

▪ plan

Contingency Plan for the Auckland Volcanic Field

■ plan

Contingency Plan for the Auckland Volcanic Field

Prepared for
Auckland Regional Council

By
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1 Introduction

Volcanic eruption within the Auckland Volcanic Field (AVF) is a very real hazard for the Auckland Region. While an AVF volcanic eruption may directly affect a relatively small proportion of the Region's population, the longer term impacts are likely to have a much wider geographic extent and significant implications for a broad range of industries and services, nation-wide.

A well-managed response is essential to ensure that the far-reaching infrastructure, social and economic issues associated with such an event are considered.

This Plan (the Plan) has been prepared to facilitate planning for and management of an eruption within the AVF.

1.1 Purpose of the Contingency Plan

Co-ordinating response to volcanic hazards

The purpose of the Plan is to establish a co-ordinated civil defence and emergency management framework to facilitate preparedness and response to, and recovery from, an eruption or hazard event from the AVF. This Plan **does not** address contingency planning for a volcanic eruption outside the AVF.

The Plan will compliment existing civil defence and emergency management planning, targeting the management and co-ordination of response to a volcanic eruption.

Identification of roles and responsibilities for organisations

The Plan identifies roles, responsibilities and actions for many different 'stakeholder' organisations. The Plan does not replace the need for these organisations to prepare their own contingency plans (for the continuance of their core business functions).

1.2 Objectives of the Plan

Objectives

The principal goal of this plan is to establish co-ordinated management of response and restoration operations. To achieve this goal, the following objectives are identified:

- Establishing protocols for the timely and efficient warning of volcanic activity to facilitate co-ordinated emergency management;
- Initiation of immediate communication and public information activities;
- Ensuring that declarations are made as necessary and that the process of declaration is transparent for those involved in civil

defence emergency management;

- Appropriate deployment of information for the management of civil defence emergency; and
- Appropriate prioritisation and allocation of regional resources in the event of an AVF eruption.

1.3 Guide to the Plan

Throughout this Plan reference is made to linkages with other civil defence emergency planning documents that are either currently available or will need to be prepared to support the Plan.

Symbols used in the Plan are:



Refer to Appendix 1 (Appendix **complete**)



Refer to Appendix 2 (Appendix **incomplete**)



Refer to separate Plan (Plan **complete**)



Refer to separate Plan (Plan **incomplete**)



Cross-reference to Section 2.1



Contact details to be recorded and attached to the Plan

1.4 National Planning



**National
Civil Defence Plan**

The National Civil Defence Plan establishes a framework of actions to be taken by Government, local authorities and other CDEM agencies in preparation for and response to a volcanic episode. This National Plan identifies:



- The Scientific Alert Levels used in the formulation of volcanic warning information;
- National responsibilities for the issuing of volcanic warning information; and
- The responsibilities of local authorities, the Ministry of CDEM and other agencies in managing volcanic emergencies (see Figure 1).

Figure 1

This Plan is prepared in accordance with the identified responsibilities for local authorities under the National Civil Defence Plan and does not obviate these national responsibilities.

Pre-Eruption and Eruption Roles and Responsibilities

**Local Authorities
(CDEM Group)**

*Undertake volcanic hazard assessment
Prepare and maintain response plans
Prepare and maintain warning systems
Carry out public education and information activities*

In the Event of Volcanic Eruption:

*Implement response plans
Acquisition of support and resources
Provide support to other local authorities
Provide public information and advice at local level
Initiation of recovery plan*

GNS

*Maintenance of surveillance capability
Interpretation and assessment of volcano status information
Assign Scientific Alert Levels
Issue Science Alert Bulletins*

In the Event of Volcanic Eruption:

*Co-ordinate on-going surveillance and hazard assessments
Set SAL
Issue Science Alert Bulletins
Provide other volcanic information*

Ministry of CDEM

*Maintain national contingency plan
Distribute Scientific Alert Bulletins and information
Establishment of working groups to investigate and co-ordinate national level reduction, response and recovery measures
Promote research
Provide assistance to local authorities
Maintain national warning systems
Advise Government and agencies of appropriate actions to take for volcanic eruption*

In the Event of Volcanic Eruption:

*Activate national warning system
Issue information and advice
Co-ordinate national level response
Activate public 'hot-line' as required.*

Departments, Organisations, SOE's & Utility Providers

*Identify probable impact on prime functions'
Co-ordinate planning procedures with MDCEM
Participate in CDEM exercises
Prepare and provide public information with respect to their interests
Identify resource available
In the event of a Volcanic Eruption
Implement response plans
Ensure continuation of essential functions (as far as possible)
Co-ordinate information material with MCDEM
Respond to information requests
Initiate recovery plans*



Figure 1
National Civil Defence Plan: Response Structure for Volcanic Eruption

2 Volcanic Hazard

This section of the plan provides a summary of the volcanic hazards and risks specific to Auckland’s volcanic field. An understanding of the special character of the Auckland Volcanic Field (AVF) allows an appropriate planning and response framework to be established.

2.1 Auckland’s Volcanic Field (AVF)

The distribution of vents within the AVF is shown in Figure 2.

Future eruption will result in the formation of a new volcano at a new location

The geologic record indicates that the AVF is a monogenetic volcanic field (only one eruption episode occurs from each vent, although some eruption episodes have involved more than one vent). The monogenetic nature of Auckland’s volcanoes means that a future eruption will involve a new volcano being formed, rather than renewed activity from an existing volcano.

The next eruption could occur at any time in the future

The return period between past events has ranged from hundreds to thousands of years. The latest eruption occurred some 600 to 800 years ago. A future eruption may therefore occur at any time in the future.





The warning period is likely to be short

The AVF volcanoes are characterised by low viscosity basaltic magma, which rises quickly to the crust (at speeds of around 5km/hr). This means that the warning period for any pending eruption (from the early stages of detection to the commencement of volcanic activity) is likely to be short, in the order of days.

2.2 Volcanic Hazards in the AVF

1 Summary of hazards

A summary of hazards and the potential level of risk associated with each hazard due to eruption within the AVF is given in Appendix 1. Risk is coded:

Severe	
High	
Moderate and	
Low.	

Particular consideration should be given to those hazards that potentially pose a high or severe risk for which some mitigation options are available.

2.3 Risk

Some risks could be mitigated prior to eruption

The assessed impact of the hazards is summarised in the Risk Matrix in Table 1 (risk = hazard x vulnerability, where vulnerability is a function of the perceived effect on the Auckland community and infrastructure). The risk matrix identifies the level of risk likely to be associated with each hazard and broadly evaluates those for which mitigative solutions could be considered. For example, crater formation poses a severe risk, but there are no known options for mitigation (other than evacuation with sufficient prior warning). Whereas lava flow and airfall tephra pose high and moderate risks, against which some mitigative options are available for risk reduction.

Table 1: Volcanic Risk Matrix

Hazard	Area Affected <i>(radial distance from vent, km)</i>	Immediate Risk	Ongoing Risk	Anticipated Loss	Mitigation	Recovery Period following Cessation of Activity
Earthquake	3 - 5	Low	Nil	Small	Not applicable	Not applicable
Crater, Cone or Ring Formation	0.3 - 1.5	Extreme	Low	Extreme	None	Several months to years
Fire Fountaining*	0.2 - 0.5	High	Low	Extreme	Minor	1 week to several months
Lava*	3 - 5	High	Low	High	Moderate	Several weeks to several months
Base Surge	3 - 5	High	Low	Extreme	None	1 week to several months
Shock Waves	3 - 5	High	Low	High	None	1 week to several months
Lava bombs*	0.4 - 0.5	Moderate	Low	Moderate	Minor	1 week to several months
Airfall Tephra	3 - 100	Low	Moderate	Low	Moderate	1 week to several months
Gas	3 - 5	High	Moderate	Moderate	Minor to Moderate	Not applicable
Lightning	3 - 100	Low	Low	Low	None	Up to 1 - 2 days
Tsunami	1	Low	Nil	Low	Moderate	Up to 1 - 2 days

* Events which are likely to be repeated over a period of time (weeks to months) following the initial event

2.4 Issues for Contingency Planning

In summary, the following issues have been identified for contingency planning:

- The site of future eruption cannot be predicted;
- There will be a relatively short pre-eruption period (possibly only a couple of days);
- It is possible that there will be more than one eruption vent (though it is expected that any vents in a multi-vent episode will be in relatively close proximity);
- Unlike many other natural hazards in New Zealand, a volcanic activity will occur over a long time frame, over a period of months up to a year or more;
- Volcanic activity will give rise to a number of hazards which will have minor to severe impacts both in terms of damage and geographic extent.

2.5 Local Effects

Local effects of volcanic eruption include physical, social, economic and political impacts

The risks and impacts of a volcanic eruption in the AVF are diverse and complex, with different physical processes likely to give rise to many different physical, social and economic impacts. These effects are likely to be both 'moderate term' (for the months or years of volcanic activity) but also significantly longer term (e.g. for the volcanic vent area where reoccupation of the area may not be possible for many years, if ever).

While not exhaustive, the following is intended to provide general guidance on the possible impacts resulting from a volcanic eruption:

Physical Impacts:

- Disruption to the Region's transport and lifeline networks, including direct physical impacts on infrastructure, severance of transport corridors or service lines, closures to ports, airports and maintenance/operational impacts (e.g. ash fall disruptions) (dependent on the location of any volcanic vent);

- Displacement of residents and businesses from the immediate area of impact;
- Health and safety impacts on the region's resident population (e.g. resulting from ash fall);
- Potential hazardous impact on hazardous chemical and fuel storage areas;
- Damage to infrastructure from ash and requirements for ash removal and disposal.

Economic Impacts:

- Disruption to regional and local business and to economic operations (e.g. loss of staff, loss of access to supplies, loss of business operation centres);
- Potential disruption to the port, airport or main land based transport corridors, major gateways for goods and access to the region;
- Disruption to commercial activity (particularly retailing due to loss in market confidence and loss of markets);
- Loss of tourism market;
- Insurance availability and premium loadings;
- Long term (or possibly permanent) loss of land use and economic return from volcanic vent area.

Social Impacts:

- Disruption to operation of community services (e.g. loss of school roles and increased roles of other groups);
- Psychological impacts on community;
- Displacement of community and social networks (moderate to long term);
- Loss of employment and economic security;
- Long term disruption, loss and impact to society.

2.6

Potential National Effects

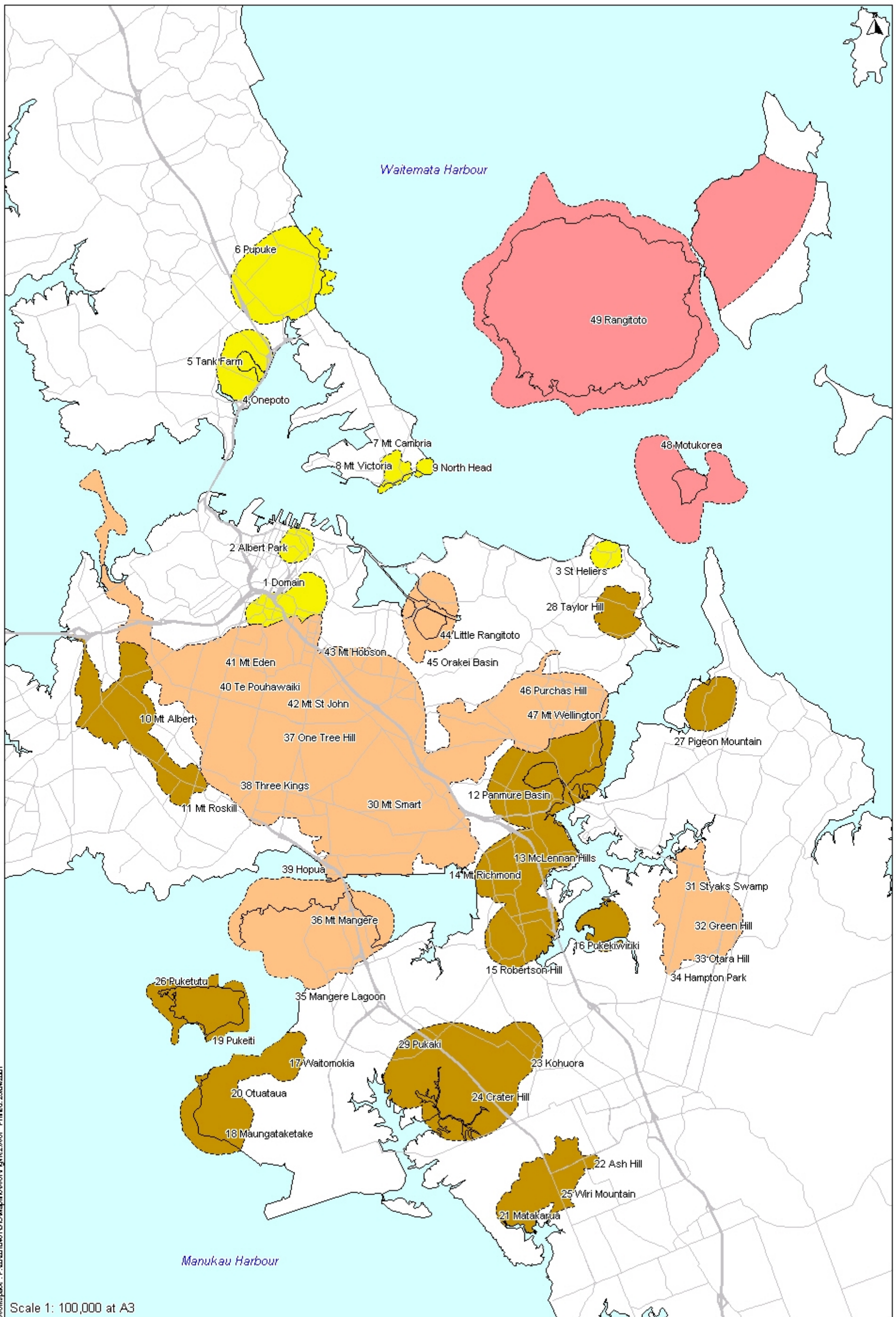
National effects of volcanic eruption may result in a National Declaration

Nationally a volcanic eruption in the AVF could affect New Zealand in the following ways:

- Disruption to Auckland International Airport as a major portal to the country;
- Disruption to nationally significant business and economic operations (particularly if the CBD affected);
- Pressure on the New Zealand dollar;
- Disruption to the Port as a major national gateway for goods to the country;
- Disruption of transport and infrastructure services to and from the north (e.g. the Harbour Bridge, Marsden Point Pipeline and the Main Power Trunk);
- The need for national support and resources to be deployed.

➡ National Volcanic Contingency Plan

In such instances, a national state of emergency may be considered appropriate and the Ministry of CDEM would take national control. In this case, the **National Volcanic Contingency Plan** would also be relevant for civil defence emergency management.



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Scale 1: 100,000 at A3



Estimated Age of Eruption

- < 10,000 yrs
- 10,000 - 20,000 yrs
- 20,000 - 100,000 yrs
- > 100,000 yrs

1 - 49: Volcanoes numbered in eruption sequence from earliest (1) to most recent (49) as reported by Allen and Smith 1994
 Ages < 40,000 yrs assessed by C¹⁴ dating
 Ages 150,000 - 40,000 yrs assessed by thermoluminescence.

— Main Highways

The Auckland Volcanic Field
Figure 2

3 Command and Control

3.1 Co-ordination / Lead Agency

Early nomination (SAL1) of a Lead Agency for emergency management response


In the event of a volcanic eruption in the AVF it is considered most likely that a *regional response* would need to be activated. This will require a multi-agency response and it will be necessary for a **Lead Agency** to be nominated to co-ordinate response.

Due to both the possible scale of a volcanic eruption and the expected duration of the event, flexibility will be needed to allow the **Lead Agency** selected to be the most appropriate for the specific events and issues associated with the different phases of volcanic activity.

 CEG

 5.2

The **CDEMG** should be convened as the **Lead Agency** at the outset of volcanic activity (SAL 1) and during the *Alert Phase*. Depending on the location of volcanic activity and the likely impacts of any eruption, the CDEMG, in consultation with **CEG** may consider nomination of an alternative Lead Agency.

 National CD Plan (Part IV)

The **New Zealand Police** have responsibilities for maintaining law and order under the Police Act. Under the National Civil Defence Plan the Police have identified roles and responsibilities in a state of emergency.

Police possible alternate Lead Agency

 NZ Police

 Police Emergency Plans

The Police have a day-to-day role as co-ordinators of emergency situations and it is possible that the Police may be an appropriate alternate **Lead Agency**.

