

Volcanic Hazards Simulation: Instructions to Students

Before we start:

1. Do your reading!: Based on your **role** and responsibilities, read or skim over the relevant **literature** from the [Interactive Bibliography](#).
2. Respect the **group organization**, and your roles. The Section Manager and Controller is 'in charge' but your group must work democratically to achieve the best solutions. Refer to **Flow of Information** ([GeoNet team](#); [Emergency Management Team](#)) documents at the end of this packet.

During the Simulation:

3. You should **record** all of your observations on your **data log**. Include interpretations, sketches or whatever is helpful to you. Put your name, date and role on **EVERYTHING** that you record during the simulation (Be accountable ☺)
4. **Communication** and **teamwork** are essential tools used by REAL GeoNet scientists and Emergency Managers in order mitigate disasters! Be sure to use these best that you can!
5. **Ask questions** to the 'Experts' whenever you think you need help or are stuck.
6. **Fill out** the relevant **paperwork** or **maps**, at the appropriate times!

GeoNet:

[Alert Level Change Reports](#);
Ash Dispersal Map (Isopach)
Flow Dispersal Maps.
[Media Releases](#)
[Fieldwork Risk Assessment](#)

Emergency Managers:

[Volcanic Impacts Reports](#);
Evacuation Routes or
Road Closure Maps;
[Media Releases](#)

7. There are **engineered PAUSES** into the simulation, to allow you more time to think and do the tasks that are given to you.

After the Simulation:

8. You will be graded by yourself (a self-assessment) and someone seated next to you using a Rubric ([Overall performance in the Simulation](#); See the end of this document).

Learning Goals for Volcanic Hazards Simulation

Prior to the simulation, students should be familiar with....

1. The variety of volcanic hazards associated with different types of volcanism
2. Reading and understanding geological and topographical maps
3. Volcanic monitoring data types and interpretation of these data in case studies and in “real-time”
4. How different monitoring data go together to form a working model of what’s happening in the volcano
5. Knowledge of New Zealand Alert levels (two levels; when to raise them)
6. A general idea of what the GeoNet and Emergency Management teams do during a crisis.

After the simulation, students should be able to...

1. Observe volcanic monitoring data and social media in “real-time”, record observations and **communicate** these observations to a team (orally and in writing).

2. Collaborate within a team, by using multiple streams of data in “real-time” to develop a working-model (inclusive of scientific and social-economic data) together in order to:

- a.) assess the current state of volcanic activity;
- b.) identify major changes in volcanic activity,
- c.) judge if changing conditions threaten the human population.
- d.) use a-c to assign appropriate GNS alert levels
- e.) respond to community concerns

3. Estimate and **illustrate** the distribution of volcanic products (e.g. volcanic ash) based on the volume and style of activity in order to **create** volcanic hazard maps using geological and socio-political map data (i.e. geology map, geological history, and contoured topographic map).

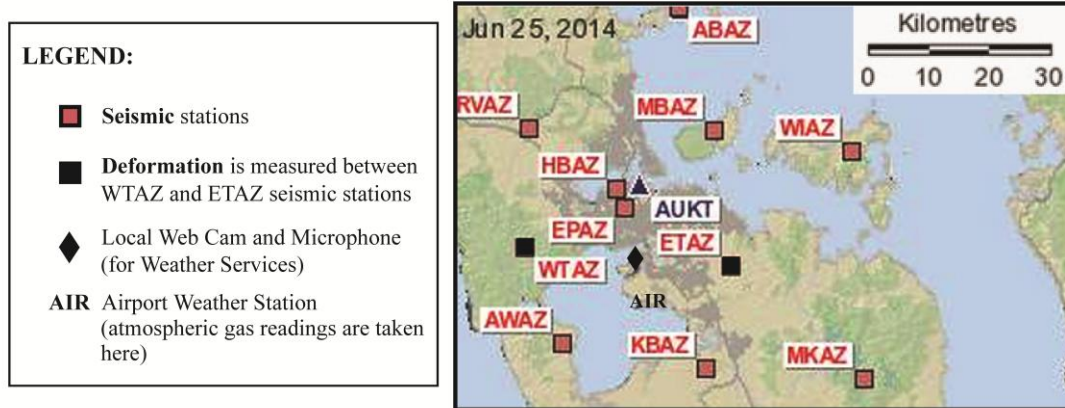
4. Estimate the impact to social and political sectors based on the distribution and style of volcanic activity, given the alert level of the volcano in question. **Respond** to crises (in a timely manner) in order to mitigate the impact before/during/and after a volcanic disaster.

