Pros and Cons of Alert Sirens in Halls Gap

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Table of Contents

1 Introduction

1.1 Background

In the event of an emergency, Incident Controllers are required to ensure that warnings are issued, and information is provided to the community in relation to the emergency, for the purposes of protecting life and property.

At the Resilience Group meeting on 23 August 2022, a number of items were agreed to be a priority for the subsequent three months. One of these items was: “The pros and cons of a community alert siren should be explored so that a report can be provided to the next meeting.”

If community alert sirens are to be established in Halls Gap, they must comply with the Emergency Management Victoria (EMV) *Policy and Guidelines* for community alert sirens. In particular:

- The need for sirens must be identified and supported by the community, and assessed and approved.
- The community must follow the procedures set out in the *Policy and Guidelines* for establishing new community alert sirens.
- The sirens must be approved by the respective Municipal Emergency Management Planning Committee (MEMPC) and recommended to the CFA and EMV.
- The sirens must be referenced in the respective *Municipal Emergency Management Plan* (MEMP), and where implemented, the *Community Information Guide* or *Local Incident Management Plan*.
- The sirens must be of a type approved by CFA that can be incorporated into the broader system of emergency warnings.

1.2 Purpose

This document is intended meet the above requirements.

1.3 Audience

The audience for this document is the members of the Halls Gap Resilience Group.

1.4 Scope

The pros and cons of community alert sirens can only be fully considered in the context of alternative warning systems, so the scope of this report also includes consideration of

- VicEmergency channels
- Emergency broadcasters
- The Emergency Alert telephone alerting system
- Door knocking by emergency personnel
- Electronic message signs

2 Overview of Alert Sirens

This section of the report provides general information on sirens only. Further characteristics of alert sirens are included in section 5, which provides a comparison of warning systems.

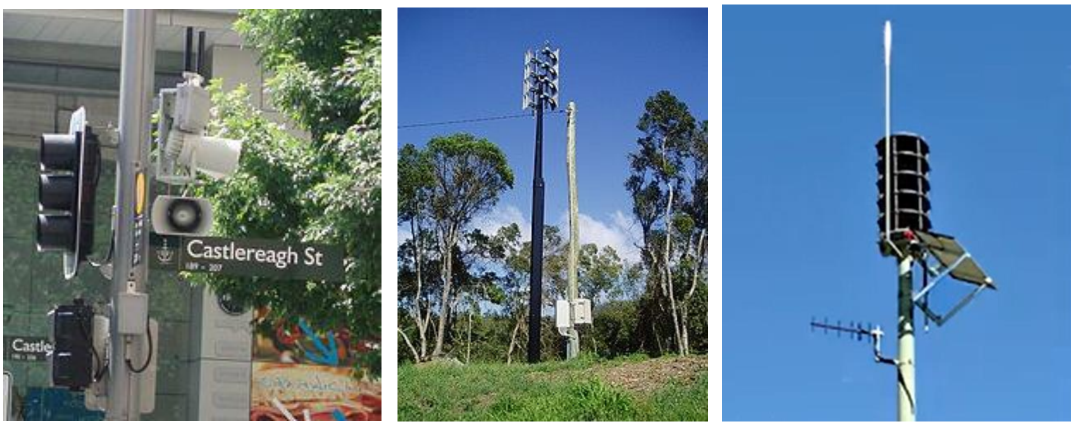
2.1 Usage

Alert sirens are in use in at least 35 countries around the world, including in Africa, Asia, the Middle East, Europe, North America, and Oceania (including Australia and New Zealand.)[1]

In Australia, sirens are used in every state, and for many different purposes, including

- the Sydney and Melbourne CBD emergency warning systems,
- at fires stations,
- as shark alarms,
- at prisons to warn of break outs,
- at industrial plants for emergency evacuations,
- as warnings for impending disasters including bushfires and floods, and
- as warnings of potential dam breaks.

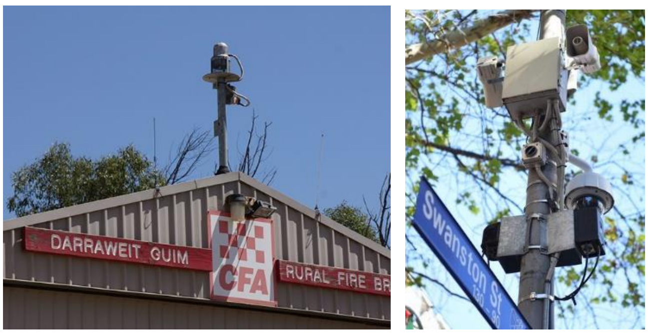
Figure 1: Examples of Alert Sirens



Sydney CBD warning siren | QLD bushfire warning siren | QLD Copperlode Falls Dam siren

In Victoria, community alert sirens are part of the all-hazards warning system used for flood, fire, storm, etc. As at 2021, there were over 40 towns with alert sirens. Some towns had 2-4 sirens (e.g. Blackwood, Ferny Creek, Kalorama, Sassafras, and Upwey.)[2]

