



Tsunami Advisory and Warning Plan

Supporting Plan [SP 01/09]

Revised February 2010



**Resilient New Zealand
Aotearoa Manahau**



Te Rākau
Whakamarumaru

Ministry of Civil Defence
& Emergency Management

Tsunami Advisory and Warning Supporting Plan [SP 01/09]

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Authority

This document has been issued by the Director of the Ministry of Civil Defence & Emergency Management pursuant to s9(3) of the Civil Defence Emergency Management (CDEM) Act 2002. It is a support plan to the functional arrangements set out in the *National CDEM Plan* and *The Guide to the National CDEM Plan*. This plan is referenced in Appendix 1 of *The Guide to the National CDEM Plan*.

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Preface

This plan describes the national arrangements to receive and assess tsunami information and to disseminate national tsunami advisories and/or warnings.

New Zealand is a member of the Pacific Tsunami Warning System (an international system under the auspices of the Intergovernmental Oceanographic Commission of UNESCO) designed to provide timely and effective information about tsunamis or potential tsunamis generated in the Pacific Basin. In New Zealand the system is complemented by GNS Science geological hazards and sea level monitoring. MCDEM is the agency responsible for initiating national tsunami advisories and warnings to the communities of New Zealand.

This plan describes the procedures to receive, assess and disseminate tsunami notifications at the national level. However, national tsunami advisories or warnings may not reach all local communities at all times. Local authorities must therefore maintain public alert systems and procedures to communicate tsunami advisories or warnings received from the national level further down stream to local communities. The arrangements for local level public alerting should be contained in CDEM Group Plans.

For any tsunami warning to be effective, the population in general must be aware of the nature of tsunamis, the damage they can cause in their areas and ways to mitigate (prevent or avoid) the destructive aspects of tsunamis. The responsibility for public awareness rests at both national and local levels.

Additional information about tsunamis may be found in the *National Hazardscape Report* on the MCDEM website, www.civildefence.govt.nz, in the Publications section.

Introduction

Purpose of this plan The purpose of this plan is to outline the national procedures to warn local authorities and national agencies of the approach of known or possible tsunamis that could affect coastal areas of New Zealand.

The scope of this plan This is a **National Advisory and Warning Plan** and deals with the arrangements to receive and assess tsunami information at the national level, and the dissemination of national official¹ notifications via the National Warning System.

The plan does not address the detailed actions to be taken by local authorities and national agencies upon receipt of national official tsunami notifications. Matters such as local public alerting systems, possible areas of inundation and evacuation arrangements must be incorporated into local plans. This plan can assist in the preparation of local plans and educational material.

This plan also does not address the response arrangements after a tsunami has struck. Generic response arrangements are detailed in the *National Civil Defence Emergency Management (CDEM) Plan* and CDEM Group Plans for multi-hazard response.

Use of this plan This plan is to be used by:

- Ministry of Civil Defence & Emergency Management (MCDEM).
- Science agencies associated with civil defence and emergency management
- Emergency services
- Other government agencies
- Civil Defence & Emergency Management (CDEM) Groups
- Local government

These organisations must plan their actions for when they receive information through the National Warning System to enable them to respond appropriately.

Testing of this plan Testing of this plan will be done in conjunction with the testing of the National Warning System as well as specific exercises that MCDEM initiates or is involved in.

Annexes to this plan The annexes attached to this plan provide examples of templates and action guides that are used in the response to a tsunami event, as well as additional information to assist local agencies in the development of their own area plans. The list of annexes are:

Annex A - Action Guides

Annex B - Examples of tsunami notifications

Annex C - Tsunami categories and threat

1. "Official" notifications or warnings are issued by designated authorities. They are different to "natural" warnings (felt, heard, and observed experiences) and "informal" warnings (informal means of communication e.g. Person to person or unconfirmed media reports)

Other documents relevant to this plan

Other documents that must be read in conjunction with this plan are:

- *Directors Guideline: Tsunami Evacuation Zones [DGL 08/08]*
- *Technical Standard: National Tsunami Signage [TS 01/08]*

These documents can be found on the Publications page of the Ministry's website, www.civildefence.govt.nz

Responsibilities

Introduction

This section provides an overview of the responsibilities of organisations responding to a tsunami event. Annex A (page 19) provides detailed Action Guides for some agencies mentioned in this section.

Pacific Tsunami Warning Centre (PTWC)

The Pacific Tsunami Warning Centre (PTWC) is located in Hawaii and serves as the operational headquarters for the Pacific Tsunami Warning System (PTWS). The PTWS is a tsunami warning system governed by Pacific member countries of the Intergovernmental Oceanographic Commission (IOC) which is a body under the United Nations Educational, Scientific and Cultural Organization (UNESCO).

The PTWC monitors an expansive seismic and sea level network in the Pacific and issues tsunami bulletins under the following categories (using the location and magnitude of earthquakes as the only initial determinants):

- Tsunami Information Bulletin/Statement
- Tsunami Advisory
- Tsunami Watch, and
- Tsunami Warning

The PTWC bulletin categories do not apply in New Zealand. MCDEM uses the PTWC categories as one of several considerations to initiate official advisories or warnings in New Zealand.

PTWC tsunami bulletins are disseminated directly to MCDEM and GNS Science. MCDEM, with the support of GNS Science assess all bulletins received from the PTWC to determine the threat for New Zealand.

PTWC tsunami bulletins are also faxed to Airways Corporation in Christchurch via the Aeronautical Fixed Telecommunication Network (AFTN) and to the MetService in Wellington via the Global Telecommunication System (GTS) as redundancy measures for MCDEM.

GNS Science

GNS Science maintains a national geological hazards monitoring and data collection system through its GeoNet project. Geonet incorporates dual data centres with duty officers on 20 minute 24/7 response time. Through this system GeoNet is able to detect earthquakes in the seas around New Zealand. GeoNet also monitors and maintains New Zealand's sea level monitoring network around New Zealand coasts and off-shore islands. GNS Science is also expanding its GeoNet data management centre capability to include sea level information.

GeoNet earthquake reports are disseminated to MCDEM and GNS Science serves as MCDEM's primary advisor for tsunami threat analysis. It can activate a tsunami experts panel usually consisting of representatives of GNS Science, National Institute of Water and Atmospheric Research (NIWA) and academic institutions for this purpose when required.

Responsibilities (continued)

MCDEM

The overall responsibility for the initiation and issue of national official tsunami notifications in New Zealand rests with the Ministry of Civil Defence & Emergency Management (MCDEM). The next section of this plan describes the process applied and the types of notifications to be used.

MCDEM uses the National Warning System (NWS) to disseminate official tsunami notifications in the form of national advisories and warnings on a 24/7 basis. Section 19 of *The Guide to the National CDEM Plan* describes the NWS.

MCDEM represents New Zealand in the Pacific Tsunami Warning System.

MCDEM also maintains a Memorandum of Understanding with GNS Science for the provision of earthquake and tsunami information and response advice to MCDEM.

Airways Corporation and MetService

Upon receipt of PTWC bulletins, Airways Corporation and MetService send a copy to MCDEM and contact the MCDEM Duty Officer to confirm receipt of the bulletin.

Land Information New Zealand (LINZ)

Land Information New Zealand (LINZ) is responsible for the installation and operation of New Zealand's sea level monitoring network. LINZ maintains a partnership with GNS Science to build and maintain the network of sea level monitoring stations.

CDEM Groups

CDEM Groups and CDEM Group members are responsible for the planning for, development and maintenance of appropriate public alert and tsunami response systems for their areas.

All the CDEM Groups and CDEM Group members receive national tsunami advisories and warnings via the NWS. CDEM Groups and CDEM Group members are responsible for further local threat assessment and deciding on appropriate local public alerting.

Media

Under the arrangements contained in Section 22 of *The Guide to the National CDEM Plan*, MCDEM can request public radio and television stations to broadcast national advisories and warnings.

CDEM Groups may also include local broadcasters in their local public alerting systems.

Maritime New Zealand

Maritime New Zealand's Maritime Operations Centre is responsible for safety of life at sea communications in the area of the Pacific stretching from the equator to the South Pole and the Mid Tasman to 120 degrees west. This includes the dissemination of maritime safety information in the area it is responsible for.

Responsibilities (continued)

Other agencies

A number of other New Zealand agencies, including the emergency services, receive national tsunami advisories and warnings from MCDEM. These agencies respond to the information in accordance with their own arrangements and/or procedures and where applicable, in support of CDEM Groups.

Process: Tsunami notifications

Introduction

This section explains MCDEM’s process for assessing tsunami information and determining the appropriate response.

Responsibility of MCDEM

MCDEM is responsible for:

- Receiving notifications from PTWC and GNS Science
- Assessing the information
- Seeking advice from GNS Science
- Making decisions on appropriate response, which may include:
 - No action required, or
 - Issue national advisories, warnings or cancellations (including media statements)

Assessing the information received

The MCDEM Duty Officer determines if the information received from PTWC/GNS Science meets the indicators identified in **Table 1: Response Indicators** (opposite).

Where necessary the MCDEM Duty Officer will engage with the GNS Science Duty Officer who will consider the information against source modelling and historical data and make an initial assessment of the level of threat to New Zealand. The GNS Science Duty Officer may activate the Tsunami Experts Panel (TEP) for support in this regard.

SPECIAL CONSIDERATION – LOCAL SOURCE TSUNAMIS

A tsunami generated in conjunction with a nearby large earthquake or undersea landslide may not provide sufficient time to implement official warning procedures.

Persons in coastal areas who:

- experience strong earthquakes (hard to stand up);
- experience weak earthquakes lasting for a minute or more;
- observe strange sea behaviour such as the sea level suddenly rising and falling, or hear the sea making loud and unusual noises or roaring like a jet engine;

should not wait for an official warning. Instead, let the natural signs be the warning. They must take immediate action to evacuate predetermined evacuation zones, or in the absence of predetermined evacuation zones, go to high ground or go inland.

“Response indicators” for MCDEM

The following table explains the “Response indicators” used by MCDEM to initiate national tsunami advisories or warnings. The table details the thresholds for the respective originating locations and templates to use if the thresholds are met.