5. Communicate effectively (orally and written) within your team and to the other teams and to the public (newsfeed) in order to effectively handle any possible volcanic threat. These are assessed by:

- a.) Press Conferences (Questions and Responses)
- b.) Effective group discussions
- b.) Media Releases
- c.) Volcanic Impact Reports
- d.) Effective Inter-agency (between GeoNet and EM) conversations & meetings

6. Have an awareness of a.) scientists and emergency managers responsibilities, agendas, and expertise; b.) team structures, hierarchy and protocols; c. external agencies that assist Emergency Managers, and c.) the public’s concerns; during a simulated volcanic crisis.

GeoNet Team: Auckland Volcanic Field Monitoring Network and Measurements



Seismicity: 11 seismographs (refer to map above) report activity around the volcano. The reports given to you represent information about the earthquake activity:

- the **number** of quakes that occurred;
- the maximum **magnitude** (~Richter scale, New Zealand Modified);
- average **depth** (km); and
- the **type** of quakes. The type of quakes reported include: **HF** (high frequency), **LF** (low frequency), **EX** (explosion signals) and **T** (tremor).

Gas Readings: CO₂ and SO₂ gas are both reported as daily measurements taken from the **AIR** weather station. These measurements are taken to observe anthropogenic gas levels.

Weather: Wind Direction (e.g. N – Winds coming from the North), Wind speed (Maximum reported km/hour), and Precipitation (mm). This data is remotely reported from the **AIR** airport weather station. Reported by New Zealand's MetService. **IMPORTANT:** *Additional Weather forecasts will show up in the NewsFeed.*

Deformation: (meters) **Deformation** is measured by calculating the present distance between two GPS located stations (**WTAZ to ET AZ**), and assessing any changes from ongoing readings. A positive value indicates that the stations have moved away from one another, and a negative indicates that they have moved closer to one another. Most volcanoes do not inflate or deflate by more than a couple meters per year. **Tilt** data is not available at these GPS sites.

Visual Data includes: Webcams all over the city which stream the visual information back to GeoNet (see **images**, and the descriptive **text**). A **microphone** is also part of each station. If an eruption were to occur, the webcam **closest to the activity** will be activated. In the event of an eruption, MetService will also report the **Maximum Plume height** (in meters) recorded by satellites and the **local ash thickness** – these data are found in the **Ash Reports** tab.

Ash Thickness Estimates + Isopach Maps – The ash volcanologist can use an [Ash Plume Model \(excel file\)](#) to help estimate ash thicknesses immediately after an eruption to make predicted thicknesses. See Ash Plume Model excel sheet for more assistance.

New Zealand Volcanic Alert Level System

	Volcanic Alert Level	Volcanic Activity	Most Likely Hazards
Eruption	5	Major volcanic eruption	Eruption hazards on and beyond volcano*
	4	Moderate volcanic eruption	Eruption hazards on and near volcano*
	3	Minor volcanic eruption	Eruption hazards near vent*
Unrest	2	Moderate to heightened volcanic unrest	Volcanic unrest hazards, potential for eruption hazards
	1	Minor volcanic unrest	Volcanic unrest hazards
	0	No volcanic unrest	Volcanic environment hazards

An eruption may occur at any level, and levels may not move in sequence as activity can change rapidly.

Eruption hazards depend on the volcano and eruption style, and may include explosions, ballistics (flying rocks), pyroclastic density currents (fast moving hot ash clouds), lava flows, lava domes, landslides, ash, volcanic gases, lightning, lahars (mudflows), tsunamis, and/or earthquakes.

Volcanic unrest hazards occur on and near the volcano, and may include steam eruptions, volcanic gases, earthquakes, landslides, uplift, subsidence, changes to hot springs, and/or lahars (mudflows).

Volcanic environment hazards may include hydrothermal activity, earthquakes, landslides, volcanic gases, and/or lahars (mudflows).

***Ash, lava flow, and lahar (mudflow) hazards may impact areas distant from the volcano.**

This system applies to all of New Zealand's volcanoes. The Volcanic Alert Level is set by GNS Science, based on the level of volcanic activity. For more information, see geonet.org.nz/volcano for alert levels and current volcanic activity, gns.cri.nz/volcano for volcanic hazards, and getthru.govt.nz for what to do before, during and after volcanic activity. Version 3.0, 2014.



