NZ Comparative Study Programme:

Second Visit, April 2016

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GNS Science International Consultancy Report 2016/35

Strengthened Indonesian Resilience: Reducing Risk from Disasters (StIRRRD)

Universitas Gadjah Mada,
GNS Science International,
Ministry of Foreign Affairs and Trade (MFAT)
New Zealand Aid Programme

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BIBLIOGRAPHIC REFERENCE

Daly, MC; Fathani, TF, Glassey, PJ, Wilopo, W; Anantasari, E; Satyarno, I; Woods, R; Setianto, A; Retnowati, A. 2016. New Zealand Comparative Study Programme: Second Visit, April 2016. Lower Hutt (NZ): GNS Science. 26 p + 13 Appendices. (GNS Science international consultancy report 2016/35).

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EXECUTIVE SUMMARY

Twenty-Nine Indonesian delegates, from 4 District Emergency Management Offices and other district government departments, associated University staff and National Government representatives, took part in a 14-day Study Visit to New Zealand from 3–15 April 2016. The visit was part of the Strengthened Indonesian Resilience: Reducing Risk from Disasters (StIRRRD) programme supported by New Zealand AID and implemented by GNS Science and the Universitas of Gadjah Mada (UGM). The Objectives of this Comparative Study Visit were:

1. Introduce and expose delegates to New Zealand's risk reduction, disaster preparedness and management practices, and
2. Further develop and revise the district Disaster Risk Reduction (DRR) plans developed in workshops held in the districts, learning from and interacting with other districts.
3. Facilitate peer support and peer learning amongst districts and universities.

The programme included workshops and field visits in Auckland and Wellington. The workshop sessions were a mixture of presentations and discussion, including the District representatives presenting draft DRR Action Plans developed in workshops held in Indonesia prior to the Study Visit, and sessions to further review and modify these Action Plans.

A 4-day field trip to Hawkes Bay and Gisborne gave the participants an opportunity to see a variety of hazards in the region, and hear from local government staff the actions to reduce risk from these various perils. A visit to Muriwai Marae (Ngāi Tāmanuhiri) in Gisborne gave an opportunity to gain some Maori culture perspectives to hazards and Disaster Risk Reduction.

A two-day extension training in Wellington provided more technical learning for the university delegates. This training comprised a mixture of workshop presentations, discussion, a tour of GeoNet and an interactive RiskScape workshop. Examples of science and research activities that are influencing policy and planning, along with examples of multi-stakeholder, multi-funded collaborative research were given. A session was held at the Joint Centre for Disaster Research (JCDR) Massey, Wellington Campus, where University of Gadjah Mada staff presented on topics related to Indonesia.

A number of social and cultural events were included, such as a dinner at Auckland University of Technology, a reception and seminar hosted by NIWA, Wellington, and a reception at the Indonesian Embassy in Wellington. While in New Zealand UGM staff gave presentations at GNS Science Avalon, NIWA, and at the JCDR in Wellington.

The Study Visit was a success, as indicated in participant feedback, and in general the second visit was better organised than the first. Holding the event in April was a significant improvement from the first visit as there was more daylight and milder weather. The marae visit and interaction with Ngāi Tāmanuhiri was a highlight for many of the delegates. Catering still seems to be an issue as many Indonesian find New Zealand food not to their liking.

General Outcomes from the Study Visit included:

- The participants learnt about the involvement of the local/traditional community in DRR and how the government and the traditional community cooperate in managing disasters.
- The districts learnt from each other and through shared experiences. This is important to build the chemistry and relationship between the local government, the local House of Representatives and the university, as well as between regions.
- Each district gained in promoting DRR programmes by having a parliamentarian on the tour to engender support from the House of Representatives and other institutions.
- Central government was able to observe more closely the actual needs and problems of each region so that it can propose programmes in the regional action plans into the national programmes planned by the ministries.

Specific Outcomes from the Study Visit include:

- A commitment by the Director of Readiness for the National Emergency Management Agency (BNPB) to align the StIRRRD activities with the Risk index and demonstrate how the programme has reduced these districts risks.
- Commitment from head of Parliament, Seluma, to increase DRR budget.
- Ensuring Action Plans include building a map inventory in each district.
- The formation of relationships between Iwi and Indonesia and a commitment to participate in an exchange between Iwi and ethnic population in the Agam District provided funding application is successful.
- The formation of other project ideas such as
    - "It's my sisters' fault" to use the multi-stakeholder funded "It's Our Fault" Research Project in Wellington and transfer the concept to Central Sulawesi (Palu and Morowali).
    - Tsunami "Blue Line" concepts extended to Seluma and Agam coasts.
    - Engagement with Mining activities in Morowali and Sumbawa.
    - Risk modelling partnerships strengthened.
    - Concentrating on resilient small islands particularly for Morowali and extending it to Pesisir Selatan.