Region	Location	Thresholds	Template to use
1	South West Pacific (includes NZ local source)	PTWC Warning for NZ or Mw ≥8 and Depth <100km	National Warning – Tsunami: Threat to NZ
		PTWC Watch for NZ or Mw >7.5 – ≤7.9 and Depth <100km	National Advisory – Tsunami: Potential threat to NZ
2	South America	PTWC Watch or Warning for NZ or Mw ≥8.0 and Depth <100 km	National Advisory – Tsunami: Potential threat to NZ
3	Central America	PTWC Watch or Warning for NZ or Mw ≥8.0 and Depth <100 km	
4	Cascadia	PTWC Watch or Warning for NZ	
5	Aelutians Rat Island		
6	Kurile Islands Kamchatka		
7	Japan		
8	Other (any location not inside a circle on map)		

Table 1: Response Indicators

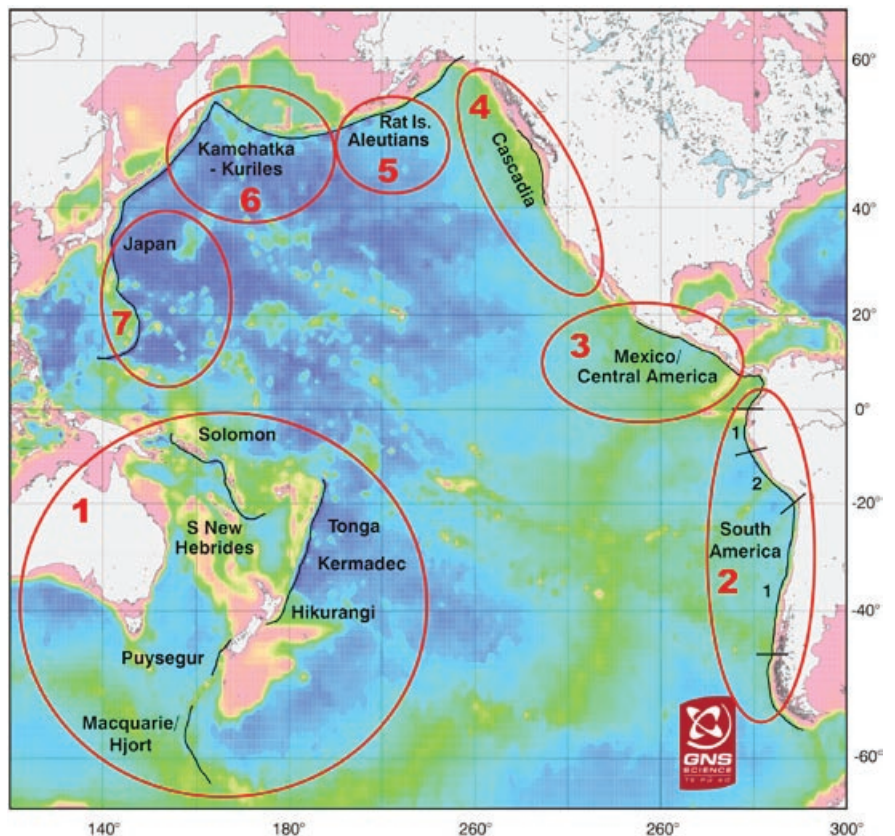


Figure 1: Origin Locations (Regions 1-7)

Types of notifications by MCDEM

Notifications from MCDEM

Depending on the assessment of the information received for an earthquake, MCDEM may issue one or more of the following notifications:

National Advisory - Tsunami: No threat to NZ

National Advisory - Tsunami: Potential threat to NZ

National Warning - Tsunami: Threat to NZ

National Advisory - Tsunami cancellation message

National Warning - Tsunami cancellation message

Request for the broadcast of an emergency announcement

Note:

Annex A to this plan details the actions to be taken by CDEM agencies and associated organisations when receiving national tsunami notifications.

Annex B to this plan shows examples of the templates used to format the message for each type of notification issued.

National Advisory – Tsunami: No threat to NZ

Description

A *National Advisory – Tsunami: No Threat to NZ* is a message that tsunami information has been received and the tsunami does not pose a threat to New Zealand coastlines but the event is deemed to be within the interests of the CDEM sector.

Note:

An example of the *National Advisory – Tsunami: No Threat to NZ* template is located in Annex B to this plan.

Issuing process

A *National Advisory – Tsunami: No Threat to NZ* is issued through the National Warning System to all those that are registered on the NWS database, including the media.

A *National Advisory – Tsunami: No Threat to NZ* is the final message for the event and it is **not** followed up by subsequent information or notifications and a cancellation message will **not** be issued.

National Advisory – Tsunami: Potential threat to NZ

Description

A *National Advisory – Tsunami: Potential Threat to NZ* is a message that tsunami information has been received and:

- the current threat is unknown, and
- the impact of the earthquake is being assessed to determine the potential tsunami threat for New Zealand, or
- the characteristics of the earthquake are such that there is a possibility a tsunami has been generated.

Note:

An example of the template *National Advisory – Tsunami: Potential Threat to NZ* is located in Annex B to this plan.

Issuing process

A *National Advisory – Tsunami: Potential Threat to NZ* is issued through the National Warning System to all those that are registered on the NWS database, including the media.

MCDEM will follow up a *National Advisory – Tsunami: Potential Threat to NZ* by issuing a *National Advisory Tsunami: Cancellation Message* or escalate the event to a warning by issuing a *National Warning – Tsunami: Threat to NZ*.

A *National Advisory – Tsunami: Potential Threat to NZ* will be followed up by hourly (or more frequent) messages until a cancellation message is issued.

A *Request for Broadcast of an Emergency Announcement* will be made to radio and television under the arrangements in Section 22 of *The Guide to the National CDEM Plan*.

National Warning – Tsunami: Threat to NZ

Description

A *National Warning – Tsunami: Threat to NZ* is a message that a tsunami threat to the New Zealand coastline is imminent or likely. In a developing situation some information may not be available or may reflect a degree of uncertainty. However, if this is the case this will be stated. Where known it will contain the following information:

- estimated tsunami arrival times at key New Zealand coastal points,
- estimated wave height (if available),
- regional threats,
- advice for the general public.

Note:

An example of the template *National Warning – Tsunami: Threat to NZ* is located in Annex B to this plan.

Issuing process

A *National Warning – Tsunami: Threat to NZ* is issued through the National Warning System to all those that are registered on the NWS database, including the media.

MCDEM will follow up a *National Warning – Tsunami: Threat to NZ* with hourly updates or will formally cancel the warning by issuing a *National Warning – Tsunami Cancellation*.

A *Request for Broadcast of an Emergency Announcement* will be made to radio and television under the arrangements in Section 22 of *The Guide to the National CDEM Plan*.

National Advisory or Warning – Tsunami cancellation message

Description

A *National Advisory or Warning – Tsunami Cancellation Message* is a notification to inform all agencies that there is no longer a tsunami threat to New Zealand. MCDem will issue this notification once it has received confirmation from its scientific advisors that a threat no longer exists. If there is a degree of uncertainty the Advisory or Warning will remain in place.

Note:

An example of the template *National Advisory or Warning – Tsunami Cancellation Message* is located in Annex B to this plan.

Issuing process

A *National Advisory or Warning – Tsunami Cancellation Message* is issued through the National Warning System to all those that are registered on the NWS database, including the media.

All agencies will follow stand-down procedures as detailed in their own agency or group plans.

A request will be made to terminate the *Broadcast of an Emergency Announcement* made under the arrangements in Section 22 of *The Guide to the National CDEM Plan*.

Request for the broadcast of an emergency announcement

Description

A *Request for the broadcast of an emergency announcement* is made by MCDEM when a *National Advisory - Tsunami* or a *National Warning - Tsunami: Threat to NZ* is issued.

The radio and television stations requested to broadcast the announcement under the terms of the MOU agreement with MCDEM are:

- Radio New Zealand
- Radion New Zealand International
- Classic Hits
- NewstalkZB
- More FM
- Radio Live
- TVNZ
- TV3

Depending on the priority (urgency), a *Request for the broadcast of an emergency announcement* can state that the information must be broadcasted at least every 15 minutes or at least hourly until a request is made to terminate the broadcast.

Note:

Examples of the templates *Request for the broadcast of an emergency announcement* and *Request to terminate the broadcast of an emergency announcement* are located in Annex B to this plan.

Issuing process

MCDEM maintains formal arrangements with radio and television for the broadcast of emergency announcements. These arrangements are described in Section 22 of *The Guide to the National CDEM Plan*.

Any request for the broadcast of an emergency announcement must be closed by an official *Request to terminate the broadcast of an emergency announcement* forwarded in the same manner as the initiating request for broadcast.

Annex A : Agency action guides

Introduction

This section contains Action Guides for organisations that are responsible for responding to tsunami notifications. The guides list what action each organisation should carry out once they have received a tsunami notification.

The following are the list of Action Guides contained within this section:

- MCDEM (page 20)
- GNS Science (page 22)
- CDEM Groups (page 23)
- Maritime New Zealand (page 24)
- National Agencies (page 25)

MCDEM action guide

Notification

MCDEM may receive one or more the following notifications for a tsunami event:

- GNS Science earthquake reports,
- Pacific Tsunami Warning Centre (PTWC) Tsunami Information Bulletin, or Advisory
- PTWC Tsunami Watch or Warning

The actions that will be carried out by MCDEM are detailed in the tables below.

Estimated time to complete steps 1–3: 15 to 30 minutes		
On receipt of any or the above notifications:		
Step	Event and action	Responsibility
1	Assess the risk to New Zealand	Duty Officer
2	Consult GNS Science	Duty Officer/ GNS Science and TEP
3	<p>If deemed appropriate, or advised by GNS Science, or if initial information meets the thresholds detailed in Table 1: Response Indicators on page 11 of this plan, MCDEM will issue appropriate notifications to agencies via the National Warning System:</p> <p>“National Advisory–Tsunami No Threat to NZ” “National Advisory–Tsunami Potential Threat to NZ” “National Warning–Tsunami Threat to NZ” “Request for the broadcast of an emergency announcement”</p>	Duty Officer

Estimated time to complete steps 4–8: 30 minutes ongoing until a cancellation message is issued		
Step	Event and action	Responsibility
4	When a <i>National Advisory – Tsunami: Potential Threat to NZ</i> or a <i>National Warning – Tsunami: Threat to NZ</i> is issued, request the broadcast of an emergency announcement and activate the National Crisis Management Centre.	Duty Team
5	Open communications or teleconference line for discussions with GNS Science and the TEP for updated assessments.	Duty Officer
6	Provide updates at least hourly via the NWS and the media. Upgrade advisory to warning if necessary.	Duty Manager
7	Depending on the severity and scope of the anticipated threat, MCDEM may advise the Minister of Civil Defence to declare a state of national emergency.	National Controller
8	Issue a cancellation message when there is no longer a threat or potential threat to New Zealand.	Duty Manager

GNS Science action guide

Notification

GNS Science may receive one or more of the following notifications:

- GNS Science seismic and sea level data
- PTWC Tsunami Information Bulletin
- PTWC Tsunami Watch or Warning

The actions that will be carried out by GNS Science are detailed in the tables below.