Regardless, the Police would retain the role as **Incident Controller** in many emergency operations (e.g. evacuation and management of cordoned areas around the eruption site).

CDEM Group leads co-ordination

 CDEMG

If not already, once a declaration had been made the **Lead Agency** would become the CDEM Group and response co-ordination would be the responsibility of the nominated '**Controller**'.

3.1.1

Emergency Operations Centre

 4.1.1

 CDEMG Plan

In the event of any volcanic activity in the AVF, the nominated **Lead Agency** will be responsible for selecting the **EOC**. While the **EOC** can not be predetermined, it is anticipated that one of the EOC nominated in the CDEMG Plan would be appropriate.

Once identified, the EOC will be the focal point for many organisations responding to volcanic activity.

 5.2

The **EOC** location should be confirmed and mobilised as quickly as possible, e.g. within the *Alert phase* of the warning system.

3.2

Lead Agency Structure

In the event of a volcanic eruption, the **Lead Agency** will be primarily responsible for response co-ordination, with a number of other organisations responsible for specific operations and incident responses. A volcanic eruption will require a multi-incident / multi-agency response structure in accordance with **CIMS**.

 **CIMS**

EOC Structure
Figure 3



Figure 3 sets out the proposed structure of the EOC for response co-ordination.

The following support roles are identified to ensure the functioning of the EOC and its emergency management operations:

 3.2.3

- **Planning and Intelligence**

This section will be responsible for the collection and evaluation of information related to volcanic activity and reporting this to the response co-ordinator of the Lead Agency;

 **Public**
Information Plans
 7

- **Public Information**

This section will be responsible for managing public information on volcanic activity in accordance with National, Regional and Local Public Information Plans.

 3.2.3

- **Liaison**

This section will be responsible for communication with representatives from other organisations (e.g. utilities, welfare);

 3.2.4

 **National CD**
Plan and
 **CDEMG Plan**

- **Logistics**

This section will be responsible for the allocation and prioritisation of facilities, services and materials or resources necessary for emergency management response to a volcanic eruption in accordance with the principles, functions, and responsibilities set out in the National CD Plan and Auckland CDEM Plan.

 4

- **EOC Manager (Operations)**

In order to maintain effective response, it will be necessary for the EOC and related facilities to be managed and maintained. This role will be to provide for the operation and safety of personnel in the EOC.

3.2.1

Extraordinary Functions and Powers of the Controller / NZ Police

While the regional **EOC** will primarily be involved in co-ordination and management of response, under a *state of civil defence emergency* the **Controller and NZ Police** are empowered to exercise specific functions which may be required. In addition to the powers for requisition and allocation of resources, these powers relate specifically to the:

- Restriction of access (road closures etc);
- Ordering of evacuation in nominated areas; and
- Power to regulate traffic.

The exercise of these powers may be relevant to particular operations in response to the civil defence emergency.

3.2.2

Planning and Intelligence

In the event of a volcanic eruption it is important to recognise that expertise for this function is diverse and specialist advice is likely to be required.

☒ CEG

Resources established within the **CDEM Group** will provide assistance for planning and intelligence (e.g. **CEG**) however other nominated positions may need to be filled to successfully implement response operations, particularly following a declaration of CD emergency. The **CEG** will no longer have a role in management of an emergency once a declaration has been made.

The following expert advice be sought to support the **Planning and Intelligence Leader**:

☒ SAG

- Scientific advice – It is proposed that a **Scientific Advisory Group (SAG)** be established to provide detailed assessment of the likely physical impacts of volcanic activity (Hazard mapping). The Group may include representatives of the following:
 - Volcanologists – e.g. nominated representatives from GNS, the ARC and/or the University of Auckland;
 - Meteorologists – e.g. specialist representatives from the Meteorological Service of New Zealand Ltd, NIWA;
 - Specialist Medical Advisors – e.g. for respiratory advice, Public Health Board representatives; and
 - Others.

3.2.3

Liaison

The function of this management section is to ensure that information between organisations and emergency service providers is integrated and co-ordinated.



Through the Lead Agency, the **Liaison Leader** will manage communications. Liaison will consult with *Amateur Radio Emergency Corps* for support in this role, particularly where land based telecommunication networks are not available.

3.2.4

Logistics

The function of this management section is to, as far as possible, ensure that limited resources are allocated appropriately and that response operations are undertaken in a co-ordinated manner.



The National Civil Defence Plan sets out the principles, functions, responsibilities and planning considerations in the procurement and management of basic goods and services for civil defence purposes.



In the event of a volcanic eruption, the **Logistics Leader** will, through the Controller, be responsible for:



- Co-ordination of any medical support facilities and resources required;
- Deployment of personnel and resources for evacuation operations to the Incident Controller of any evacuation incident site;
- Maintenance of a regional resource database for evacuation, communication, welfare and restoration;
- Mobilisation and management for provision of emergency communication systems (sources from numerous sources in consultation with AREC);
- Co-ordination of resources for clearance of supply and evacuation routes; and
- Co-ordination of temporary accommodation for response teams (particularly volunteers).



While the **Logistics Leader** will be responsible for allocation of resources over the region, Incident Controllers on site will be responsible for the allocation of resources and facilities at the incident site.

✉ TAG

To support the Logistics and Resources Team, it is recommended that the following expert advice team be established:

- **Technical Advisory Services** – It is proposed that a **Technical Advisory Group (TAG)** be established to undertake planning and design (including identification of resource requirements) for response and remediation / mitigation measures. The Group will consist of a core group and then will have nominated specialists in particular resource areas who may be included in the TAG should the need be identified by the TAG Core Group. Representatives for TAG will include the following:
 - Transport Network Advisors– e.g. road, rail, airport specialists;
 - Utility Advisors – e.g. specialists to provide advice on structural impacts and mitigation;
 - Police / Defence Forces;
 - Health Services – St Johns Ambulance, Public Health, Hospital Services; and
 - Others.

3.2.5

Roles and Responsibilities Summary

③ Summary
Action Lists

Appendix 3 provides a checklist for the roles and responsibilities of the Lead Agency Team.

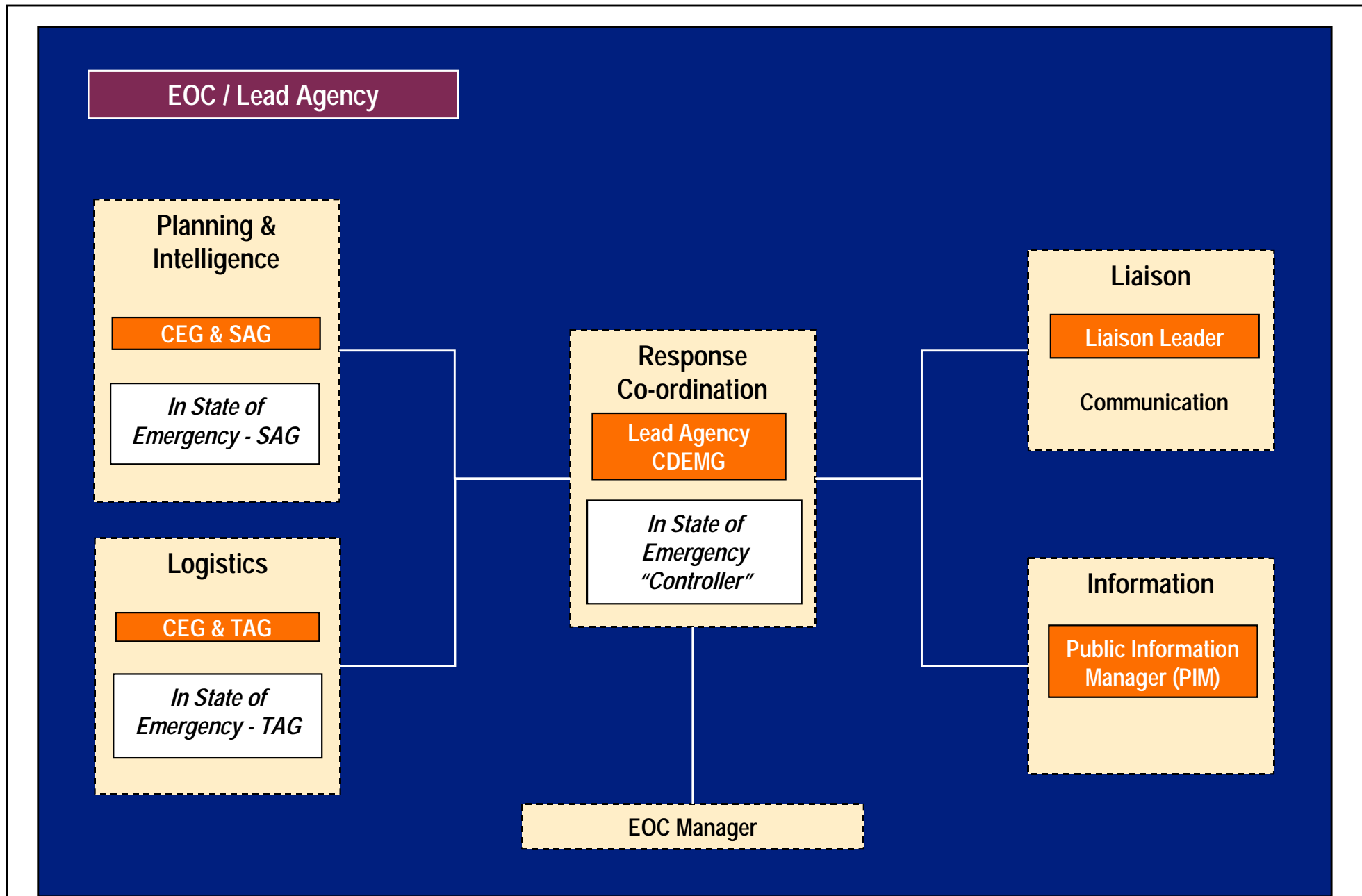


Figure 3
Co-ordination response structure for a volcanic eruption in the AVF

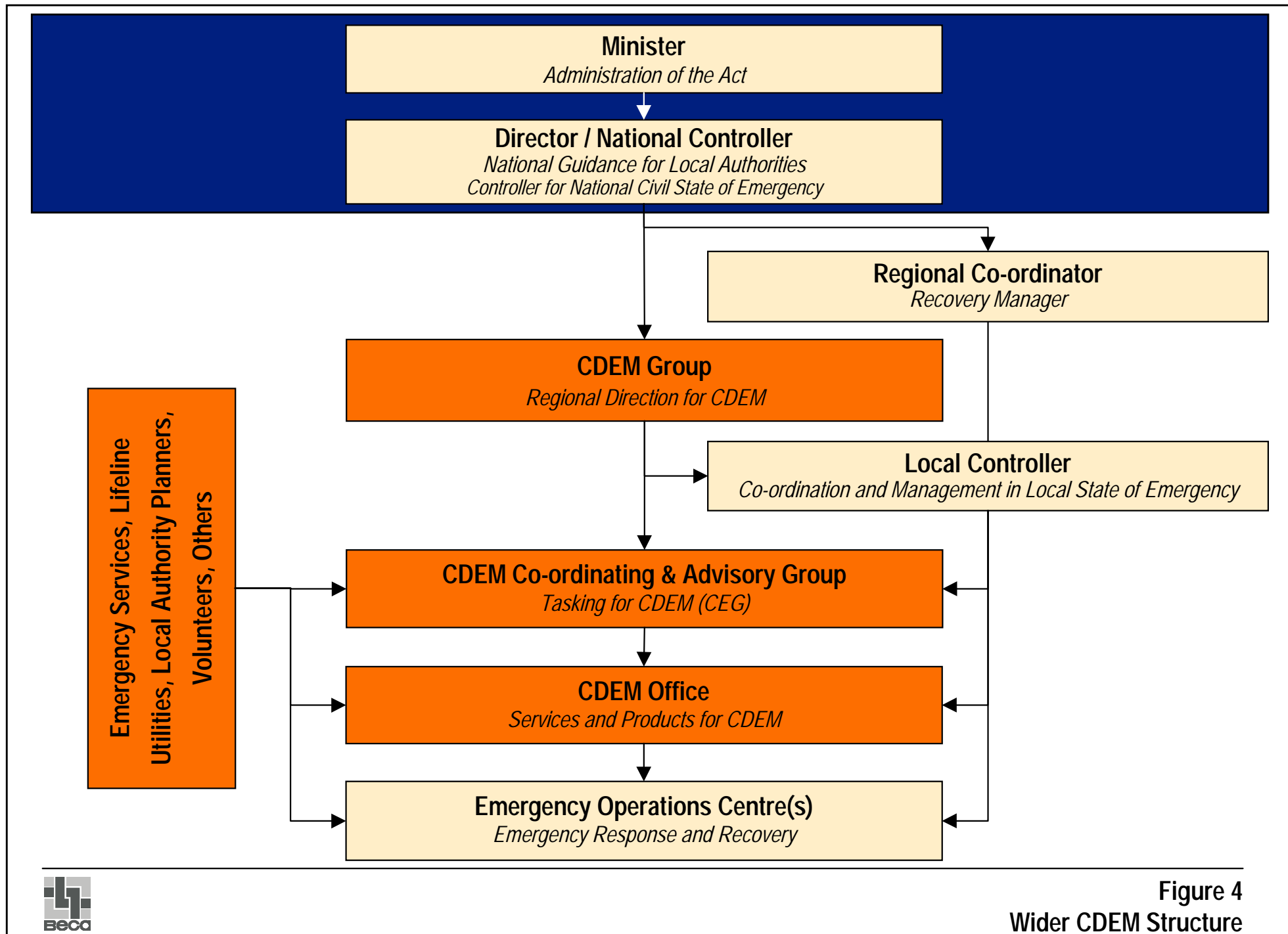


Figure 4
Wider CDEM Structure

See inset

Scale 1: 15,000,000 at A4

Legend

- Auckland Region
- CBD** Central Business District

Seismic Monitoring Network

- Seismometers
 - 1 - Waiatarua
 - 2 - Mounoukai
 - 3 - Motutapu
 - 4 - Otaru
 - 5 - Kauri Point
- Repeaters
 - 1 - Waiatarua
 - 2 - Mangatangi
 - 5 - Kauri Point

See Figure 2

Scale 1: 1,200,000 at A4



The Auckland Region
Figure 4

Source: F. G. ...

4 Civil Defence Emergency Management Response Resources

4.1 The Emergency Operations Centre

In the event of any volcanic activity within the Auckland Volcanic Field (AVF) the **Lead Agency** will be responsible for selecting a regional **Emergency Operations Centre (EOC)** (this is the overall Incident Control Centre for emergency management operations).

Nominate an EOC in 'Alert' Phase of volcanic activity



5.2

The EOC will be the focal point for many organisations responding to volcanic activity. It is important that a confirmed location for the **EOC** is established as quickly as possible (within the *Alert phase* of the warning system). This site will need to be clearly identified and access to the site will need to be controlled.

Criteria for EOC

Given the nature of volcanic eruption hazard in the AVF, it is not possible to pre-determine the site of the regional EOC. Site suitability is likely to depend on the phase of activity (for example, in the early stages of activity it is likely that the *Police Control Centre* may be used as the operations centre prior to activation of the CDEM or nomination of an alternate Lead Agency). Given the regional scale of activity, it is likely that one of the *regional EOC facilities* will be used. These facilities are identified in the **CDEM Plan**. Key selection criteria are:

EOC facilities as identified in CDEM Plan



CDEM Plan

- Ease / Speed of mobilisation for operation of the EOC;
- Space availability;
- Accessibility and proximity;
- Cost;
- Communications;
- Surety of utility services; and
- Functionality.

Process for Identifying EOC



5.4

The following provides a guide for determining where an EOC may be appropriately located:

- Identify the likely centre of volcanic eruption (from *scientific information* provided);
- Use the *Hazard Zone Overlay* to determine the likely extent of impact from volcanic eruption;

- Ensure that any EOC site is located away from areas of impact from the HZO and from any valleys (which may become lava flow corridors);
- Elevation of facilities for operation of communication systems (particularly radio communications);
- Proximity to staff accommodation;
- Consider network connections, particularly land-based transportation and the potential for these services to be affected (e.g. the risk of secondary hazards). In this regard, the EOC in North Shore City is unlikely to be suitable unless the volcanic eruption is north of the EOC site.

**Nominate alternate
EOC site/s**

 **EOC**
*Operational
Procedures*

An alternative site for the EOC may be appropriate, particularly if there may be a change in the Lead Agency through the event. To ensure continuity of emergency operations, **the Lead Agency** should nominate possible alternate sites for the EOC (in accordance with the *Operational Procedures for the EOC*) and identify this site to the **Emergency Management Team**.