UC Volcanic Hazards Simulation



Time 00:00, Feb 6

Seismic 1

Seismic 2

Gas

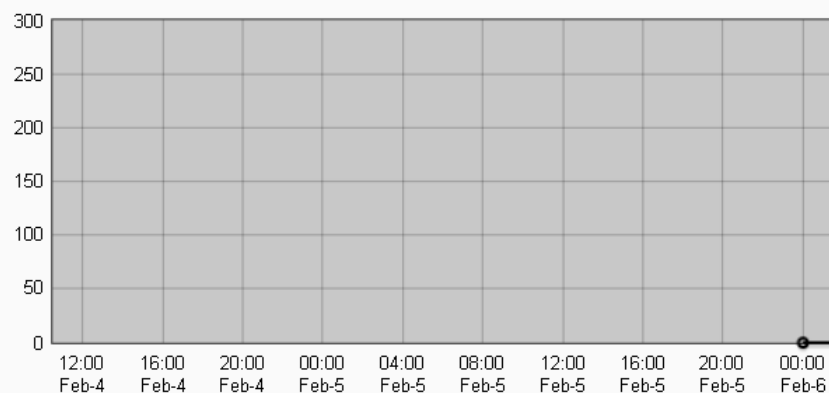
Deformation

Weather

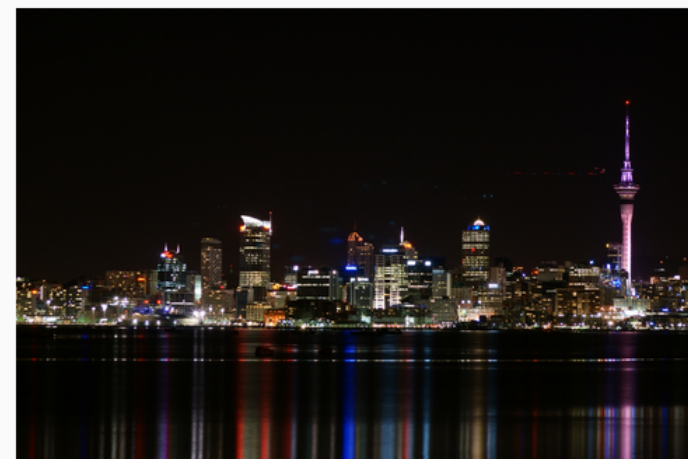
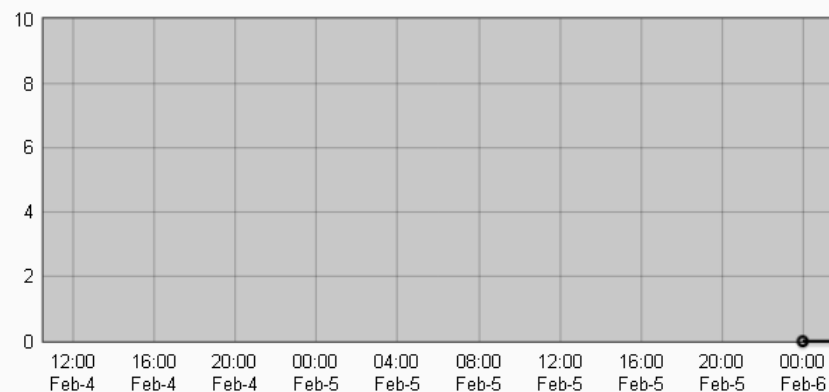
Visuals