1.0 INTRODUCTION

The 14-day New Zealand Comparative Study Visit 2 was held from the 3-15 April 2016 as part of the StIRRRD (Strengthened Indonesian Resilience: Reducing Risk from Disasters) programme. StIRRRD is funded by New Zealand Aid Programme with the Universitas Gadjah Mada (UGM) and GNS Science partnering to implement the programme. The 5-year activity supports the Indonesian Government to reduce the impacts of natural disasters through increasing the disaster risk reduction (DRR) capability of local government and local universities. The Activity assists selected districts and their universities to understand their DRR issues and priorities, helps develop their capability to understand and capacity to manage these issues, and then to develop an action plan and implementation programme. A key part of this involves cementing relationships between local government and local universities who will develop teaching and research programmes in aspects of disaster risk management to support their local communities. The districts involved in the Activity will also provide peer support to each other on the learning journey (see StIRRRD.org).

Such a visit exposes the Indonesian delegates (Appendix 1) to a range of New Zealand risk reduction practices and also includes preparedness and disaster management aspects (e.g. a visit to an emergency operations centre). Draft Action Plans that were developed during preceding workshops will be revised, and participants asked to present their Plan back to the wider audience. The study visit enables input into each district's Plan from other district representatives and this peer support and peer learning aspect is a key feature of the entire Activity. It also enables the New Zealand participants to hear what is being implemented in Indonesia.

1.1 Training Objectives

The Objectives of the Comparative Study Visit are:

1. Introduce and expose delegates to New Zealand's risk reduction, disaster preparedness and management practices, and
2. Further develop and revise the district DRR plan developed in workshops held in the districts, learning from and interacting with other districts.
3. Facilitating peer support and peer learning amongst districts and universities

1.2 Pilot and Visit #1 Lessons

A Pilot programme was completed in 2012. The participants of the Pilot New Zealand Study tour expressed a high degree of satisfaction with the training including logistics. However, the following learnings were identified:

- The training was intense to ensure enough topics were covered in the time available. More free time could have been built into the programme to break the programme up, or accept a less intense programme with fewer topics.
- A few presenters covered topics in too much detail - 'less is more' in most circumstances.
- Translation should be built into future workshops.

- Some participants (BPBD) were interested in learning more about emergency management structures and how these processes worked in New Zealand. The focus of the training was on risk reduction and there wasn't enough time to cover response planning topics or emergency management in detail. Consideration could be made to provide this type of training (at another time) to complement the DRR focussed training.
- The benefit of on-going relationships developed during these visits was highlighted from the pilot study.

The first New Zealand Comparative Study Visit, as part of the main StIRRRD programme, was held in June (winter) 2015 which meant short daylight hours, potentially inclement weather for the field trips and very cold temperatures for the Indonesians. Having this second Study Visit in early April 2016, meant longer daylight hours and in general mild and settled weather.

The first study visit met or exceeded expectations and the visit was helpful or very helpful in the delegates work and resulted in changes to the DRR Action Plans. Some participants considered that there could be more time for discussions and questions, more rest time and there were specific suggestions made regarding improving the catering.

Feedback from the Pilot and the First Comparative visits were considered in logistics and adjustments to the programme made accordingly. However, some government delegates were not granted by their organisations the full 10 days to attend the Local Government component and had to return to Indonesia early.

1.3 Broad Outline of Programme

The Study Visit programme included presentations, discussion sessions and field trips, targeted at specific learning objectives identified during the preceding Action Plan workshops. Presenters were a mix of GNS staff, from local and central government, other crown research institutes, universities and the private sector. The workshops are designed to be interactive, with a mix of presentations, group discussion and problem solving. Most of the workshops had common content for all participants but with breakout sessions catering specifically for the diverse backgrounds of participants: government staff; politicians; and university. Organised functions and social events enabled interaction, development of relationships and the formation of peer groups. An overview of the visit is given in Appendix 2.

The programme for this visit included workshops in Auckland and Wellington (Appendix 3) as well as associated field visits (Appendix 5 and Appendix 6). A field trip to the Hawkes Bay and Gisborne (Appendix 7), intermixed with presentations from local government staff, gave the participants an opportunity to experience seismic and other hazards on a tectonic margin, and also gain some Maori culture perspective, with a visit to Muriwai Marae (Ngāi Tāmanuhiri). The two-day extension training provided more technical learning for the university delegates (Appendix 4).