Estimated time to complete steps 1–3: 15 to 30 minutes		
On receipt of notifications that indicate a potential threat to New Zealand		
Step	Event and action	Responsibility
1	Monitor and assess information to provide advice to the MCDEM Duty Officer.	GNS Science Duty Officer
2	Provide advice to MCDEM Duty Officer if required.	GNS Science Duty Officer
3	Activate the Tsunami Experts Panel (TEP) if required.	GNS Science Duty Officer

Estimated time to complete steps 4–6: 30 minutes ongoing until a cancellation message is issued		
Step	Event and action	Responsibility
4	Provide continual assessments of information to the Duty Officer/NCMC including the following specific areas if known: <ul style="list-style-type: none"> • travel-time estimates for the tsunami • wave height estimates • threat for respective regions 	GNS Science Duty Officer/TEP
5	Send a Liaison Officer to the NCMC when requested.	GNS Science/TEP
6	Provide ongoing advice to the Duty Officer/National Controller/Planning and Intelligence function if required.	GNS Science/TEP liaison

CDEM Groups action guide

Notification

CDEM Groups will receive one or more of the following notifications:

- “National Advisory - Tsunami No Threat to NZ”
- “National Advisory - Tsunami Potential Threat to NZ”
- “National Warning – Tsunami Threat to NZ”

The actions that will be carried out by CDEM Groups are detailed in the table below.

Estimated time to complete steps 1–2: 15 to 30 minutes		
On receipt of one or more of the notifications listed above.		
Step	Event and action	Responsibility
1	Follow Group emergency response procedures. If appropriate, issue local warnings.	Group Controller
2	In the event of <i>National Advisory Tsunami Potential Threat</i> or <i>National Warning - Tsunami: Threat to NZ</i> inform the appointed MCDEM Regional Emergency Management Advisor about the response taken. Similarly when responding in reaction to any other notification, inform the appointed MCDEM Regional Emergency Management Advisor.	Group Controller
3	Upon activation of the CDEM Group Emergency Coordination Centre, establish contact with the NCMC	Group Controller
4	Update the NCMC and neighbouring CDEM Groups on response taken.	Group Controller

Maritime New Zealand action guide

Notification

Maritime New Zealand will receive one or more of the following notifications:

“National Advisory - Tsunami No Threat to NZ”

“National Advisory - Tsunami Potential Threat to NZ”

“National Warning – Tsunami Threat to NZ”

The actions that will be carried out by Maritime New Zealand are detailed in the table below.

Estimated time to complete steps 1–2: 15 to 30 minutes

On receipt of one or more of the notifications listed above.

Step	Event and action	Responsibility
1	Broadcast the <i>National Advisory – Tsunami: Potential Threat to NZ</i> or <i>National Warning – Tsunami: Threat to NZ</i> to mariners.	Duty Officer
2	Carry out own agency response actions.	Duty Officer

National Agencies action guide

Notification

National Agencies will receive one or more of the following notifications:

- “National Advisory - Tsunami No Threat to NZ”
- “National Advisory - Tsunami Potential Threat to NZ”
- “National Warning – Tsunami Threat to NZ”

The actions that will be carried out by these agencies are detailed in the tables below.

Estimated time to complete step 1: 15 to 30 minutes

On receipt of one or more of the notifications listed above.

Step	Event and action	Responsibility
1	Follow agency emergency response procedures.	Agency Duty Officer

Estimated time: 1 hour from receipt of *National Advisory – Tsunami: Potential Threat to NZ* or *National Warning – Tsunami: Threat to NZ*

Step	Event and action	Responsibility
2	Inform the NCMC about decisions made and activities undertaken.	Agency Duty Officer
3	Provide Liaison Officer(s) to the NCMC if requested.	Agency Controller
4	Provide Sit-Reps to NCMC from Agency Emergency Operating Centre (EOC).	

Annex B : Tsunami notification examples

Introduction

This section contains examples of the various templates used for tsunami notifications. Templates are subject to change in order to accommodate operational improvements and changes in contact details.

All of these templates exist in electronic format with clearly marked fields for the insertion of relevant information by operational staff. The examples shown here retain some colour-coded fields for editing. In their completed state however, all colour coding will be removed.

Note: Telephone numbers and email addresses are not included in the examples provided.

Example: National Advisory – Tsunami no threat to NZ

National Advisory: Tsunami - No Threat to New Zealand

No: 01

Issued at [insert time _: _] hours on [insert date _ / _ / _].
Issued by the Ministry of Civil Defence & Emergency Management (MCDEM).

An earthquake has occurred with these parameters:

Origin time:	[insert UTC, ZULU or GMT time and date]
NZ time:	[insert NZST or NZDT time and date]
Co-ordinates:	[insert]
Depth:	[insert]
Location:	[insert]
Magnitude:	[insert]

The above magnitude is provisional and may be increased or decreased as more seismic data becomes available.

Summary:

The Pacific Tsunami Warning Centre (PTWC) has issued a Tsunami Information Bulletin in response to the above earthquake.

Only messages issued by MCDEM represent the official warning status for New Zealand.

MCDEM has assessed the information with the assistance of scientific advisors. Based on current information, the initial assessment is that the earthquake is unlikely to have caused a tsunami that will pose a threat to New Zealand.

This advisory has been issued to all local civil defence authorities, emergency services, other agencies and media.

This will be the final message via the national warning system for this event unless the event parameters change significantly.

NCMC status:

The National Crisis Management Centre (NCMC) is not activated.

Normal Ministry of Civil Defence & Emergency Management contact details apply.

General enquiries to 04 473 7363

Media enquiries to 04 494 6951

Useful websites:

<http://www.civildefence.govt.nz/>

<http://www.getthru.govt.nz/>

Issued by:

Message authorised by the National Controller, Civil Defence Emergency Management.

End of Message

SMS text

National Advisory: Tsunami - No Threat to NZ. No 1. Issued at [insert time] hours on [insert date] by MCDEM. Detail in fax and email.

Yellow highlights fields within the template that need to be edited.

The examples shown here retain some colour-coded fields. In their completed state however, all colour coding will be removed.

Some telephone numbers have been removed in the examples provided.

Example: National Advisory – Tsunami potential threat to NZ

National Advisory: Tsunami - Potential Threat to New Zealand

No: 01

Issued at [insert time __:__:__] hours on [insert date __/__/__].

Issued by the Ministry of Civil Defence & Emergency Management (MCDEM).

A tsunami potential threat advisory is in effect for New Zealand:

The advisory will remain in effect until it is upgraded to a national warning or a cancellation message is issued by MCDEM.

An earthquake has occurred with these parameters:

Origin time:	[insert UTC, ZULU or GMT time and date]
NZ time:	[insert NZST or NZDT time and date]
Co-ordinates:	[insert]
Depth:	[insert]
Location:	[insert]
Magnitude:	[insert]

The above magnitude is provisional and may be increased or decreased as more seismic data becomes available.

Summary:

The Pacific Tsunami Warning Centre (PTWC) has issued a Tsunami [Information Bulletin/Watch - delete one] in response to the above earthquake.

Only messages issued by MCDEM represent the official warning status for New Zealand. Local civil defence authorities may supplement these messages by applying local threat assessments.

A tsunami is possible. MCDEM and scientific advisors are assessing the severity of the threat to New Zealand.

If a tsunami has been generated, the first wave may arrive in New Zealand in the areas around [insert place] at approximately [insert time NZDT/NZST on insert date]. The first wave may arrive later and may not be the largest. Waves may continue for several hours.

People in coastal areas should:

1. Stay off beaches
2. Stay out of the water (sea, rivers, estuaries, including boating activities)
3. Do not go sightseeing
4. Share this information with family, neighbours and friends
5. Listen to the radio and/or TV for updates
6. Follow instructions of your local Civil Defence authorities.

Yellow highlights fields within the template that need to be edited.

The examples shown here retain some colour-coded fields. In their completed state however, all colour coding will be removed.

Some telephone numbers have been removed in the examples provided.

MCDEM and scientific advisors are closely monitoring the situation to determine whether a tsunami has been generated and to assess the severity of the threat to New Zealand. More information about this event will follow.

This advisory has been issued to all local civil defence authorities, emergency services, other agencies and media.

Information for emergency managers:

Local Civil Defence Emergency Management should stand by for further information and may:

1. Activate appropriate response arrangements
2. Alert potentially at-risk communities as appropriate.

Local emergency services should act in coordination with local Civil Defence Emergency Management.

MCDEM is activating the Memorandum of Understanding (MoU) with public broadcasters to broadcast this advisory.

NCMC status:

The National Crisis Management Centre (NCMC) is being activated.

Further information:

A further update with more information will follow within the next hour. Until a cancellation is issued, updates will continue at least hourly. All further updates will be communicated by MCDEM via the national warning system.

Media enquires to 04 494 6951.

Useful websites:

<http://www.civildefence.govt.nz/>
<http://www.getthru.govt.nz/>

Issued by:

Message authorised by the National Controller, Civil Defence Emergency Management.

End of Message

SMS text

National Advisory: Tsunami - Potential Threat to NZ. No 1. Issued at [insert time] hours on [insert date] by MCDEM. Detail in fax and email.

Example: National Advisory – Tsunami potential threat to NZ, still awaiting confirmation

National Advisory: Tsunami Potential Threat to New Zealand Update: Still awaiting tsunami confirmation

No: [insert eg. 02]

Issued at [insert time __: __] hours on [insert date _/ _/ _].

Issued by the Ministry of Civil Defence & Emergency Management (MCDEM).

A tsunami advisory is still in effect for New Zealand:

The tsunami advisory will remain in effect until it is upgraded to a national warning or a cancellation message is issued by MCDEM.

An earthquake has occurred with these parameters:

Origin time:	[insert UTC, ZULU or GMT time and date]
NZ time:	[insert NZST or NZDT time and date]
Co-ordinates:	[insert]
Depth:	[insert]
Location:	[insert]
Magnitude:	[insert]

The above magnitude is provisional and may be increased or decreased as more seismic data becomes available.