Ash Reports

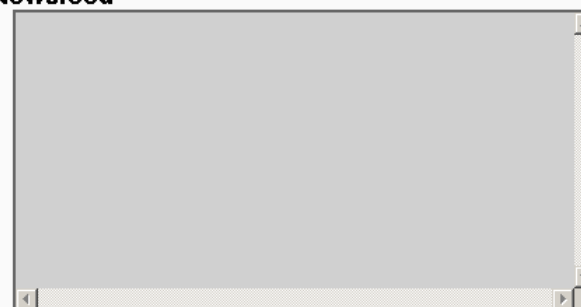
No. of Quakes



No. of Quakes {clipped to 10}

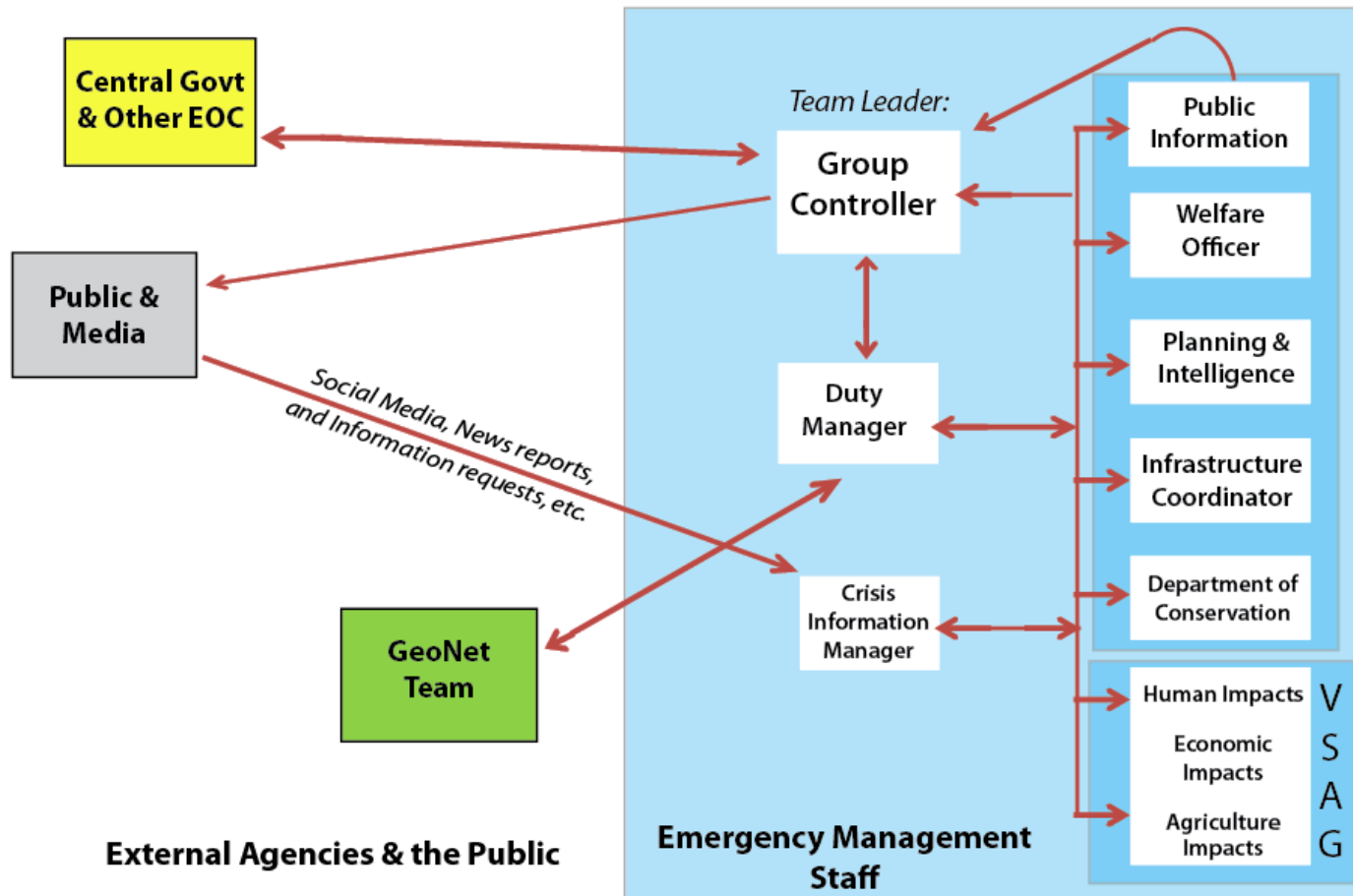


Newsfeed



