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:	**Emergency Managers:**
Alert Level Change Reports; Ash Dispersal Map (Isopach) Flow Dispersal Maps. Media Releases Fieldwork Risk Assessment	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
6. A general idea of what the GeoNet and Emergency Management professionals 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.

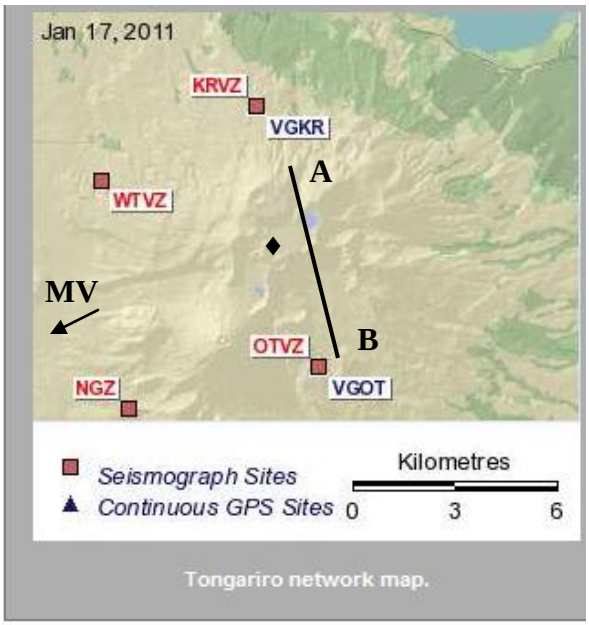
3. **Estimate** and **illustrate** the distribution of volcanic products (e.g. volcanic ash) based on the volume and style of activity in order to create volcanic hazard maps using geological and socio-political map data (i.e. geology map, geological history, and contoured topographic map).

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
d.) the public's concerns; during a simulated volcanic crisis.

GeoNet Team: Tongariro Monitoring Network and Measurements



A –B	Cross section, along which Deformation is calculated
♦	Volcano Cam, and Microphone Station
MV	Mangatepopo Valley Weather Station

Seismicity: 4 seismometers (KRVZ, WTVZ, OTVZ, and NGZ) report activity around the volcano. The reports given to you represent information about earthquake activity:
a. the **number** of quakes that occurred;
b. the maximum **magnitude** (~Richter scale, New Zealand Modified);
c. average **depth** (km); and
d. the **type** of quakes. The type of quakes reported include: **HF** (high frequency), **LF** (low frequency), **EX** (explosion signals) and **T** (tremor).

Gas Readings: CO_2 and SO_2 are both reported as weekly to daily measurements from the Volcano Cam site (diamond). Airborne surveys report an emission rate (tonnes/day) for SO_2 and CO_2.

Weather: Wind Direction (e.g., N – Winds coming from the North), Wind speed (Maximum reported km/hour), and Precipitation (mm). These data are remotely reported from a weather station located in Mangatepopo Valley (**MV**). Reported by New Zealand's MetService.

Deformation: (meters) **Deformation** is measured by calculating the present distance between two GPS located stations (VGOT and VGJR) (Line A-B, above), and assessing any changes from the last reading. 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: (µR) Microradians is the measure of extremely small angular distance. A increase in slope of the volcano is indicated by increasing values, while a decrease in values represents a decrease in the slope. Tilt is measured from the **VGOT** station and has a precision of 5-10 µR.

Visual Data: Webcam located near Red Crater which streams the visual information back to GeoNet. A microphone is also part of the same station. Views of Ngauruhoe are also possible from this location. In the event of an eruption, MetService reports the **Maximum Plume height** (in meters) recorded by satellites.

