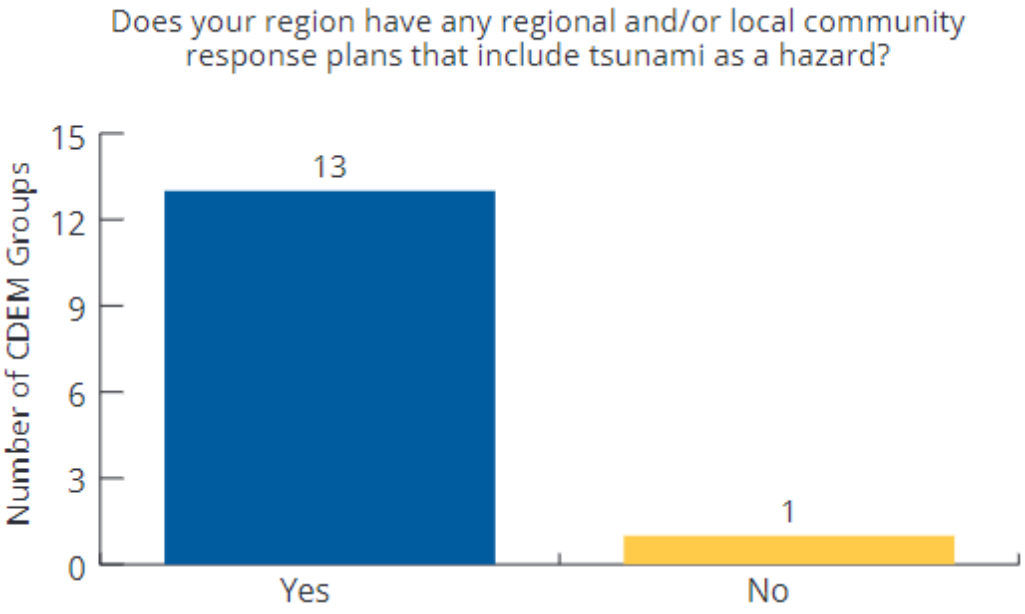
The stocktake data obtained from the CDEM Groups indicated that the biggest risk to delivering tsunami work programmes is capability and capacity, particularly financial, constraints. The next biggest risk identified was the suitability of current and future national guidelines and standards for regional/local implementation.

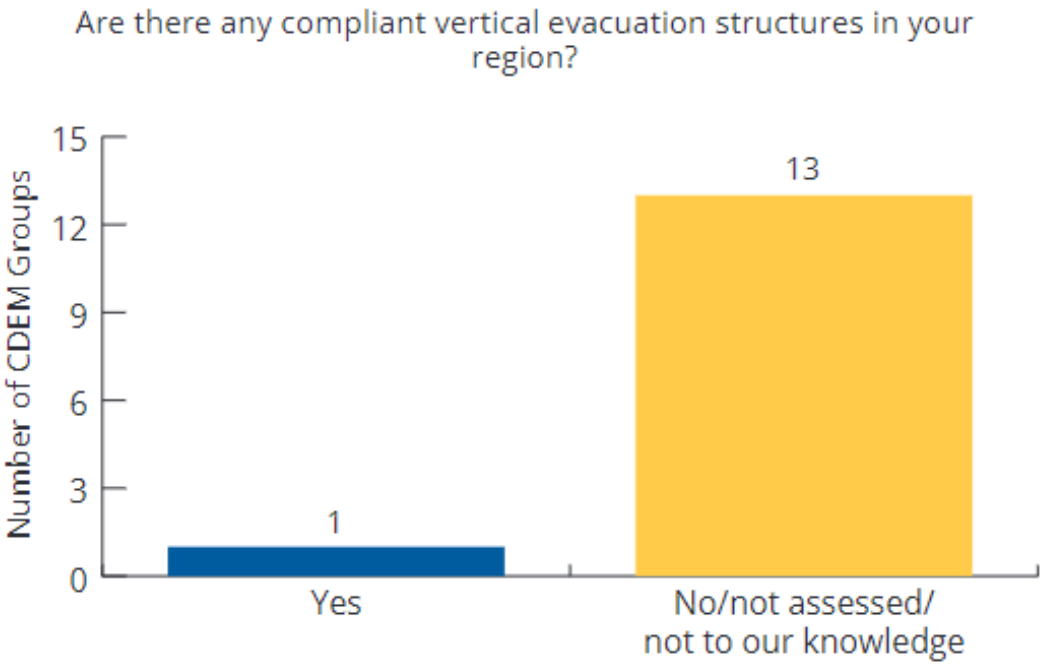
Other challenges that were specified included: ensuring adequate partnership with Māori to make certain that Māori priorities and perspectives are being captured, uncertainty within science research and absence of research in some regions, and extensive coastlines meaning implementation of mitigation measures is beyond capacity.