1.4 Delegation

Delegates for the second visit of the New Zealand Comparative Study Program were invited from four districts and associated Universities, the central government, and UGM (see Table 1 and Appendix 1). The districts involved in this second New Zealand visit were Agam District, Seluma District, Morowali District, and Sumbawa District (Figure 1).

District representatives included various local government agencies (BPBD/the Regional Disaster Management Agency, Bappeda/the Provincial Development Planning Agency, Ministry of Home Affairs (MoHA), as well as parliamentarians from Seluma, Morowali and Sumbawa.

Figure 1 Location of StIRRRD districts involved in New Zealand Comparative Study Visit 2.

Selection of delegates from each institution was well considered. Prioritised delegates were those who had strategic positions in DRR activities in their respective regions and were actively involved in previous StIRRRD workshops (Introductory and Action Plan Workshop, DRR Seminar, Base-Isolation Training, RiskScape Training). Delegates from the local governments included Head of District BPBDs, Planning Department (Bappeda), Spatial Planning, and Head of Parliament. Unfortunately, the Head of Agam Parliament (DPRD) was not able to come.

Delegates from the associated local universities included staff from the Faculty of Engineering, University of Tadulako (UNTAD), Staff from the Disaster Study Centres at University of Bengkulu UNIB and Andalas University (UNAND), and from the engineering Faculty Mataram University (UNRAM).

The Delegates from central government included the Director of Preparedness BNPB (National Disaster Management Agency), the Head of the Disaster Management Section, Ministry of Home Affairs (MoHa) and the Head of Data and Information Management, Ministry of Rural, Development of Disadvantaged Regions, and Transmigration (Kemendesa).

The UGM delegation during this visit included the Project Director of StIRRRD, Project Adviser, province leaders and programme manager.

Table 1 List of Participants, New Zealand Comparative Study Visit 2, April 2016.

No	Name	Position	Institution
	Government		
1	Medi Herlianto	Director of Preparedness	BNPB
2	Aryo Wicaksono	Head of Data & Information Sub Division Kemendesa	KEMENDESA
3	Yoga Wiratama	Head of Disaster Management Section	MOHA
4	Bambang Warsito Saroji	Head of BPBD	BPBD, Agam District
5	Yunelimeta Asman Djannas	Head of Prevention and Preparedness Division	BPBD, Agam District
6	Azwardi Binap Pangkuak	Head of BPBD	BPBD, Seluma District
7	Husni Thamrin	Head of Parliament	Parliament, Seluma District
8	Julian Zuherwan Dain	Head of BAPPEDA	BAPPEDA, Seluma District
9	Yosar Kardiat	Head of BPBD Morowali	BPBD, Morowali District
10	I Wayan Sugita	Head of Spatial planning	Spatial Planning Agency of Morowali
11	Ambo Dalle Side Abbas	Head of Parliament	Parliament Morowali District
12	Mukmin	Head of BPBD	BPBD, Sumbawa District
13	Lalu Budi Suryata	Head of Parliament	Parliament Sumbawa District
14	Didi Sumardi Hamdan	Head of Parliament	Parliament Mataram City
	University		
1	Tesri Maideliza	Lecturer, Faculty of Biology	Universitas Andalas
2	Ade Sri Wahyuni	Lecturer, Faculty of Engineering	Universitas Bengkulu
3	I Ketut Sulendra	Lecturer, Faculty of Engineering	Universitas Tadulako
4	Ida Sri Oktaviana	Lecturer, Faculty of Engineering	Universitas Tadulako
5	Eko Pradjoko	Lecturer, Faculty of Engineering	Universitas Mataram
6	Yudhy Harini Bertham	Center for Natural Disaster	Universitas Bengkulu
7	Teuku Faisal Fathani		UGM
8	Iman Satyarno		UGM
9	Wahyu Wilopo		UGM
10	Esti Anantasari		UGM
11	Fransisca Ediningtyas Mahanani		UGM
12	Arry Retnowati		UGM
13	Agung Setianto		UGM
14	Gumbert Maylda Pratama		UGM
	Translator		
1	Zamira Eliana Tatapamang		Translator

2.0 PROGRAMME CONTENT

2.1 Local Government Training Component

2.1.1 Emphasis and Structure

The Local Government component of the Study Visit comprised a mixture of workshop presentations, discussion sessions, field trips, cultural and Action Plan sessions. A detailed programme is given in Appendix 3. Simultaneous translation was provided in the workshop sessions, and consecutive translation during field trip visits. Presentations were translated into Bahasa Indonesia before the visit and hard copies provided to the delegates along with a workbook containing the programme, logistics, speaker bios and relevant New Zealand cultural material.