Figure 2: Examples of Victorian Sirens



Darraweit Guim warning siren | Melbourne CBD warning siren

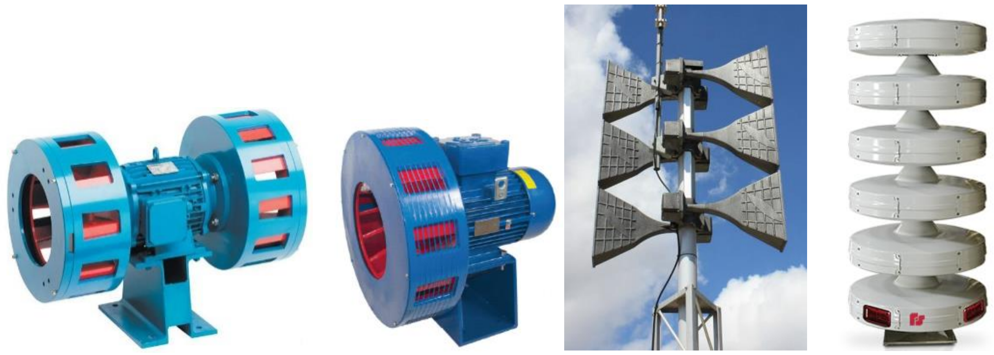
[1] Wikipedia (2022) *Civil defence siren*, https://en.wikipedia.org/wiki/Civil_defense_siren, retrieved 28 August 2022

[2] CFA (2021) *Community Alert Sirens*, https://www.cfa.vic.gov.au/warnings-restrictions/about-warnings/community-alert-sirens

2.2 Types of Alert Sirens

Some historic sirens have been mechanical or pneumatic, but most modern sirens are electromechanical or electronic (see examples in Figure 3.)

Figure 3: Types of Sirens



Directional Omni-directional

Examples of electro-mechanical sirens Examples of an electronic sirens

Electro-mechanical sirens can disseminate sound only, while electronic systems can disseminate both sound and voice.

Electro-mechanical siren tones are intended to provide a generic message i.e. “A threat has been identified which may impact people in the local area and you should seek further information immediately.” They generally cover wider areas than electronic sirens.

Electronic sirens can store digital files of emergency messages, which can be broadcast through the siren. Some sirens come with a jack to allow broadcast of live messages via a microphone i.e. in addition to a warning tone, electronic sirens can provide specific messages about an emergency, and what people should do in response to it.

Sirens may be integrated into other warning systems such as telephony messaging, mobile applications, web-based messaging, and social networks. This multi-layered approach can enhance the credibility of warnings and reduce the risk of assumed false alarms by corroborating messages through multiple media. Victoria has adopted such a multi-layered approach.

In order to integrate with a multi-layered system, both types of sirens can typically be activated by multiple methods, including radio, ethernet, landline, cellular and/or satellite communications. They can be manually activated if electronic activation fails. They can typically be powered by AC, DC, or solar (batteries charged from a solar panel.)

2.3 CFA Policy

The CFA is generally against the installation of new sirens, but where the unique environment of a town justifies it, sirens are installed despite the CFA’s position – see for example *Ferny Creek Fire Alert Siren Evaluation Report*.[3]

Halls Gap also has a unique environment, and the decision to use (or not use) sirens needs to be made on an objective basis, not on the basis of CFA policy. This report attempts to provide such an objective assessment.

[3] http://royalcommission.vic.gov.au/getdoc/d25e72df-50cc-41f8-ac3a-12656f36668d/WIT.005.001.0738.pdf

3 Using Sirens in Halls Gap

This section outlines how alert sirens would need to be implemented in Halls Gap.

3.1 Use of Sirens

Community alert sirens must only be used when there is imminent threat to the community. The Victorian government has established a state-wide standard for siren alerts:

- Short Siren (up to 90 seconds) – indicates a CFA Brigade has responded to an emergency incident nearby, and people should stay informed.
- Extended Siren (5 minutes) – indicates that a current emergency has been identified in the local area and people should seek further information immediately.

Community alert sirens are not used for any form of ‘all-clear’ signal.

Alert sirens need to be tested regularly. An appropriate community policy for testing may be:

- For the CFA to complete the testing
- To only test the alert siren in off-peak months when tourists are at a minimum
- To test the siren monthly during these off-peak periods
- To test the siren at the same time on the same day of every off-peak month (e.g. the second Wednesday of the month at 12 noon) so people know it is just a test.
- To warn the community before each test using social media, the *Fill the Gap* newsletter, the community web site, and other communication channels.
- To ask residents and business owners to advise if they cannot hear the siren during testing.
- To cancel the test (and announce the cancellation) if there is an imminent threat to the community on the testing day, so that the testing is not interpreted as a real alert.

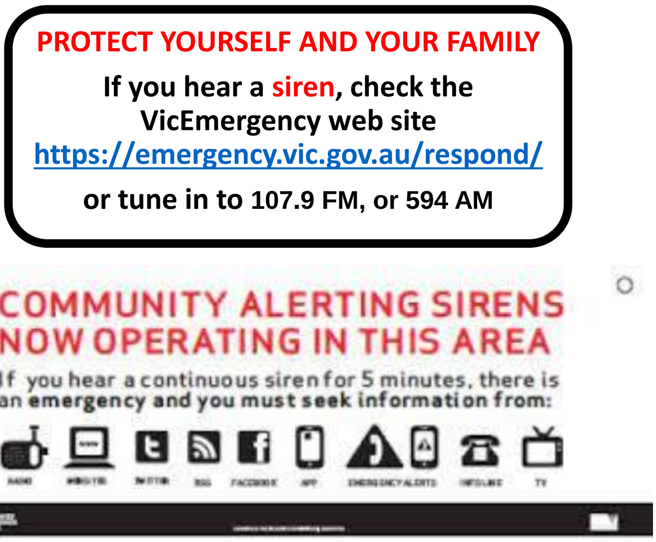
3.2 Training and Education

People need to know what to do when they hear a siren. Education about sirens and other warning systems will reduce public confusion when an emergency arises.