4.1.1

Operational Resources for the EOC

 **EOC**
*Operational
Procedures*

The operation and maintenance of the EOC will require consideration of the following matters:

- Access
- Registration and Personnel Rosters
- Emergency Power
- Maintenance
- Communication Systems
- Water Supply

The following matters are considered particularly relevant in the event of a volcanic eruption:

■ **Water Supply**

The EOC is likely to be dependent on mains water supply. Consideration should be given to the possibility of temporary disruption to supply (both in terms of disruption to lifeline networks and contamination of water supply from ash), including provision of an alternative water supply to the EOC.

 Watercare

The **Planning and Intelligence Leader** is responsible for advising of any imminent threat to water supply.

■ **Maintenance**

In addition to those general matters of maintenance and operation of the EOC, consideration of the following is considered particularly relevant to local volcanic eruption:

 Ash Disposal
Plan

- Ash removal and disposal from building;
- Electrical services (e.g. maintenance of electrical facilities due to ash);
- Building services (maintenance of air conditioning, air re-circulation services may need to be considered);
- Specialist cleaning services (e.g. for acid rain, ash deposits).

The **EOC Manager** (Operations) will be responsible for establishing and maintaining the EOC building and facilities.

4.2 Emergency Management Identification

4.2.1

Personnel and Vehicle Identification

 CDEM Plan

All Civil Defence and emergency workers operating in the field during a volcanic eruption must be identifiable. It is recognised that emergency managers have generic operating procedures for identification and registration of personnel in the event of an emergency, including existing computer programmes. These principles will apply in the event of an AVF eruption.

The **Operations Leader** of the **Lead Agency** will be responsible for preparation and distribution of a common identification system for regional emergency managers. Consideration should be given to both personal and vehicle identification.

In addition to standard emergency operating procedures, in the event of a volcanic eruption, identification is likely to be required for the following groups:

- SAG and TAG representatives;
- Media;
- Monitoring agencies;
- Officials or CDEM personnel using rental vehicles or from outside the region.

4.2.2

Registration

 *EOC
Operational
Procedures*

The **Welfare Liaison Leader** will be responsible for maintaining a database of registration at the EOC. The Incident Controller for any specific Incident Control Point will be responsible for ensuring registration of personnel at any incident site.

4.3

Liaison

 **National Civil
Defence Plan**

The National Civil Defence Plan (Part Ten) sets out the principles and responsibilities for establishing, maintaining and restoring emergency management communication systems and processes.

 **CDEM Plan**
 **Communication
Resource Contacts**

The **CDEM Plan** identifies responsibilities and arrangements for the necessary communication systems for operation in a state of emergency, including nomination of the **Liaison Manager** and contact details for people responsible for communication resources.

In accordance with the responsibilities of regional civil defence and emergency management options, under the National Civil Defence Plan, the following matters need to be addressed for communications in the event of a volcanic eruption:

4.3.1

Volcanic Hazards for EOC Communication Systems

 **Communications
Plan**

Emergency radio communications may be required. It is likely that ash fall may impact on radio frequencies and therefore provision should be made for alternative frequencies (e.g. FM and AM) and short-wave radio. Consideration will also need to be given to issuing public information on syndicated radio stations, which may be transmitted outside the region.

 7

Other communication systems that may be utilised and will need to be considered include Emi-communications (DOS based computer programmes).

These matters need to be considered with respect to **public information**.

4.4

Other Resources

 **National Civil
Defence Plan**

The National Civil Defence Plan (Part Nine) sets out the principles, functions, responsibilities and planning considerations in the management and provision of resources for civil defence emergency management.

This Plan identifies the pre-planned inventories required for resources and resource suppliers that are likely to be required in the event of a volcanic eruption.

There are a number of resource issues that will need to be considered once a warning of volcanic activity has been issued (*Alert Phase*). Individual organisations will be responsible for the maintenance of their own operations and services, and should have their own contingency plans. In the event of lifeline failure or disruption, resources will be required from beyond the region. Given the likely scale of impact of an AVF eruption, deployment or co-ordination of such resources would need to be initiated as soon as the EOC was operational (**Logistics**).

 5.2

4.4.1

Water Supply

 **Water
Supply Plan
(Watercare)**

Water supply to the region will need to be maintained in the event of a volcanic eruption. A *Water Supply Plan* should be prepared to identify methods for protection of existing water supply, identification of alternative water resources, and to establish protocols for storage, transport and distribution of water.

4.4.2

Fuel and Energy Stocks

 **National
Energy Plan**

Section 11 of the National Civil Defence Plan outlines the arrangements required for the restoration, operation and maintenance of electricity and piped gas and LPG supplies under emergency conditions, and the planning required to ensure the availability of resources in the event of a civil defence emergency.

Section 9 of the National Civil Defence Plan outlines the logistic arrangements for supply of energy stocks that can be transported by road, rail or sea.

 **Petroleum
industries**

The **Lead Agency (Logistics)** will co-ordinate with **petroleum industries** to manage the provision of petroleum fuel stocks for emergency management.

In the event of a volcanic eruption, the management of petroleum fuel stocks may be necessary for the following emergency management operations:

- Evacuation;
- Supply of stations and on-going operation of areas outside the evacuation area (particularly with regard to the potential impact of disruption to the Marsden Point Pipeline);
- Port operations; and

- Fuel for emergency and critical services (e.g. Fire Service, Police, health services and welfare organisations).

The **Lead Agency (Planning and Intelligence)** will be responsible for reporting on the status of fuel stocks and notification of any disruption to supply.

 **CDEM Plan**

In accordance with the National Civil Defence Plan (Parts Nine and Eleven), the CDEM Plan (and associated operational procedures) will provide communication processes for liaison with energy suppliers.

In the event of a volcanic eruption, the following potential energy network issues will need to be considered and reported on:

- Disruption to the Marsden Point Pipeline (PIEAC);
- Disruption to electricity transmission, including supply north and local;
- Disruption to gas both regional/national and local; and
- Potential disruption of access or operation of Wiri Oil Services Ltd.

Network operators and other energy supply organisations will be responsible for their own contingency planning for restoring and maintaining supply of energy resources.

4.4.3

Transport

 **National Civil
Defence Plan**

In the event of a volcanic eruption it is likely that transport resource will need to be mobilised for the purpose of transporting resources across the region and for evacuation. Part Nine of the National Civil Defence Plan sets out the principles, functions, planning and responsibilities for logistics operations.

The following identifies particular transport resources that may need to be mobilised in the event of a volcanic eruption.

Evacuation Transport Resources

***Transport
resources may be
required to assist
evacuation***

Transportation resources for evacuation will need to be co-ordinated from the EOC (**Lead Agency (Logistics)**). However, mobilisation of these resources on-site would be managed and led by the nominated **Incident Controllers (NZ Police)** located at the relevant evacuation control points.

Passenger transport is likely to be required to assist in the transport of residents from evacuation areas to evacuee centres. While it is anticipated that a significant proportion of the population will have their own private transportation, consideration needs to be given to mobilisation of those without private transport and those with special mobility needs (including the elderly and physically disabled).



ARC and territorial authorities



ARC Evacuation Plan

The **Planning and Intelligence Leader** will be responsible for ascertaining the proportion of households requiring evacuation that are likely to require transportation (information from **Auckland Regional Council** and **Territorial Authorities**).

Consideration will also need to be given to the numbers of public transport vehicles available for mobilisation. While it is anticipated that the Evacuation Plan will identify organisations responsible for provision of transport resources, the following specific matters may need to be considered in the event of volcanic eruption:

- The number and location of passenger transport vehicles available in the Auckland Region;
- The use of resources from Defence Forces;
- Special mobility passenger transport;
- The carrying capacity of each standard bus (allowing for 15-20kg of luggage for each passenger);
- Fuelling requirements for transport vehicles.



AELG Safe Routes

In co-ordinating resources for evacuation, it will also be necessary to identify appropriate evacuation routes with reference to the *AELG Priority Emergency Routes Plan*.



St Johns Ambulance

St Johns Ambulance would be responsible for the evacuation of people from medical facilities. St Johns will liaise with the **Lead Agency (Logistics)** to co-ordinate the evacuation of people from medical facilities in terms of regional resource requirements. It is anticipated that medical facilities will nominate their own Incident Controller for evacuation on-site.

Additional transport may be required for distribution of resources during volcanic eruption

 **Ash Disposal Plan**

4.4.4

 **Ministry CDEM**

Resource Transportation

Transportation may also be required for the effective allocation and management of resources. The **Lead Agency (Logistics)** will be responsible for identification and management of resource transport requirements. The **Lead Agency** will need to liaise with transport resource operators (e.g. NZ Defence).

Consideration should be given to the need for transportation of the following:

- Water and supply tanks;
- Fuel stocks;
- Food and welfare resources;
- Medical equipment and supplies;
- Personnel for civil defence emergency management;
- Ash for disposal;
- Emergency Power.

Safety Equipment

While it is anticipated that organisations and emergency services will provide safety equipment for their personnel, it is recognised that some operational personnel may not be adequately equipped for volcanic hazards. The **Lead Agency / EMO** may be required to facilitate provision of some equipment to particular groups (e.g. voluntary agencies and transport personnel).

The **Lead Agency (Planning and Intelligence)** (through the SAG) will be responsible for advising on mask and other safety requirements.

Dust Masks

Provision of **dust masks** is expected to be necessary *immediately* to civil defence personnel operating within Hazard Zones 1 and 2 (as determined from the *Hazard Zone Overlay (HZO)*).

Dust masks may also need to be made available to local residents and those working within the ash impact area (Hazard Zones 2, 3 and 4). Provision of dust masks to residents is likely to be a national supply issue. In this instance, the **Lead Agency (Liaison)** will be responsible for liaising with the national **Ministry CDEM** to procure necessary supplies.

Other Safety Equipment

In addition to dust masks, other safety equipment is likely to be required, particularly for operational civil defence personnel in areas of potential gas emissions, 'acid rain' and ash fall. While it is the responsibility of organisations and emergency services to provide for the health and safety requirements of their personnel, information on safety requirements should be made available to such organisations. The **Lead Agency (Planning and Intelligence)** will be responsible for advising on potential health and safety requirements for operation in impact areas. This information will need to be conveyed both to the public and to organisations and emergency services (through the **Public Information Leader** and the **Liaison Leader**).

Organisations requiring additional safety resources for personnel should notify the **Lead Agency (Liaison)**. The **Logistics Leader** will be responsible for identification and procurement of the necessary resources from organisations beyond the region, and for allocation.

4.4.5

Transport and Network Route Maintenance

The maintenance and restoration of network utilities and transport corridors will principally be the responsibility of each organisation and it is anticipated that these organisations will prepare their own contingency plans to ensure the availability of planners and operators for network and route maintenance and operation.

Transport operators are responsible for advising the **Lead Agency (Liaison)** of any additional resource they require for maintenance.

Transport Routes

The AELG 'Safe Routes' identifies priority route networks for road transport (with alternative routes provided in areas of identified vulnerability).

In the event of a volcanic eruption, the **Lead Agency** will be responsible for advising the transport network providers on the following matters (to facilitate maintenance and transport of network routes):

- Ash fall and disposal locations (for clearance of ash and debris from routes and networks);
- Impact areas and hazard zones (for establishment of detour corridors should sections of highway be within 3-5km of the eruption site (areas at risk of significant damage and with longer term access restrictions)); and

 Transport
Network Providers
List

 Ash Disposal
Plan

 5

- Priorities for resource allocation (for repairs and maintenance).

4.4.6

✉ Ministry
CDEM

Resources Beyond the Region

The **Lead Agency (Liaison)** will be responsible for communicating with regional, and as required, with national civil defence emergency management organisations on any resource requirements from beyond the Region.

5 *Volcanic Warnings in the AVF*

➡ National Civil Defence Plan

The National Civil Defence Plan (Part Three) sets out the responsibilities and procedures for civil defence emergency warnings and those requirements that should be contained in CDEM plans.

➡ CDEM Plan

The National Civil Defence Plan identifies the responsibilities of Regional Councils and Territorial Authorities for warnings. The CDEM Plan will identify general civil defence warning procedures. The purpose of this section is to detail the warning system for a volcanic eruption in the AVF.

5.1 Physical Warnings

Changes in seismicity provide initial warning before eruption occurs

The next AVF eruption will occur when magma presently forming beneath Auckland rises to the surface. As the magma rises through the crust, it will generate small tremors which can be detected using seismometers and later, earthquakes which can be felt. A volcanic eruption is expected to occur after a period of earthquakes lasting a few days to a few weeks. Results of seismometer monitoring to date indicate a very low level of background seismicity which improves the likelihood of detection of an impending eruption and eventual location of its vent.

5.1.1

The Auckland Volcano-Seismic Monitoring Network

Auckland Volcano-Seismic Monitoring Network (AVSN)

The **Auckland Volcano-Seismic Monitoring Network (AVSN)** comprises five sites distributed around the AVF, at which seismic activity is monitored continuously (Waiatarua, Moumoukai, Motutapu, Otara and Kauri Point) (Figure 5). This network is owned by the Auckland Regional Council and the data collected is radioed to a central recording site at the ARC, where it is digitally recorded and then transmitted via satellite to the Institute of Geological and Nuclear Sciences (GNS) at Wairakei and Wellington, for computer analysis. Data can also be viewed at the ARC.

☒ GNS

☒ ARC seismic

The AVSN is designed to monitor seismic activity associated with the onset of volcanic activity, but also detects non-volcanic earthquakes. By recognising a change in the prevailing seismic pattern that might signify magma movement within the volcanic field, some warning of impending volcanic eruption can be given.

➡ National Contingency Plan – Volcanic Eruption

Under the National Contingency Plan – Volcanic Eruption, **GeoNet (GNS)** is required to undertake routine volcano surveillance and assess the significance of information gathered in terms of the status

of the AVF. **GNS** are responsible for the interpretation of the data and preparation of **Surveillance Reports** and **Scientific Alert Bulletins** (containing the allocation of appropriate **Scientific Alert Levels**).

 7.2

The **CDEM Group / Lead Agency** will receive early advice from GNS of any imminent science alert bulletin or any change in SAL and the **CDEM Group / Lead Agency** will be responsible for issuing **Volcanic Information Notices** within the region. Notwithstanding this, it is recognised that GNS (GeoNet) have a national statutory responsibility in reporting on volcano status and alert information to the Ministry of CDEM and other agencies (MetService, MAF etc).

5.1.2

Scientific Alert Levels

 National CD
Plan

The status of the volcanic field at any time is defined by an assigned *Scientific Alert Level* (SAL) as described in Table 2a. **GNS** is primarily responsible for assessing the level of activity of Auckland's volcanoes and issuing Scientific Alerts.

 GNS

**Warnings based on
SALs**

Because volcanic activity in the AVF is likely to develop over a relatively short time, warning periods have been associated with SALs. Table 2b identifies the status of the AVF as defined by the assigned SALs, establishing for planning purposes, an estimated 'period' or duration for each Level.

The periods indicated in Table 2b do not reflect either the minimum or maximum duration of each level, but provide an indication of a realistic lower bound time period between warning levels. These periods are an indication of the mobilisation or resourcing time that can be anticipated.

**Warning system
provides period to
prepare for
response**

The durations suggest that early changes in seismicity (SAL 0 to 1) provide the most valuable warning of impending eruption because such changes occur over a time period in which mitigative responses can be reasonably implemented. In other words, this is the period where emergency managers have an opportunity to prepare for response to a volcanic eruption. Once volcanic activity progresses beyond SAL 1, hazardous effects could be experienced within hours, and full-scale eruption within as little as a day.