The Local Government Training is designed to expose the Indonesian delegates to a range of New Zealand risk reduction practices, policies, guidelines and tools, but also includes preparedness and disaster management aspects (e.g. a visit to an emergency operations centre). Examples of science and research activities that are influencing policy and planning, along with examples of multi-stakeholder, multi-funded collaborative research are included, as are sessions to present, discuss and develop draft Action Plans that were developed during preceding workshops held in Indonesia.

Figure 2 Interactive discussion session.

The programme started in Auckland where learning objectives were developed and the National, District and University representatives given an opportunity to present on their particular DRR issues and actions. New Zealand, and its emergency management structure, was introduced. A field trip to Mt Eden and the Auckland Museum was followed by a session with Auckland University of Technology (AUT), and University of Auckland (UoA), and then dinner.

Presentations the next day focussed on risk reduction legislative tools in New Zealand, land use planning, hazards management in Auckland and a session focussing on volcanic hazards management. Delegates learnt that a suite of complementary reduction options are required to implement a comprehensive DRR approach. There was particular interest in how New Zealand local authorities can regulate development through a range of land use planning options. This session was followed by a visit to the Auckland Civil Defence and Emergency Management (CDEM) Coordination Centre. CDEM staff introduced delegates to New Zealand emergency management practices and presented on tsunami reduction activities being implemented in Orewa. Following this session, the group was transferred to Wellington.

The delegates then moved to Wellington for a local government perspective of DRR, field visits, Action Plan revision sessions, receptions and culture experiences. The final component involved a field trip to Hawkes Bay and Gisborne, and included presentations from local government staff involved in DRR initiatives and a cultural exchange with Maori in Gisborne, before the local government delegates left for Indonesia

2.1.2 Fieldtrips

The programme included two half-day field trips in Auckland and Wellington, and longer field trips/seminars in Hawkes Bay and Gisborne. The field trip guides are given in Appendices 5, 6 and 7. Several experts from different organisations and within GNS Science participated in the field trips to provide the benefit of their expertise and experience.

The field trips provided an opportunity for the participants to see some New Zealand hazards and impacts, as well as DRR initiatives, interact with different experts, further build relationships and gain cultural experiences.

Auckland fieldtrip (4 April 2016)

The first half-day field trip in Auckland (Appendix 5) started with a visit to Mt Eden summit to view the physiography and hazardscape of the city. An overview of the Auckland Volcanic Field was provided with some discussion on DRR options for future eruptions. Of note was discussion relating to the city's tsunami risk and similarities with many parts of Indonesia. This was followed by a visit to the Maori and Volcano displays at Auckland Museum where delegates were introduced to Maori culture and how Maori perceived hazards prior to European colonisation. The field trip ended at Auckland University of Technology where there were presentations on Indonesian DRR work at AUT and the University of Auckland, followed by dinner.

(a)

(b)

Figure 3 Photos from the Auckland field trip. (a) Mt Eden and (b) Auckland Museum

Wellington fieldtrip (8 April 2016)

The second half-day field trip in Wellington (Appendix 6) included a visit to the base isolation beneath the Wellington Hospital, an overview of the physical setting of Wellington, illustrations of community response to tsunami and coastal erosion in Island Bay.

Figure 4 Damage to Island Bay sea wall and the community response being explained by Nicci Wood (WCC) and Kate Crowley (NIWA).

(a) (b)

Figure 5 (a) Dan Neely (WREMO) explains the Tsunami Notice Board at Island Bay and (b) the Tsunami Safe Evacuation Zone (Blue Line) painted on Ribble St, Island Bay.

Figure 6 The delegates in the base-isolated Wellington Regional Hospital

Hawkes Bay/Gisborne fieldtrip (10–13 April 2016)

The four-day field trip to Napier and Gisborne began with a morning flight to Napier, followed by visits to Ahuriri Lagoon which was uplifted by the 1931 Napier earthquake (tectonic setting), Bluff Hill (landslide hazard), Te Awa subdivision (liquefaction), and a visit to Napier Museum to view a display on the 1931 earthquake. The next morning presentations were given on the East Coast Lab and Hawke's Bay Hazard Portal (websites for natural hazard information), and the Hawke's Bay Coastal Hazard Strategy. A short field visit was made to Haumoana to discuss issues associated with coastal erosion and impacts on houses (Figure 7). Lunch was at Te Mata Peak where participants had views over Hawke's Bay. In the afternoon further presentations were given on CDEM Group Planning and Risk Management, Tsunami Community Response Plans and Emergency Management. Dinner was held at a local Indonesian restaurant.

Figure 7 Delegates listen to Mike Adye (HBRC) explain how HBRC is dealing with the coastal erosion at Haumoana Beach.

