



# To the Tauranga City Commissioners

## A critique of the policy document concerning Public Alerting

[https://www.tauranga.govt.nz/Portals/0/data/council/long\\_term\\_plans/2021-31-amendment/files/ltpa-consultation.pdf](https://www.tauranga.govt.nz/Portals/0/data/council/long_term_plans/2021-31-amendment/files/ltpa-consultation.pdf)

This document discusses the needs for public alerting, **both prior to and after** a potential disaster event, such as a major tsunami, the Tauranga Region, and the relevance of currently available technologies.

It is the author's opinion that the current Tauranga Council stance has ignored more effective options already presented to the previous Council, which is leaving the population of Tauranga vulnerable for when a disaster strikes.

Author: Gary Benner CITPNZ

Director

**IAD Technologies Ltd**

e. [gary@benner.nz](mailto:gary@benner.nz)

m. 021 966 992

## Critique

### 1. Summary

*“We think sirens will be of little use in the event of a worst-case tsunami and that the alerting systems now available and regular community awareness campaigns focusing on tsunami evacuation routes and planning will keep us all safer.”*

1.1. The current systems individually and collectively have major flaws, as I will outline in this document. TSUNADO technology, developed by my company, has been on the scene for over a decade, and at one point, was voted for adoption by all 16 managers of all the Civil Defence Regions in New Zealand.

1.2. As a result of that approval, management of the implementation was passed to what was then MCDEM. However, unknown to everyone else, they had a government direction to use exclusively the NEMA (presidential) system based on cell broadcasting technology, which relies on users receiving messages on the smartphones.

1.3. While we acknowledge the benefits of the NEMA system, as a component in an overall alerting solution, it has significant deficiencies, as outlined in the **Appendix E Comparison Document**.

1.4. Sadly the default reliance on just being alert for “*long and strong*” shaking is an acknowledgement of the failure of their decision to go with NEMA as a sole mechanism for alerting.

1.5. In our initial dealings with the then National Civil Defence Manager John Hamilton, he explained that a fundamental tenet of their organisation was not to rely on any one system or technology. The reversal of such a fundamental philosophy is hard to comprehend.

### 2. *“The worst-case scenario for a tsunami in Tauranga is based on an earthquake of greater than magnitude 9 in the Kermadec Trench. This would likely be the largest earthquake ever felt in the Bay and would give us less than 50 minutes to evacuate.”*

2.1. We agree with this indication. However we strongly disagree with the way current strategies are in place to handle such an event.

### 3. *“The best and most reliable warning system for local source tsunami in New Zealand is the natural warning (physical shaking from an earthquake).”*

3.1. We disagree entirely. As an initial counter, one must only look at the fact that for about one third of our lives we are asleep. Waking a sleeper requires a significant impact on our bodies to awaken the average person. Please see our White Paper on “**Waking A Sleeper**” included as an Appendix, to fully understand what is required.

3.2. In 2015 I visited the Pacific Tsunami Warning Centre (PTWC) in Hawaii and was able to assess both the systems they have, but also to understand the capability of their

technology to generate the raw alerts, almost instantaneously.

- 3.3. Different types of earthquakes generate different effects. Some that are felt greatly but do not necessarily generate a Tsunami. And it is possible to have a tsunami generated without feeling the shaking to a significant degree. This is particularly relevant with what are known as “**submarine landslides**”. Ref: <https://www.usgs.gov/faqs/what-are-tsunamis>

This established understanding makes a mockery of the official policy that just staying alert for shaking will keep us all safe.

4. ***“On the other hand, a tsunami that is caused by an earthquake further away, and therefore not felt by our local community, is likely to have less impact and arrive later, which means there would be more time to warn community. ”***

- 4.1. Just tell that to the people at Tutakaka after the Tonga eruption, over 2000 km away. Millions of dollars of damage, and had people been on their boats at the marina, lives could have been lost.
- 4.2. If an event occurs early evening, say in Tonga, or Samoa, or the Kermadec Trench, how do you expect to alert the public at 2am when you finally realise it is a major event?