Table 2a: Scientific Alert Levels - Reawakening Volcanoes

Scientific Alert Level	Indicative Phenomena	Volcano Status
0	Typical background surface activity; deformation, seismicity, and heat flow at low levels.	Usual dormant or quiescent state.
1	Apparent seismic, geodetic, thermal or other unrest indicators.	Initial signs of possible volcano unrest. No eruption threat.
2	Increase in number or intensity of unrest indicators (seismicity, deformation, heat flow etc).	Confirmation of volcano unrest. Eruption threat.
3	Minor steam eruptions. High increasing trends of unrest indicators, significant effects on volcano, possible beyond.	Minor eruptions commenced. Real possibility of hazardous eruptions.
4	Eruption of new magma. Sustained high levels of unrest indicators, significant effects beyond volcano.	Hazardous local eruption in progress. Large-scale eruption now possible.
5	Destruction with major damage beyond active volcano. Significant risk over wider areas.	Large hazardous volcanic eruption in progress.
National Contingency Plan for Volcanic Eruption, Annex B2 Volcanic to Part 1 Response: Amendment 14		

Table 2b: Scientific Alert Levels - Auckland Volcanic Contingency Plan

Scientific Alert Level	Indicative Phenomena	Volcano Status	Period*
0	Typical background surface activity; deformation, seismicity, and heat flow at low levels.	Usual dormant or quiescent state. Advisory Phase	Not applicable
1	Apparent seismic, geodetic, thermal or other unrest indicators	Initial signs of possible volcano unrest. No significant eruption threat. Alert / Warning Phase I or II	A few days and up to a few weeks
2	Increase in number or intensity of unrest indicators (seismicity, deformation, heat flow etc).	Confirmation of volcano unrest. Eruption threat. Warning Phase II	Up to 1 to 3 days
3	Minor steam eruptions. Relatively high and increasing trends shown by unrest indicators. Significant effects in eruption area and beyond.	Commencement of minor eruptions. Real possibility of hazardous eruptions. Warning Phase III	A few hours to 1 day
4	Eruption of new magma. Sustained high levels of unrest indicators, significant effects beyond volcano.	Hazardous local eruption in progress. Large-scale eruption now appears imminent. Warning Phase IV	Up to a few hours
5	Hazardous volcanic eruption in progress. Destruction within Zone 1 (HZO), major damage beyond active volcano. Significant risk over wider areas.	Large hazardous volcanic eruption in progress. Warning Phase IV	Not applicable
* Warning periods assessed for the Auckland Volcanic Field. Periods have been assigned to Scientific Alert Levels (SALs) as a tool for planning purposes only. The SAL may rise to 1 and then return to 0 and is not intended to be a predictive tool.			

5.2 AVF Alert and Warning System

See Figure 6

The warning system proposed utilises the established SALs, but because of the likely rapid progression through the levels beyond SAL 1, sets the SALs in the context of warning phases as follows:

Warning System includes Advisory, Alert and Warning phases

- **Advisory Phase** – The status quo. No response required, that is, AVSN monitored by GNS and reported to the ARC;
- **Alert Phase** – Activated with an SAL 1 announcement (public message automatically generated). Possible volcano-seismic activity has been detected. A “gearing up” phase with very limited information available;
- **Warning Phases:**
 - Warning Phase I** – Commences within SAL 1, as soon as a general vent area for volcanic eruption can be established;
 - Warning Phase II to IV** – Generally coincident with the SAL stages, though it is noted that in areas of high population density or significant infrastructure risk Warning Phase II may be issued during SAL1.

5.2.1

Advisory Phase

Table 3

✉ CEG, SAG, TAG

- *SAL 0.*
- AVSN is monitored by **GNS** and reported to the **ARC** and Ministry CDEM.
- **EMO, CEG, SAG** and **TAG** established and meet on a regular basis to confirm and discuss AVF activity, changes or refinements in contingency plans or other planning and response documents.
- Make recommendations for update of the Plan as appropriate.
- Public education programme and awareness campaigns.

5.2.2

Alert Phase

Table 3

 3.2

- Announcement of *SAL 1* – volcanic activity but no eruption threat recognised;
- **GNS** (GeoNet) advise Ministry of CDEM and CDEM Group of volcanic activity;
- **CEG, SAG, TAG** notified and convened.
- Nomination of **Lead Agency**.

Early 'alert' to key organisations to inform of possible volcanic eruption

- Priority to maintenance of communications (phone, fax, email).
- Consistent with the National Civil Defence Plan this phase is early notification of a threat.
- Alert of threat provided from the **ARC** direct to:
 - Ministry CDEM;
 - Territorial Authorities;
 - New Zealand Police;
 - New Zealand Fire Service;
 - New Zealand Defence Force;
 - Transit New Zealand;
 - TAG;
 - AELG;
 - Auckland Health Board;
 - Harbour Master;
 - Civil Aviation Authority;
 - New Zealand Airways Corporation.

5.2.3

Warning Phase I

Table 3

 8.2

 TAG

 CDEM Plan

 7.2

 6

- *SAL 1*. Potential volcanic vent location identified.
- The general area of activity has been identified by **GNS**.
- Information on the extent of potential impact is 'predicted' using the HZO. This phase is likely to precede any declaration and will primarily be a mobilisation phase.
- GNS install additional portable seismometers and monitoring as required.
- TAG convened.
- Review of **Lead Agency** (consideration of CDEMG as Lead Agency);
- Notification of warning to all those relevant organisations identified above and the following (as per the CDEM Plan):
 - Media;
 - Welfare Agencies;
 - Other utility providers;
 - Communication providers;
 - AREC;
 - MetService, NIWA.
- Regional public information dissemination begins.

2 HZO

If the HZO suggests a high-density population area or key strategic resource may be affected, proceed directly to Warning Phase 2.

5.2.4

Warning Phase II

Tables 1 – 2

1 Hazard matrix

 6

 8

 CIMS

- SAL 1 and 2. Significant eruption threat or potentially significant effects to life or strategic utilities.
- GNS install additional portable seismometers and monitoring as required.
- Review of **Lead Agency** (consideration of CDEM Group as Lead);
- CDEM Group to consider recommendation for declaration of a Civil Defence Emergency.
- **Lead Agency** to consider commencement of *Evacuation* within HZO Zone 1 area (within 3 - 5km of anticipated vent) and management of this area as an 'Incident Control' area (as per CIMS). Notification of warning to public through the following:
 - Media;
 - Public address systems of warning sirens within evacuation Incident Control area (as per local civil defence operations);

5.2.5

Warning Phase III

Tables 1 – 2

1 Hazard matrix

 6

- SAL 3. Development of volcanic gas clouds. Ground deformation recorded. Minor eruptions commenced. Real possibility of hazardous eruptions.
- Hazardous eruption anticipated within hours to days.
- GNS continue to monitor volcanic activity, set SAL and issue Scientific Alert Bulletins as appropriate.
- SAG and TAG mobilised to monitor, warn of and respond to hazards as these develop.
- Review of **Lead Agency**;
- CDEM Group to consider recommendation of a Civil Defence Emergency.

5.2.6

Warning Phase IV

Tables 1 – 2

 Hazard matrix

- SAL 4 and 5. Eruption in progress.
- GNS continue to monitor volcanic activity, set SAL and issue Scientific Alert Bulletins as appropriate.
- SAG and TAG continue to provide regional warnings and respond to hazards as these develop. In particular, water quality, lava flow, wind direction and ash fall, air quality, gas emissions.

5.3

Information Dissemination

Provision of Scientific Information


It is proposed that the **CDEMG** as the Lead Agency, be responsible for the distribution of *Scientific Information* on volcanic activity **within** the region in the event of volcanic activity. This position should be maintained through the establishment of the CDEM Group and the ARC representative of the CDEM Group will be responsible for information dissemination. The structure of responsibility for dissemination of scientific information on volcanic activity is given in Figure 7.

It is noted that the National Civil Defence Plan provides for issue of volcanic warning and information to and from other agencies, including GNS and MetService. This Plan does not obviate these responsibilities.

5.4

Hazard Zone Overlay

One of the key requirements for civil defence emergency management is to understand the risks associated with an event, and the areas most likely to be at risk.

 2.1 – 2.3

 AELG

As the future sites of volcanic eruption cannot be predicted, predicting the hazards and risks associated with volcanic eruption in the AVF is more complex. For example, hazards from a volcanic eruption will be dependent on whether the eruption occurs on land or below water and the risks will depend on the location of the eruption in the AVF.

Hazard Zone Overlay as an initial hazard assessment tool for planning purposes

For the purposes of contingency planning, a uniform distribution of hazard zones identified for a scenario eruption in the Auckland CBD (eruptive mass of 0.01km³ and a column height of 6km) as part of the ARC’s technical investigations on volcanic activity, are proposed as a *preliminary* guide for impact assessment. The *Hazard Zone Overlay*

2 HZO

(HZO) is a tool for *initial* assessment of the likely area at risk from volcanic eruption following detection of a change in seismicity by the AVSN.

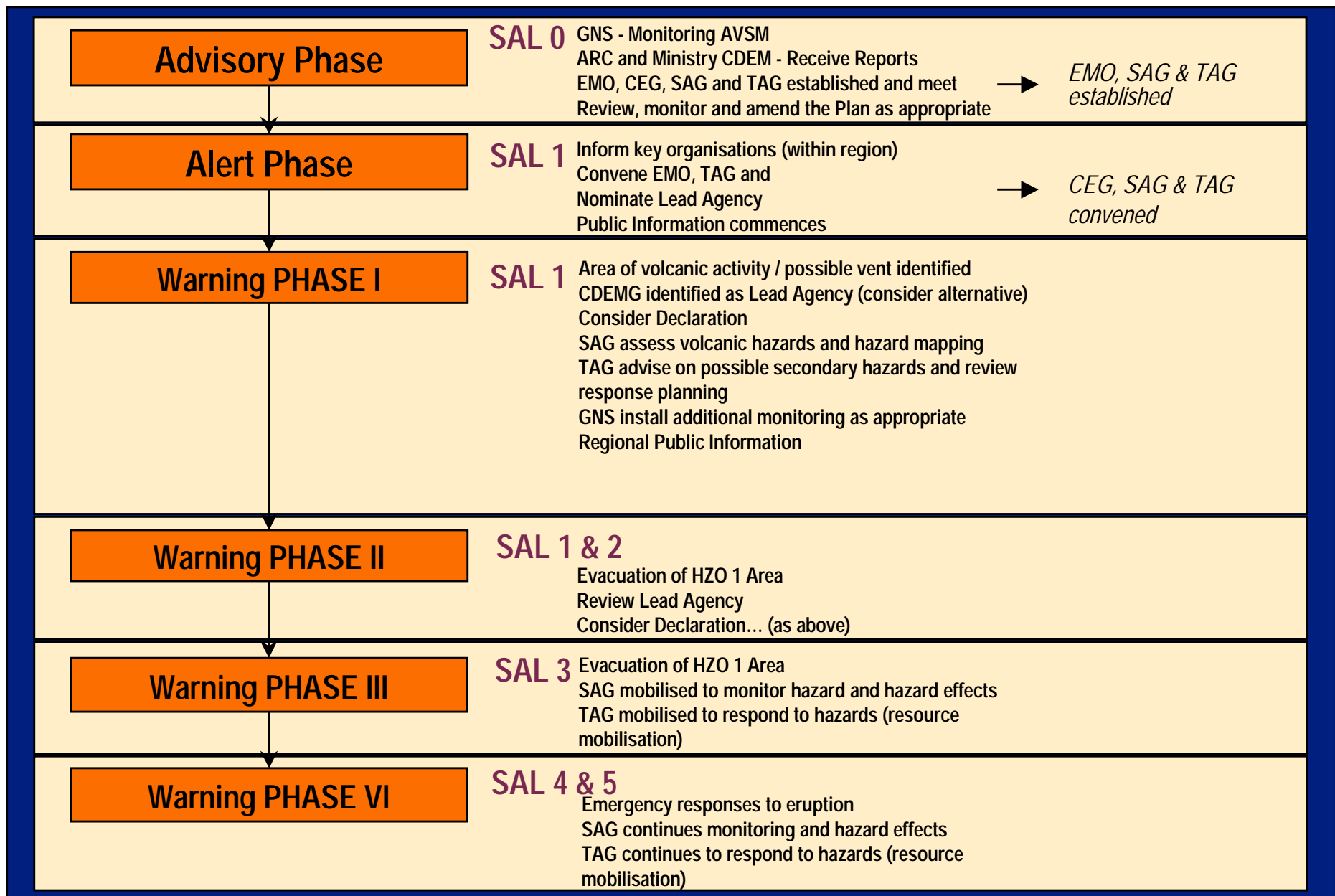
As the HZO is an initial assessment tool it should be used in conjunction with ongoing scientific updates to refine understanding of the likely areas and impacts.

✉ SAG

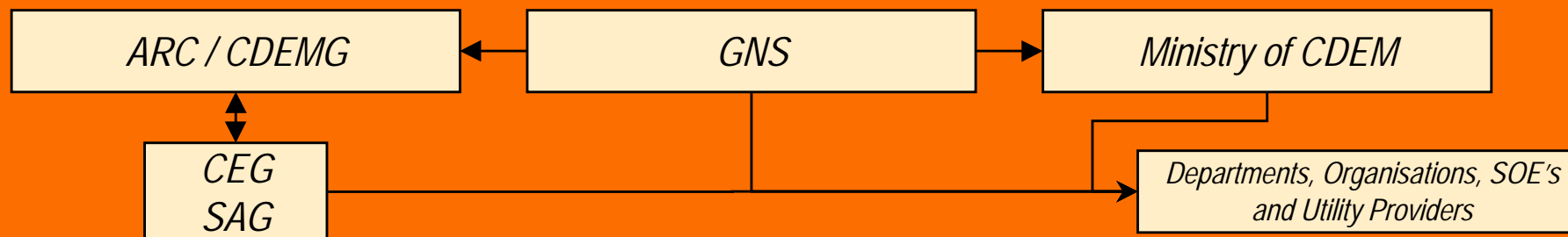
The volcanic **Scientific Advisory Group** (SAG) shall be mobilised following detection of atypical seismicity. The **SAG** will assess and map areas of hazard impact and provide advice to the **CEG** and **Lead Agency / EMO**.

✉ TAG

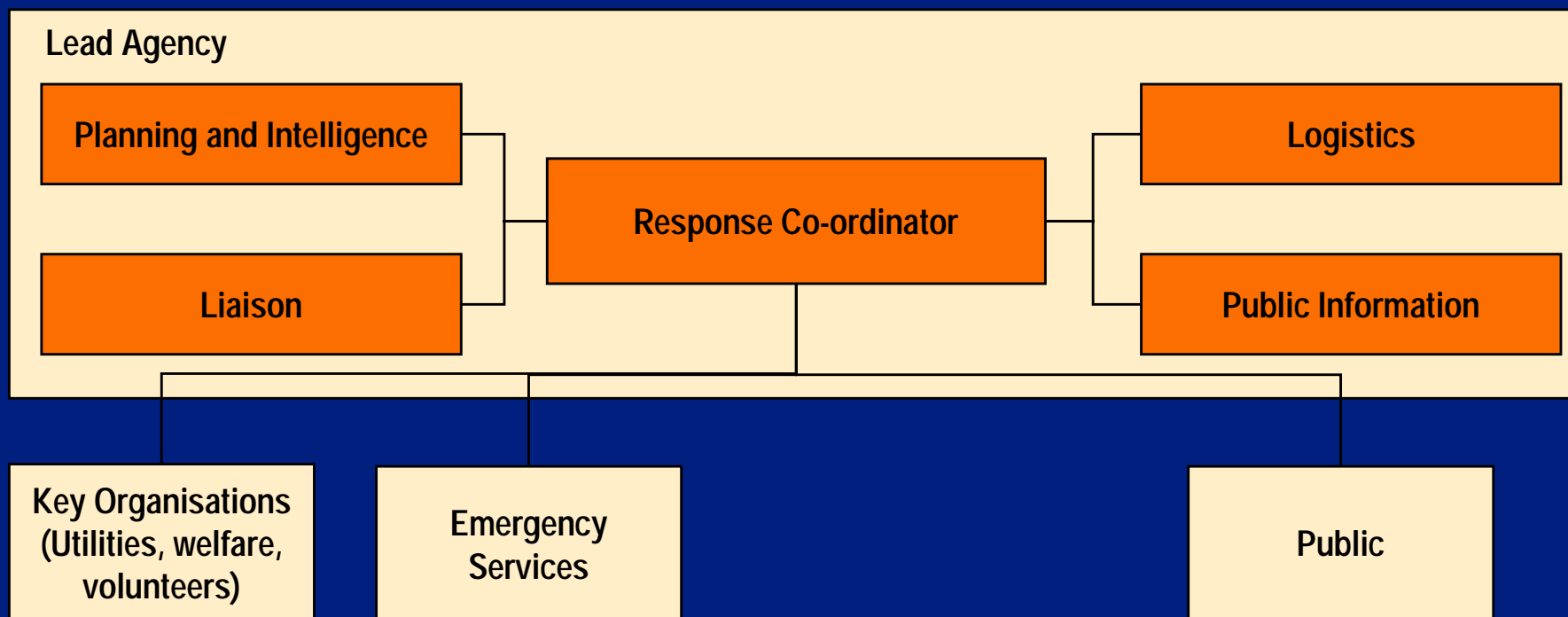
At Warning Phase 1, the **Technical Advisory Group** (TAG) shall be convened to provide advice to stakeholders on mitigation or response options. For example, the **TAG** will be expected to provide recommendations for temporary engineering works such as works to mitigate lava flow, bypass or repair works and structural recovery of buildings.