If sirens are adopted:

- A *Community Alert Siren Factsheet* should be developed and distributed to Halls Gap residents and accommodation providers.
- Signs could be erected at the entrances to the town, and at locations where there is often a large public presence (see examples below.)

Figure 4: Example Warning Signs



- Local digital channels should be used to educate the community on what the sirens are, how they are used, and how they will be tested (*Fill the Gap*, HG Community web site, social media, etc.)
- Education sessions on siren systems and their usage should be run at the Primary School for students, and at community venues for adults.

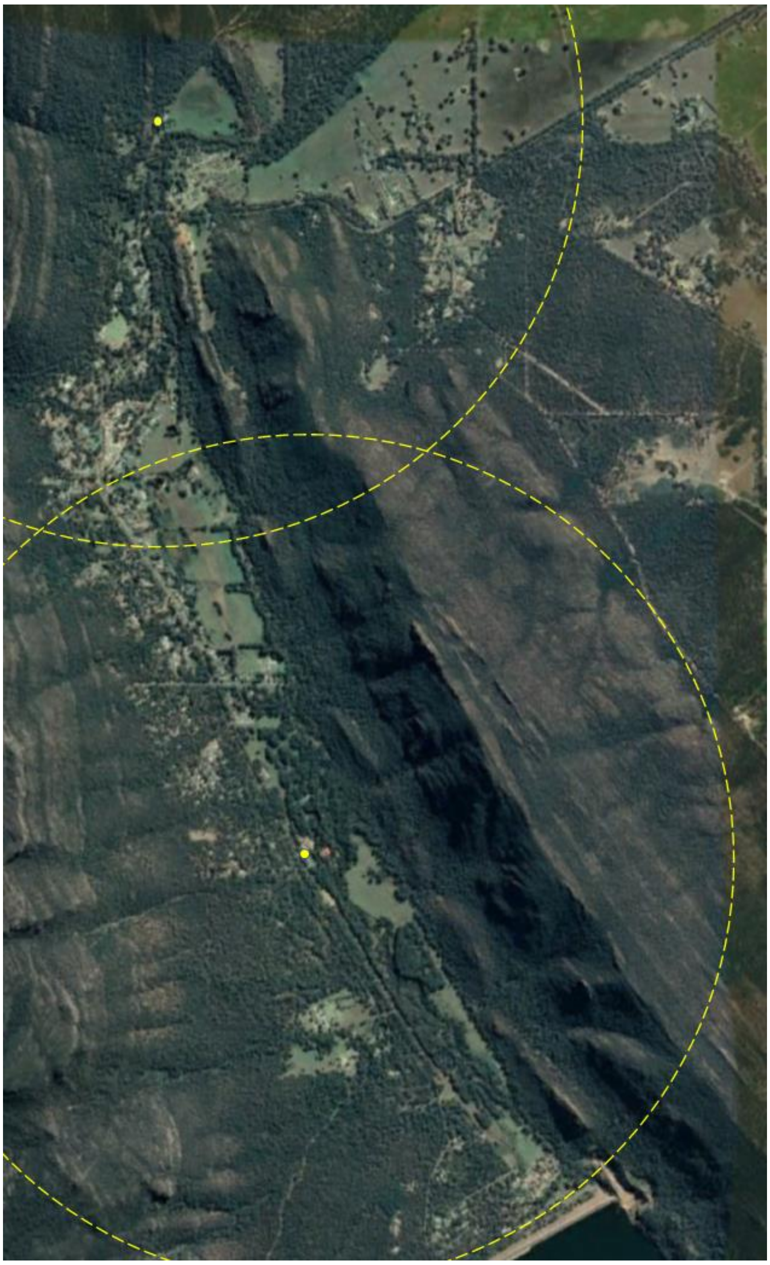
3.3 Siren Positioning

Sirens are typically mounted on poles that are 13-15m high, and sirens should be above the height of surrounding buildings and trees.

A detailed technical assessment of siren locations would be needed to be completed prior to installation, so the locations outlined below are speculative and may change.

However, assuming each siren has a 2km coverage (some go out to 4km) complete coverage would require omni-directional sirens positioned at Brambuk, and next to Mt Zero Road (see Figure 5.) Permission of Parks Victoria would be required in both cases.

Figure 5: Possible Positioning of Sirens



Imagery: Google Maps, © 2022 CNES/ Airbus, Maxar Technologies

4 Requirements for Community Alert Systems

This section attempts to define the requirements that a community alert system must meet.