The next day delegates were driven to Gisborne by bus, stopping on the way at Lake Tutira to hear about the 7000-year natural hazard record that has been identified in the lake sediments. The afternoon was spent at Muriwai Marae on the Gisborne Plains, where the Tour Party was hosted by Ngāi Tāmanuhiri (see 2.1.3). In the evening a presentation was made at the hotel on the Joint Management Agreement between Ngāti Porou (local iwi) and Gisborne District Council for co-management of land and water resources.

Figure 8 Group photo outside the Wharenui at Muriwai Marae of Ngāi Tāmanuhiri.

Figure 9 Prof Iman Satyarno (with guitar) leading the Indonesian waiata at Muriwai Marae.

The fourth day consisted of a field trip around the Waipaoa Catchment to see natural hazards and their management. These included coastal erosion, flooding and river aggradation, landslide and gully erosion. The emphasis of the day was on the effects of land use and land management, and especially the impact of tree planting, on hazards and risks.

Figure 10 Delegates listening to Mike Marden (Landcare Research) explain how forestry has helped to reduce gully erosion in the Mangatu forest, at the head of the Waipaoa catchment.

Our sincere thanks to the following who contributed to the success of the field trips: Kate Crowley (NIWA), Richard Sharpe (Beca), Dan Neely (WREMO), Nicci Woods (WCC) Mike Page, Brenda Rosser, Phaedra Upton, Diane Bradshaw (GNS Science), Jon Kingsford, Marcus Hayes Jones (Napier CC), Lisa Pearse, Mike Adye, Jae Sutherland (HBRC), Ian MacDonald (HB CDEM Group Controller), Louise Bennett, David Wilson, Kerry Hudson (GDC), Mike Marden (Landcare Research), Dave Peacock (Consultant), Joe McLeod (Te Piringa O Te Awakairangi), Pia Pohatu (Ngāti Porou), Jody Toroa (Ngāi Tāmanuhiri), Gus Spence (Wi Pere Trust), Adam Taylor-Eruera (Auckland Museum), Auckland Council, Keith Suddes (Auckland CDEM), Emma Hunt (Auckland CDEM).

2.1.3 Cultural and Social Activities

NIWA (Wellington) hosted a reception which included several invited guests from the Geoscience and Geotechnical societies and the Natural Hazards Cluster on the evening of 6 April. An outline of the StIRRRD programme and achievements to date was given, along with a guest lecture by Project Director, Dr Faisal Fathani from UGM on Landslide Early Warning Systems and ISO Accreditation.

A reception was held at the Indonesian Embassy, Wellington on the evening of Thursday 7 April (see section 4 and Appendix 12).

As part of the Hawke's Bay/Gisborne field trip, the Study Tour party was hosted by local Gisborne iwi Ngāi Tāmanuhiri on their marae at Muriwai on 12 April. This provided an opportunity to gain some Maori culture perspectives on natural hazards and Disaster Risk Reduction. The visit commenced with a Powhiri, followed by a visit to the Wharenui, and presentations by iwi, Indonesian delegates, and GNS Science on natural hazards and the StIRRRD programme. The tour party was then taken on a "walkabout" to see local impacts of natural hazards, followed by dinner and Ngāi Tāmanuhiri and Indonesian singing (Figure 9).

Later that night at the hotel Pia Pohatu from Ngāti Porou (the iwi north of Gisborne) and David Wilson from GDC gave a joint presentation on the recently signed Joint Management Agreement between the iwi and the Council to co-manage land and water resources in the Waiapu Catchment. This agreement is a New Zealand first which will see iwi given equal rights and responsibility in resource management. This visit gave UGM and BNPB staff an opportunity to meet with iwi members of the proposed Vision Matauranga project that will visit Indonesia to exchange indigenous knowledge and experiences of natural hazards. Discussions were held on a proposed itinerary to visit Agam Regency/District.

2.2 Extension Training Component

An extension workshop was held for the university participants of the study visit on Thursday 14 and Friday 15 April, and was more technically focussed than the Local Government workshop. The extension workshop programme is given in Appendix 4. As most of the participants had excellent English, there was no simultaneous translation of the workshop. However consecutive translation was provided as required. As with the local government session the delegates were provided a workbook and the presentations translated into Bahasa Indonesia. The presentations were nominally 20 minutes with 10 minutes allowed for questions and discussion

The extension training comprised a mixture of workshop presentations, discussion sessions, a tour of GeoNet and an interactive RiskScape workshop. In addition, a session on Risk Language was held at the Joint Centre of Disaster Research (JCDR) at the Massey University Campus, Wellington, which included presentations by JCDR staff, a short reception, presentations by Dr Esti Anantasari and Dr Arry Retnowanti to the EsocSci communication research and natural hazards network, followed by dinner. These sessions stimulated excellent discussion.