Volcano Surveillance & Assessment



Emergency Mobilisation - Protocol for Regional Information Distribution (additional to above)



6 Declaration

Assessment of the level of risk

Risk is the sum of the likelihood of a particular event occurring and the consequences of the event. Understanding the risks is central to planning and managing civil defence response. In Auckland, one of the key issues in assessing risks from eruption relates to the uncertainty of the future eruption site. Risks associated with an eruption in the CBD of Auckland will differ from those associated with an eruption north of Rangitoto, particularly for that area within HZO Zone 1 (the area subject to surge, lava flows, uplift and deformation). The uncertainty of location is further complicated by the probable short warning period for any volcanic eruption in the AVF.

5.2

The following systems and structures are therefore proposed to efficiently identify the likely level of risk and effects at *Warning Phase 1*:

Consideration shall be given to:

- Impact on the community (the number of people and households likely to be affected by volcanic hazards);
- Impact on utilities (road networks, communication networks, power and fuel supplies, health care services, water supply and waste disposal);
- Impact on businesses and their operational viability;
- Impact on hazardous sites and other areas (damage to such sites and areas may result in secondary hazards (e.g. damage to fuel depots or hazardous chemical sites may result in fire); and
- Safe options for impact resolution.

Emergency Plan CDEM

The HZO will be used to provide an initial assessment (rapid, though coarse) of the likely impacts of volcanic eruption. That is:

- The Territorial Authorities likely to be affected by eruption;
- The population within each hazard zone;
- The number of households within each hazard zone; and
- Strategic lifelines within each hazard zone.

HZO

While this information is only an initial ‘indicator’ of impact, it allows some of the possible early consequences of an eruption to be gauged. For example, if activity is indicated such that the ‘Hazard

Zone 1¹ would fall wholly within Auckland City it is estimated that some 70,000 people or 25,000 households will be within the 'impact area'. By contrast, if the 'Hazard Zone 1' area was likely to be further north (for example, covered an area wholly within North Shore City), it is estimated that the population within the 'impact area' might be around 42,000 (or 15,000 households).

The HZO will also allow preliminary assessments of impacts on other key infrastructure and services including:

- Hospitals;
- Hazardous chemical facilities;
- Main roads and highways;
- Petroleum storage facilities.

6.1 Process for Declaration

SAL sequence may fluctuate

Volcanic activity may not follow a linear progression from one SAL to the next. After reaching SAL 1, volcanic activity may cease, and the SAL return to 0. At some point, the escalation of volcanic activity will require response through a declaration of civil defence emergency.

A state of emergency defined by legislation

A state of emergency, as defined under the Civil Defence Emergency Management Bill, is the result of any happening (such as an eruption) that causes or may cause loss of life or injury or illness or distress or in any way endangers the safety of the public or property in part of New Zealand and **cannot be dealt with by emergency services or otherwise requires a significant and co-ordinated response.**

6.1.1

Who Will Make the Declaration?



CD Act

The lead agency, the **CDEM Group** shall recommend declaration of a state of emergency following consultation with SAG and CEG. The recommendation should include identification of the area of declaration (if the whole region is not considered to be affected by the emergency).



CDEM Bill



CDEMG Plan

The declaration will be made by the nominated persons identified in the CDEM Group Plan (in accordance with the CDEM Bill).

¹ The 'Hazard Zone 1' area is defined by a 3 km radius circle about the eruption vent, as per the Eruption Hazard Zone Overlay.

6.1.2

➡ CDEM Bill
(s64)

When Will a Declaration be Made?

A state of emergency should be declared when an *emergency* has occurred or may occur in an area (unless a state of national emergency has been declared) (see definition above).

Following an initial identification of the 'Area of Risk', the **CDEMG** shall co-ordinate information requirements and consult with the **SAG** to assess the risks and scale of effects likely from the impending eruption. The **CDEMG** (with support from the **SAG**) will need to report on the following:

Matters to be considered in declaration

- The time required for the effective evacuation of people in areas of life threatening risk;
- The time required for civil defence stakeholders to prepare;
- The ability of civil defence stakeholders to respond without a declaration of a state of emergency;
- The ability of the community and stakeholders to respond to warnings.

And the following general considerations:

- The risk of delaying (making a declaration too late), particularly given the short warning period likely prior to volcanic eruption in the AVF;
- The legal, financial and political risk of declaring a state of emergency too early; and
- Credibility in the event of unnecessary declaration.

The CDEMG will base their recommendation for a declaration on the criteria identified under legislation and consider the following:

- When co-ordinated and managed response is required;
- When the ordinary functions and powers of emergency services are no longer adequate and additional powers provided in a state of emergency are required.

Lifeline utilities to report potential effects and risks

Co-ordinated information input will be required between agencies. Following release of the 'Warning 1' notification of a volcanic eruption, the following information will need to be provided to the **CDEM Group** through the **CEG**:

- **Utility providers:** detail on the effects of volcanic activity on their resources, particularly in terms of possible network impacts across wider than the immediate area of impact; and
- **ARC or Territorial Authorities:** information on the effects of eruption on the population and the likely numbers of households requiring evacuation.



5.2

It is considered that the recommendation to declare a civil defence emergency will generally coincide with Warning Phase II.

6.1.3

Triggers for Declaration



5.2

1. Alert Phase notification issued;
2. HZO indicates urban or strategic area may lie within, or be located within 2km of Hazard Zone 1 (ie within 5km of the inferred eruption centre);
3. Consultation with SAG and CEG (including emergency services) identifies potential risk to life and functioning and operation of government significant; and that evacuation is likely to be necessary.

6.1.4

What Will the Declaration Achieve?

Under both the Civil Defence Act and the CDEM Bill, a declaration of a state of emergency provides response agencies extraordinary powers, including:



CD Act



CDEM Bill

- Access to additional resources (including financial resources);
- Powers to respond (including ability to enter property, acquire property and remove property);
- Control of information mechanisms to inform the public;
- Ability to co-ordinate, access and deploy resources; and
- Clear lines of authority and control.

In this regard, a declaration of a state of emergency is a distinct and important phase in response.

Step 1
SAL 1 (*Volcanic Activity Identified and Reported*) - GNS

Step 2
Nomination of a Lead Agency

Step 3
Issue of Alert / Warning (*CDEMG / Lead Agency*)

Step 4
Assessment of potential impacts of eruption
(*Lead Agency - Planning and Intelligence*)

Step 5a
Other Impacts
(*possible secondary hazards*)
(*Lead Agency - Liaison*)

Step 5b
Assessment of potential impacts
and secondary impacts
(*Lead Agency - Planning and Intelligence*)

Step 5c
Ability for emergency services
to Respond
(*Lead Agency - Liaison*)

Step 6
Recommendation on Declaration (*Lead Agency / CDEMG*)

Step 7
Decision to Declare CD Emergency



Figure 8
Declaration Process

7 *Public Information*

In the event of a volcanic eruption, the timely and appropriate release of public information will be critical to successful response.

Part Seven of the National Civil Defence Plan sets out the national protocols for delivery of public information. The National Plan requires civil defence organisations to nominate a **Public Information Manager** (PIM) for the overall management of public information. The procedures and processes for the release of public information will be set out in the CDEM Plan and the Communication Plan (currently under preparation).



CDEM Plan &
Communication Plan

The following relates specifically to public information in the event of volcanic eruption.

7.1 **Responsibilities**

7.1.1 *Public Information Prior to Declaration*



5.2

At this time, it is anticipated that public information will be largely 'informational', advising the community of volcanic activity and precautionary measures that should be undertaken to avoid harm. During the *Alert Phase and Warning Level I*, **GNS** in conjunction with the **SAG**, will be responsible for communicating changes in volcanic activity and implications to the **CDEMG** and providing regular up-to-date assessments of hazards and risks. The **Lead Agency** will be responsible for the release of any regional public information (through the PIM).

7.1.2 *During a State of Emergency*

Following a declaration, the **Lead Agency / Controller** will be responsible for *issuing* all statements and warnings to the public.

7.1.3 *During Later Stages of Volcanic Activity*

As with the initial stages of volcanic activity, it is anticipated that public information will be largely 'informational', advising the community of ongoing precautionary measures that should be undertaken to avoid harm and updating them on latest volcanic activity.

The emphasis on public information during this phase will be on maintaining (as far as possible) 'normal activities' for the wider area impacted by volcanic hazards.

The **Lead Agency** will continue to be responsible for the release of any regional public information (through the PIM).

7.2 Protocols for the Release of Statements to the Public

The community will need to be informed of volcanic activity within the AVF and updated on a regular basis. The release of *Public Statements* will allow the community to be provided with regular, authorised statements of volcanic activity and reduce speculation and uncontrolled reporting.

7.2.1 *Template for Public Statements*



Public statements should be prepared according to a standard template set out in the *Communication Plan*.

Prior to Warning Level III, Information Statements may:

- Advise the public of volcanic activity and warning phases (Volcanic Information Notices), including 'lay' detail on what the SAL means;
- Advise the public of the likely extent or distribution of impacts due to activity/eruption;
- Advise the public of possible impacts of volcanic activity on communication media (phone, television, radio communications);
- Advise the public of who the **Lead Agency** is;
- Inform the public of who they can contact for further information and how they can contact them;
- Inform the public of preparations that they should make:
 - Collection of water supplies;
 - Short-term power provisions (battery, torches);
 - First aid kits and dusk masks;
 - Possible health risks.

- Instructions for evacuation of the *Public-at-Risk*, including:
 - Identification of provisions to take,
 - Notification / registration of their whereabouts,
 - Arrangements for evacuation of those without private transport or with disabilities;
 - Other evacuation assistance available;
- Inform the *Public Generally* of further information sites, routes and resources affected, access-controlled areas.

Following Warning Phase II, Information Statements may (in addition to the above):

- Advise the public of the status of volcanic activity;
- Advise the public of the likely extent / distribution of impact due to volcanic eruption, including ash fall;
- Inform the public of immediate preparedness measures:
 - Collection of water supplies;
 - Short-term power provisions (battery, torches, food);
 - First aid kits and dusk masks;
 - Remain indoors in areas of ash deposition.
- Instructions of measures to be taken for people outside immediate risk zones (e.g. in Ash fall areas):
 - Potential health risks (need for masks, protective clothing, when to seek medical attention);
 - Recommendations on actions to be taken (stay indoors, keep windows and doors closed, minimise use of fans and equipment with exhausts);
 - Potential risks to domestic animals;
 - Building maintenance (e.g. removal of ash);
 - Electrical disturbance impacts (particularly if ash is wet);
 - Vehicle maintenance (maintenance of air vents, use of windscreen wipers, cleaning instructions, oil and air filter maintenance).
- Instruct *Public-at-Risk* to remain indoors and provide medical/safety advice on treatment of minor burns and dealing with ash fall;
- Warn the *Public Generally* of areas to be avoided, or special care to be taken due to hazardous ash fall (for example, slippery road surfaces, obscured vision while driving);

- Instruct the *Public at Risk and the Public Generally* of maintenance for homes, vehicles, pets, others in the event of ash fall;
- Instruct the *Public-at-Risk* of evacuation assistance;
- Inform the *Public Generally* of further information sites;
- Inform the *Public Generally* of procedures for searching registered evacuees;
- Address other 'commonly asked questions'.

 **Communication**
Plan

The **Public Information Leader** is responsible for *preparing* public information statements. The **Controller** is responsible for the *release* of any statements.

In the event of full-scale volcanic eruption or declaration (Warning Phases 2 – 5), **public statements** should be prepared and issued regularly (initially at least *daily* and during later stages at least *weekly* but immediately upon any change) to inform the community at large of the status of volcanic activity. Immediately following Declaration, during evacuation and during the initial stages of volcanic eruption more frequent statements may need to be made (e.g. *twice daily*). Issued statements will need to be regularly released to the public.

The **PIM** will be responsible for ensuring that all public statements are regularly announced to the community (for example, daily or twice daily regular 'update' time slots may be appropriate for radio media).

7.3

General Information

In addition to the release of official **CDEM** Statements, general awareness material should be made available (both before and during any event) and be made widely available to the Region. This information is an important component of community preparedness. In the event of volcanic activity, any general awareness information will need to be reviewed and updated as appropriate.

Media for general information may include an official web-site and release of public brochures. Such information should also be made available at Information Centres and other community centres.

Representatives of the **SAG/TAG** may also be utilised to provide a 'specialist panel' for media updates. The **Lead Agency** will be responsible for the authorisation of any such panel.

7.4 Public Enquiries


 Communications
Plan

In addition to the release of public information, responding to community queries will be an important role in the information process. Operational procedures for responding to public enquiries will be set out in the *CDEM Communications Plan*.

 Ministry
CDEM

The **Ministry of Civil Defence Emergency Management** will be responsible for managing foreign media inquiries (though this may be delegated to the regional **Lead Agency** should the Ministry consider this appropriate).

7.4.1 Evacuee Data

 Evacuation
Plan

Given the likely requirement for evacuation of part of the Region's population in the event of a volcanic eruption, the maintenance of and access to data regarding evacuees will be an important component of the public information system. There are a number of organisations that will be required to prepare and maintain information registers on evacuees (including principally the Territorial Authorities on site and Red Cross nationally)

 District
CDEM Plans

The **Territorial Authorities** will be responsible for co-ordination of evacuee information to the **Red Cross**. It is noted that these agencies have established evacuation database and recording systems (as defined in their CDEM Plans).

7.5 Public Notices

 CIMS

Areas of impact from volcanic activity will need to be clearly sign-posted and access controls may be necessary in areas of high risk / damage.

Operators and emergency services will be responsible for cordoning the evacuation area as part of the incident control (in accordance with the CIMS).

The **Lead Agency** (through the **PIM**) will be responsible for the preparation of signage material.

7.5.1

Signage Information Requirements



 **Communications
Plan**

In addition to general public information signage (protocols in the *Communications Plan*), informational Signage will need to consider the following:

- Notice of Evacuation zones (both within the zone and when entering the zone);
- Notice of access restrictions;
- Advice on health and safety precautions (both within the area and when entering the zone);
- Notice of evacuation routes;
- Notice of potential hazards (particularly ash fall, acid rain, lightening) within the Hazard 2, 3 and 4 zones (both within the zones and when entering the zone).

7.5.2

Preparation of Signage

 8
 5.2

 **Communication
Plan**

The identification of signage requirements will be the responsibility of the **Planning and Intelligence Leader**. Signage requirements should be identified as early as possible during the **Alert Phase and Warning Phase I**. The Communication Plan should include protocols for printing of signs.

The **Logistics Leader** should organise the erection of signage throughout the event, from the commencement of Warning Phase II in priority areas (ie as evacuation procedures commence or the threat from eruption becomes imminent). Signage should be erected early, to minimise potential health and safety risks for personnel.

8 Evacuation

In the event of a volcanic eruption in the AVF it is likely that people will need to be evacuated from the areas of highest risk (the Hazard 1 zone). The number of people requiring evacuation will be dependent on the location of the eruption centre.

Evacuation Plan

The National Civil Defence Plan (Part Four) identifies the role of Law and Order for evacuation. The CDEM Plan and a separate *Evacuation Plan* will be prepared for the co-ordination of evacuation activities, and the operating procedures. The following identifies measures specific to evacuation in a volcanic eruption.

The **Logistics Leader** and **Planning and Intelligence Leader** will have key roles in the planning and implementation of evacuation operations.

8.1 Identification of 'Evacuation' Zones

Given the uncertainty for any volcanic eruption in the AVF it is not possible to pre-determine evacuation zones. The following provides a summary of key issues to be considered and processes to be undertaken in identification of *Evacuation Zones*.

Evacuation Zones have been identified as follows:

HZO

- **Primary Evacuation Zone (PEZ)** – This zone is the area most likely to be affected by volcanic hazards at Warning Phase III (generally Hazard Zone 1 as defined by the HZO or as modified in consultation with SAG to recognise factors such as predominant wind direction, topography etc). Depending on the population density within this zone, it may be necessary to further prioritise the zone into 'extreme' and 'high' priority areas.
- **Secondary Evacuation Zone (SEZ)** – This zone may include the following areas:
 - Areas which have become isolated due to the vent;
 - Areas where lifeline services have been or are likely to be severed;
 - Areas where winds or topography have the potential result in greater hazard impacts; or
 - An area to provide a 'buffer zone' beyond Hazard Zone 1 (likely to be 2km wide).