Summary:

The Pacific Tsunami Warning Centre (PTWC) has issued a Tsunami [Information Bulletin/Watch - delete one] in response to the above earthquake.

Only messages issued by MCDEM represent the official warning status for New Zealand. Local civil defence authorities may supplement these messages by applying a local threat assessment.

Confirmation has not yet been received that a tsunami was generated. A tsunami is possible.

If a tsunami has been generated, the first wave may arrive in New Zealand in the areas around [insert place] at [insert time NZDT/NZST on insert date].

The first wave may arrive later and may not be the largest. Waves may continue for several hours.

People in coastal areas should:

1. Stay off beaches
2. Stay out of the water (sea, rivers and estuaries, including boating activities)
3. Do not go sightseeing
4. Share this information with family, neighbours and friends
5. Listen to the radio and/or TV for updates
6. Follow instructions of your local Civil Defence authorities.

Yellow highlights fields within the template that need to be edited.

The examples shown here retain some colour-coded fields. In their completed state however, all colour coding will be removed.

Some telephone numbers have been removed in the examples provided.

MCDEM and scientific advisors are closely monitoring the situation to determine whether a tsunami has been generated and to assess the severity of the threat to New Zealand. More information about this event will follow.

This advisory has been issued to all local civil defence authorities, emergency services, other agencies and media.

Information for emergency managers:

Local Civil Defence Emergency Management should stand by for further information and may:

1. Activate appropriate response arrangements
2. Alert potentially at-risk communities as appropriate

Local emergency services should act in coordination with local Civil Defence Emergency Management.

MCDEM has activated the Memorandum of Understanding (MoU) with public broadcasters to broadcast this advisory.

NCMC status:

The National Crisis Management Centre (NCMC) is activated.

General enquiries	(04)
Media enquiries	(04) 494 6951
Email	operations@ncmc.govt.nz
Satellite phone	
HF radio call sign	ZKC21

Useful websites:

- <http://www.civildefence.govt.nz/>
- <http://www.getthru.govt.nz/>

Further information:

A further update with more information will follow within the next hour. Until a cancellation is issued updates will continue at least hourly. All further updates will be communicated by MCDEM via the national warning system.

Issued by:

Message authorised by the National Controller, Civil Defence Emergency Management.

End of Message

SMS text

National Advisory: Tsunami - Potential Threat to NZ. No [insert]. UPDATE Issued at [insert time] hours on [insert date] by MCDEM. Detail in fax and email.

Example: National Warning – Tsunami threat to NZ

National Warning: Tsunami Threat to New Zealand

No: 01

Issued at [insert time __: __] hours on [insert date _/ _/ __].

Issued by the Ministry of Civil Defence & Emergency Management (MCDEM).

A tsunami warning is in effect for New Zealand:

The tsunami warning will remain in effect until a cancellation message is issued by MCDEM.

An earthquake has occurred with these parameters:

Origin time:	[insert UTC, ZULU or GMT time and date]
NZ time:	[insert NZST or NZDT time and date]
Co-ordinates:	[insert]
Depth:	[insert]
Location:	[insert]
Magnitude:	[insert]

The above magnitude is provisional and may be increased or decreased as more seismic data becomes available.

Summary:

The Pacific Tsunami Warning Centre (PTWC) has issued a Tsunami [Information Bulletin/Watch/Warning - delete as appropriate] in response to the above earthquake.

Only messages issued by MCDEM represent the official warning status for New Zealand. Local civil defence authorities may supplement these messages by applying local threat assessments.

A tsunami is possible.

If a tsunami has been generated, the first wave may arrive in New Zealand in the areas around [insert place] at approximately [insert time NZDT/NZST on insert date]. The first wave may arrive later and may not be the largest. Waves may continue for several hours.

People in coastal areas should:

1. Stay off beaches
2. Stay out of the water (sea, rivers and estuaries, including boating activities)
3. Do not go sightseeing
4. Share this information with family, neighbours and friends
5. Listen to the radio and/or TV for updates
6. Follow instructions of your local Civil Defence authorities.

MCDEM and scientific advisors are closely monitoring the situation to determine if a tsunami has been generated and to assess the severity of the threat to New Zealand.

Yellow highlights fields within the template that need to be edited.

The examples shown here retain some colour-coded fields. In their completed state however, all colour coding will be removed.

Some telephone numbers have been removed in the examples provided.

More information about expected wave arrival times and wave heights will follow.

This warning has been issued to all local civil defence authorities, emergency services, other agencies and media.

Information for emergency managers:

Local Civil Defence Emergency Management should:

1. Activate appropriate response arrangements
2. Alert potentially at-risk communities as appropriate
3. Stand by for further information
4. Inform the NCMC of actions taken.

Local emergency services should act in coordination with local Civil Defence Emergency Management.

MCDEM is activating the Memorandum of Understanding (MoU) with public broadcasters to broadcast this warning.

NCMC status:

The National Crisis Management Centre (NCMC) is being activated.

Further information:

A further update with more information will follow within the next hour. Until a cancellation is issued updates will continue at least hourly. All further updates will be communicated by MCDEM via the national warning system.

Media enquiries to 04 494 6951.

Useful websites:

<http://www.civildefence.govt.nz/>
<http://www.getthru.govt.nz/>

Issued by:

Message authorised by the National Controller, Civil Defence Emergency Management.

End of Message

SMS text

National Warning: Tsunami - Threat to NZ. No 1. Issued at [insert time] hours on [insert date] by MCDEM. Detail in fax and email.

Example: National Warning – Tsunami threat to NZ, still awaiting confirmation

National Warning: Tsunami Threat to New Zealand Update: Still awaiting tsunami confirmation

No: [insert eg. 02]

Issued at [insert time __:__:__] hours on [insert date __/__/__].
Issued by the Ministry of Civil Defence & Emergency Management (MCDEM).

A tsunami warning is still in effect for New Zealand:

The tsunami warning will remain in effect until a cancellation message is issued by MCDEM.

An earthquake has occurred with these parameters:

Origin time:	[insert UTC, ZULU or GMT time and date]
NZ time:	[insert NZST or NZDT time and date]
Co-ordinates:	[insert]
Depth:	[insert]
Location:	[insert]
Magnitude:	[insert]

The above magnitude is provisional and may be increased or decreased as more seismic data becomes available.

Summary:

The Pacific Tsunami Warning Centre (PTWC) has issued a Tsunami [Information Bulletin/Watch/Warning - delete as appropriate] in response to the above earthquake.

Only messages issued by MCDEM represent the official warning status for New Zealand. Local civil defence authorities may supplement these messages by applying local threat assessments.

Confirmation has not yet been received that a tsunami was generated. A tsunami is possible.

If a tsunami has been generated, waves are not expected to be larger than [insert height in metres]. The first wave may arrive in New Zealand in the areas around [insert place] at [insert time NZDT/NZST on insert date]. The first wave may arrive later and may not be the largest. Waves may continue for several hours.

People in coastal areas should:

1. Stay off beaches
2. Stay out of the water (sea, rivers and estuaries, including boating activities)
3. Do not go sightseeing
4. Share this information with family, neighbours and friends
5. Listen to the radio and/or TV for updates
6. Follow instructions of your local Civil Defence authorities.

MCDEM and scientific advisors are closely monitoring the situation to determine whether a tsunami has been generated and to assess the severity of the threat to New Zealand. More information about expected wave arrival times and wave heights will follow.

Yellow highlights fields within the template that need to be edited.

The examples shown here retain some colour-coded fields. In their completed state however, all colour coding will be removed.

Some telephone numbers have been removed in the examples provided.

This warning has been issued to all local civil defence authorities, emergency services, other agencies and media.

Information for emergency managers:

Local Civil Defence Emergency Management should:

1. Activate appropriate response arrangements
2. Alert potentially at-risk communities as appropriate
3. Stand by for further information
4. Inform the NCMC of actions taken.

Local emergency services should act in coordination with local Civil Defence Emergency Management.

MCDEM has activated the Memorandum of Understanding (MoU) with public broadcasters to broadcast this warning.

NCMC status:

The National Crisis Management Centre (NCMC) is activated.

General enquiries	(04)
Media enquiries	(04) 494 6951
Email	operations@ncmc.govt.nz
Satellite phone	
HF radio call sign	ZKC21

Useful websites:

- <http://www.civildefence.govt.nz/>
- <http://www.getthru.govt.nz/>

Further information:

A further update with more information will follow within the next hour. Until a cancellation is issued updates will continue at least hourly. All further updates will be communicated by MCDEM via the national warning system.

Issued by:

Message authorised by the National Controller, Civil Defence Emergency Management.

End of Message

SMS Text

National Warning: Tsunami - Threat to NZ. No [insert]. UPDATE. Issued at [insert time] hours on [insert date] by MCDEM. Detail in fax and email.

Example: National Warning – Tsunami threat to NZ

Update: tsunami confirmed

National Warning: Tsunami Threat to New Zealand Update: Tsunami confirmed

No: [insert eg. 02]

Issued at [insert time _ : _] hours on [insert date _ / _ / _].

Issued by the Ministry of Civil Defence & Emergency Management (MCDEM).

A tsunami warning is in effect for New Zealand:

The tsunami warning will remain in effect until a cancellation message is issued by MCDEM.

An earthquake has occurred with these parameters:

Origin time:	[insert UTC, ZULU or GMT time and date]
NZ time:	[insert NZST or NZDT time and date]
Co-ordinates:	[insert]
Depth:	[insert]
Location:	[insert]
Magnitude:	[insert]

The above magnitude is provisional and may be increased or decreased as more seismic data becomes available.

Summary:

The Pacific Tsunami Warning Centre (PTWC) has issued a Tsunami [Information Bulletin/Watch/Warning - delete as appropriate] in response to the above earthquake.

Only messages issued by MCDEM represent the official warning status for New Zealand. Local civil defence authorities may supplement these messages by applying local threat assessments.

Confirmation been received that a tsunami was generated. A wave measuring [insert metres] was measured at [insert place/gauge] at [insert time NZDT/NZST].

Waves are not expected to be larger than [insert height in metres] in New Zealand.

The first wave to arrive to New Zealand will be in the areas around [insert place] at approximately [insert time NZDT/NZST on insert date]. The first wave may arrive later and may not be the largest. Waves will continue for several hours.

People in coastal areas should:

1. Stay off beaches
2. Stay out of the water (sea, rivers and estuaries, including boating activities)
3. Do not go sightseeing
4. Share this information with family, neighbours and friends
5. Listen to the radio and/or TV for updates
6. Follow instructions of your local Civil Defence authorities.