Examples of science and research activities that are influencing policy and planning, along with examples of multi-stakeholder, multi-funded collaborative research were given by GNS Science staff and external speakers from Beca and NIWA.

A lunchtime seminar was held at GNS Science and a presentation given to GNS Staff on aspects of hazards research at UGM, and an update on the progress of the StIRRRD programme.

Figure 11 The extension training team at GNS Science.

Figure 12 Presenters at the JCDR Risk Communication session. Clock wise from left: Dr Emma Husdon-Doyle, Dr Julia Becker, Associate Professor, David Johnston and Dr Arry Retnowati.

Figure 13 Delegates and guests interact at the JCDR reception and dinner.

Figure 14 Discussion at the extension workshop session.

Figure 15 Mostafa Nayyerloo, Kate Crowley and Nico Fournier (left) providing instruction for the interactive RiskScape session (right).

GNS Science staff were invited to morning and afternoon teas during the extension training held at GNS Science Avalon office which provided many opportunities to socialise.

2.3 Training Materials and Communications

Workbooks, containing a welcome to New Zealand, detailed programmes, speaker bios, short papers and relevant training material, were provided to the delegates for the local government training and for the Extension training. Field trip guides were also provided. A USB stick was provided to each delegate that included:

- Workbooks for both the local government training and the extension training
- Presentations from both trainings translated into Bahasa Indonesia where possible.
- Field Trip Guides
- Action plans for each district
- Photos provided by Ken George
- Additional material provided by organisations and presenters during the visit
- Summary notes from each day for the Local Government programme

The delegates were provided with a woollen hat, sleeveless Polar Fleece and a back pack. A video featuring the Hawkes Bay/Gisborne component covers many aspects of the Study Visit and includes interviews with delegates. Blogs were posted on the StIRRRD website

(StIRRRD.com) and posts made on Twitter and Facebook. Duncan Graham from the Jakarta Post, interviewed a number of people from the programme and delegates and an article was published in the paper on 19 April 2016.

3.0 ACTION PLAN DEVELOPMENT

3.1 Process Overview

A representative from each district was asked to present the status of the draft Action Plans developed in prior Action Plan workshops held in the districts. Following workshops sessions, and towards the end of the programme the district groups and associated University representatives modified Action Plans and then reported back. Government representatives commented on the Action Plans. The Action Plans will be finalised in subsequent workshops held in the districts, before being presented to district parliaments.

3.2 Action Plan Highlights and Further Work

3.2.1 Morowali

The Morowali DRR draft Action Plan (Appendix 8) was revised to incorporate more community engagement and to try and get private sector involved in DRR activities during the New Zealand Visit. Through the New Zealand comparative study, the participants from Morowali, namely the Head of BPBD and the Head of Parliament received knowledge on DRR programmes/technologies that can be applied in Morowali area.

Morowali District is newly established and is prone to many natural hazards, i.e. tsunami, flood, landslide, and earthquake. The two main hazards in Morowali are earthquake and tsunami. More attention to these two hazards has been made after the BPBD became aware that Morowali lies atop an active fault and this is now reflected in their action plan. One of the programs in their action plan is the development of a micro-zonation map. More attention has been given to flood and landslide which are annual hazard events.

One thing yet to be established in Morowali is the legal umbrella for the implementation of disaster risk reduction. Up to now, there are no regulations on disaster risk reduction in place. The government of Morowali is aware of this and therefore they have allocated funding for the development of the regulation this year.

After the New Zealand Comparative Study, the government of Morowali realized that community involvement in DRR is needed in order to make sure that the program is implemented successfully. As a result, all future programs will involve the community.

Morowali's draft Action Plan includes the development of a Corporate Social Responsibility (CSR) fund to promote private sector investment in DRR initiatives. Many mining companies operate in Morowali; however, they have never been involved in any DRR program initiated by the local government.

3.2.2 Sumbawa

As a result of the New Zealand Study Visit presentations, many changes are needed in the Sumbawa DRR draft Action Plan (Appendix 9).

a. The need for legal framework on DRR activities in Sumbawa by drafting local regulations related to disaster management activities.
b. The need for socialization to community and government staff about local regulations related to disaster management to achieve the same understanding.

c. Mapping the potential financing alternatives for DRR activities of the non-governmental funding sources.
d. Making and installation of signs for evacuation based on the types of hazards by involving local communities.
e. The establishment of the Disaster Preparedness School with a target of two schools each year.
f. Establish Data Center of Logistics and Operations of the BPBD Sumbawa to accelerate the handling of the disaster.
g. Increase the capacity of staff BPBDs and SKPD in analyzing the disaster risk

3.2.3 Agam

The Agam delegates included representatives from the BPBD and Andalas University. As a result of the discussions there are some revisions to the Agam DRR draft Action Plan as follows:

a. Adding the action plan activities and budget from previous year (2015), and activities conducted or planned in 2016 during the designated action plan supported by StIRRRD program.
b. Strengthening inclusive groups based on local characteristics or local knowledge, e.g. coastal and inland people are quite different culturally and socially.
c. Strengthening the cooperation between local University (Universitas Andalas) and BPBD Agam, e.g. signing MoU.
d. Optimizing funding related to research from Universitas Andalas
e. Introduce and disseminate any programs of BPBD Agam to local universities
f. Designated cooperation between experts and local government, e.g. building research forum.