4.1 Cohorts That Need to be Warned

There are two basic cohorts that need to be warned of any imminent disaster:

1. Those that are indoors, including:
    - Residents inside their homes
    - Tourists inside built accommodation
    - Travellers inside vehicles
    - Owners and employees inside business premises
    - Residents and tourists inside business premises, including Visitor Centres, or one of the many retail outlets in the town (general store, newsagent, pharmacy, restaurants/cafes, bakery, souvenir/ gift shops, jewellery store, wine cellar, luxury goods store, outdoor activities outlet, Post Office, e-bike hire outlet, etc.)
2. Those that are outdoors in (or in close proximity to) the township, including:
    - Tourists or locals attending local outdoor events such as the Halls Gap market, Run the Gap, the Grape Escape, music festivals, etc.
    - Tourists or locals walking in the area e.g. to shops in the town, walking the asphalt walking track through the town, walking along the Lake Bellfield dam wall, walking through the Botanic Garden, etc.
    - Tourists or locals seated at picnic tables or at outdoor seating of cafes or shops
    - Tourists or locals hiking close to the town including to Venus Baths, Chatauqua Peak, Boronia Peak, around the Fyans Creek loop, etc.
    - Tourists or locals at outdoor recreation venues such as the fitness park, cricket pitch or practice nets, pétanque pistes, the recreation area playground, the swimming pool, the tennis courts, the golf club, etc.
    - Tourists in outdoor areas of caravan parks and camp grounds, including in tents
    - Residents outdoors on their own property e.g. in their garden or backyard

These cohorts vary by time of day. From late evening until early morning most residents and tourists will be indoors and asleep. During daylight hours most tourists will be outdoors.

As a minimum, warning systems need to reach both cohorts.

4.2 Pull versus Push Warnings

Some warning systems are ‘pull’ systems i.e. the user is required to access the source and download (pull) the warning information they are seeking from the source.

Other warning systems are ‘push’ systems i.e. the source sends out (pushes) the warning to the user, without the user’s intervention.

Most tourists are in Halls Gap for rest and recreation, are only present for a short period, and will not spend time searching for emergency information (pull technology) unless something triggers the need. They need a ‘push’ notification (alert) to get them focussed on any impending emergency. For example, in 2014, 32% of people expected to rely upon Emergency Alert (a ‘push’ technology - see section 5.3) as their only source of warning, and 80% of people who previously received an Emergency Alert expected to receive one in the event of a future incident.[4]

As a minimum, any warning system needs to provide ‘push’ alerts, although it may supplement this with additional ‘pull’ information.

4.3 Language Limitations

Many visitors to Halls Gap do not use English as their first language. Some have very little English at all. Warnings systems must be capable of reaching this group.

[4] Ipsos Social Research Institute (2014) *National Review of Emergency Alert*

4.4 Dealing with Disabilities

Some residents and tourists will be hearing impaired, vision impaired, or otherwise have difficulty in receiving emergency information. Where possible, warning systems must be capable of communicating despite these disabilities.

4.5 Reliability

4.5.1 System Components

As a minimum any warning system must be made up of components that are reliable and which maximise the availability of the system.

4.5.2 Telecommunications Infrastructure

Some alert systems are reliant on communications infrastructure to work e.g. cell phone networks or wi-fi networks,

There are some permanent intermittent cell phone ‘black spots’ in and around Halls Gap, and during peak tourist periods there is simply too great a demand on cell phone and wi-fi networks for reliable performance. For example, TRILITY and GWMWater experience difficulties in remotely monitoring instruments for the treatment plant, clear water tank, and Lake Bellfield dam during peak tourist periods, and many residents experience poor network service during the same period i.e. alerts using these networks cannot be relied on to reach residents and tourists in a timely manner.

As a minimum, warning systems must not rely solely on telecommunications infrastructure.

4.5.3 Power Supply

Any warning system that requires electrical power to work is at risk from a power failure, which is a common event when disasters strike. Ideally a back-up power supply should be provided e.g. via batteries and solar panels. The warning system itself should also have minimal power consumption when in standby mode so batteries are not drained.

4.6 Cost

Based on international and Australian research, a credible estimate of the value of a statistical life is $5.1 M[5] i.e. any warning system that saves just one life is justified if the cost is less than $5.1 M. However such a cost is not sustainable in a community as small as Halls Gap.

The financial criteria used in the *Halls Gap Threat & Risk Assessment* are summarised in Table 1. A more reasonable cost would be in the Minor category e.g. up to $50,000. (This would need to be raised by grant applications and donations.)

Table 1: Financial Cost Criteria

Category	Amount
Negligible	$0-5,000
Minor	$5,000-50,000
Moderate	$50,000-$500,000
Major	$500,000-5,000,000
Extreme	>$5,000,000

[5] OBPR (2021) *Best Practice Regulation Guidance Note Value of statistical life*, https://obpr.pmc.gov.au/sites/default/files/2021-09/value-of-statistical-life-guidance-note-2020-08.pdf, August

4.7 Responsiveness

Responsiveness deals with how long it takes to get an alert into the hands of a recipient. Ideally this will be as short as possible.

4.8 Effectiveness

Effectiveness deals with how many recipients within a population receive an alert. Ideally this will be 100% of the population, but in reality warning systems typically achieve much lower outcomes.

4.9 Activation/ Testing

The warning system must be easily activated e.g. by the Incident Controller of the emergency situation or his/her delegate.

To ensure the warning system works, it should be regularly tested. (Some systems operate continuously and do not need to be tested.)