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*
Eruption	4	Moderate volcanic eruption	Eruption hazards on and near volcano*
Eruption	3	Minor volcanic eruption	Eruption hazards near vent*
Unrest	2	Moderate to heightened volcanic unrest	Volcanic unrest hazards, potential for eruption hazards
Unrest	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), tsunami, 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.**

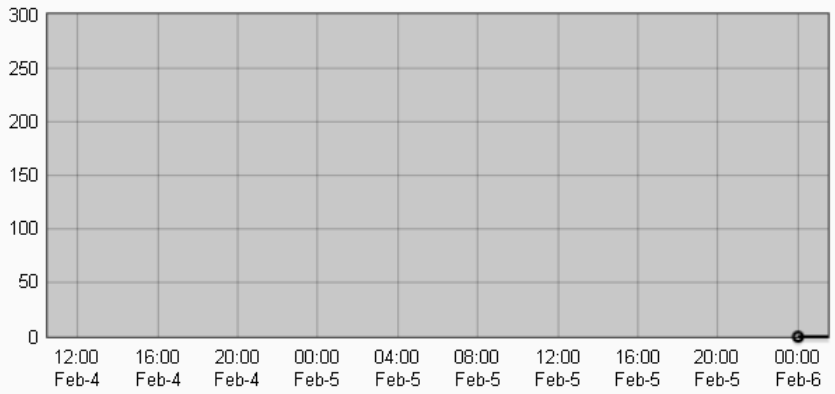
This system applies to all of New Zealand's volcanoes. The Volcanic Alert Level is set by GNS Science, based on the level of volcanic activity. For more information, see geonet.org.nz/volcano for alert levels and current volcanic activity, gns.cri.nz/volcano for volcanic hazards, and getthru.govt.nz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