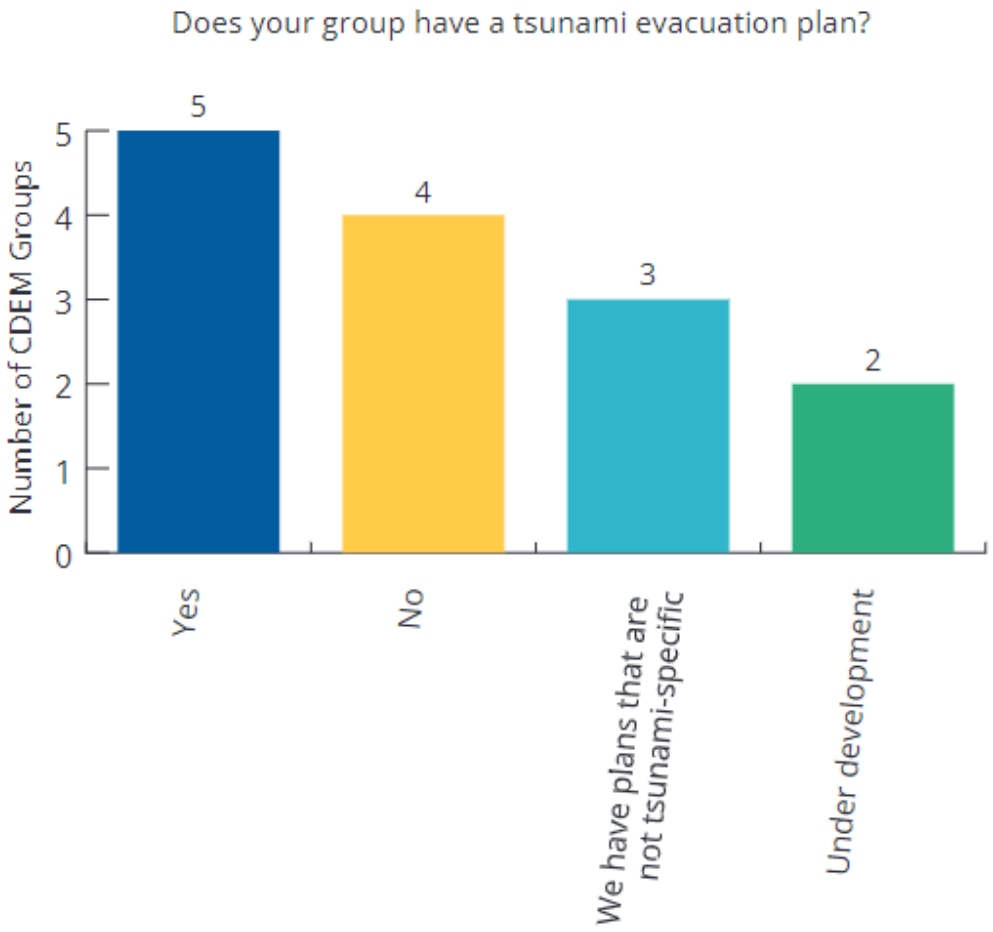
Both NEMA and the CDEM Groups are eager to address these challenges in a National Tsunami Strategy and future national guidelines, technical standards, and templates. These documents will also help to promote consistency across the regions. Clear direction from a national level can support CDEM Group tsunami work programme implementation where local and regional funding and resources may be lacking or reprioritised.