Consideration should be given to limited or partial evacuation in this zone.

8.1.1

Assessment of Primary Evacuation Zone

2 HZO

1 Hazard matrix

✉ Territorial Authorities

5.2

2 HZO

On the basis of the HZO an initial assessment should be made by the **SAG (Planning and Intelligence)** of the proportion of the region's population that is expected to be within the PEZ. Hazard Zone 1 (a 3km radius of the vent) represents the area in which the population's life or safety is likely to be at risk in the event of volcanic eruption. This area is the first priority area for evacuation.

The Planning and Intelligence will consult with **ARC** and **Territorial Authorities** to assess the potential numbers affected and the likely evacuation requirements of the resident population.

The population density within the PEZ will be important in determining the timing of a state of emergency declaration.

It is noted that the HZO is based on assumptions of the size of eruption that might occur. The intention of the HZO is to provide an **initial** assessment tool and further refinement or expansion of Hazard Zone 1 will be required as scientific information becomes available.

For example:

- Further refinement and prioritisation within the PEZ may also be possible as volcanic indicators build;
- Hazard Zone 1 boundaries may be modified according to topography;
- Priority areas may be identified on the basis of prevailing winds and weather conditions;
- Boundaries may be altered to include tsunami or other hazards if the eruption is off-shore;
- Boundaries may be altered to consider secondary hazards.

8.1.2

Assessment and Identification of Secondary Evacuation Zone

The **Planning and Intelligence Team** may also need to consider a second level evacuation zone, which might include:

- Areas where damage is likely if eruption hazards escalate;
- Areas likely to be isolated in the event of eruption (particularly in terms of water supply, wastewater disposal, power and road access);
- Areas where there is potential for significant damage due to

secondary hazards (e.g. fire, hazardous substance leakage).

8.2 Evacuation Process

8.2.1 *When to Commence Evacuation*

Lead Agency to determine timing of evacuation

In the event of any SAL warning, the **Lead Agency** will need to consider the need to evacuate the resident community. Given the high degree of uncertainty with respect to the time for volcanic activity to escalate to eruption, the **Lead Agency** will need to consider the following:

- The time required for effective evacuation of the resident population from the PEZ;
- Resource availability to assist in evacuation;
- The safety of personnel assisting in evacuation;
- The potential for 'panic' from the wider community to hinder the evacuation process (e.g. residents from outside the PEZ self-evacuating on the same routes or through areas and routes needed for evacuation of the PEZ).

 5.2 and  6

The **Planning and Intelligence Leader** and the **Logistics Team Leader** will be responsible for reporting on the above matters.

In the event of any volcanic activity in established urban centres (e.g. the isthmus of Auckland's CBD) it is expected that evacuation warnings may need to be issued as early as SAL1, recognising that the population requiring evacuation could include many thousands of households.

8.2.2 *Voluntary and Partial Evacuation*

It is recommended that the **Lead Agency** give consideration to early voluntary or partial evacuation given the likely scale of evacuation required. In particular, the following options should be considered:

- *Voluntary Evacuation* - Voluntary evacuation would be the responsibility of individuals (though any residents taking this opportunity should not be disadvantaged if a later enforced evacuation was to be issued).

- *Enforced Partial Evacuation* – Targets particular groups in the community based on their assessed susceptibility to volcanic hazards, the timing required to evacuate such groups, and/or the level of inconvenience caused by evacuation. Groups might include:
 - The elderly or those in special care facilities;
 - Households who do not have access to private motor vehicles or other private transport;
 - The itinerant population (tourists and other residents in temporary or mobile accommodation).

8.2.3

Enforced Evacuation

 CD Act

 CDEM Bill


 Ministry
CDEM

The decision to enforce evacuation is significant and may warrant the declaration of a *National State of Emergency* (particularly if evacuation requires relocation of a large number of households). The **Controller** will be responsible for liaising with the Ministry CDEM. The decision to enforce evacuation will be the responsibility of the Controller unless a state of national emergency is declared.

The resources required for an enforced evacuation are likely to require national direction and co-ordination. However, it is envisaged that the CDEM Group and the EOC will continue to provide advice and co-ordination of evacuation activities.

8.2.4

Public Information and Communication

 Evacuation
Plan

Public Statements will need to be made to the affected population to provide instructions on:

- The need for evacuation;
- Procedures for evacuation (including shutting off power and water supplies and notification or registration of evacuation);
- Resource requirements when evacuating, including medical supplies, clothing and important personal documentation.

 4

 7

All evacuation decisions will need to be communicated to emergency services, utilities and other response organisations and the community. The **Communication Leader** will be responsible for issuing statements to organisations. **The Public Information Leader** will be responsible for the issue of public statements.

8.3 Evacuation Routes



Routes



The **Logistics Leader** will be responsible for co-ordinating evacuation routes and resources with National Road Police. The AELG Priority Emergency Routes plan will provide direction on safe evacuation routes. Consultation with the **Maritime Safety Authority** and **Ports of Auckland** will be necessary to co-ordinate a sea-bound evacuation, if appropriate.

Personnel and resources will need to be deployed to provide signage for evacuation routes.

The **Lead Agency** will also need to give consideration as to whether other traffic using evacuation routes needs to be controlled. The **Liaison Leader**, through the Controller, will be responsible for informing emergency services if access restrictions to traffic are required.



The **Liaison Leader** will be responsible for liaison with the Automobile Association and Land Transport Safety Authority to advise of evacuation routes and any through traffic access restrictions on the road network.

8.4 Securing the Evacuation Area

8.4.1

Cordon Area Control



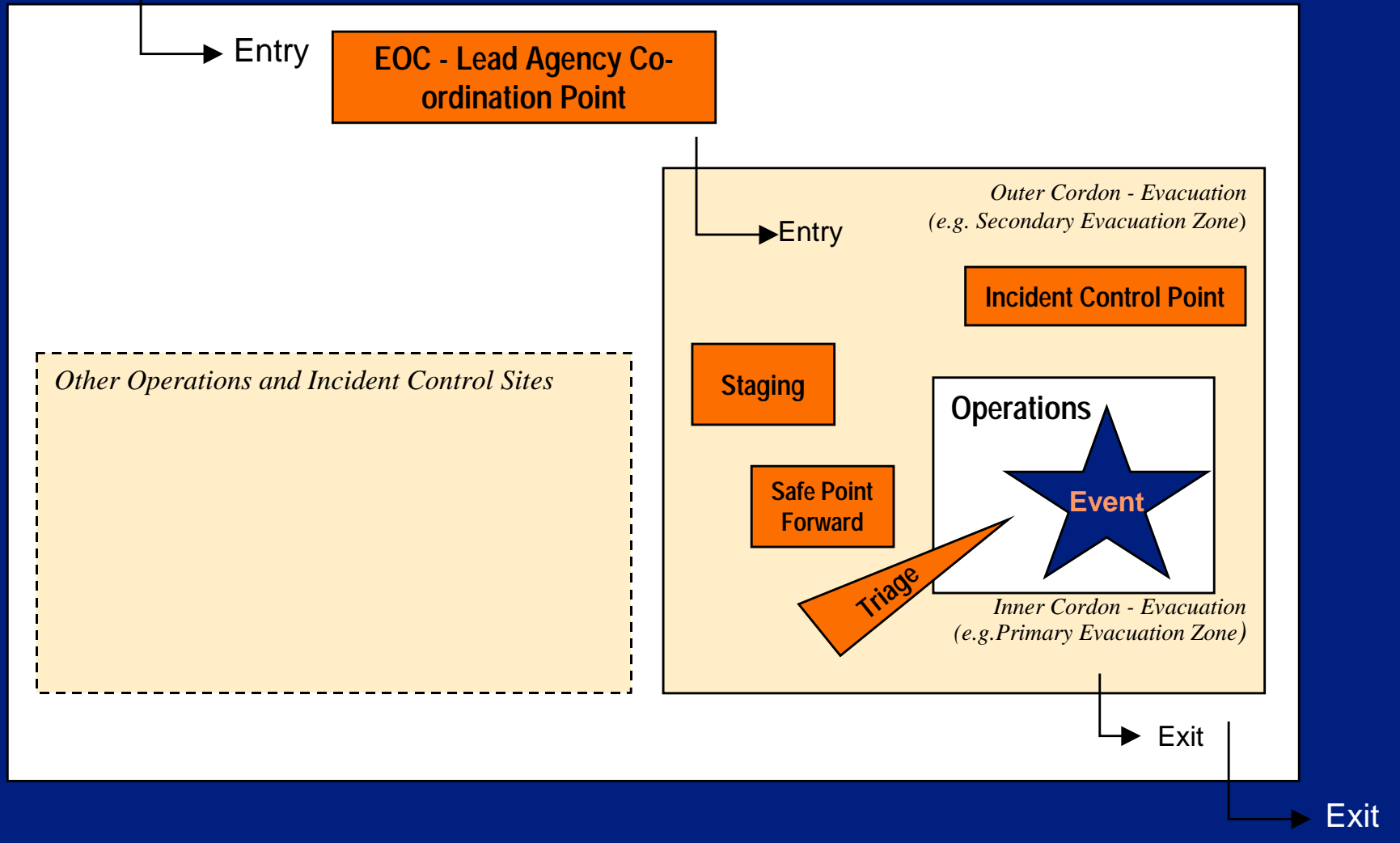
The **New Zealand Police** will be primarily responsible for security of any area evacuated during a state of emergency.

The **Planning and Intelligence Leader** will be responsible for advising on a 'safe' cordon area. Consideration will need to be given to the following matters:

- Volcanic hazards and potential secondary hazards;
- Potential for the area to become isolated due to eruption or loss of lifelines;
- Ability to provide personnel support (including shift changes, communications, shelter and staff welfare);
- Ability to evacuate from post, if required.

Inter-regional Assembly Point

Outer Cordon (e.g. area of 'managed' access due to volcanic eruption)



9 Welfare

✉ TA's

✉ Welfare
Organisations

📄 10

Territorial Authority and **welfare organisations** are responsible for the welfare of the affected community. Welfare has been included in the Plan to facilitate co-ordination of the tasks undertaken by welfare organisations across the region. The **Liaison Leader** will be responsible for liaising with the **Welfare Liaison** from territorial authorities with respect to welfare.

9.1

Registration

➡ National Civil
Defence Plan

✉ Red Cross

✉ Territorial
Authorities

The registration of evacuees and emergency workers is an important aspect of welfare. The *New Zealand Red Cross* has national responsibilities for operating a National Enquiry Centre when required and requested by the **Lead Agency**.

Territorial Authorities are responsible for ensuring a registry for the following groups:

- Evacuees and displaced persons;
- Relief workers; and
- Volunteers and welfare centre workers.

➡ Local Civil
Defence Plans

Territorial Authorities CDEM Plans will set out how different organisations will fulfil these responsibilities. The **Territorial Authorities** are responsible for ensuring that data on evacuees and displaced persons is forwarded to the Red Cross.

9.2

Accommodation

9.2.1

Emergency Workers

📄 3.1

The **Logistics Leader** will be responsible for co-ordinating accommodation for emergency workers functioning from the EOC (though the costs of such accommodation will remain the responsibility of the organisation concerned).

9.2.2

Evacuees

In the case of enforced evacuation, civil defence organisations are responsible for providing accommodation for evacuees. It is envisaged that evacuees will be encouraged to find their own accommodation and self-evacuation. In the case of a volcanic

eruption, it is recognised that a number of residents may require resettlement.

✉ TAs

Territorial Authorities will be responsible for providing accommodation and the welfare needs of evacuees that remain in their City or District in accordance with the welfare provisions of the CD Plan of CDEM Plan.

➡ CDEMG Plan

In the event of regional enforced evacuation, the **Lead Agency** will be responsible for co-ordinating welfare needs with adjoining EMOs.

9.3 Support Services

Stress / Psychological Support Services

The National Civil Defence Plan identifies the responsibilities for a number of government services for support services in stress and psychological impacts. Territorial Authorities with their overall responsibility for providing welfare, will be responsible for the co-ordination of Stress / Psychological Support Services within their Districts.

First Aid and Medical Support Services

✉ St Johns

The St Johns Ambulance services has a national role for the co-ordination of medical services in response to emergencies. St John's would be responsible for co-ordinating with Public Health and health services for provision of first aid and medical support services. The **Liaison Leader** will be responsible for notifying **Welfare Liaison** of territorial authorities, who will liaise with **St Johns** on activities to co-ordinate through the EOC, as part of the general communication and liaison role.

Catering

✉ Salvation
Army

The Salvation Army has a national role for the co-ordination and provision of welfare catering if this is required. The **Liaison Leader** will be responsible for notifying **Welfare Liaison** of territorial authorities, who will liaise with the **Salvation Army** on activities co-ordinated through the EOC.

It is not anticipated that the EOC operations will provide any further catering or support service for evacuees.

Clothing

✉ Red Cross

It is not anticipated that there will be a significant requirement for emergency clothing and other similar provisions (e.g. bedding, linen, and toiletries). However, the **Red Cross** has national responsibilities

for provision of such services and the **Welfare Liaison** for the **Lead Agency** will be responsible for co-ordinating any regional requests for such services.

9.4 Animal Welfare

The CDEM Group does not consider animal welfare as a key role for their organisation. The need for animal welfare will depend on the location of volcanic activity. For many parts of the region, it is anticipated that the role of animal welfare will principally be the care of domestic pets, however in some instances consideration may also need to be given to rural livestock. Other specialist organisations keeping animals are assumed to have their own contingency plans for animal welfare (eg the Auckland Zoo).



The need for emergency resources for animal welfare (particularly transportation) may need to be considered. The **SPCA** should advise the **Liaison Leader** of resource requirements. The **Logistics Leader** will be responsible for co-ordinating and prioritising transport.

10 Roles and Responsibilities - Summary

The roles and responsibilities of different agencies in the event of a volcanic eruption, as they relate to the Auckland Volcano Contingency Plan in the AVF are summarised in Table 3.

 **National Civil
Defence Plan**

 **CDEM Plan**

This Table is intended to outline specific regional roles and responsibilities in the event of volcanic eruption and does not divulge any organisation of the responsibilities identified under the National Civil Defence Plan or CDEM Plan.

Table 3: Key Roles and Responsibilities for Response to a Volcanic Eruption in the AVF

Agency	Responsibilities	Recommendation Notes
AELG	<ul style="list-style-type: none"> ■ Co-ordination of lifelines activities and advice. 	
Airways Corporation of New Zealand	<ul style="list-style-type: none"> ■ To advise the Lead Agency of civil aviation conditions ■ To advise aviation operators of volcanic SIGMET and appropriate VAR information.. ■ To collect, from aircraft, Volcanic Activity information and report to Lead Agency. 	
Amateur Radio Emergency Corps	<ul style="list-style-type: none"> ■ As per the National Civil Defence Plan, provide first line communications (including resources where available); ■ Provide the Lead Agency assistance in civil defence emergency management communications (EOC Communications); ■ Advise the Lead Agency of potential disruption to communication networks in the event of volcanic eruption (particularly ash fall) 	
Auckland City Mission	<ul style="list-style-type: none"> ■ Welfare resources (food, clothing, psychological support, volunteers); ■ Report to Welfare Liaison Leader nominated by Lead Agency. 	
Auckland International Airport	<ul style="list-style-type: none"> ■ Facilitation of resources and personnel; ■ Advise Lead Agency of any potential secondary hazards from volcanic eruption. 	
Automobile Association (NZ)	<ul style="list-style-type: none"> ■ Assistance in providing public information on road networks (from the Public Information Manager of the Lead Agency); ■ Provision of resources for assistance. 	
Citizens Advice Bureau	<ul style="list-style-type: none"> ■ Assistance in providing public information (from the Public Information Manager of the Lead Agency); ■ Assist in recording evacuees and report to Red Cross registration. 	
Civil Aviation Authority of New Zealand	<ul style="list-style-type: none"> ■ Ensuring a satisfactory means exists whereby civil aviation aircraft operations can be safely carried out near volcanic ash. ■ <u>Not</u> responsible for providing any service to airlines to directly assist them with such operations. 	
District Health Boards	<ul style="list-style-type: none"> ■ Identification of needs and responsibilities and advise Lead Agency of any disruption to or operation of medical facilities; ■ Medical advice to Lead Agency for the general medical needs of the community; ■ Representation on the SAG and TAG. 	
Electricity Networks (Includes: United Networks, Vector, Counties Power)	<ul style="list-style-type: none"> ■ Maintenance and continued operation of services; ■ Provide the Lead Agency information on local networks, operation and restoration ■ As requested by the Lead Agency manage supply or disconnection to areas of risk ■ Provide advice to customers on electricity supply 	
Electricity Suppliers – Transpower	<ul style="list-style-type: none"> ■ Maintenance of the Electrical Industry Emergency Contact list ■ Provide the Lead Agency information on possible and actual disruption to electricity transmission systems 	
GNS	<ul style="list-style-type: none"> ■ Provide Scientific Alert Levels and Volcanic Information Notices to the CDEMG. ■ Provide advice on the ongoing and potential effects of a volcanic eruption to the Lead Agency. ■ Representation on the SAG. 	
Jesus Christ of the Latter-Day Saints	<ul style="list-style-type: none"> ■ Provision of buildings (excluding temples) for emergency shelters, first aid stations or other welfare support. 	
Land Transport Safety Authority	<ul style="list-style-type: none"> ■ Provide assistance in evacuation and other logistical planning as required by the Lead Agency. ■ Representation on the TAG. 	
Maritime Safety Authority	<ul style="list-style-type: none"> ■ Identification of maritime transport resources for use (if any) and any other relevant resources required; ■ Provision of communication capacity (if required) ■ Representation on the TAG. 	