People will be deep in sleep, most have phones turned off, or charging in the kitchen, or may not be awoken by the NEMA system alerts, even when the phones are turned on and in the bedroom. (see **Appendix D – Waking a Sleeper**)

Smoke alarms have a worldwide standard that has been established over many decades, as how to awaken people. You need 85dB of a high pitched sound to break through into the mind of a person fast asleep. Even more where alcohol or other drugs have been consumed.

- 4.3. ***To date no-one in New Zealand has died in a house fire where there has been an active smoke alarm fitted.*** TSUNADO uses an alarm with a similar, but different, 85dB high pitched sound.

5. ***“For many years, the Tauranga community has been discussing the merits of installing tsunami sirens as a formal alerting system.”***

- 5.1. We know this because our company made a formal presentation on the TSUNADO System to the Council in December 2016, and in my ongoing dealings with individual councillors since that time, it was our understanding that TSUNADO was always an option.

We are disappointed that there is no mention of TSUNADO in your published documents, as it represents the only viable and effective siren based alerting solution – see a full comparison in **Appendix E – Comparison Document**.

6. *“we are proposing to remove the sirens from the budget, because we believe the risks of having sirens can outweigh the benefits”.*

6.1. In the example quoted, this appears to be a completely unsubstantiated statement. The only reason given in your document, was that the sirens were not activated. That appears to have been a problem with the management of the activation systems, not the sirens themselves.

6.2. We do agree that Street Based Sirens have limitations. They do, however, have relevance in what is termed **Public Space Alerting**. Areas where sirens mounted on poles outside are relevant are beaches (Tauranga has many), Shopping Malls (Tauranga has many in low lying areas), and other areas where people come together. We support having sirens at least at major beaches where people may not have cell phones or other devices on their person.

7. *“Will tsunami sirens save the day, or is there a better way? “*

7.1. Yes there is – **In-House Sirens**. TSUNADO Alert Radios, which are placed in every home, and activated via a local Broadcast Radio Station, are the only technology proven to be able to continue serving messages to the public **both before and during** a disaster. There are many reasons for this, but all the limitations and downsides of internet and cell technology communications systems are not present with broadcast radio.

7.2. We have attached a feature and capability comparison between Street Based Sirens, the NEMA National Alerting System, and TSUNADO in **Appendix E – Comparison Document**. You will see summarised how effective TSUNADO is in comparison, a fact that is not that surprising given that it was custom designed for the New Zealand environment, and actually developed here in the Bay of Plenty.

8. *“Recent global tsunami events have allowed us to learn a lot about the effectiveness of sirens. These learnings indicate that sirens can be unreliable when they are most needed and can actually reduce the level of evacuation.”*

8.1. We agree that Street Based Sirens have many limitations, especially where they are relied on as the primary means of alerting. While they may get some attention in public spaces, more significantly is that they do not **inform**, an adjunct and critical function that is required to serve the public, and one that TSUNADO is most effective with.

8.2. In-house sirens, with the additional features that TSUNADO Alert Radios provide, are designed to optimise all aspects of informing and managing the public response before and during a disaster.

9. *“Since we first started discussing the installation of sirens, New Zealand has introduced a new and highly effective national alerting system, the Emergency Mobile Alert (EMA).”*

- 9.1. The NEMA System is highly effective in communicating national alerts that are not reliant on an immediate response, for reasons that are identified in Appendix E - **Comparison Document**.
- 9.2. The NEMA System gets only average marks in getting attention 24 x 7.
- 9.3. Once critical infrastructure is compromised, the NEMA system becomes useless. Cell towers stop functioning after 4 hours as batteries run dry. Most cell phones will be flat within 12 hours. Earthquakes play havoc with glass fibre communications links (as found in Kaikoura) that are required for many cell towers backhaul communications.
- 9.4. We agree that the NEMA System was affective in issuing Covid alerts. But there was no disaster impacting infrastructure. However as mentioned earlier, it forms an effective component in an overall strategy, but like Street Sirens, it fails miserable as a total solution, for which it is being touted.