The below graphs are a snapshot of some of the data collected through the stocktake that may be of interest:


Do you have any pre-drafted advisory/warning messages that differ from the national message templates?
Number of CDEM Groups
0
1
2
3
4
5
6
7
8
6
8
Yes
No


Does your region have any regional and/or local community response plans that include tsunami as a hazard?
Number of CDEM Groups
0
3
6
9
12
15
13
1
Yes
No


Are there any compliant vertical evacuation structures in your region?
Number of CDEM Groups
15
12
9
6
3
0
1
13
Yes
No/not assessed/ not to our knowledge


Does your group have a tsunami evacuation plan?
Number of CDEM Groups
5
4
3
2
1
0
5
4
3
2
Yes
No
We have plans that are not tsunami-specific
Under development

11.3 Toka Tū Ake EQC– Natural Hazards Commission Work Programme

During the sessional period, Toka Tū Ake EQC have funded the development of Level 3 and Level 4 Tsunami Modelling in three regions across Aotearoa New Zealand. This has been completed in line with New Zealand's guidance for tsunami evacuation modelling. Level 3 and Level 4 modelling significantly improves our ability to model loss, improve natural hazard planning and refine our evacuation zones. COMCOT and COMMIT were used/are being used to simulate tsunami generation and propagation from multiple sources for the regions of Hawkes Bay, Bay of Plenty and Northland. These regions are at high risk of a local source tsunami.

In 2022 Toka Tū Ake EQC and GNS Science completed a national exposure assessment for tsunami hazard and risk. This used all historical tsunami hazard studies to understand how many buildings, and their replacement value, exist in New Zealand that could be impacted by credible tsunami events. The study found that 9.1% of buildings in New Zealand are exposed to credible tsunami events equating to $67 billion in replacement value. The results from this study will be used to inform future investment in more detailed tsunami impact studies to reduce risk in areas of high exposure.

We continue to work with GNS Science to improve our loss models to estimate the impacts of tsunami events. This provides a strong evidence base to reduce the impacts of future tsunami events. Our increasing exposure in low-lying coastal areas, means future tsunami events will have a greater impact than those we've experienced in the past. This creates an evidence base for us to plan more appropriately across our four pillars of emergency management. We are further using these loss models to inform land-use planning decision-making in relation to natural hazards, including tsunami. Using RiskScape we are creating impact data for cost-benefit analyses to determine the impact of planned greenfield and brownfield planning policies.

In July 2023, Toka Tū Ake EQC will go live with New Zealand's first National Natural Hazards Portal. This is a government initiative to improve access to data and information about natural hazards. The overall goal is to provide people with the information they need to make risk-informed choices about property and land. This will be achieved by taking users on a journey from hazard to risk, supporting users to understand what a natural hazard risk means for them and be provided with options that could reduce their risk. This includes from the risk of tsunami inundation.

11.4 GNS Science

GNS Science host the Rapid Characterisation of Earthquakes and Tsunamis (RCET) programme, which is a cross-institute research and operations programme that develops tsunami response tools. RCET currently provides:

1) Wphase moment tensor inversions, including Mww estimates, within 20 minutes for most significant earthquakes in the Pacific. These estimates are automatically delivered to the Tsunami Experts Panel (TEP) and NGMC.
2) Ensemble coastal amplitude forecasts to TEP. These forecasts are currently being used as an expert tool to assess hazard, but future work is aimed at using the ensemble approach to underpin time-dependent forecasts within 30 minutes of the event.
3) Automated inversion of DART data to the TEP.

4) Automated fault mapping from strong-motion seismic data for onshore and proximal offshore events. These solutions are available minutes after large local earthquakes and can, in some cases, be used to inform TEW.

GNS Science hosts the Resilience to Nature's Challenges (RNC) National Science Challenge. The earthquake and tsunami programme of RNC has delivered a new probabilistic tsunami hazard model for local and regional earthquake sources through the use of physics-based modelling of the earthquake cycle. Significantly, this presents a clear pathway to probabilistic inundation modelling. We anticipate that this approach will underpin future probabilistic tsunami risk models in which compounding earthquake and tsunami risks can be quantified.

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