UC Volcanic Hazards Simulation

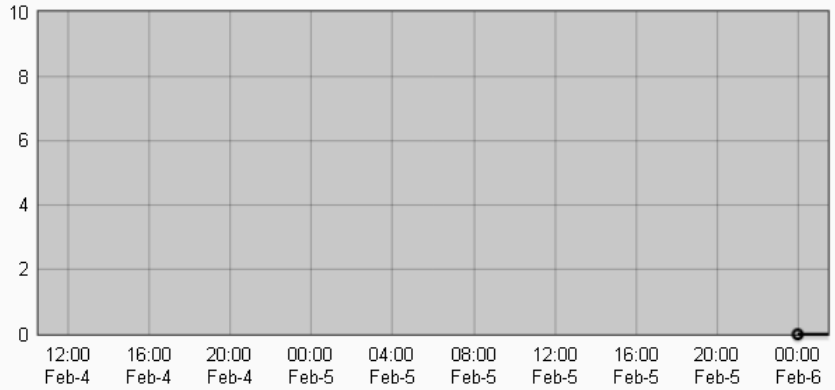
Time 00:00, Feb 6

Seismic 1 | Seismic 2 | Gas | Deformation | Weather | Visuals | Ash Reports

No. of Quakes



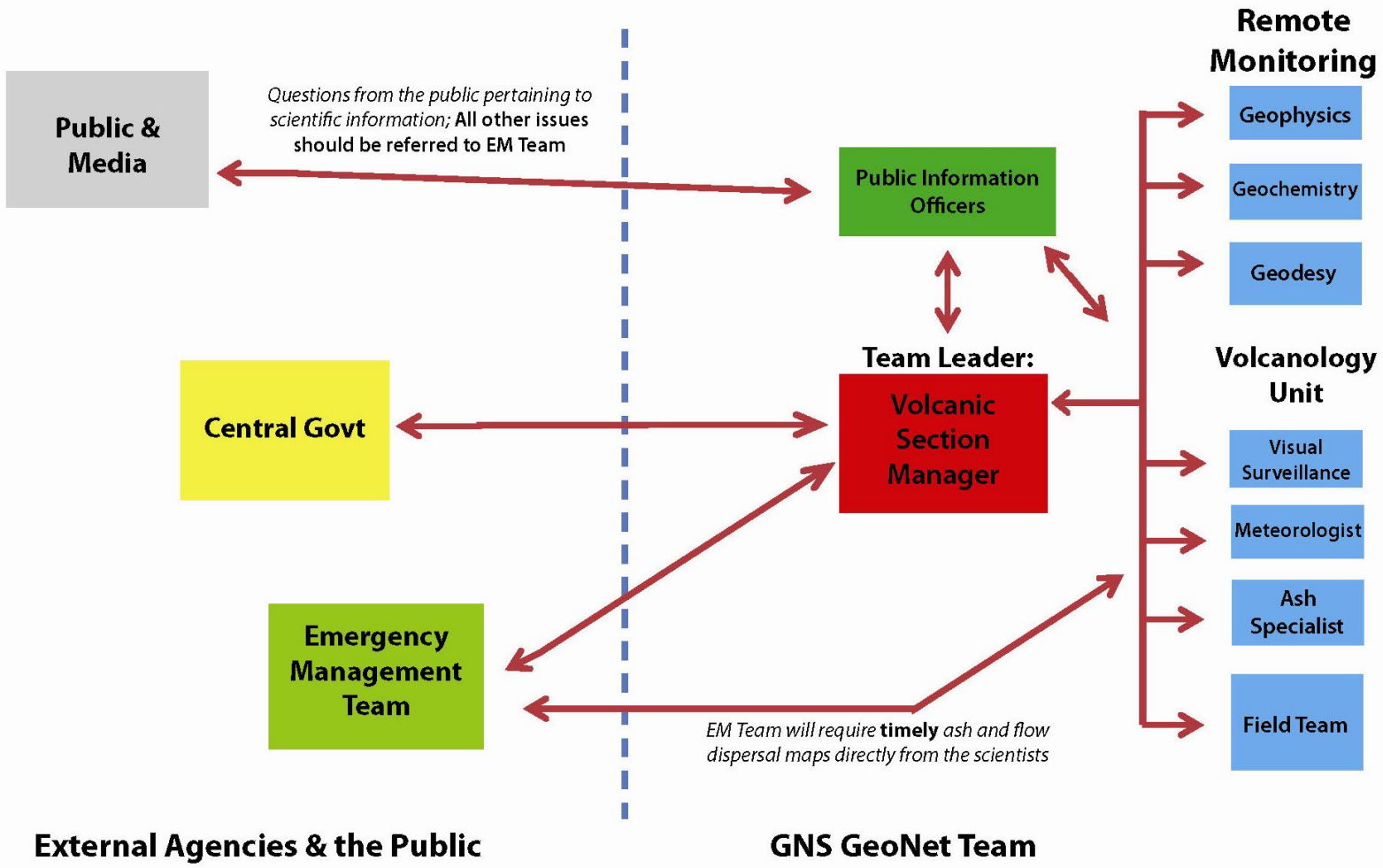
No. of Quakes {clipped to 10}



Newsfeed

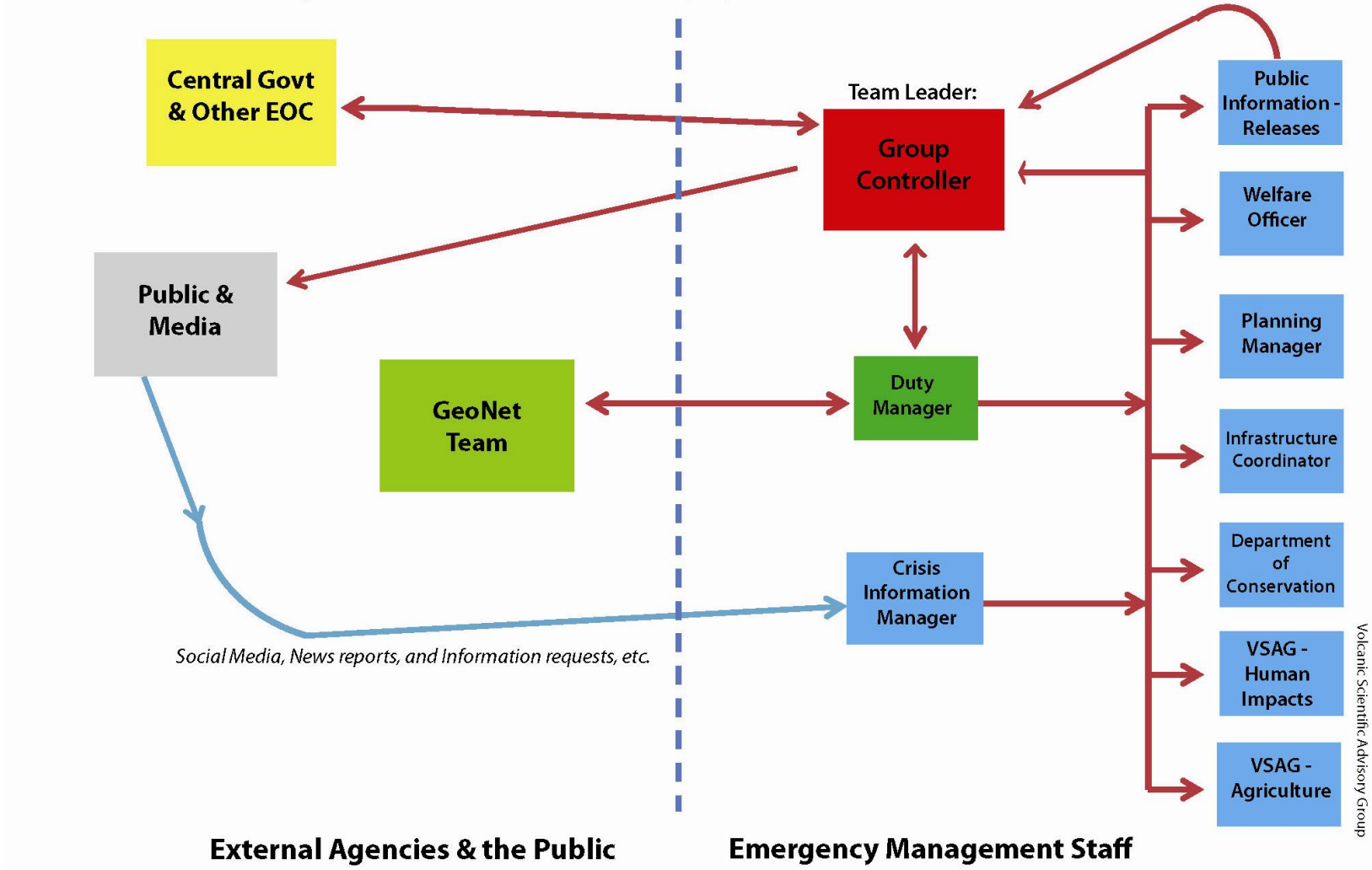
Flow of Information [GeoNet Team]