10. *“When coupled with other warning systems, such as social media, radio, TV and word of mouth, we have an effective range of notification options available.”*

- 10.1. This is simply wrong. Social media, the standard radio service, television etc, **do not perform the first stage of alerting, the action of getting attention**. They only perform the second stage of the alerting process – the delivery of information, once the person goes to them. Also they all generally fail once critical infrastructure is compromised. Except for Broadcast Radio which TSUNADO uses to deliver it’s alerts.
- 10.2. A text to your phone, even with a slightly louder tone than normal may garner your attention, but in noisy environments, or areas where cell signal is low or attenuated, will not get through. Buildings with metal frameworks and cladding create “Faraday Shields” that block out the cell signal.
- 10.3. Once power is lost the NEMA system becomes ineffective. TSUNADO Alert Radios can last up to 5 days without power. Broadcast Radio Stations are provisioned to keep working with backup generators for days. That combination works.
- 10.4. Put simply, the NEMA system in conjunction with the list above DOES NOT provide effective notification, and safety for us all.

11. *“The system sends alerts directly to mobile phones and has proved highly effective at alerting a large percentage of the community.”*

- 11.1. Given the lack of effectiveness of the NEMA System for at least 30% of the time (when people are sleeping), combined with those regions not covered by cell phones reliably, the claim that it is highly effective does not stack up for disaster alerting.

11.2. There are also fundamental problems with the NEMA System when applied to a scenario of a submarine landslide in the Kermadec Trench, sometime in the night. In this scenario there will be no guaranteed shaking to alert us, and even if there was, most people would not feel it in their sleep.

11.2.1. We agree there would be around 45 - 50 minutes before the tsunami arrived.

11.2.2. The NEMA System relies upon a notification from the PTWC, and a process of data analysis to determine the potential impact of the Tsunami on the various parts of New Zealand. I have personally witnessed this process in action, including the practical side of getting the on call GNS scientist in front of the appropriate computer, getting access to the data, perform the analysis, and then deliver a recommendation to management who make the decision as to what alert to deliver. This can take anywhere between 35 to 60 minutes or longer to complete, and get an appropriate alert approved and underway.

11.2.3. In that scenario, with a large tsunami, half of the people who live in Papamoa will be floating out past Mayor Island when the NEMA Alert sounds on their cellphones.

11.2.4. With TSUNADO, we have implemented three levels of alerting:

- 1. POSSIBLE**
- 2. PROBABLE**
- 3. CERTAIN**

11.2.5. A **POSSIBLE** Alert can be generated automatically from the data generated publicly over the internet and available via satellite (if necessary) from the PTWC in Hawaii. This provides enough information to give a level of certainty to automatically generate this level of alert. This can reach the public within 5 – 10 minutes.

POSSIBLE Alerts are relevant for those who are responsible for others, such as the Emergency Services, Hospital Managers, Rest Home Managers, School Principals, or families with young children.

11.2.6. A **PROBABLE** Alert can be generated after initial review of the data, and could be delivered within 20 minutes.

PROBABLE Alerts are relevant to everyone who is in a vulnerable region, low lying area, etc.

11.2.7. The **CERTAIN** Alert would be generated from GNS who initiate the NEMA System, which TSUNADO can link directly in to.

11.2.8. Users of TSUNADO can decide which level of alerting they wish to subscribe to. This means that those who are responsible for others can prepare in advance, should the status be raised in subsequent alerts.

11.2.9. **Families in particular are vulnerable in a time of disaster**, and need to prepare in advance of leaving their home. Food and clothing for their children is critical, and most would appreciate having the option to get a heads up “*just in case*”.

**12. *“We believe that the best way to keep people safe is to continue investing in education, awareness and supporting community networks to ensure more isolated or vulnerable members of the community are supported.”***

12.1. We agree with this completely. However the current NEMA system does not, and never will fulfil that aspiration to support isolated and vulnerable members of the community. Neither will adding Street Based Sirens, as both are systems with limitations that are not complementary, that even when combined will not bring the desired outcome.

12.2. TSUNADO was designed from the ground up to reach everyone geographically, and also those with disabilities that cannot be alerted using normal technologies. There are existing devices that support the disabled, eg flashing lights, and these can be integrated into TSUNADO Alert Radios.