MCDEM and scientific advisors are closely monitoring the situation to determine the severity of the threat to New Zealand. This warning has been issued to all local civil defence authorities, emergency services, other agencies and media.

Yellow highlights fields within the template that need to be edited.

The examples shown here retain some colour-coded fields. In their completed state however, all colour coding will be removed.

Some telephone numbers have been removed in the examples provided.

Example: National Warning – Tsunami threat to NZ, Update: tsunami confirmed (continued)

Information for emergency managers:

Estimates of expected wave arrival times are as follows:

Note: These times are provisional and based on the best information available. Arrival times may be as much as one hour later and may be adjusted in subsequent messages.

Location	Estimated Wave Arrival Time	
Chatham Islands-Kaingaroa	[insert NZST or NZDT time and date, or No Information]	delete one
Chatham Islands-Waitangi	[insert NZST or NZDT time and date, or No Information]	delete one
North Cape	[insert NZST or NZDT time and date, or No Information]	delete one
Whangarei	[insert NZST or NZDT time and date, or No Information]	delete one
Auckland	[insert NZST or NZDT time and date, or No Information]	delete one
Mt Maunganui	[insert NZST or NZDT time and date, or No Information]	delete one
East Cape	[insert NZST or NZDT time and date, or No Information]	delete one
Gisborne	[insert NZST or NZDT time and date, or No Information]	delete one
New Plymouth	[insert NZST or NZDT time and date, or No Information]	delete one
Napier	[insert NZST or NZDT time and date, or No Information]	delete one
Wanganui	[insert NZST or NZDT time and date, or No Information]	delete one
Wellington	[insert NZST or NZDT time and date, or No Information]	delete one
Nelson	[insert NZST or NZDT time and date, or No Information]	delete one
Marlborough Sounds	[insert NZST or NZDT time and date, or No Information]	delete one
Westport	[insert NZST or NZDT time and date, or No Information]	delete one
Greymouth	[insert NZST or NZDT time and date, or No Information]	delete one
Lyttelton	[insert NZST or NZDT time and date, or No Information]	delete one
Timaru	[insert NZST or NZDT time and date, or No Information]	delete one
Milford Sound	[insert NZST or NZDT time and date, or No Information]	delete one
Dunedin	[insert NZST or NZDT time and date, or No Information]	delete one
Bluff	[insert NZST or NZDT time and date, or No Information]	delete one
Stewart Island	[insert NZST or NZDT time and date, or No Information]	delete one

Local civil defence emergency management is advised to:

1. Activate appropriate response arrangements
2. Alert potentially at-risk communities as appropriate
3. Stand by for further information
4. Inform the NCMC of actions taken.

Local emergency services should act in coordination with local Civil Defence Emergency Management. MCDEM has activated the Memorandum of Understanding (MoU) with public broadcasters to broadcast this warning.

NCMC status:

The National Crisis Management Centre (NCMC) is activated.

General enquiries	
Media enquiries	(04) 494 6951
Email	operations@ncmc.govt.nz
Satellite phone	
HF radio call sign	ZKC21

Useful websites:

<http://www.civildefence.govt.nz/>
<http://www.getthru.govt.nz/>

Further updates:

A further update with more information will follow within the next hour. Until a cancellation is issued updates will continue at least hourly. All further updates will be communicated by MCDEM via the national warning system.

Issued by:

Message authorised by the National Controller, Civil Defence Emergency Management.

End of Message

SMS text

National Warning: Tsunami - Threat to NZ. No [insert] UPDATE TSUNAMI CONFIRMED Issued at [insert time] hours on [insert date] by MCDEM. Detail in fax and email.

Example: National Advisory – Tsunami potential threat to NZ cancellation

National Advisory: Tsunami - Potential threat to New Zealand Cancellation: Advisory now cancelled

No: [insert eg. 02]

Issued at [insert time __: __] hours on [insert date _ / _ / _].

Issued by the Ministry of Civil Defence & Emergency Management (MCDEM).

Tsunami advisory cancelled:

[Insert appropriate free text relevant to the situation and have wording checked by the National Controller].

Earthquake parameters:

Origin time:	[insert UTC, ZULU or GMT time and date]
NZ time:	[insert NZST or NZDT time and date]
Co-ordinates:	[insert]
Depth:	[insert]
Location:	[insert]
Magnitude:	[insert]

The above magnitude is provisional and may be increased or decreased as more seismic data becomes available.

Summary:

This is the last message via the national warning system for this event.

This cancellation message has been issued to all local civil defence authorities, emergency services, other agencies and media.

This cancellation message will be broadcast under the Memorandum of Understanding (MoU) with public broadcasters.

NCMC status:

The National Crisis Management Centre (NCMC) is standing down from [insert time and date].

After this time, normal Ministry of Civil Defence & Emergency Management contact details will apply:

General enquiries to: 04 473 7363

Media enquiries to: 04 494 6951

Useful websites:

<http://www.civildefence.govt.nz/>

<http://www.getthru.govt.nz/>

Issued by:

Message authorised by the National Controller, Civil Defence Emergency Management.

End of Message

SMS text

National Advisory: Tsunami - Potential Threat to NZ CANCELLED No: [INSERT]. Issued at [insert time] hours on [insert date] by MCDEM. Detail in fax and email

Yellow highlights fields within the template that need to be edited.

The examples shown here retain some colour-coded fields. In their completed state however, all colour coding will be removed.

Some telephone numbers have been removed in the examples provided.

Example: National Warning – Tsunami threat cancellation message

National Warning: Tsunami - Threat to New Zealand Cancellation Warning now cancelled

No: [insert eg. 02]

Issued at [insert time __: __] hours on [insert date __/__/__].

Issued by the Ministry of Civil Defence & Emergency Management (MCDEM).

Tsunami warning cancelled:

[Insert appropriate free text relevant to the situation and have wording checked by the National Controller].

Earthquake parameters:

Origin time:	[insert UTC, ZULU or GMT time and date]
NZ time:	[insert NZST or NZDT time and date]
Co-ordinates:	[insert]
Depth:	[insert]
Location:	[insert]
Magnitude:	[insert]

The above magnitude is provisional and may be increased or decreased as more seismic data becomes available.

Summary:

This is the last message via the national warning system for this event.

This cancellation message has been issued to all local civil defence authorities, emergency services, other agencies and media.

This cancellation message will be broadcast under the Memorandum of Understanding (MoU) with public broadcasters.

NCMC status:

The National Crisis Management Centre (NCMC) is standing down from [insert time and date].

After this time, normal Ministry of Civil Defence & Emergency Management contact details will apply:

General enquiries to: 04 473 7363

Media enquiries to: 04 494 6951

Useful websites:

<http://www.civildefence.govt.nz/>

<http://www.getthru.govt.nz/>

Issued by:

Message authorised by the National Controller, Civil Defence Emergency Management.

End of Message

SMS text

National Warning: Tsunami - Threat to NZ CANCELLED No: [INSERT]. Issued at [insert time] hours on [insert date] by MCDEM. Detail in fax and email.

Yellow highlights fields within the template that need to be edited.

The examples shown here retain some colour-coded fields. In their completed state however, all colour coding will be removed.

Some telephone numbers have been removed in the examples provided.

Example: MOU request for broadcast of emergency announcement



REQUEST FOR THE BROADCAST OF AN EMERGENCY ANNOUNCEMENT

This is an official request for the broadcast of an Emergency Announcement in accordance with the Memoranda of Understanding between the Ministry of Civil Defence & Emergency Management and radio and television broadcasters.

[insert time date month year]

Broadcast priority: 1 An event of life-threatening or national significance. Broadcast every 15 minutes.

Broadcast Target Areas: National

Period of Broadcast: Immediate

This request for an Emergency Announcement is made by the Civil Defence Emergency Management National Controller. Before broadcast, this message must be verified by the MCDEM Public Information Manager on 04 494 6951.

Emergency Announcement

The Ministry of Civil Defence & Emergency Management is **[advising/warning]** New Zealand coastal communities that a tsunami is possible following a magnitude **[insert number]** earthquake **[at/near]** **[insert place]** at **[insert time]** New Zealand time **[today/yesterday]**.

If a tsunami has been generated, the first wave may arrive in New Zealand in the areas around **[insert place]** at approximately **[insert time NZDT/NZST on insert date]**. The first wave may arrive later and may not be the largest. Waves may continue for several hours.

People in coastal areas should:

1. Stay off beaches
2. Stay out of the water (sea, rivers and estuaries, including inshore boating)
3. Do not go sightseeing
4. Share this information with family, neighbours friends and colleagues
5. Listen to the radio and TV for updates about the threat or for the all clear
6. Follow instructions of your local Civil Defence authorities.

This warning has been issued to all local civil defence authorities, emergency services, other agencies and media.

Local civil defence authorities have been asked to activate local response arrangements and alert potentially at-risk communities as appropriate.

This Emergency Announcement was issued by the Civil Defence Emergency Management National Controller. Stay tuned to this station for more information.

Media contact:

Public Information Duty Manager,
Telephone: 04 494 6951
E-mail: pim@ncmc.govt.nz
Web: <http://www.civildefence.govt.nz/>

Useful websites:

People can find practical information about what they can do to help themselves prepare for an emergency on the Ministry's 'Get Ready Get Thru' website <http://www.getthru.govt.nz/>

Example: MOU request to terminate emergency announcement



REQUEST TO TERMINATE THE BROADCAST OF AN EMERGENCY ANNOUNCEMENT

Time/Date

This is an official request to terminate the broadcast of the Emergency Announcement issued in accordance with the Memoranda of Understanding between the Ministry of Civil Defence & Emergency Management and radio and television broadcasters.

(Details)

This request for Termination of an Emergency Announcement is authorised by (name of Civil Defence Manager).....

Before broadcast, this message must be verified by the MCDEM Duty Officer on:
.....

Annex C : Tsunami categories and threat

Categories of tsunami

The three categories of tsunami

For the purposes of emergency management, tsunamis are divided into three categories:

- Distant source
- Regional source
- Local source.

The categories are based on the shortest time it would take the tsunami to travel from its source to an area of concern – in New Zealand’s case, the closest part of the New Zealand coastline. This categorisation by travel time is fairly consistent with the geographical location of the source. The travel times for the three categories are:

- Distant Source – more than 3 hours
- Regional Source – 1 to 3 hours
- Local Source – 0 to 60 minutes: most local source tsunamis are generated in less than 30 minutes

Warning consideration for the three categories of tsunami

Most major distant tsunami sources are more than 10 hours travel time from New Zealand, giving in theory, adequate time for National Advisories or Warnings to be issued and subsequent response actions to be initiated. While wave heights may be difficult to predict initially, more confident predictions will become available over time but still early enough to support local level decision making and response.