3.2.4 Seluma

The Seluma DRR draft Action Plan (Appendix 11) has changed significantly as a result of the New Zealand Visit. The participants from head of BPBD, Head of Parliament, Head of District Development Plan Agency (BAPPEDA) and University of Bengkulu collectively had input to develop a more comprehensive Action Plan. Important changes to the Action Plan include

a. More emphasis on the non-structural DRR activities such as DRR dissemination to community,
b. Evacuation drills including how to best utilise the existing vertical shelter, and
c. Updating tsunami risk map and landslide risk map.

The Head of Parliament also pushed the BPBD to coordinate with all stakeholders related to disasters, especially the Public Works Agency to repair all the roads which are used during evacuation, for example. The Head of Parliament also gave a commitment to support the budget for DRR activity from BPBD action plan. In order to finalize the action plan and ensure good coordination, they will continue to have regular meetings after the New Zealand study and include all related stakeholders.

3.3 Summary

Participation of various BPBDs, Parliament, BNPB, MoHA, Kemendesa as well as the University was highly effective in synchronizing the disaster risk reduction activities and in influencing plans. Training in New Zealand provided new, important knowledge about disaster risk reduction which the districts will include into Action Plans and attempt to apply, such as the Tsunami blue line. In addition, they also exchanged experiences on disaster risk reduction activities in their respective regions which highlighted other areas that had been overlooked, such as the regional regulations (Peraturan Daerah/PERDA) concerning disaster management.

However, some action plans still cover too many activities and have not been focused on disaster risk reduction activities. Hence, there is the need for simplification based on the available time, resources, and funds. Before the action plan is executed, it requires a final discussion to confirm the proposed activities and to standardize the monitoring and evaluation system.

4.0 INDONESIAN EMBASSY FUNCTION

A reception for the delegates and invited guests was held at the Indonesian Embassy in Wellington, hosted by the ambassador Jose Tavares. Guests included other key staff from GNS Science, representatives from Wellington City Council (Mayor Celia Wade), and members of the New Zealand Indonesian Council (see Appendix 12 for guest list).

Figure 16 Participants at the reception at the Indonesian Embassy, Wellington New Zealand.

The reception included a performance by Padhang Moncar, a traditional Indonesian Gamelan music group based in Wellington and a short speech by Megan Collins on the use of music in relating disaster history from a west Sumatra perspective.

Figure 17 Megan Collins and Padhang Moncar, a traditional Indonesian gamelan music group perform at the Embassy reception.

5.0 IMPACTS

Summary of Impacts resulting from the Study Visit.

- The delegates from the local and central governments were shown how to build cooperation between the relevant institutions in DRR, the schemes used, the coordination methods, as well as the advantages and problems in the implementation of DRR activities.
- The delegates saw first-hand the disaster risk reduction activities, such as the implementation of base-isolation building assessment and regulation, assessment of areas that are vulnerable to landslide-flooding-erosion and the management of such areas, liquefaction maps, tsunami evacuation maps, blue line for tsunami, etc.
- The participants also gained knowledge about the involvement of the local/traditional community in DRR and how the government and the traditional community cooperate in managing disasters.
- The participants gained an understanding of the role of universities, research institutions, and study centres in supporting the government in relation to DRR, as well as the coordinated projects applied in New Zealand.
- Each district was able to learn from each other and share their experiences. This is important to build the chemistry and relationship between the local government, the local house of representatives, the university as well as interregional relationships. Learning from the New Zealand visit, each district gained confidence in promoting DRR programmes with support of the house of representatives and other institutions (aside from BPBD).
- The central government was able to observe more closely the actual needs and problems of each district so that it can propose programmes into the relevant national programmes. It can now revise the focus of its activities to StIRRRD target areas.