4.10 Requirements Summary

An ideal community alert system for Halls Gap should

- Reach both indoor and outdoor cohorts at all times of the day
- Provide ‘push’ alerts as a minimum, but may supplement this with ‘pull’ information
- Overcome language limitations so that it reaches non-English speaking populations
- Reach those that are hearing or vision impaired or otherwise have difficulty receiving emergency information
- Be robust and reliable in the face of network, broadcast, or power failures
- Cost no more than $50,000
- Deliver alerts to recipients quickly
- Reach as many people in the population at risk as possible
- Be easily activated, and regularly tested (if necessary)

5 Comparison of Emergency Warning Systems

Victoria has an integrated warning system that include the use of telephony, mobile applications, emergency broadcasts on radio and television, web-based messaging, social networks and individual notification by the emergency services ("door knocking".)

This section assesses each warning channel against the requirements listed in the previous section.

5.1 VicEmergency

5.1.1 Cohorts

VicEmergency targets both indoor and outdoor cohorts. If network services are available, both cohorts should be able to access emergency information, or receive alerts, provided they decide to do so.

5.1.2 Push vs Pull

Push:

The VicEmergency app, where the user is notified of any emergency alerts near their location, is a 'push' technology. However, for this to work users must first 'pull' (download) the app to their phone. If they don't, then they won't receive the alerts.

Pull:

The VicEmergency website, VicEmergency Facebook channel, VicEmergency Twitter channel and the VicEmergency Hotline (1800 226 226) where the user calls to receive emergency information, are all 'pull' technologies. Emergency alerts may be promulgated by social media, but the user still has to sign in to the social media service before they can receive them.

5.1.3 Language Limitations

Push:

- The VicEmergency app is currently English only, but is being updated to become accessible to people who don't speak English.

Pull:

- For the VicEmergency website, translation services are often provided as a web browser tool, provided the language settings of the browser are set up appropriately.
- For the VicEmergency Hotline (1800 226 226) the Translating and Interpreting Service on 131 450 can be used to obtain translated emergency information.

5.1.4 Dealing with Disabilities

Push:

- The VicEmergency app is currently being updated to become accessible to vision-impaired people. Audible tools may help in the interim (see below.)

Pull:

- For vision impaired people, most browsers have a 'read aloud' function. and many smartphones have a 'read screen' function (e.g. the iPhone *Speak Screen* function or the Android *Select to Speak* function.) In addition some smartphone apps provide 'read screen' functions e.g. Google Assistant. However, these technologies may not help those who are also hearing impaired.

5.1.5 Reliability

Push:

VicEmergency alerts are dependent on the cell phone network.

As stated in 4.5.2, there are some permanent intermittent cell phone ‘black spots’ in and around Halls Gap, and during peak tourist periods there is simply too great a demand on the networks for reliable performance i.e. VicEmergency alerts cannot be relied on to reach all residents and tourists in a timely fashion.

Depending on which network the user has subscribed to, they may be out of network coverage, which will affect when they receive messages.

Pull:

The ‘pull’ VicEmergency channels are also network dependent. Information downloads may not be available, or may be slow during peak tourist seasons.

5.1.6 Cost

There are no costs to the community from using VicEmergency. The app and web sites are funded by the government, and the network costs are born by users.

5.1.7 Responsiveness

Push:

A VicEmergency alert must be received by a user’s device, identified as a message by the user, and read and comprehended. The time this process takes can be adversely impacted by the recipient’s behaviour. For example:

- Some people don't check their messages often. This may be because other things have higher priority, or they may assume that if something is really urgent the sender will call them rather than message them.
- People may forget to take their phones with them, or accidentally leave their phones in places they visit.
- Travellers may keep their devices in their bags / backpacks, or use ‘airplane mode’, reducing their ability to recognise that an alert has been received.
- Device batteries may go flat and people may not bother to (or may not be able to) charge them for a period.
- The user may turn the device off at a meeting or event, and forget to turn it on again for a period, etc.

The net result of these factors is that a VicEmergency alert may not be as responsive as expected i.e. may not get through to the user in a timely fashion.

Pull:

The user may not be aware of the warning information, and may not search for it, unless the user receives an alert.

As stated above, the ‘pull’ VicEmergency channels are network dependent, so information may not be available, or downloads may be slow during peak tourist seasons.

5.1.8 Effectiveness

Push:

In 2021 there were almost 2.7 million users of the VicEmergency app out of a population aged over 15 of 5.4 million i.e. the penetration of the app is about 50%. While app users are likely to pass on news of an alert to other people, the app is not as effective as Emergency Alert, which sends alerts to all phones in a geographic area.

For tourists, who only visit for a relatively short period, the likelihood of downloading the VicEmergency app will be severely reduced i.e. the effectiveness of the app will be much lower.

Pull:

The effectiveness of the ‘pull’ VicEmergency channels is partially dependent on the effectiveness of alerts, as the user may not search for the emergency information without being alerted.

5.1.9 Activation/ Testing

There are formal procedures and tools (e.g. EM-COP) available to emergency agencies for creating warnings and publishing them to the VicEmergency website and app. Templates for warning messages can be used to speed the process up.

There is no requirement for testing of VicEmergency functions. The app and web site are generally available on a 24/7 basis.

5.2 Emergency Broadcasters

5.2.1 Cohorts

Provided reception is good, both cohorts should be able to access emergency broadcasts, if they seek to do so.