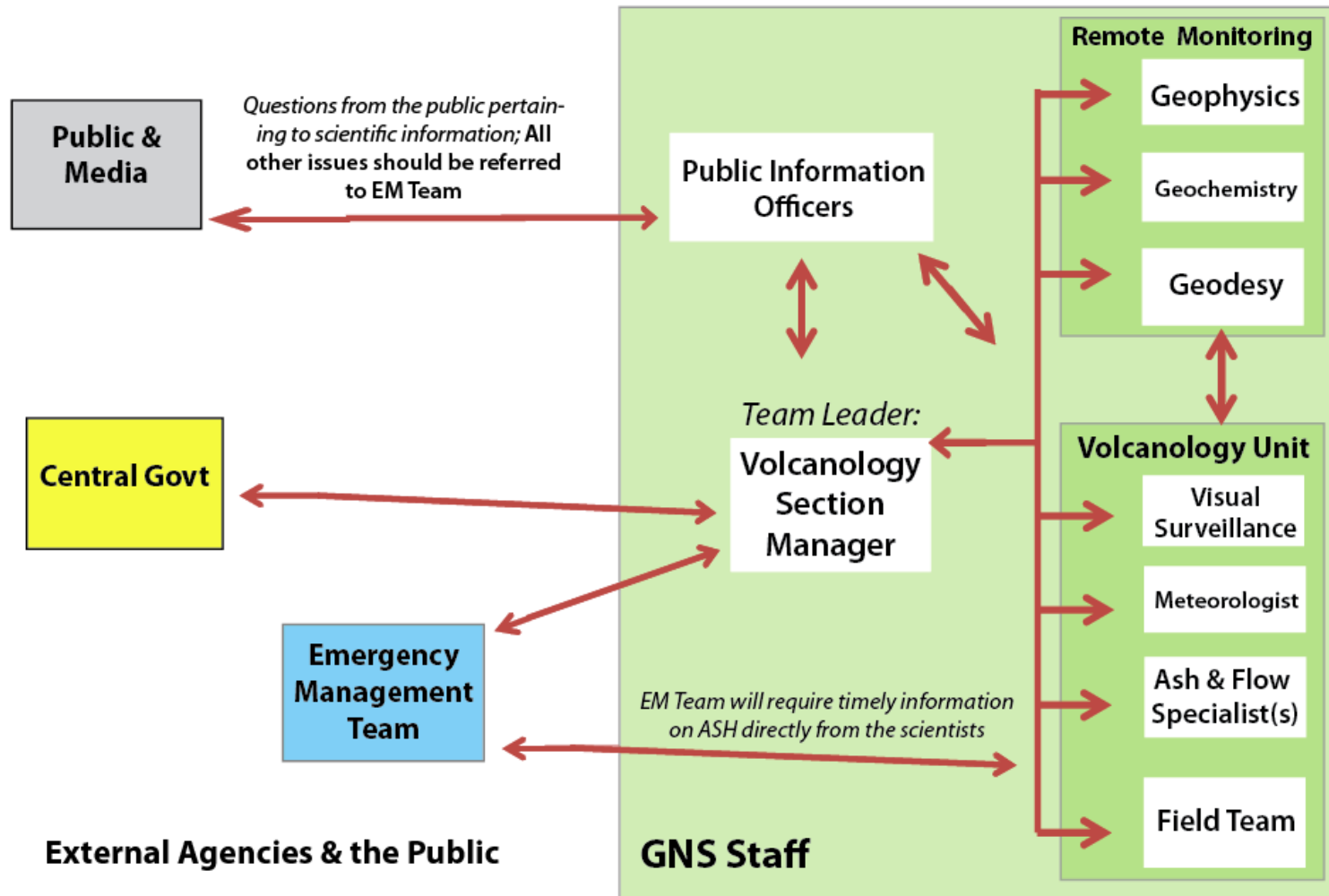
Flow of Information for the EM Team

Note: The direction of arrows represents the flow of information, from one party to another.