Regional tsunami sources are one to three hours travel time to New Zealand and therefore provide much less time for assessment before National Advisories or Warnings are issued. Initial National Advisories or Warnings are likely to be issued on the basis of ‘rule of thumb’ thresholds based on the location, size and depth of the earthquake. These National Advisories and Warnings are unlikely to include confident predictions of wave height and local decisions may have to be made without that knowledge. The assessment of regional sources contained in this Annex must be used to support decision making at local level.

Warning consideration for the three categories of tsunami (continued)

Local tsunami sources offer very little (if any) time for formal warnings as most local source tsunamis are less than 30 minutes travel time to the nearest New Zealand coast. In this case public awareness to be able to recognise and individually respond to natural warnings¹ is vital.

However, local source tsunamis will take longer to travel to other areas and therefore do not exclude formal warnings. National Advisories or Warnings are unlikely to include predictions of wave height and local decisions will have to be made without that knowledge. The assessment of local source tsunami contained in this Annex must be used to support decision making at local level.

1. 'Natural warnings' are personal observations of natural occurrences. They can experience any of the following:

- strong earthquakes (it's hard to stand up), weak earthquakes lasting for a minute or more,
- 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.

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

The tsunami threat to New Zealand

Introduction

This section outlines the risk that New Zealand would face from a tsunami if an earthquake of reasonable magnitude occurred in the Pacific Rim.

New Zealand's tsunami risk is comparable to its earthquake risk. Large tsunamis have occurred in New Zealand within written history, but have resulted in few deaths and only modest damage. However, early Maori historical traditions record several large tsunamis killing many people within the last 1000 years. Archaeological evidence indicates that several coastal settlements around New Zealand were abandoned for higher ground in the mid-1400s perhaps due to tsunami inundation. There is also geological evidence of tsunamis with up to 35 metre run-ups affecting the New Zealand coast within the last 6000 years.

National hazard and risk assessment

In 2005 GNS Science led an urgent assessment of the tsunami hazard and risk in New Zealand based on existing knowledge, and of New Zealand's preparedness for this hazard. Subsequent research may have been done in some areas since this report was completed which may provide further detail. The results of the review are contained in the *National Hazardscape Report* which can be found at www.civildefence.govt.nz in the publications section.

The 2005 review showed estimated damages of \$12-21 billion nationally from a 500-year return period tsunami – approximately 10% probability of occurrence in 50 years, or annual probability of 0.2%. (see Figure 1 on page 44)

The risk in terms of mortality in the 19 urban centres assessed in the review (for the same return period) arises from losses in many towns and cities in New Zealand, but is predominantly from those along the east coasts of the North and South Islands as a result of large earthquakes in South America (about 60% of total deaths) or along the Hikurangi subduction margin of the eastern North Island (about 34% of total deaths). Tsunamis generated by offshore local faults are likely to account for 5% of deaths and those generated by regional sources 1%.

Deaths and injuries are highly dependent on the time of year and time of day, and on whether an effective warning can be issued before the tsunami reaches the coast.

The information on the respective tsunami sources relevant to New Zealand in this Plan was taken from the 2005 GNS Science assessment.

National hazard and risk assessment (continued)

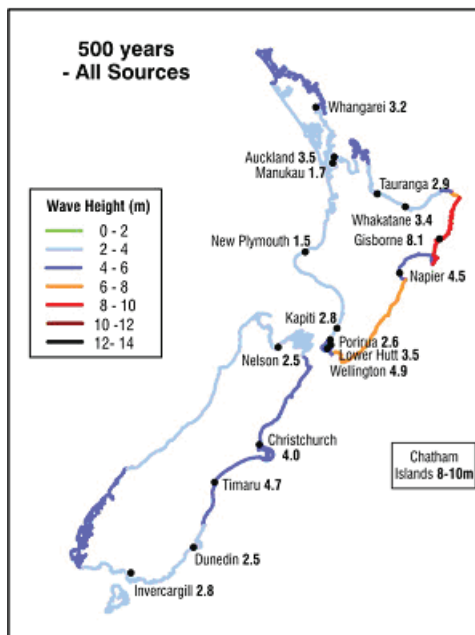
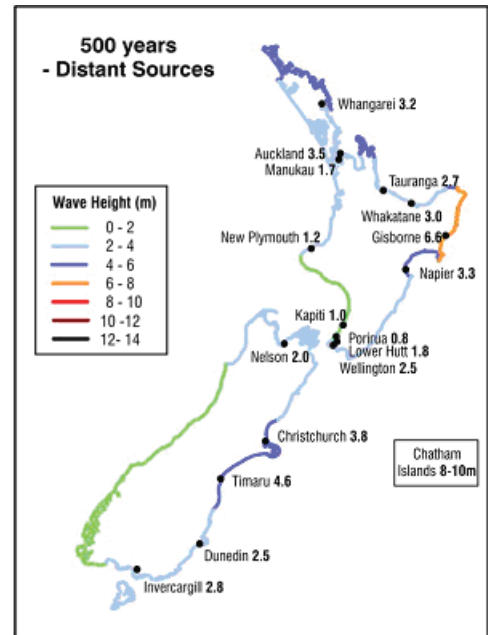
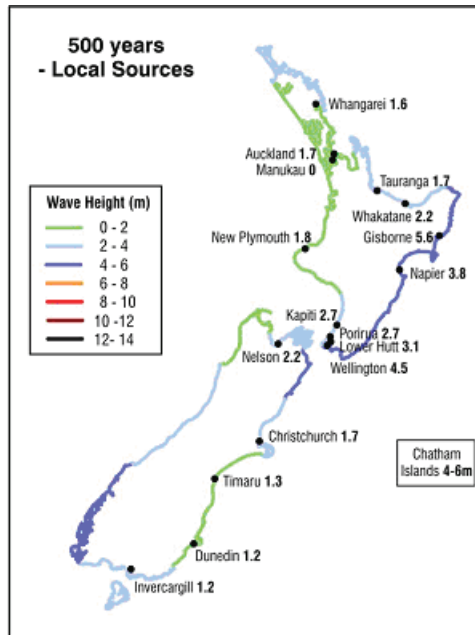


Figure 2

General estimate of tsunami hazard in New Zealand expressed as expected mean wave height above mean sea level at the shore for a 500-year return period. Significantly higher or lower water elevations may occur locally. These maps should not be used for site-specific assessments.

Source: Review of Tsunami Hazard and Risk in New Zealand, GNS Science 2005.

Regions where tsunamis originate

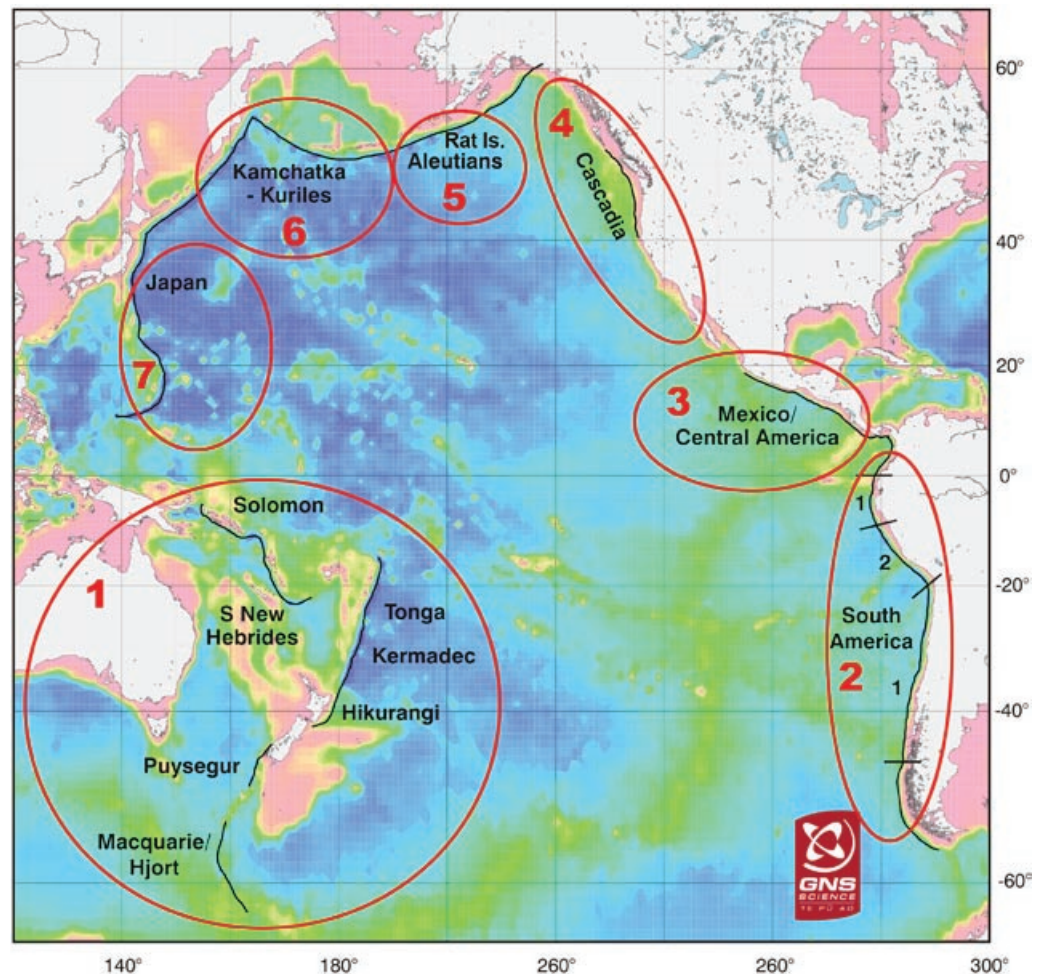
List of regions

The following regions represent potential origins of tsunami that can affect New Zealand:

Region	Description
1	New Zealand, Solomon Islands, Papua New Guinea and the rest of the South West Pacific
2	South America, which is divided into three areas
3	Central America
4	Cascadia (NW USA and Vancouver Island, Canada)
5	Aleutians / Rat Island
6	Kurile Islands, Kamachatka
7	Japan

Figure 3

Subduction margins in the Pacific where tsunamis are generated. The South American margin is partitioned into three areas: area 2.2 propagates tsunami westward towards eastern New Zealand, especially the eastern South Island; areas marked 2.1 propagate tsunami further northward. These are more likely to affect the northern North Island and the North Pacific.