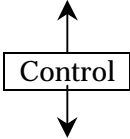
Agency	Responsibilities	Recommendation Notes
Meteorological Service of New Zealand	<ul style="list-style-type: none"> ■ Provide weather information and forecasting services to the Lead Agency ■ Provide warnings on volcanic ash emissions including: <ul style="list-style-type: none"> – Notification to Airways that NOTSAMS are in place; – Issuing SIGMETS (significant meteorological advice for pilots); – Issuing volcanic ash advisory statements about ash-cloud. ■ Responsible for Volcanic Ash Advisory Centre ■ Representation on the SAG. 	Recommend Weather Ambassador for SAG.
Ministry CDEM	<ul style="list-style-type: none"> ■ Co-ordination of national response and resources ■ Warnings and information as set out in the National Civil Defence Plan. ■ Monitoring of resources; ■ Liaison with Lead Agency. 	
National Institute of Water and Atmospheric Research	<ul style="list-style-type: none"> ■ Representation on the SAG. 	
Natural Gas Corporation of New Zealand – Infrastructure Management	<ul style="list-style-type: none"> ■ Inform Lead Agency of any actual or potential disruption to gas supply and any associated hazard risks. ■ Mobilisation of resources for the ongoing supply of gas. ■ Co-ordinate with the Lead Agency to ensure gas supply or management of gas supply in areas of eruption risk. ■ Co-ordinate the Gas Industry Mutual Aid Plan. 	
NZ Defence Force	<ul style="list-style-type: none"> ■ Undertake emergency services as set out in the National Civil Defence Plan. ■ Provision of personnel as required and requested by the Lead Agency; ■ Provision of available transport resources as requested by the Lead Agency; ■ Representation on the TAG. 	
NZ Fire Service	<ul style="list-style-type: none"> ■ Undertake emergency services as set out in the National Civil Defence Plan. ■ Representation on the TAG. 	
NZ Police	<ul style="list-style-type: none"> ■ Undertake those responsibilities for emergency management as set out in the National Civil Defence Plan ■ Representation on the TAG 	
NZ Red Cross	<ul style="list-style-type: none"> ■ Undertake those responsibilities for emergency management as set out in the National Civil Defence Plan ■ Supply of welfare resources (clothing and blankets) to evacuees and community affected; ■ Maintain a National register of evacuees 	
Order of St John	<ul style="list-style-type: none"> ■ Provide ambulatory services for response ■ Provide first aid services for response ■ Co-ordinate healthcare response ■ Provide for the evacuation of hospitals and other persons requiring medical assistance 	
Petroleum Industries	<ul style="list-style-type: none"> ■ Provision of fuel stocks to the Lead Agency ■ Co-ordination of fuel distribution ■ Identify any potential secondary hazards or risks associated with disruption to fuel supply. 	✉ Petroleum Industries
Ports of Auckland	<ul style="list-style-type: none"> ■ Facilitate supply of emergency resources by management of port operations; ■ Logistics assistance in sea-based evacuation, in consultation with Maritime Safety Authority. 	
Ports of Auckland	<ul style="list-style-type: none"> ■ Advise Lead Agency of any disruption or potential disruption to the Port operations resulting from a volcanic eruption ■ Identification of any facilities available for the evacuation of people (if evacuation by sea required). 	
Royal New Zealand Air Force	<ul style="list-style-type: none"> ■ Provide logistics support (including provision of manpower and resources) as required by emergency services and at the direction of the Lead Agency and New Zealand Police. 	
Salvation Army	<ul style="list-style-type: none"> ■ Co-ordination and provision of emergency catering facilities in liaison with Territorial Authorities. 	
Shell Wynyard Wharf Terminal	<ul style="list-style-type: none"> ■ Secure bulk fuel tanks; ■ Report to Lead Agency any potential secondary hazard risks resulting from damage to fuel tanks. 	

Agency	Responsibilities	Recommendation Notes
Telecom / Clear Communications	<ul style="list-style-type: none"> ■ Maintenance and continued operation of telecommunication networks; ■ Advise Lead Agency of any disruption or potential disruption to telecommunications resulting from volcanic eruption ■ Mobilise resources for the maintenance of civil defence communications and essential services as per the National Civil Defence Plan ■ TAG Representative 	
Territorial Authorities – Roading	<ul style="list-style-type: none"> ■ Maintenance and continued operation of the local transport network; ■ Identification of 'Safe Routes' for evacuation and liaison with Lead Agency. 	
Transit NZ	<ul style="list-style-type: none"> ■ Maintenance and continued operation of the state highway network; ■ Identification of 'Safe Routes' for evacuation and liaison with Lead Agency; ■ Roles and responsibilities as per the National Civil Defence Plan ■ TAG Representative 	
Tranz Rail Ltd	<ul style="list-style-type: none"> ■ Roles and responsibilities as per the National Civil Defence Plan 	
University of Auckland	<ul style="list-style-type: none"> ■ Provide the Lead Agency will advise and expert opinion on volcanic eruption ■ SAG Representative 	
Watercare Services	<ul style="list-style-type: none"> ■ Maintenance of bulk water supply operations; ■ Report to Lead Agency any potential disruption to or failure of bulk water supply; ■ Participation in preparation of a Water Supply Contingency Plan to maintain potable water supply to the region in the event of an emergency. 	
Wiri Oil Services	<ul style="list-style-type: none"> ■ Provision of Petroleum Products in consultation with the Lead Agency (Logistics); ■ Advise Lead Agency of status of petroleum stocks; ■ Advise Lead Agency of any potential disruption to or secondary hazards resulting from impact on Petroleum supply or service lines. 	

List of Acronyms

AA	Automobile Association
ARC	Auckland Regional Council
AVF	Auckland Volcanic Field
AVSN	Auckland Volcano-Seismic monitoring Network
AELG	Auckland Engineering Lifelines Group
CEG	Co-ordinating and Executive Group to CDEM Group
CD	Civil Defence
CDEM	Civil Defence Emergency Management
CEO	Chief Executive Officer
CD HQ	Civil Defence Headquarters
CIMS	Co-ordinated Incident Management System
EMC	Emergency Management Centre
EMO	Emergency Management Overview
EOC	Emergency Operating Centre
EQC	Earthquake Commission
IGNS	Institute of Geological and Nuclear Sciences
LTSA	Land Transport Safety Authority
MoT	Ministry of Transport
MSA	Maritime Safety Authority
Ministry CDEM	Ministry for Civil Defence Emergency Management
PIEAC	Petroleum Industry Emergency Action Committee
PIM	Public Information Manager
POA	Ports of Auckland
PEZ	Primary Evacuation Zone
SAG	Scientific Advisory Group
SAL	Scientific Alert Level
SEZ	Secondary Evacuation Zone
SPCA	Society for the Prevention of Cruelty to Animals
TA	Territorial Authority (District/local governance)
TAG	Technical Advisory Group

Glossary of Terms

Command	<p>The internal direction of members and resources of an agency in the performance of its role and tasks. Command operates vertically within an 'agency'. (See CIMS)</p> <p>In the organisational diagrams of this Plan, command functions are shown:</p> 
Control	<p>The overall direction of response activities in an emergency situation. Control relates to situations and can operate both within an agency and horizontally across agencies. (See CIMS)</p> <p>In the organisation diagrams of this Plan, control functions are shown:</p> 
Incident	<p>An event which requires a response from one or more agencies. In the event of a volcanic eruption it is likely that a 'multi-incident' response will be required (e.g. the volcano vent is likely to be one 'incident' while the rendezvous site for evacuees may be a second 'incident' site).</p>
Incident Control	<p>The overall management of the response to an incident. In the case of a volcanic eruption, incident control is likely to involve 'multi-incident' response. Further detail on the control of such an incident is provided in section 3 of the Plan.</p>
Lead Agency	<p>The organisation with agreed authority for control of an incident.</p>
Liaison	<p>Co-ordination between agency representatives.</p>
Logistics	<p>The provision of facilities, services and materials in accordance with incident action plans and this Contingency Plan.</p>
Operations	<p>The direction, supervision and implementation of tactics in accordance with action plans and this Contingency Plan.</p>
Planning and Intelligence	<p>The collection, evaluation and dissemination of information related to an incident in the preparation and implementation of action plans.</p>
SAG	<p>Scientific Advisory Group providing planning and intelligence assistance in the event of volcanic activity. The principle function of SAG is for the mapping and definition of potential hazards from a volcanic episode for the purpose of assisting regional response. (See section 3.2 of this Plan).</p>
TAG	<p>Technical Advisory Group providing planning and intelligence and logistic assistance in the event of volcanic activity. The principle function of TAG is to assist in planning and co-ordinating response to the impacts of a volcanic episode for the purpose of assisting regional response. (See section 3.2 of this Plan).</p>

Report Prepared By: Amelia Linzey *Signed*

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- **Appendix 1**
Hazard Matrix for the
Auckland Volcanic Field

Appendix 1: Hazard Matrix for the Auckland Volcanic Field

Hazard	Description	Area Affected	Infrastructure Damage	Damage to Life	Warning (from given SAL)	Recovery Post Cessation of Activity	Mitigation
Volcanic Earthquake	Ground shaking caused by movement of magma through the crust both before and during eruptions. (Earthquakes may also be generated by fault movement. Such earthquakes are tectonic earthquakes, not caused by volcanic processes.)	Volcanogenic earthquakes, uplift and deformation are expected to affect an area of 3km ² to 5km ² .	Damage to structures located close to the eruption vent and those built on low strength soils or man-made ground. Very low risk of liquefaction; low risk of damage to non-ductile pipework located in moderate slopes; low risk of damage to older multi-level brick or masonry structures (pre c.1975); low risk of damage to civil structures (eg concrete tanks and reservoirs, embankments, earth dams), particularly where founded on steeper slopes.	Low risk of injury or death due to falling debris or loss of support to infrastructure in damaging earthquake or deformation.	Earthquakes are common pre-cursors to eruptive phenomena and are expected to be felt for a period of days prior to commencement of an eruption. Establishes Scientific Alert Level 1 (SAL 1), Table 2.	As earthquakes are likely to focus beneath the site of eruption, eruption effects will quickly override earthquake effects. Recovery unlikely to be immediate priority.	<ul style="list-style-type: none"> ■ Transport Redirect traffic away from seismic centre; avoid unnecessary work on or in structures located on reclaimed land (eg Ports) ■ Energy Shut down areas of gas supply still supplied via non-ductile pipes. Conduct checks of fuel storage tanks and associated pipework ■ Water Supply Undertake regular checks for pipe leakage and integrity of connections; monitor dam embankment integrity; prepare for controlled release of water if ground shaking high in these areas ■ Wastewater Undertake regular checks for pipe leakage, integrity of connections and of concrete tank integrity
Earthquake		3km – 5km	Immediate Risk Low; Ongoing Risk Nil; Anticipated loss small		Days	Not Applicable	Minor
Crater, Cone or Ring Formation <i>(while these are strictly eruption products, as they result in significant hazards they are included here for planning purposes)</i>	Maars, tuff rings and tuff cones may be produced during an eruption. Maars: vertical-walled craters cut into pre-eruption country rock and surrounded by low rims. Tuff rings: constructional craters lying mostly on or above pre-eruption surface. Tuff cones: smaller cones and higher rims.	Crater of up to 1.5km ² diameter produced with anticipated maar affecting an area of 0.35km ² (a 300m to 500m radius). Formation of steep sided scoria cones of up to 1km across.	Destroy all infrastructure at the site of the vent and for a radial distance of 500m to 1.5km; Significant damage to, or partial burial of infrastructure adjacent to this zone; May dislocate communications networks, power transmission, water supply distribution, sewage transfer pipes, and transport routes.	Immediate loss of all life within the vent crater, cone or ring.	Earthquakes recorded by the Auckland Volcano-Seismic Network (AVSN) up to 1 to 2 weeks prior to eruption, shallowing and increasing in frequency resulting in felt ground shaking within a day to a few days of eruption; slightly elevated sea-water temperature up to a few days prior to eruption; Cracking of ground resulting in steaming fissures several hundred metres long. Commence at SAL 3 and continue through 4 and 5, Table 2.	<ul style="list-style-type: none"> ■ Communications Identify extent of area affected and establish bypass over period of days. ■ Transport Excavate and clear obstructions. Re-route around affected area. May take a few to several days. ■ Energy Full recovery up to several weeks depending on the extent of loss of services. ■ Water Supply Essential services supplied within 1 week; Full recovery within minimum of 4 months still with temporary stations. ■ Wastewater Major problem areas identified and essential sites repaired within 1 week; Full recovery with use of temporary pump stations and catchments re-routed around devastated region; up to 4 months. 	<ul style="list-style-type: none"> ■ No effective mitigation options for near vent infrastructure. ■ Pre-event, development of infrastructure 'redundancy' or network duplication. ■ Evacuation ■ Asset stripping within impact area may minimise loss. ■ Energy, Water Supply, Wastewater Shut down supplies in area likely to be affected prior to eruption to reduce damage
Crater, Cone or Ring Formation		0.3km - 1.5km	Immediate Risk Extreme; Ongoing Risk Low; Anticipated loss Extreme		Hours to Days	Several months to years	None