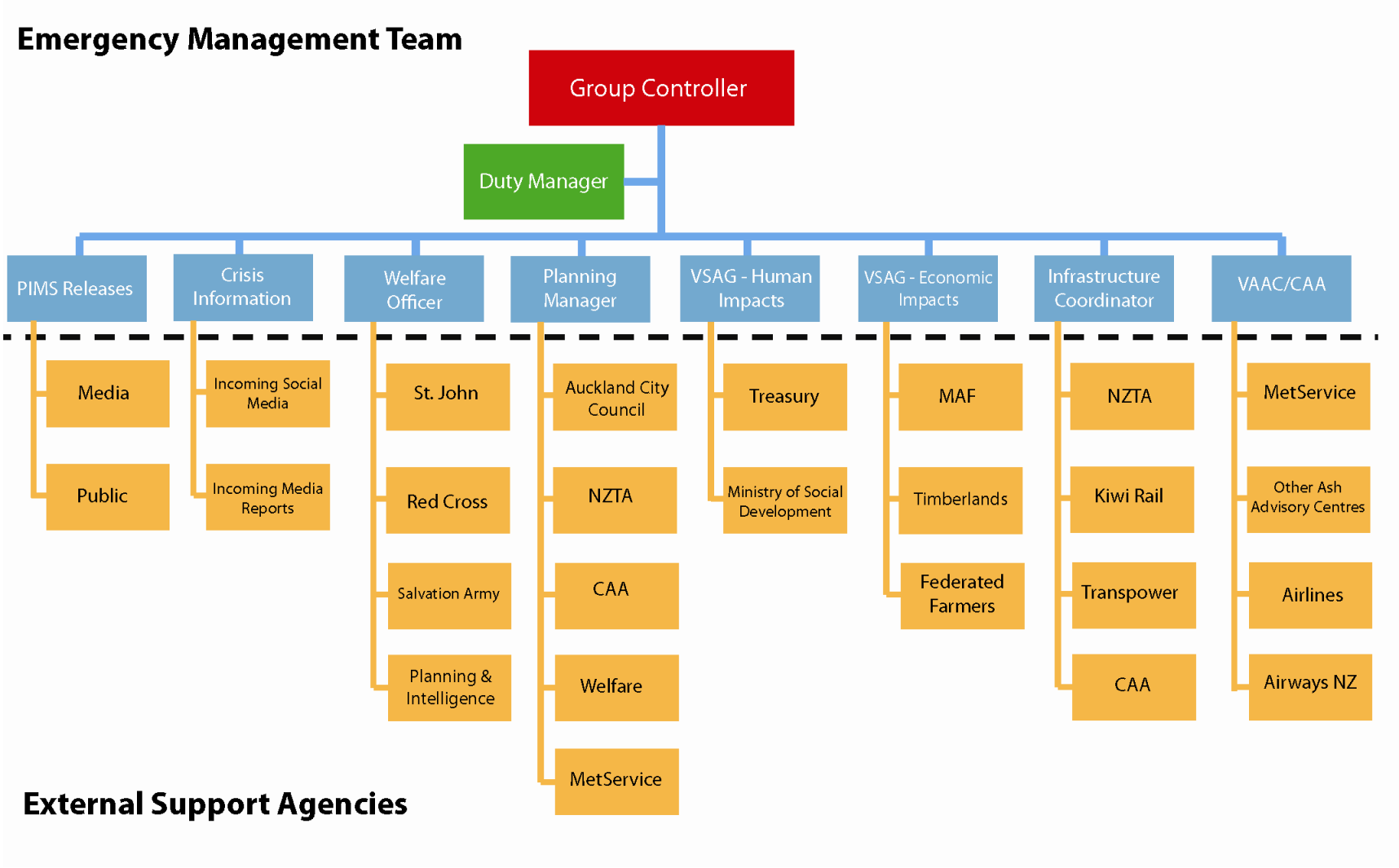
Note: The direction of arrows represents the flow of information, from one party to another.



Flow of Information [EM Team]

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




Emergency Management Team
Group Controller
Duty Manager
PIMS Releases
Crisis Information
Welfare Officer
Planning Manager
VSAG - Human Impacts
VSAG - Economic Impacts
Infrastructure Coordinator
VAAC/CAA
Media
Public
Incoming Social Media
Incoming Media Reports
St. John
Red Cross
Salvation Army
Planning & Intelligence
Auckland City Council
NZTA
CAA
Welfare
MetService
Treasury
Ministry of Social Development
MAF
Timberlands
Federated Farmers
NZTA
Kiwi Rail
Transpower
CAA
MetService
Other Ash Advisory Centres
Airlines
Airways NZ
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* *(Reports, Data logs)*	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* *(Press conferences and team discussions)*	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