## Appendix A – Other Relevant Points

- ❖ TSUNADO was awarded a \$255,000.00 Callaghan Innovation grant to complete the production engineering of the devices, and the alerting activation software.
- ❖ In a subsequent audit by MBIE commissioned by MCDEM, the product engineering passed with flying colours, with the MCDEM report stating “*The technical aspects of the Tsunado system passed all the required tests and comments from MBIE staff suggested that the system was well designed.*”
- ❖ TSUNADO has always seen itself as an innovative startup, and has thus reached out to a number of companies to assist in the manufacture and deployment the systems. Manufacture of an initial run of 300 units was undertaken by a contract manufacturer in Auckland, and negotiations have been undertaken with a well-established Christchurch communications company to take over project management of any large projects. ***Councils can thereby be assured of a continued level of support in any ongoing rollout.***
- ❖ TSUNADO have worked with a variety of national and local radio stations / networks in a variety of trials a round New Zealand, including:
  - Radio New Zealand,
  - TRN (now NZME – NewsTalk ZB),
  - Sky TV (activation via Satellite),
  - Coromandel FM, and
  - 1XX in Whakatane.

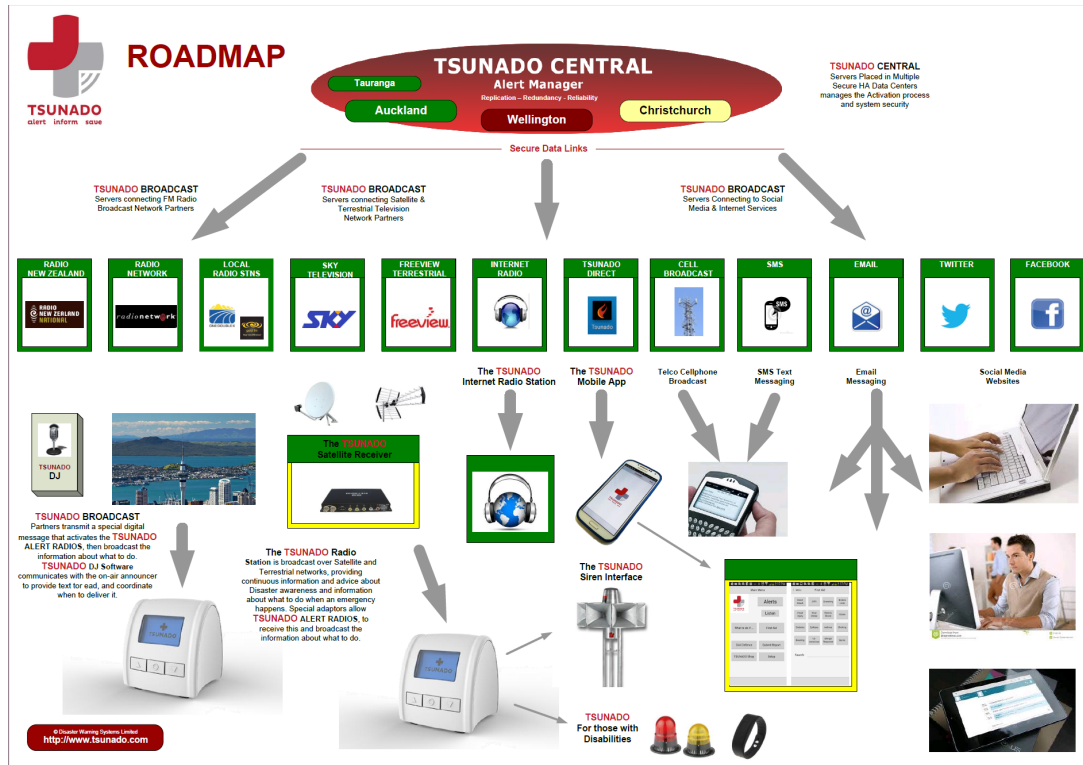
In all cases the Radio Stations have been keen to work with us, and we have successfully installed TSUNADO activation links into their transmission systems.
- ❖ Extensive trials of the TSUNADO System have been completed, including activation via satellite, the latest being with almost 200 users in the Coromandel. All trials have shown the system to be user friendly and effective in alerting people at all times of the day, and delivering the required message
- ❖ TSUNADO Staff worked with a committee with representatives from Auckland, Waikato, and Bay of Plenty Emergency Services to develop the protocols for using TSUNADO in conjunction with other systems at a local Council level.