The outdoors cohort would need to have a radio or portable TV, something that may be readily available in a caravan park or camp ground, but not very common when people are engaged in outdoor activities like hiking.

5.2.2 Push vs Pull

If users want to receive information from an emergency broadcaster, they need to tune in the emergency radio or TV station and listen/watch for warnings i.e. this is ‘pull’ technology.

5.2.3 Language Limitations

The official emergency broadcasters in Victoria are English services and do not cater for other languages.

5.2.4 Dealing with Disabilities

Vision impaired people can listen to emergency radio broadcasters, and hearing impaired people can watch Sky News TV (the official emergency TV broadcaster.)

5.2.5 Reliability

There are known problems with “spotty” and unreliable radio and TV reception within the Halls Gap community.

Further if there is a power failure, which is common during disaster events, neither radio or TV will be available to most residents. (Some may have a battery radio, or solar battery.)

5.2.6 Cost

There are no costs to the community from listening to, or watching. emergency broadcasters other than cost of power, which is born by the user. The broadcasts are free-to-air services.

5.2.7 Responsiveness

The responsiveness of emergency broadcasts is dependent on how quickly and how often the service broadcasts the emergency information, and how quickly the user tunes in to the broadcast. If the user does not receive an alert, there may be significant delays in tuning in.

5.2.8 Effectiveness

While conceptually broadcasts should be able to reach all users in a broadcast area, if there are no alerts to warn the user, broadcasts may not be listened to, or watched, at all.

In addition, there are known problems with “spotty” and unreliable radio and TV reception within the Halls Gap community which may undermine the effectiveness of a broadcast.

People engaged in outdoor activities such as hiking may not have access to radio or TV broadcasts.

5.2.9 Activation/ Testing

Warnings are provided to the broadcasters by the Incident Controller (or delegate.)

There is no requirement for testing of broadcast services. They are generally available on a 24/7 basis.

5.3 Emergency Alert

5.3.1 Cohorts

The Emergency Alert (EA) system targets both cohorts, whether they are indoors or outdoors.

5.3.2 Push vs Pull

EA does not rely on an app. It simply relies on the user having a phone that can receive the alert messages which are sent out to them i.e. it is ‘push’ technology

5.3.3 Language Limitations

EA only issues voice and text warning messages in English.

5.3.4 Dealing with Disabilities

EA does not support TTY services.

For vision impaired cell phone users, many smartphones have a ‘read screen’ function (e.g. the iPhone *Speak Screen* function or the Android *Select to Speak* function.) In addition some smartphone apps provide ‘read screen’ functions e.g. Google Assistant. However, these technologies may not help those who are also hearing impaired.

5.3.5 Reliability

Like VicEmergency alerts (see section 5.1.5) EA alerts rely on telecommunication infrastructure, which is not always reliable.

5.3.6 Cost

EA is funded by state and territory governments. They also pay the usage charges associated with alert messages i.e. there are no costs to the community.

5.3.7 Responsiveness

EA starts sending messages immediately the alert is triggered. It has the capacity to send 500 text messages per second and 1,000 voice messages per minute, so it is very responsive.

However, receipt of the message may be delayed if the message ends up on an answering machine, or in voice mail. Further, there are mobile ‘black spots’ in Halls Gap and periods where poor service is caused by excessive demand on networks i.e. EA cannot be relied on to reach all residents and tourists in a timely manner.

5.3.8 Effectiveness

EA is not used in all emergency circumstances, and its use depends on the nature of the incident. It sends voice messages to landline telephones if the billing address is in a specific location, and text messages to mobile phones that have recently contacted a cell phone tower in the area. People with landlines may not receive messages if their answering machine or voicemail is full, and cell phones may not receive a text if they do not have service, or their phone is turned off, or the cell phone’s text message inbox is full.

A 2011 review[6] found that the success of receiving EA messages across all telecommunication channels (landline phones, answering machines, cell phones, and voice mail) varied between 61% and 98%.

5.3.9 Activation/ Testing

An EA alert is activated by an Incident Controller (or delegate.)

There is no requirement for testing of EA services. They are generally available on a 24/7 basis.

[6] RMIT University (2011) *Systematic Review of Reports On Emergency Alert*, Centre for Risk and Community Safety, December

5.4 Door Knocking by Emergency Personnel

5.4.1 Cohorts

Door knocking is targeted at the indoor cohort (those at home or in rented accommodation.) Those outdoors who are met by door knockers moving between houses will also be warned.

5.4.2 Push vs Pull

Door knocking is a 'push' form of warning

5.4.3 Language Limitations

Door knocking is generally conducted in English only (depending on the skills of the door knocker.)

5.4.4 Dealing with Disabilities

Those that are vision impaired will still be able to hear door knockers, Those that are hearing impaired will have more difficulty depending on the skills of the door knocker (e.g. knowledge of Auslan.)

5.4.5 Reliability

Door knocking is subject to human error e.g. missed houses or missed streets or inadequate planning of the campaign.

5.4.6 Cost

The 2014 evacuation door knock in Halls Gap involved 80 members of VICPOL, many of whom were called in from surrounding communities. At an average hourly wage of $45 over four hours, the cost would have been $14,400 plus transport costs to bring members into Halls Gap, plus other ancillary costs. An overall cost of about $16,000 per door knock is probably reasonable.