Local Sources, Region 1 - South West Pacific (earthquake)

Summary

Local earthquakes have the potential to produce catastrophic tsunami, with seven to ten metres or more run-up, over a small length of coast (local impact, i.e. tens of kilometres of coast) or over a longer length of coast (regional impact, i.e. hundreds of kilometres of coast). The impact depends on the extent of fault rupture and seafloor deformation, which in turn depends on the magnitude of the earthquake. The tsunami resulting from a very large, 200-300 km long rupture of the plate-interface on the east coast of the North Island may affect 200-300 km or more of the nearby coast with large run-ups. Such an event could cause significant to severely damaging waves along much of the east coast and in the Chatham Islands.

Some coasts are more at risk from tsunami than others because of their proximity to areas of high local seismic activity, but no part of New Zealand coastline can be considered completely free from local source tsunami hazards.

Eastern North Island

A significant source of vertical-slip faulting exists in conjunction with the Hikurangi subduction margin off the eastern North Island. Tsunami could be generated by large earthquakes (magnitude 7.0 - 9.0) on the plate interface itself as co-seismic slip between the two opposing plates, or as rupture of steeper faults that break up through the Australian plate (see Figure 3).

Many faults have been mapped in the offshore area from the inner shelf to the deep ocean of the Hikurangi subduction margin. Studies of these faults show a potential of large surface rupturing earthquakes every 615-2333 years (Barnes et al., 2002; Berryman, 1993).

Subduction thrust earthquakes in the Hikurangi margin are recognised as a potential large earthquake (and tsunami) hazard. However little data is available on the timing and size of large-to-great earthquakes from this source. The Hikurangi margin is apparently more efficient at making large subduction thrust earthquakes in the southern part adjacent to Wellington than further north off the Raukumara Peninsula.

Maximum possible wave-heights cannot be accurately estimated because the maximum earthquake magnitude that this region can produce is not well known. The March 1947 Gisborne tsunami, caused by a magnitude 7.1 earthquake, produced run-ups of up to about ten metres, but this is likely to be exceeded in larger earthquakes. Until better constraints are available it seems reasonable to assume that wave heights of 10-15m are possible, leading to run-ups of up to 30-35m on steep slopes close to the coast, at locations directly adjacent to the Hikurangi margin. Such extreme events are, however, likely to be very infrequent (ie >800 year return time) if they do occur.

Bay of Plenty

There are many active faults in the offshore area of the Ruapehu-White Island volcanic zone. These faults typically have smaller dimensions than the faults offshore of the eastern North Island, and the maximum earthquake that these

faults can produce is about magnitude 7 with two to three metres of potential seabed displacement on a fault up to 30 km long. These relatively small sources are not capable of producing large tsunamis, with fault sources more than 30 km from the coast not capable of producing tsunami wave heights of more than two metres. (No active fault sources are known in the Bay of Plenty that is within 30 km of Tauranga).

Auckland

The active Kerepehi Fault probably extends into the Hauraki Gulf about 40 km east of Auckland, and is the only offshore active fault known in the Auckland region. This fault could produce earthquakes up to about magnitude 7, similar to those in the Bay of Plenty. At 40 km distance, the fault is considered unlikely to pose a tsunami hazard to Auckland, or at least not of two metres or more.

Cook Strait & offshore Marlborough

Numerous active faults occur in the Cook Strait area and offshore Marlborough including the offshore southern part of the Wairarapa Fault that, in 1855, generated a tsunami with ten metres of local run-up (and up to five metres run-up in Wellington). The 1855 earthquake is estimated to have been magnitude 8.2.

Other Marlborough and Wellington region faults, including the Wellington, Ohariu, Awatere and Wairau faults are considered unlikely to produce damaging tsunamis because of their primarily strike-slip character (Barnett et al., 1991). However, some local tsunami damage is possible if the fault motions include a vertical component, or if the fault shaking initiates landslides.

South Island

In the offshore Fiordland region plate boundary structures including the Alpine Fault and the Puysegur subduction zone are capable of producing earthquakes greater than magnitude 8. Because the Alpine Fault is predominantly a strike-slip fault the structure is not considered likely to generate significant tsunamis except at localised areas where the fault steps from one strand to another, and locally large vertical movements are possible. Thus, the tsunami source tends to be very localised, which could generate a large run-up locally, but it is not a very coherent source to travel as far as Invercargill.

The bathymetry (sea floor topography) off the southern South Island appears to offer some natural protection to southern shores. This is because the water shallows at a substantial distance from the coast and much of the energy is dissipated in the shallow coastal waters.

Local Sources, Region 1 – South West Pacific (landslide)

Local Sources: All NZ areas

Being an island nation surrounded by a large deep sea, New Zealand has a tsunami hazard from coastal and submarine landslides. Several landslides that have been triggered by earthquakes have resulted in significant tsunami, at least locally.

There is no doubt that large submarine landslides feature prominently over much of the sea floor around New Zealand, and that future large submarine landslides will cause large tsunamis at some time. Mass failure of sediment is a ubiquitous geological process on New Zealand's continental margin (Lamarche et al., 2003). Mass failures are recognised essentially along the entire margin from north of Bay of Plenty to south of Fiordland.

Most historical landslide-generated tsunami have been associated with earthquakes, but earthquakes are not the only cause. Wave action in large storms can trigger coastal and submarine landslides, heavy rain or a wet season can trigger coastal landslides, and a few landslides occur without an obvious trigger.

Submarine landslides on the New Zealand margin are recognised in water depths ranging from a few tens of metres to several kilometres, and sizes vary greatly from relatively small slides of smaller than 0.25 cubic kilometre volume (Walters et al., 2005) to giant debris avalanches of thousands of cubic kilometres. The c. 170,000 year-old, giant Ruatoria debris avalanche on the northern Hikurangi margin, with a volume of more than 3000 cubic kilometres (Collot et al., 2001), was a high-speed landslide, and must have generated a large tsunami. Estimates of the likely height of the tsunami generated by this landslide vary widely (125–700m), depending on which empirical formula is used. These very large landslides fortunately happen very rarely.

Off the east coast, landslides contribute to deposits in the Hikurangi and Bounty Troughs with recurrence intervals of the order of several hundred years (Carter and Carter, 1993; Lewis et al., 1998; Lewis and Plantin, 2002). Not all landslides however, disaggregate and reach such basins, and the recurrence interval for failures of various sizes in different areas of the margin is poorly known. It has been estimated that significant landslides occur about once every 200 years or so in Kaikoura Canyon (Lewis and Barnes, 1999), and as frequently as once every 13-45 years in the northern Hikurangi (Poverty) margin (de Lange and Moon, 2004).

Local Sources, Region 1 – South West Pacific (volcano)

Local Sources: All NZ areas

Mayor and White Island volcanoes represent potential local tsunami sources.

Mayor Island has produced both explosive and lava flow eruptions, and includes three phases of caldera collapse. The last caldera collapse, associated with the largest eruption, occurred 6,300 years ago (Houghton et al., 1992) and included the transport of rock and ash flows into the sea. This 6,300 year ago event is probably the only recorded instance of rock and ash flow entering the sea within the New Zealand region. Numerical modelling of a credible 1 cubic kilometre (“Mt St Helens scale”) rock and ash flow from Mayor Island, that enters the sea, would produce a 0.5m high tsunami on the adjacent coast around Whakatane (de Lange and Healy, 1986; de Lange, 1997).

The possibility of a significant tsunami generated from White Island is considered to be low (de Lange and Healy 1986; de Lange and Prasetya, 1997), not least because the most likely sector collapse direction is towards the east and any tsunami generated would be directed offshore.

Regional Sources, Region 1 – South West Pacific (earthquake)

Summary

In New Zealand's historical record, the largest earthquakes along the arc between New Hebrides (Vanuatu), Kermadec Islands and Tonga have been less than magnitude 8.5. Only one of these is known to have caused run-ups in New Zealand approaching one meter.

The Lord Howe Rise to the west of New Zealand channels some of the energy of tsunami originating in the northern part of this zone towards New Zealand. The first waves to arrive in New Zealand from this area are likely to be very small relative to the largest waves which may not arrive until several hours later.

To the south of New Zealand, only a few large earthquakes have occurred since the 1960s, when the installation of a worldwide seismic network allowed large earthquakes to be identified and located. The only three large earthquakes in the last 40 years had magnitudes between 7.8 and 8.4, and all were in areas of the plate boundary where earthquakes with horizontal (strike-slip) movement occur predominantly. These earthquakes do not usually generate large tsunami and none had run-up of more than one meter in New Zealand (along the south and west coasts of the South Island).

Most of the tsunami energy generated from the southern part of this zone (Puysegur and Macquarie-Hjort Trench areas) will tend to be channelled away from New Zealand towards the west and south-west.

Southern New Hebrides

Large earthquakes of no more than magnitude 8.5 causing tsunami with run-ups of twelve metres locally have occurred near Vanuatu in the central part of the New Hebrides region. The subduction zone is not well oriented to direct tsunami towards New Zealand except at its southern part, where the record of earthquakes is probably only complete since 1960.

Preliminary modelling of a magnitude 8.6 earthquake on the southern section of the New Hebrides region indicates that this could present a significant hazard for Northland. An under-sea ridge extends north from Cape Reinga and acts as a waveguide, leading to potentially hazardous wave heights in the northern North Island. Wave heights over ten metres seem possible at highly amplifying sites in the far north. For the urban centres considered in the GNS Science risk evaluation there appears to be a small possibility of wave heights exceeding two metres at those sites on the north and west coasts of the North Island.

Tonga and northern Kermadec Trench

Historically, earthquakes have not exceeded magnitude 8.5 in the Tonga/Northern Kermadec subduction margin, and the tsunamis produced have not affected New Zealand, probably because of the orientation of the zone. It is uncertain whether larger earthquakes with larger tsunami could occur and whether they could be a threat. Therefore, the potential of the zone to produce tsunami with wave heights of two metres or more at urban sites is assessed to be low.

Southern Kermadec Trench

The circa 1000 km long southern Kermadec Trench has a moderate level of historical seismicity (263 events of magnitude 5-7 in 29 years from 1976 to 2005) originating on the shallow part (≤ 40 km depth) of the plate interface.