## Appendix B – What is the TSUNADO System

The TSUNADO System was developed as an integrated system for the management of alerts, and deployment via various means to ensure the most reliable delivery possible.

This diagram shows the original system design.



This shows clearly the philosophy of many forms of communication, integrated through a centralised by redundant alerting management system, capable of operating even in the worst disaster scenarios.

Major features include:

- ❖ Redundant but synchronised central management systems (Auckland – Wellington – Christchurch)
- ❖ Use of Satellite communications to ensure land based disasters have minimal effect on the system operation
- ❖ Use of multiple delivery technologies, broadcast radio, paging, internet, SMS, etc, with delivery to all and any devices, supporting those with disabilities as well.
- ❖ Smaller systems can, and have already been setup with just the essential components of the overall system deployed.

## APPENDIX C - TSUNADO Alert Radios (In-House Sirens)



**TSUNADO Alert Radios are basically smart radios with a high powered alarm, and enough battery to last up to five days.**

Major features include:

- ❖ Ergonomically designed (ie they look good – suitable for every home)
- ❖ Battery powered, with power saving capabilities
- ❖ Loud (85db) alarm – just like a smoke alarm
- ❖ Connect to local radio stations for activation
- ❖ Can be used as a radio everyday
- ❖ Text message screen
- ❖ Can also deliver low level alerts, such as updated weather events, pollen counts etc.
- ❖ Can deliver custom alerts to specific groups (emergency services, managers, council, etc)
- ❖ Useful for many other purposes
- ❖ Multiple level alerts – Possible, Probable, Certain

## Appendix D – Waking a Sleeper



White Paper

# Waking a Sleeper

Date: 20 October 2016

Author:

**Gary Benner**  
Technical Director  
IAD Technologies Limited

## Introduction

**IAD Technologies Limited (aka DIWA) has developed a system for nationwide Public Alerting based on Broadcast Radio technologies called TSUNADO.**



TSUNADO Alert Radios are devices intended for placement in homes and at work, to alert the community when a disaster is imminent. The alert sound is similar to a smoke alarm, however research was done to find an optimum alert sound that was unique and effective. The basis of this research is outlined in this White paper.

## Executive Summary

### 1 Waking a Sleeper

Disasters can occur at any time of the day or night. In defining the function of the TSUNADO Alert Radios, the designers considered the nature of the sound required to wake even a deep sleeper during the night.

### 2 Learning from Smoke Alarms

Smoke alarms are almost universal in homes around New Zealand. The sound they make appears to be effective as there are few if any deaths from fire or smoke inhalation where they are fitted and operative.

### 3 Research to Change the Paradigm

In the course of development of the IAD Alert Radios it was found that latest research indicated that there were more effective sounds to waken a deep sleeper.

## The New Research

### Who conducted the research

Research funded by the Australian Fire Protection Research Foundation, and conducted by Dorothy Bruck and Ian Thomas of Victoria University in Melbourne, looked at the effectiveness of current smoke alarm signals, and what if any changes would make them more effective.

Their research paper can be found here:

<http://strategicfire.org/wp-content/uploads/2015/04/bruck-article.pdf>

### What they found

“A summary of the evidence concerning the best and worst signal shows that the 520 Hz square wave signal is at least 4 to 12 times more effective than the current high pitched signal in the populations tested.

Research supporting lower frequency signals and mixed frequency signals as being the best alarms for people when awake is also discussed. It is argued that the 520 Hz square wave signal, which has been tested now in six different experimental studies, has a sufficient evidence base to warrant the recommendation for its widespread introduction as a new smoke alarm signal for the whole population.”