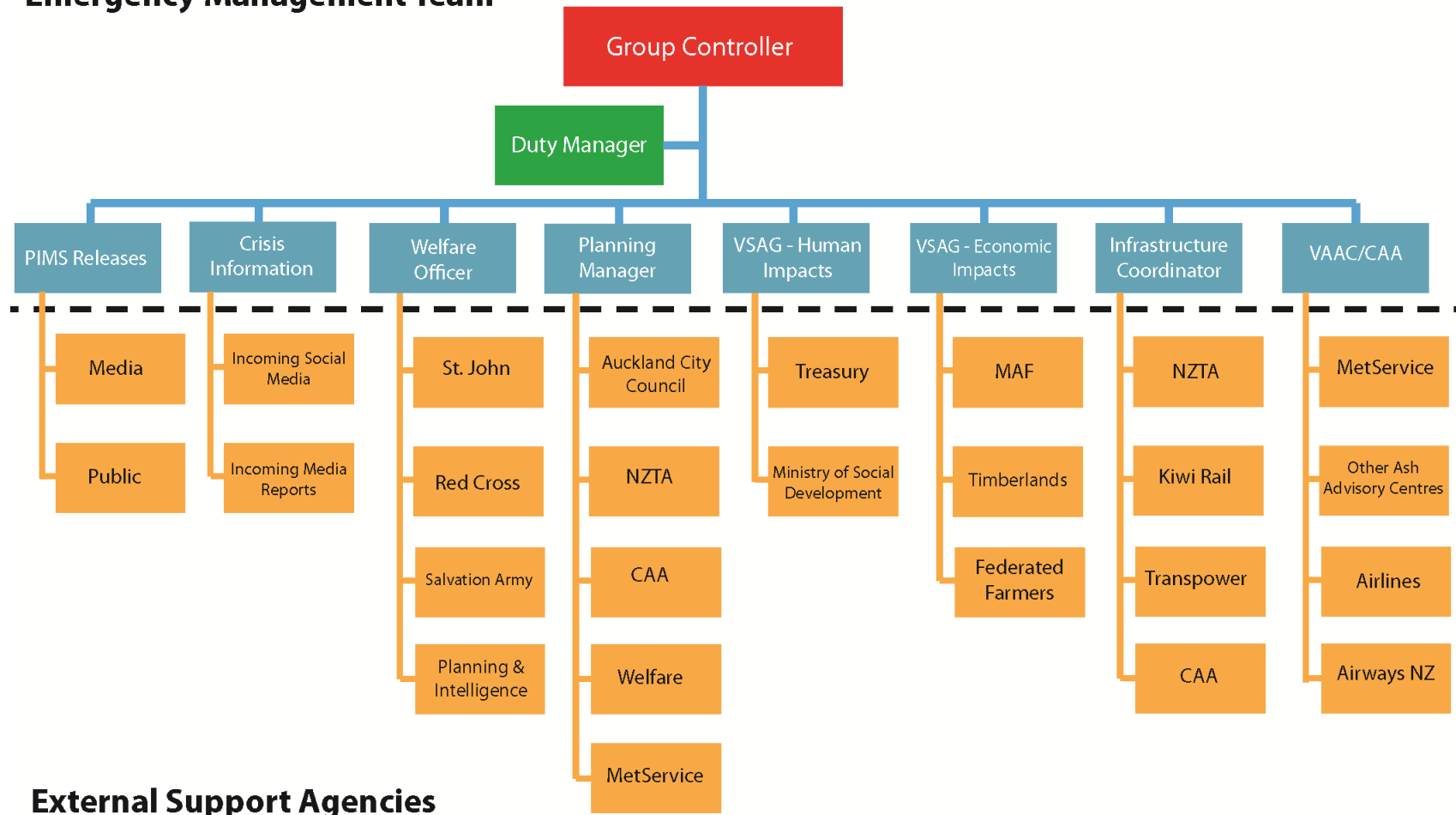


Flow of Information for the GNS Team

Note: The direction of arrows represents the flow of information, from one party to another.



Emergency Management Team



External Support Agencies

Overall Performance in the Volcanic Simulation Rubric

Student Name _____

The following standards describe your performance in this simulation. This is used to give you feedback about your performance and to help you improve in the future! *Instructor notes: Should check (with an x) the box for each category and tally up, for a final score out of 10. Half marks can be used.*

Standards	Exemplary (2 Marks)	Satisfactory (1 Mark)	Needs Major Improvement (0 Marks)	Your Score	Final Comments from Instructor:
Critical Thinking Skills	Student illustrated excellent use of critical thinking skills: utilizing: objectivity, thoughtful interpretations, and weighing all the options	Student illustrated good critical thinking skills with some minor mistakes in one of the categories (left)	Student did not illustrate good use of critical thinking skills and made errors such as being subjective, false interpretations, and/or failing to weigh all the options before making conclusions		
Written communication* <i>(Reports, Data logs)</i>	Written material made by the student are complete, accurate, and well written	Written materials are for the majority – complete, accurate, and well-written with some minor errors	Written materials are not complete, contains obvious errors, may not be easy to read or understand		
Oral communication* <i>(Press conferences and team discussions)</i>	Student communicates very well with the ‘public’ (avoids jargon) and within their team with efficiency, accuracy and professionalism.	Student communicates with ‘public’ and within their team efficiently, with minor errors, and a mostly professional attitude	Student communicates with ‘public’ and within their team poorly. Illustrating some inaccuracies, or displaying unprofessional attitudes or demeanors		
Collaborative Skills	Student illustrates excellent use of collaborative skills: brainstorming, sharing, debating and diplomacy	Student illustrates satisfactory use of collaborative skills with some minor problems	Student does not use collaborative skills well and had difficulty working in a team-setting		
Enthusiastic Participation	Student illustrated strong efforts to participate and enact their role during the simulation	Student illustrated a moderate level of participation and enacted their role mostly well during the simulation	Student illustrated a poor level of participation and did not make an effort to ‘get into’ their role.		

Reviewer _____

Grand Total _____ / 10