Hazard	Description	Area Affected	Infrastructure Damage	Damage to Life	Warning (from given SAL)	Recovery Post Cessation of Activity	Mitigation
Fire Fountaining	Eruption of hot magma which may rise hundreds of metres above an active vent. Lumps of cooled magma are deposited as ash, lapilli and bombs. Restricted to a vent or series of vents along a fissure. Preserved at 77% of AVF volcanoes.	Most significant effects expected within a 200m to 500m radius of the vent.	Impact and fire damage to structures located within the zone of fire fountaining activity; damage to structures above ground susceptible to damage by fire; potential for spread of fires via underground service networks	Loss of life within 500m of the vent; damage, injury or death to all life due to hot debris impact and burns	Dependent on the nature of the eruption and stage in the volcanic eruption sequence. Occurs within hours of commencement of volcanic activity, therefore little warning. Commences at SAL 3 and continues through 4 and 5, Table 2.	Recovery of essential services to bypass area affected by fire fountaining within one week; Reconstruction of infrastructure within the zone of fire fountaining may take several months to years following cessation of activity.	Evacuation of immediate area. Maintain hospital based services for treatment of burns, injuries and other medical emergencies. Few mitigation options available for near vent infrastructure. Shut down gas and electricity services in area; flush water pipes.
Fire Fountaining*		0.2km – 0.5km	Immediate Risk High; Ongoing Risk Low; Anticipated loss Extreme	Hours	1 week to several months	Minor	
Lava	Streams of magma which flow by gravity into and along topographic lows; hot (1000°C or more); associated with 61% of AVF volcanoes. Generated by dry eruptions. May comprise: <ul style="list-style-type: none"> Continuous and voluminous discharge of highly fluidised lava, often with gas-driven fire fountaining of scoria to hundreds of metres above the vent; or Lava flows produced directly from primary or secondary vents; possibly associated with partial cone collapse or breaching. 	Fire-fountaining of lava (at temperatures in excess of 1000°C) to 200 – 300m in height, falling back to the ground and flowing as lava for periods of 1 to several months. AVF lava flows have travelled distances of 0.5km to 9.5km related to lava volume, viscosity and topographic gradient. Damage limited to within a few kilometres of the erupting vent.	Burn, crush and bury everything in their path. <ul style="list-style-type: none"> Domestic and Commercial Structures Loss of integrity of structures in path; generation of fires in buildings. Communications Interruption of distribution where transmission lines destroyed by lava flows; damage to distribution centres impacted by lava flows. Transport Blockage of shipping channels and loss of access to ports; obstruction of transport routes. Energy Interruption of distribution where transmission lines destroyed; damage/destruction of power stations in flow path; risk of explosion and fires if lava impacts petroleum product storage facility. Water Supply May explode on contact with water; heat from lava flows may pressurise water remaining in underground pipes, causing local explosions; may block or break existing reticulation and alter local topography causing local flooding. Wastewater May explode on contact with water or organic gases. May block or break existing reticulation and alter local topography leading to local ponding of sewage. 	Generation of fires. May explode when coming into contact with water or as a result of organic gases produced when hot lava over-runs vegetation. Move at speeds slow enough for people and animals to move out of their way. Lethal if caught in path of lava.	Generally occur later in the sequence of volcanic activity, following fire-fountaining. Because lava flows are strongly controlled by topography, the shape of the area destroyed by a flow can be easily predicted. Develops at SAL 3 to 4 and continues through SAL 5, Table 2.	<ul style="list-style-type: none"> Transport Redevelopment of ship passage if feasible (if severe, may require development of new port site); lava removal and road and rail reconstruction or re-routing around affected section; depending on vent location, port or airport facilities may be destroyed – partial recovery within 6 months to 1 year. Energy Full recovery up to several weeks depending on the extent of loss of services. Water Supply Essential services supplied within 1 week; Full recovery within 4 months, but with temporary stations, and catchments re-routed around devastated region. Wastewater Major problem areas identified and essential sites repaired within 1 week; Full recovery with temporary pump stations within 4 months. 	Immediate evacuation within 3km of the expected vent and topographic lows. Possibly slow progress by cooling with water to increase viscosity (not found to be effective elsewhere). Barriers may be able to be constructed (earth) or explosives used to divert /control flow (not found to be effective elsewhere). Issue warnings of potential lava path. Maintain hospital based services for treatment of major burns, injuries and other medical emergencies. <ul style="list-style-type: none"> Transport Signage to direct traffic away from areas in path of flows Energy Shut down gas supply in area likely to be affected prior to eruption Water Supply Controlled release of ponded surface water
Lava*		3km – 5km	Immediate Risk High; Ongoing Risk Low; Anticipated loss High	Hours to days	Several weeks to several months	Moderate	
Base surge	Ground-hugging turbulent mixtures of steam and solid ejecta that flow out laterally from the base of the eruption column in phreato-magmatic eruptions. Surges range from wet to dry and cool to hot. May develop rapidly as lateral blasts without an associated eruption column. Multiple explosions at short time intervals. Associated with 73% of AVF volcanoes.	Surges are expected to flow out over an area of up to 5km from the vent in a period of seconds to a few minutes depending on local topography and eruption energy. May surmount topography. Near-vent, deposits are likely to be more than 0.2m thick. Surge thickness, density and speed decrease towards the limits of flow.	Destroy all infrastructure in its path over a distance of 500m, and result in significant damage to or partial burial of structures (eg transport routes) at distances of 500m to 5km. Damage to all infrastructure limited to within a few to several kilometres of the vent.	Destroy all living things in their path and those affected by blast; Suffocation due to heat, burial or asphyxiation.	Little to no warning. Fluctuating intensity dependent on the availability of water, variations in the eruption column and widening of the vent (fissures) at commencement of, or possibly within hours of volcanic activity commencing. Initiated at SAL 2/3 and continues through 4 and 5, Table 2.	All infrastructure: Uncover buildings and services; Establish damage due to loading applied by surge; Reconstruction as required. Essential services operational within 1 week; Full recovery of non-essential infrastructure and services may take several months.	<ul style="list-style-type: none"> No effective mitigation measure other than evacuation. Asset stripping within impact area may minimise loss. Maintain hospital based services for treatment of burns, injuries and other medical emergencies
Base Surge		3km – 5km	Immediate Risk High; Ongoing Risk Low; Anticipated loss Extreme	Nil	1 week to several months	None	

Hazard	Description	Area Affected	Infrastructure Damage	Damage to Life	Warning (from given SAL)	Recovery Post Cessation of Activity	Mitigation
Shock Waves	Sound and pressure waves associated with energetic eruptions.	Propagates in all directions away from the vent, usually travelling ahead of a base surge.	Break windows, flatten weak structures, dislodge and scatter loose items	Flatten trees and people	Nil. May occur during initial larger explosions when volcanic activity commences. May occur from SAL3 to 5, Table 2.	Not applicable.	No effective mitigation measure. Maintain hospital based services for treatment of major burns, injuries and other medical emergencies.
Shock Waves		3km – 5km	Immediate Risk High; Ongoing Risk Low; Anticipated loss High		Nil	1 week to several months	None
Lava Bombs	Blocks and bombs (cobble to boulder sized material >60mm) follow ballistic trajectories from the vent and are released from the eruption column at 100 – 500m height. Includes both cooler country rock and hot lava.	Dispersal is influenced by projectile velocity and mass and possibly to a minor extent, by wind velocity. Most blocks and bombs deposited within 0.4km of the vent, but may spread up to 1 to 2km.	All infrastructure is at high risk of impact damage due to a direct hit, potentially also resulting in fire ignition.	Severe burns and threat to life	No warning. Generally occurs earlier in the eruption sequence and again later when the lava has degassed. May occur from SAL 3; continues through SAL 4 and 5, Table 2.	Refer to fire fountaining.	Evacuation. Maintain hospital based services for treatment of burns, injuries and other medical emergencies
Lava Bombs*		0.4km – 0.5km	Immediate Risk Moderate; Ongoing Low; Anticipated loss Moderate		Nil	1 week to several months	Minor
Airfall Tephra and Eruption Column (volcanic ash)	<ul style="list-style-type: none"> ■ Eruption Column Explosive reactions generate an eruption column of pyroclastic material rising several kilometres into the air. In phreatomagmatic eruptions, steam condensation in the eruption plume produces ash rainout. ■ Airfall Tephra Includes all volcanic products aerially ejected from the vent (ash <2mm, lapilli 2 - 64mm and bombs >64mm, derived from fire fountaining, ballistic projectiles and fall-out from the eruption column). 	<p>Ash plume may rise 6km – 15km resulting in the deposition of up to 1 million m³ of tephra spread up to 100km from the vent (although at 100km, there will be no risk to infrastructure other than air traffic). The distribution of ash will be dependent on the size of eruption, prevailing winds at the time of eruption (wind direction and strength) and particle weight.</p> <p>As upper level westerly winds predominate in Auckland, tephra is most likely to be deposited thickest to the north-east and east of a vent.</p> <p>Tephra thickness is likely to range from a few mm thick up to about 600mm thick.</p>	<ul style="list-style-type: none"> ■ Domestic and Commercial Structures Abrasion; enters buildings through broken windows etc; tephra loading may lead to collapse of roofs, walls or columns ■ Communications Emergency generation and air conditioning plants vulnerable to abrasive dust and over-heating resulting in service interruption; potential for damage to CBD fibre optic ring and isolation due to power failure; land lines more vulnerable than cellular system; congestion of services ■ Transport (Road, Rail, Ports, Airports) Temporary road closure, impaired visibility, vehicle damage; blockage of drains resulting in flooding; engine damage resulting in disruption of port activity; closure of air-space and airports. ■ Energy Electricity supply restriction and outages due to insulator flash-overs at transmission and distribution systems; minor affect on petroleum or gas pipeline valve controls and petroleum SCADA systems; heavy ash fall may sink floating roofs on petrol tanks causing spills and creating hazardous vapour cloud with risk of explosion ■ Water Supply Suspension of ash in water supply reservoirs and leaching of contaminants (eg F), lowering of pH, disruption of treatment process; interference with electrical equipment, filter stations overloaded; damage to pumps ■ Wastewater and Stormwater Pipe blockage and local flooding, damage to pumps and plant equipment, interference with treatment process; operational, maintenance and odour problems, overload bypassed to land or harbour with consequences for sanitation 	<ul style="list-style-type: none"> ■ Hinder visibility resulting in accidents ■ Inhalation of gas and particles causing respiratory problems ■ Burial of crops and damage to fruit ■ Pastoral land also lost 	An eruption column will be generated following commencement of the eruption. Tephra will be produced within hours over the wider area. Prediction of wind directions critical to defining likely hazard zones. Earthquakes a few hours and up to a few days prior to eruption due to upwelling may provide an indication of the area likely to be affected by these hazards at that time. Develops from SAL 3 and continues through SAL 4 and 5, Table 2.	<ul style="list-style-type: none"> ■ Domestic and Commercial structures Dependent on availability of water supply and access ■ Communications May be hindered by ability to access sites and high temperatures. Some recovery within 2 to 7 days ■ Transport Regular removal of ash from roads, rail, port and airport; increased maintenance of aircraft to exclude ash from engines and machinery. Some capacity within 1 week of cessation of ash fall ■ Energy Temporary repairs and alternative supplies in place within 1 week ■ Water Supply Turbidity and acidity of water returns to normal levels within a few hours to days of cessation of ash fall. Essential water supply recovered within 1 week; non-essential supply provided by tanker ■ Wastewater Essential recovery within 1 week of cessation of ash fall <p>A contingency plan for disposal of ash must be prepared to avoid restricting recovery.</p>	<p>Clean-up and removal. Maintain hospital based services for treatment of burns, injuries and other medical emergencies</p> <ul style="list-style-type: none"> ■ Commercial structures Prioritise key structures (eg hospitals) and check for likely ash loading; upgrade to withstand as necessary ■ Communications Fit temporary pre-filters to internal/ external air-conditioning units within exchange centres; Seal off exchange centres during the event to minimise ash effects ■ Transport Remove from roads and stockpile during eruption; Minimise driving movements; Install extra air filters in vehicles operating within ash fall-out zones ■ Energy Encapsulate gas gate stations and shut down gas supply prior to eruption ■ Water Supply Prevent ash ingress to water pumping stations, cover filters; Monitor water quality ■ Wastewater Bypass and/or shut down vulnerable parts of the plant during ash fall
Airfall Tephra		3km – 100km	Immediate Risk Low; Ongoing Risk Moderate; Anticipated loss Low		Hours, up to a few days	1 week to several months	Moderate

Hazard	Description	Area Affected	Infrastructure Damage	Damage to Life	Warning (from given SAL)	Recovery Post Cessation of Activity	Mitigation
Gas	CO, CO ₂ and HF may escape from vents. CO ₂ generated by burning vegetation may become concentrated in low-lying areas. Boiling of seawater due to flowing lava creates dense white clouds of HCl aerosols (laze) carried downwind at low elevation. Discharge of SO ₂ gas adjacent to lava flows. SO ₂ and laze generate acid rain. Steam hazard.	Asphyxiating gases CO, CO ₂ and HF are likely to be localised around vent, and concentrated in low-lying areas. SO ₂ gas likely to accompany lava flows. Concentrations decrease sharply with distance from the source. Acid rain may be experienced up to 10km downwind of the vent.	Corrosion problems downwind.	Breathing difficulties, nausea, skin irritation; hinders recovery operations; burns; acid rain damage to vegetation.	Volcanic gas clouds expected within the first few hours of onset of volcanic activity. Steam may be generated wherever hot material impacts on water, for the duration of these hazards. Develops at SAL 2/3, and continues throughout and post event, Table 2. Vents may continue to de-gas for a period of years.	Dispersal of gases from active vents and cooling lava following cessation of activity.	Evacuation of immediate area; Maintain hospital based services for treatment of breathing difficulties, injuries and other medical emergencies Regular washing of all exterior fittings and surfaces; Check items potentially impaired by gases.
Gas		3km – 5km	Immediate Risk High; Ongoing Risk and Anticipated loss Moderate		Less than an hour	Not applicable	Minor to Moderate
Lightning	Pulses within the eruption column generated as a result of electrically charged ash in a convecting eruption column.	Immediate area of eruption column and plume and up to 10km downwind of the vent. Frequent lightning pulses will occur within the eruption column and plume within hours of eruption onset.	<ul style="list-style-type: none"> ■ Communications Ash can conduct electricity causing lightning strikes or inducing short circuits in radio and telephone communication systems ■ Energy Induces short circuits in electricity supply systems 	May result in fire – damage/partial loss of vegetation; minor damage to residential areas; low risk of human injury or death.	Nil. May occur any time during eruption, SAL 3 - 5, Table 2.	<ul style="list-style-type: none"> ■ Communications and Energy Recovery as per normal maintenance procedures. 	<ul style="list-style-type: none"> ■ Communications Installation of lightning conductors on towers.
Lightning		3km – 100km	Immediate Risk Low; Ongoing Risk Low; Anticipated loss Low		Nil	Up to 1 to 2 days	None
Tsunami	Long-period waves generated by updoming of the seafloor or coastal area, fall-out of the lava column into a body of water; base surges and accompanying shock waves; pyroclastic flows impacting on water and submarine explosions.	Tsunami run-up height will be dependent on the volume of seawater displaced, direction of displacement, area affected and duration of the disturbance. The majority of these processes are likely to be of relatively long duration and therefore generate relatively small tsunami run-up. Low-lying coastal areas within 1km of the disturbance may be affected; waves may be amplified in embayments or estuaries. Likely to affect Waitemata or Manukau Harbour, but not both.	Damage to low lying areas close to the coast (eg Auckland's ports and international airport); structures or land adjacent to and down gradient of affected reservoirs. Minor erosion, settlement and possible loss of support to structures due to high velocity currents and partial removal of founding materials; partial burial of coastal roads and piling up of sediment adjacent to coastal structures; abrasion of structures by transported sediment and objects; dispersion of contaminants encountered; minor inundation and flooding.	Low risk of injury to persons directly exposed to wave due to impact by transported material, or abrasion by entrained sediment; inundation by saline waters may affect plant life.	No warning; tsunami will only occur in response to a rapid displacement of water, ie source or products need to be in or enter the sea. May be initiated by activity at SAL 3, 4 or 5, Table 2.	<ul style="list-style-type: none"> ■ Communications Few sites are considered vulnerable; recovery within 2 days. ■ Transport Airport, coastal roads, rail and port facilities recover full capacity within 1 day. ■ Energy Full recovery to any damaged coastal structures within 1 day. ■ Water Supply Few sites are considered vulnerable; recovery within 2 days. ■ Wastewater Maintenance and repairs within 1 week; Operating capacity unlikely to be affected. 	<ul style="list-style-type: none"> ■ Transport Design vessel mooring systems to withstand appropriate tsunami velocities; evacuation plans at key low-lying sites in the coastal area (eg Ports and Airports). ■ Energy Location of environmentally sensitive operations (eg petroleum installations) clear of tsunami hazard. ■ Communications, Water, Wastewater Waterproofing of gas, water, sewage and phone cables in coastal areas prior to event.
Tsunami		1km	Immediate Risk Low; Ongoing Risk Nil; Anticipated loss Low		Nil	Up to 1 to 2 days	Moderate

* Risks which are likely to be repeated over a period of time (weeks or months) following the initial event

- Appendix 2

Hazard Zone Overlay

- Appendix 3

Checklists: Roles & Responsibilities

Roles and Responsibilities – Lead Agency Co-ordinator Leader

	TASK	Description
<input type="checkbox"/>	Initial assessment of Situation	<i>Review of situation and evaluation of appropriate Lead Agency.</i>
<input type="checkbox"/>	Appointment of Team Leaders	<i>In accordance with Section 3 of the Plan</i>
<input type="checkbox"/>	Confirmation of EOC	<i>See Section 4.1 of the Plan</i>
<input type="checkbox"/>	Set priorities and allocate resources	<i>See Section 4 of the Plan</i>
<input type="checkbox"/>	Receive warnings and hazard information	<i>In accordance with Section 5 of the Plan</i>
<input type="checkbox"/>	Ensure warnings issued	<i>In accordance with Section 5 of the Plan</i>
<input type="checkbox"/>	Evaluate evacuation zone	<i>See Section 8 of the Plan</i>
<input type="checkbox"/>	Review need for declaration	<i>See Section 6 of the Plan</i>
<input type="checkbox"/>	Conduct briefings	
<input type="checkbox"/>	Review Contingency Plan and revise as required	
<input type="checkbox"/>	Organise Changeovers	
<input type="checkbox"/>	Maintain Log of Activities	
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		