### What we did

While trialling the first version of the TSUNADO Alert Radio, we became aware of the need to distinguish ourselves from smoke alarms, so as not to confuse householders as to what was happening.

We also had two of the trialists who did not wake during the night-time test.

This led to an investigation of alternate sounds, and based on the results of this research, we developed our own unique sound that is comprised of a square wave signal at alternating frequencies of 520Hz and 2200Hz.

In subsequent trials we had a 100% success rate for the test to wake persons from a deep sleep.

Appendix E – Comparison Document

**Street Based Sirens**

**NEMA Emergency Mobile Alert**

**TSUNADO**

**Capabilities**

	Pros	Cons	Pros	Cons	Pros	Cons
<b>Coverage</b>	<p>Able to alert anyone within earshot.</p> <p>Well suited to public spaces</p>	<p>Varies according to distance from siren site.</p> <p>Does not penetrate well into insulated homes</p>	<p>Covers most highly populated areas</p>	<p>Remote areas excluded</p> <p>Not good in metal buildings</p> <p>Fails when power fails</p>	<p>Covers most highly populated areas, including remotes areas coverage with radio signal. All significant from FM population areas are covered by Broadcast Radio transmissions.</p> <p>Can utilise satellite for 100% coverage of entire country.</p>	<p>Relies on coverage from Broadcast Radio, or requires satellite support.</p>

**Getting Attention**

<p>Good where there is coverage</p>	<p>Not good inside homes or at night</p>	<p>Only when users awake, and near phone. Does not wake most users, especially as phones often switched off at night, or left in other rooms (for work-life balance etc)</p>	<p>Alerts a whole household, similar to smoke alarms – 85dB</p>	<p>None</p>
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<p><b>Waking sleepers</b></p>		<p>Typically will not arouse a normal person asleep. Especially when windows are closed.</p>	<p>Only if your phone is turned on, beside the bed, and you are a light sleeper</p>	<p>Designed to work on the same principle as a smoke alarm, TSUNADO Alert Radios will wake almost everyone with an 85dB alarm. Can also link to devices for the disabled; eg flashing lights.</p>	<p>None</p>
<p><b>Informing and Conveying Information</b></p>		<p>Low. Sirens are used for many reasons, and unless population, including visitors are educated, it can create panic, or disdain, as the case maybe.</p>	<p>Good Limited in detail by virtue of the control, systems built in to the overall system.</p>	<p>Excellent. The TSUNADO ALERT Radios include a message screen, as well as a speaker to automatically switch on the nominated radio station to hear more details.</p>	<p>None</p>
<p><b>Timeliness</b></p>		<p>Depends on activation</p>	<p>Can only deliver national level alerts that require a high degree of curation, leading to long preparation times. Often 45 minutes to one hour.</p>	<p>Excellent. Alerts can be configured for three levels: POSSIBLE, PROBABLE, CERTAIN. This allows users to select the service they require, so an earthquake in the Kermadec Trench (45 minutes warning of a TSUNAMI) can be automatically alerted within about 5 minutes to coastal population.</p>	<p>None</p>

**Targeting**

Good as for coverage as only discernable where the siren is.	Bad for as to who may be affected, as no information is included.	Basic	Only targets down to the cell tower level, as the underlying technology (Cell Broadcasts) is granular to only the cell tower. No user groups or other categorisation of alerts – only full alerts.	Excellent. Targeting built in with both a region capability, and is so fitted, by GPS, allowing a street level target. Also TSUNADO provides a GROUPS feature, where in addition to the Service level described above, alerts can be targeted to Emergency Services, Health providers, Police etc.	None
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**After disaster strikes**

	Depends on capability of infrastructure to support operation, but generally not of much use.		Not good. Generally when there is a major event, one of the first things to go down is the mobile phone network, and internet. Once power of off for any length of time the cell towers cease to operate. Overloading of message and calls is typical.	Excellent. TSUNADO was designed to work, and continue working before, during, and after a disaster event. TSUNADO Alert Radios continue working for up to five days on battery, allowing continuous updates, and especially important to notify when it is safe to return.	None
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**Security**