5.4.7 Responsiveness

Planning the door knock, mobilising the resources required to complete it, and briefing/ training the resources, will all delay the start of the process. Once started, the door knock itself took 4 hours in 2014.

5.4.8 Effectiveness

Door knocking is probably the most effective night-time warning system. It may wake someone sleeping indoors and alert them to a threat, something some other warnings cannot do. However, during the day its effectiveness is reduced by residents who are not at home and tourists that are not in their rented accommodation, although written advice can be left at the door. It is also impacted by human error e.g. missed houses or missed streets.

5.4.9 Activation/ Testing

A door knock would be activated by the Incident Controller (or delegate.) There is little purpose in testing a door knock, although participants need to be briefed/trained.

5.5 Community Alert Sirens

5.5.1 Cohorts

The sound of a siren can be attenuated by hills or walls i.e. it is most effective in reaching an outdoor cohort, and is not very effective in reaching an indoor cohort (including people in vehicles) unless doors or windows are open, or the building/vehicle is close to the siren site.

5.5.2 Push vs Pull

Community Alert Sirens are a 'push' technology.

5.5.3 Language Limitations

Sirens are language neutral. They are used globally, and based on pre-COVID data, most international tourists who visit the Grampians would be familiar with them (see Table 2.)

Table 2: Familiarity With Sirens Among International Tourists Visiting the Grampians

Country	% of International Tourists (2019)[7]	Description of sirens usage in country of origin[1,8]
UK	17.2%	Historically widely used. Today largely decommissioned. About 1,200 sirens remain, mostly to warn of severe floods
Germany	16.7%	At least 50,000 stationary sirens
USA	8.6%	Exact number unknown, but widely used for weather warnings throughout the country e.g. for tornados, cyclones, etc
Netherlands	8.3%	About 4,200 sirens across the country
Singapore	6.2%	Network of 284 stationary sirens called the Public Warning System
Switzerland	5.1%	About 8,500 mobile and stationary civil defence sirens and 700 sirens located near dams
New Zealand	5.1%	Several networks of town-based civil defence sirens, some also used for fire or tsunami warnings
France	4.9%	Emergency population warning network of about 4,500 sirens called the "Réseau national d'alerte" (RNA)
Scandinavia	2.8%	Norway has about 1,250 sirens, Sweden has 4,600 sirens, and Denmark has 1,078 sirens
Malaysia	2.8%	Network of sirens called the Public Warning System (PWS)
Canada	2.1%	A nationwide network of sirens was used until the 1970s, but now largely decommissioned
Mainland China	2.1%	Has sirens located in most cities and towns, particularly those located in or near disputed territories
Taiwan	1.7%	Taiwanese civil defence sirens are erected on police stations throughout the country
Korea	0.9%	Nearly all towns and cities have civil defence sirens in case of natural disasters or missile attacks from North Korea
Japan	0.7%	J-ALERT National Instant Warning System warns of earthquakes, tsunamis, volcano eruptions, and other disasters

[7] Grampians Tourism (2020) *Travel to the Grampians For the period January 2019 to December 2019*, https://grampianstourism.com.au/wp-content/uploads/sites/4/2020/04/Grampians-Tourism-travel-snapshot-YE-Dec-19-Datainsights.pdf

[8] Where not sourced from reference 1, information is sourced from internet searches

International research suggests that non-English speakers rely heavily on sirens to make them aware of emergency situations.[9] Once they are aware that a situation exists, they can focus on understanding what is going on and what they should do about it e.g. by contacting others in the community, or calling the Translating and Interpreting Service on 131 450 and asking for translated information from the VicEmergency Hotline (1800 226 226.)

Here is a common myth, often associated with sirens, that people panic when warned of a disaster. In reality, "…most people behave rationally in disaster. While panic is not to be ruled out entirely it is of such limited importance that some leading disaster sociologists regard it as insignificant or unlikely".[10]

5.5.4 Dealing with Disabilities

Sirens will warn vision impaired people. Hearing impaired people may not hear the alert.

5.5.5 Reliability

A siren's message is not dependent on cell phone technology, and is not affected by black spots or excessive network demand.

Sirens are technically dependent on the power supply to operate, but in most cases are designed with backup power options.

5.5.6 Cost

The capital cost of a community alert siren includes the cost of the siren itself, the post or tower the siren is mounted on, the control system used to activate and deactivate the siren, and the installation and configuration cost required to set the siren up. Costs for two omni-directional sirens could be about $50,000.

Ongoing costs relate to maintaining and testing the siren on a regular basis. If the siren is elevated (on a tower or pole) maintenance may require the use of bucket trucks.

5.5.7 Responsiveness

Once activated, siren warnings are immediate. They are more responsive than most other alternatives. They are regarded as particularly useful for rapid-onset emergencies.

Halls Gap is at risk from rapid-onset flash flooding as the steep sides of the Fyans Valley contribute to rapid runoff.

5.5.8 Effectiveness

See 5.5.1 above i.e. sirens may not reach people who are indoors, or in vehicles. Sirens are also not very effective in warning special populations e.g. the hearing impaired, and may not be effective in areas with high ambient noise levels. Sirens have a maximum audible range of 1-4 km on a clear, calm day with no obstructions between the person and the siren. Factors such as trees, wind, rain and hail can reduce the ability of people to hear a siren. Placing sirens in appropriate locations can overcome some of these issues (see Figure 5) but people who are out of range will not hear the alert.