Only earthquakes of about magnitude 8.5 and above are assessed to have the potential to produce a damaging tsunami above two meter run-up in urban areas at least 500 km distant. The potential for this area to produce earthquakes larger than about magnitude 8 is currently unclear.

South of New Zealand (including Macquarie Ridge)

Most plate boundary zones in the Southern Ocean are strike-slip and large earthquakes in these zones are unlikely to produce large tsunamis. There are no highly active subduction zones in the Southern Ocean. The Hjort Trench and subduction zone is the only part of the margin where orientation of the zone would partially direct tsunami towards New Zealand.

Historically, large earthquakes along the Macquarie Ridge (magnitude 8.1 earthquakes in 1989 and 2004), and further south near Balleny Islands (magnitude 8.1 in 1998) have been strike-slip events, producing small tsunamis (less than 50 cm) in southern New Zealand. The effects of a magnitude 8.3 earthquake on the Macquarie Ridge in 1924 are not yet researched.

Hence, at present, it is assessed unlikely that this zone will produce tsunami with run-ups of 2 metres or more at urban sites.

Regional Sources, Region 1 - South West Pacific (landslide)

Regional Sources: No landslide sources, at regional distances, thus far identified are sufficiently large
All Regional Areas or frequent to justify inclusion in this review.

Regional Sources, Region 1 – South West Pacific (volcano)

Southern Kermadec arc

There are 26 volcanoes (>10 km in diameter) along the active Taupo – Kermadec arc that lie between 300 km and 1000 km from mainland New Zealand. For these volcanoes there are three “scenarios” for the generation of possible regional tsunami:

- catastrophic submarine silicic eruption and caldera collapse
- large catastrophic sector collapse
- small, frequent, avalanching of edifice flanks.

However, no historical records exist of volcanic activity in the Kermadec chain producing tsunami in New Zealand or elsewhere. In general, the volumes of eruptions, associated caldera collapses and the scale of sector collapse features so far identified are significantly (at least in order of magnitude) smaller than has been proposed in the literature for damaging tsunami effects at distances of 1000 km or so. Additionally, a numerical model of a 1 cubic kilometre rock and ash avalanche entering the sea from Mayor Island in the Bay of Plenty produced only a 0.5 m tsunami on the coast about 30 km distant (de Lange and Prasetya, 1997) so it is expected that events with volumes typically ten times larger but at 10-30 times the distance will have effects no larger than indicated by the modelling of the Mayor Island event.

Volcanic unrest in the Kermadec volcanoes leading to a major eruption is expected to have a long lead time, so an extended period of preparation prior to any tsunami should be possible.

Distant Sources, Regions 1-7 (earthquake)

Region 1: Solomon Islands

The maximum historical earthquake in the Solomon Islands is thought to be less than magnitude 8.5, though ongoing research has questioned whether there may be potential for earthquakes of magnitude 9.0 or greater.

The April 1 2007 magnitude 8.1 earthquake produced a tsunami that was measured to be in excess of 1.1m peak-to-trough at Charleston. Due to the wave-guiding effects of the Lord Howe Rise the largest waves arrived several hours after the first.

Region 2: South America

The historical evidence suggests that South America is the most important distant tsunami source region. Earthquakes along this coastline produce tsunamis that are often well directed towards New Zealand.

This is due to:

- the orientation of the plate boundary on which the earthquakes occur
- the focusing of the tsunami by the sea-floor shape between South America and New Zealand
- there are few island chains to scatter the tsunami.

The average return period based on seismological assessment (50 years) is about the same as has occurred in the last 160 years, and provides an indication of the frequency of potentially damaging South American-source tsunami in New Zealand.

The location of the earthquake along the South American coast however has a direct influence on the expected impact on New Zealand. The following two tsunamis illustrate this:

Example 1: 1868 Peru earthquake: Region 2, area 2

The distant-source tsunami that caused the most damage to New Zealand in historical times was caused by a magnitude 9.1 earthquake on the southern coast of Peru in 1868 (see area 2.2 of Figure 2, page 46). This area of South America's coastline is orientated in such a way that the tsunami energy is more effectively directed towards New Zealand than further north into the Pacific.

Should a larger earthquake than the 1868 event occur in this part of the coast, the effects of a tsunami in New Zealand could be considerably greater than they were in 1868 which destroyed a village, killed one person in the Chatham Islands, and caused damage in Lyttelton Harbour and other bays around the Banks Peninsula.

Example 2: 1960 Chile earthquake: Region 2, area 1

In contrast, the 1960 tsunami, although caused by a much larger earthquake than the 1868 event (magnitude 9.4, possibly 9.5), occurred on a part of the South American plate boundary that is not as well oriented to New Zealand as the 1868

location (area 2.1 on Figure 2). It produced a smaller tsunami in New Zealand than would have occurred had the location been ideally oriented. Nevertheless, the 1960 tsunami caused run-ups of up to four metres in parts of the North and South Islands. The magnitude of the 1960 earthquake probably represents the upper limit for earthquakes for the whole South American coastline (and worldwide).

Computer models (Power et al., 2004), combined with historical observations, suggest that South American earthquakes with magnitudes less than 8.5 generate a minimal risk of a damaging tsunami in New Zealand. The historical record of Peru and Chile, which is hundreds of years longer than New Zealand's, indicates that large earthquakes and tsunami have occurred relatively frequently in the past 450 years. Nine earthquakes with estimated magnitudes >8.5 caused near-source run-up heights near to, or greater than, those produced locally by the 1868 event, and hence probably produced significant tsunami in New Zealand prior to European settlement.

Region 3: Central America

The maximum historical earthquake in Region 3 is thought to be less than magnitude 8.5, though ongoing research has questioned whether this could be as high as magnitude 9. The potential for a much larger earthquake is thought to be small and the coastline in this region is not oriented towards New Zealand. Hence, the area is not regarded as a significant risk.

Region 4: Cascadia

In Region 4, rupture of the plate interface is thought to occur either:

- as whole-region earthquakes of about magnitude 9 at intervals of approximately 800 years (Witter et al., 2003), or
- as earthquakes with magnitude <9, which may occur more frequently (Clague, 1997). These earthquakes would probably not bring about a significant tsunami risk to New Zealand.

The last great Cascadia earthquake occurred in 1700 AD. This date is before written records in New Zealand, the US and Canada, and the only means of estimating its likely impact for New Zealand is numerical modeling. Japanese researchers have estimated the magnitude of the 1700 event at magnitude 9. The resolution of New Zealand information is poor, but research suggests that this source could result in wave heights of possibly three metres in places along the north and east coasts, but no more than two metres at any of the main urban centres.

Region 5: Aleutians/ Rat Island

The plate boundary between Alaska and the Aleutians is a highly active source of great plate interface earthquakes and tsunami in the Pacific. Historically, three earthquakes have caused run-ups of up to two metres along the north and east coasts of New Zealand, but not at any of the main urban centres. These earthquakes were:

- 1964 magnitude 9.4 Alaska
- 1957 magnitude 8.7-9.1 Rat Island
- 1946 magnitude 7.9 Aleutians

The historical record has not captured the full range of tsunami that New Zealand might experience from the Alaskan and Aleutians region. However, most parts of this coastline produce tsunamis that are not particularly well directed to New Zealand, with the exception of the area around the source zone of the 1957 Rat Island earthquake.

Region 6: Kurile Islands, Kamchatka

The largest earthquake to have occurred in this area in New Zealand's historical record is a magnitude 9 earthquake south of Kamchatka Peninsula in 1952. This produced a maximum run-up of nearly 19m locally, and a maximum in New Zealand of over one meter in Gisborne. A larger tsunami, with a maximum run-up of 63m locally and 15m at a distance of over 1000km, was recorded in 1737 from a magnitude 8.3 earthquake. Its effects in the larger Pacific area are unknown. The capacity of the area to produce earthquakes with magnitudes greater than magnitude 9 in the historical record is unknown, and no numerical modeling of potential effects in New Zealand has been carried out. However, it is thought wave heights of two to three metres may be possible at amplifying sites in New Zealand from this source.

Region 7: Japan

Region 7 has one of the longest historical records of large earthquakes and tsunami, spanning several hundred years. In that time, no events are thought to have reached magnitude 9, although there are many events over magnitude 8. In New Zealand's historical record, only very small wave heights of less than one meter have been recorded from Japanese earthquakes. Although several key events have not yet been researched for their effects on New Zealand, the orientation of the subduction zone and the island-studded propagation path are thought to protect New Zealand from wave heights of two metres or more.

Distant Sources, Regions 2-7 (landslide)

Distant Sources: All Regions

Submarine landslides have been argued to have added substantially to the trans-Pacific tsunami resulting from the 1946 earthquake from the Aleutians (Fryer et al., 2004). It is argued that the narrow “beam” of devastating tsunami that swept Hawaii and the Marquesas Islands, and had run-up of four metres in Antarctica was the result of a 200 cubic kilometre landslide triggered by the magnitude 7.9 subduction earthquake. Others (e.g. Tanioka & Seno, 2001) have suggested the earthquake had very large slip for its apparent magnitude, such that it would fall into the “tsunami earthquake” category.

Huge sector collapses (1000-5000 cubic kilometres) of the flanks of the Hawaiian volcano chain have been modelled to produce Pacific-wide tsunami as well as very large local tsunami of hundreds of metres (McMurtry et al., 2004). While it is likely that flank collapses of this scale would produce large tsunami in New Zealand, their return periods from any one source are well in excess of 2500 years.

No landslides at global distances are currently considered viable tsunami sources for New Zealand within a 2500 year return period.

Distant Sources, Regions 2-7 (volcano)

Distant Sources: All Regions

Other than the potential for flank collapse on the slopes of volcanoes, no volcanoes in the historical record are known to have directly produced significant tsunami at great distances.

Distant Sources, Regions 2-7 (meteorite)

Distant Sources: All Regions

As an island nation surrounded by a large deep sea, New Zealand has a tsunami hazard from impacts of asteroids and comets. This hazard is real, finite and determinable, but the probability of a damaging tsunami from these sources is low.

Current technology allows for detection and tracking of the larger (larger than a few metres in diameter) Near Earth Objects (NEOs) and the calculation of their probability of hitting Earth days, weeks, and sometimes months in advance of their closest approach.

Numerical estimates of the frequency of impact of a meteorite of sufficient size within a distance range of New Zealand that could cause a damaging tsunami appear to have a recurrence interval many times longer than 2500 years.

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