	Low .Multiple fails around NZ indicate a low level of security in these systems	Good	None	Excellent. The TSUNADO Alert Radios include a special military grade security chip manufactured with an encryption code just for these systems, ensuring no man-in-the-middle attacks, spoofing etc.	None
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<b>Flexibility</b>		Little	Little	Versatile, with the ability to update itself inline, and provide a set of options to users to suit their needs.	None	
<b>Compatibility Interoperability</b>		Standalone	None . Works only unto itself	An open system that can integrate alerts from other systems, using standards such as The Common Alerting Protocol (CAP).	None	
<b>Special Support for aged &amp; those with disabilities</b>		None	None	TSUNADO Alert Radios are Plug & Play and do not require special technical skill. They have the capability to connect to devices used by the disabled, such as flashing lights, to get their attention. With both visual and audible messaging, there is a high degree of support for the disabled.	None	
<b>Reliability</b>	Average	Already there have been multiple fails around NZ	Good before any disaster	But will only work when the internet and mobile networks are working, so cannot function when infrastructure is compromised.	Excellent. Based on broadcast radio technology run by major networks, which have been proven multiple times in the last 50 years to continue operating during major disasters.	None

<b>The Night Shift</b>		Little ability to alert effectively	Not effective	Excellent. Smoke alarms have saved countless lives because they wake sleepers. TSUNADO Radios use the same mechanisms to wake sleepers, unlike any other alerting technology.
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<b>Other</b>	Good for public space alerting. Can be activated by and integrated into a TSUNADO Central activation system, to cover beaches, shopping malls etc.	Expensive costs for so little effectiveness.	Of fundamental benefit to communicate details.	Limited by the nature of the overall system – ie national alerts only, and a highly curated system before delivery. A “one in every home” system, designed specifically for New Zealand conditions and available technologies, for a level of cost that is very affordable. Needs more official support
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## Appendix F – The Original Council Document

### Will tsunami sirens save the day, or is there a better way?

**We think sirens will be of little use in the event of a worst-case tsunami and that the alerting systems now available and regular community awareness campaigns focusing on tsunami evacuation routes and planning will keep us all safer.**

The worst-case scenario for a tsunami in Tauranga is based on an earthquake of greater than magnitude 9 in the Kermadec Trench. This would likely be the largest earthquake ever felt in the Bay and would give us less than 50 minutes to evacuate. That is why it is so important that everyone knows the natural warning signs of a tsunami and evacuates immediately, without waiting for official warnings. The best and most reliable warning system for local source tsunami in New Zealand is the natural warning (physical shaking from an earthquake).

If an Earthquake is LONG or STRONG, Get Gone, don't wait for official warnings. This key message has been the focus of a tsunami awareness promotion campaign carried out by the Council over summer.

On the other hand, a tsunami that is caused by an earthquake further away, and therefore not felt by our local community, is likely to have less impact and arrive later, which means there would be more time to warn community.

For many years, the Tauranga community has been discussing the merits of installing tsunami sirens as a formal alerting system. In fact, in the 2021-31 Long-term Plan, there is budget for sirens to be installed in 2022/23. However, through this Annual Plan, we are proposing to remove the sirens from the budget, because we believe the risks of having sirens can outweigh the benefits.

Will tsunami sirens save the day, or is there a better way? Recent global tsunami events have allowed us to learn a lot about the effectiveness of sirens. These learnings indicate that sirens can be unreliable when they are most needed and can actually reduce the level of evacuation. Sadly, there have been incidents of major loss of life, because people waited for a siren that never sounded (including the Japan tsunami in 2011).

Since we first started discussing the installation of sirens, New Zealand has introduced a new and highly effective national alerting system, the Emergency Mobile Alert (EMA).

The system sends alerts directly to mobile phones and has proved highly effective at alerting a large percentage of the community. This system has been used recently for major COVID-19 announcements.

When coupled with other warning systems, such as social media, radio, TV and word of mouth, we have an effective range of notification options available. We believe that the best way to keep people safe is to continue investing in education, awareness and supporting community networks to ensure more isolated or vulnerable members of the community are supported. Before making a final decision though, we want to know what you think.