Conversely hikers in cellular dead spots in the National Park may hear the siren, and this may be the only timely alert they receive i.e. for a small number of people the siren will be their *only* warning of an emergency, making it an important communication channel in its own right.

5.5.9 Activation/ Testing

During an emergency, the Incident Controller (or delegate) will arrange the activation of the siren, if it is needed.

Testing is described in section 3.1.

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[9] Kuligowski E.D., and Wakeman K. (2017) *Outdoor Siren Systems: A review of technology, usage, and public response during emergencies*, NIST Technical Note 1950, February

[10] Duffy N. (2020) *Disaster Education, Communication and Engagement*, April

5.6 Electronic Message Signs

5.6.1 Cohorts

Electronic message signs are typically deployed at the side of roads leading into the town, or near an area where there is a large public presence. As such they only target a subset of the outdoor cohort i.e. those travelling into the town, or those close to the site of the sign, as applicable.

5.6.2 Push vs Pull

Electronic message signs are a ‘pull’ technology in that users have to travel past the sign, and decide to read the message.

5.6.3 Language Limitations

Electronic message signs are in English only,

5.6.4 Dealing with Disabilities

Electronic message signs will not be very effective for vision impaired people. Hearing impaired people will still be able the read the alert.

5.6.5 Reliability

Electronic message signs can be affected by technical faults with the display, flat batteries, and similar problems. However, they are generally reasonably reliable.

5.6.6 Cost

A trailer-based solar-powered electronic message sign can be purchased for $10,000-$15,000 or rented for $200-$300 per week.

5.6.7 Responsiveness

If the electronic message board is on-site in Halls Gap it may take 0.5 hours to position the sign and set up the message. If it has to come from Stawell it may take 1-1.5 hours.

Once set-up it may take time before residents/ tourists pass the sign i.e. for many it will not a very responsive warning.

5.6.8 Effectiveness

Many residents/ tourists will not pass the sign i.e. while this alternative has its place in some situations (e.g. traffic control), as a mass notification channel it has the worst effectiveness of all alternatives reviewed.

Some drivers or passers-by may simply choose to ignore the message, or misunderstand it due to poor message construction, or lack of English skills.

5.6.9 Activation/ Testing

During an emergency, the Incident Controller (or delegate) will arrange the activation of the message board, if it is needed.

Testing would be completed as part of the set-up of the sign.

6 Justification for Community Alert Sirens in Halls Gap

6.1 The Need for Alerts/ Warnings

Halls Gap has an EXTREME bushfire risk, is subject to rapid onset flash flooding and landslides, and has a need for a fast response to any imminent dam break i.e. it has a genuine need for appropriate and responsive emergency alert systems.

6.2 Limitations on Existing Warning Systems

Based on the assessment in section 5, no single public warning system is capable of alerting all of the people in Halls Gap all of the time.

For telecommunication-based alerts and warnings, Halls Gap is subject to network black spots and poor service due to networks being overwhelmed during peak tourist periods.

For emergency broadcasts, Halls Gap has problems with both radio and TV reception.

6.3 'Push' as a Minimum Requirement

As a minimum, 'push' technologies are required to attract the attention of residents and tourists. Based on the assessment in section 5, there are only four 'push' technologies available:

- The VicEmergency app,
- EA,
- door knocking, and
- community alert sirens.

Door knocking is most effective at night as, if applied vigorously, it may awaken someone who is asleep in a house, whereas a siren or EA may not. However door knocking during the day is deficient in other areas:

- It is focussed primarily on the indoor cohort, and will not promptly alert those who are not at home, or not in their rented accommodation.
- It is an English-only service.
- It is labour-intensive and subject to human error.
- It is relatively unresponsive.

Tourists (particularly international tourists) cannot be relied upon to download the VicEmergency app, so will probably not receive VicEmergency alerts. EA is therefore the best electronic alert option, as it does not depend on an app. However,

- EA is an English-only service, whereas sirens are language neutral and likely to be familiar to most tourists, and
- EA is dependent on networks providing service and users checking their phones, whereas sirens are dependent on neither, and provide an immediate alert.

Having multiple warning systems provides redundancy and resilience against failure of key systems such as cell phone towers or wi-fi networks, or the loss of electrical power which is common in disaster situations. Use of Emergency Alert, sirens, and door knocking as 'push' warnings meets this need, as door knocking and sirens are not dependent on cell phone towers, wi-fi networks, or loss of electrical power (assuming batteries and solar panels are used for sirens, which is a standard part of most siren systems.)

Consistent alerts from all warning systems will also encourage comprehension and increase the credibility of the alerts.

6.4 Recommendation

It was recommended

- that the level of support for sirens in the community be established, and.
- if the support is there, that community alert sirens be installed in Halls Gap, provided the cost is about $50,000 or less (raised by grants and donations.)

6.5 Outcomes

The level of community support for sirens was assessed by placing an article in the *Fill the Gap* newsletter on two successive months, asking residents to indicate their support (or not) by emailing the Resilience Group Secretary.

Only four emails supporting sirens were received - two from residents and two from business operators.

As there was insufficient support, it was resolved to drop the issue of sirens at the February Resilience Group meeting.