Specific Outcomes from the Study Visit include:

- A commitment by the Director of Readiness for the National Emergency Management Agency (BNPB) to align the StIRRRD activities with the Risk index and engage UGM to demonstrate how the programme has reduced these districts risks.
- Commitment from the Head of Parliament, Seluma, to increase the DRR budget.
- The formation of relationships between Iwi and Indonesia and a commitment to participate in an exchange between iwi and ethnic population in the Agam District, dependent on a successful funding application to Vision Matauranga.
- The formation of Community project ideas such as
- “It’s my sisters’ fault” to use the multi-stakeholder funded “It’s Our Fault” Research Project in Wellington and transfer the concept to Central Sulawesi (Palu and Morowali).
- Tsunami “Blue Line” concepts extended to Seluma and Agam coasts, particularly the community engagement/consultation component.
- Engagement with Mining activities in Morowali and Sumbawa, including catchment management initiatives.

- Risk modelling partnerships, and in particular focussing on collecting the data required, which can be utilised for a number of other government department functions.
- Concentrating on creating resilient small islands communities particularly for Morowali and extending it to Pesisir Selatan as appropriate
- Ensuring Action Plans include building a map inventory in each district.

6.0 EVALUATION

6.1 Post-Workshop Evaluation Survey

Post workshop evaluation questionnaires were completed by the participants of the Local Government training and the extension workshops. The Survey was completed by 23 of the participants. The questionnaires and detailed results are given in Appendix 13. In general, the Comparative Study visit programme met or exceeded expectations and the visit was helpful or very helpful in their work and resulted in some to many changes to the DRR Action Plans.

6.1.1 Local Government Evaluation

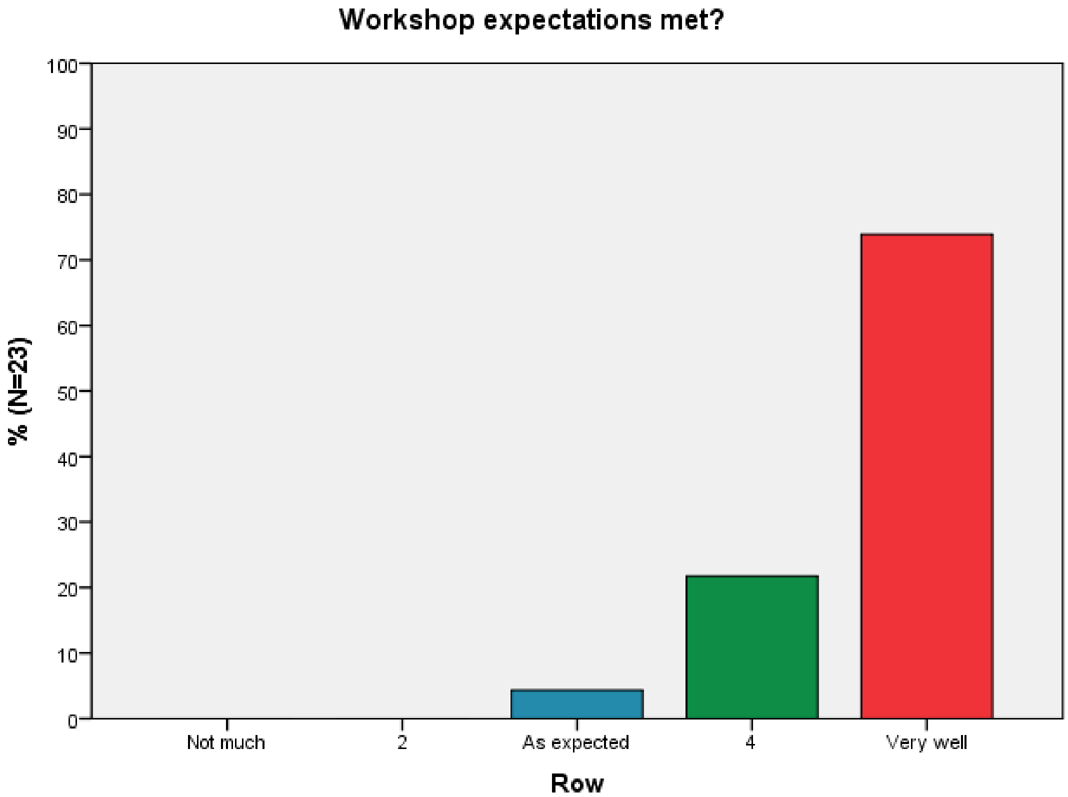

Figure 18 Graph of delegates expectations of New Zealand Comparative Study Visit.

In general, the participants seemed pleased with the logistics of the visit, but as for the first visit, some aspects of the catering needed improvement.

6.1.2 Extension workshop evaluation

The evaluation survey indicated that the extension training met or exceeded expectations (Figure 19). Most thought that it added significantly to the local government workshop and was most helpful for their work. The results indicate that there was sufficient discussion time and the logistics in general were of high quality.

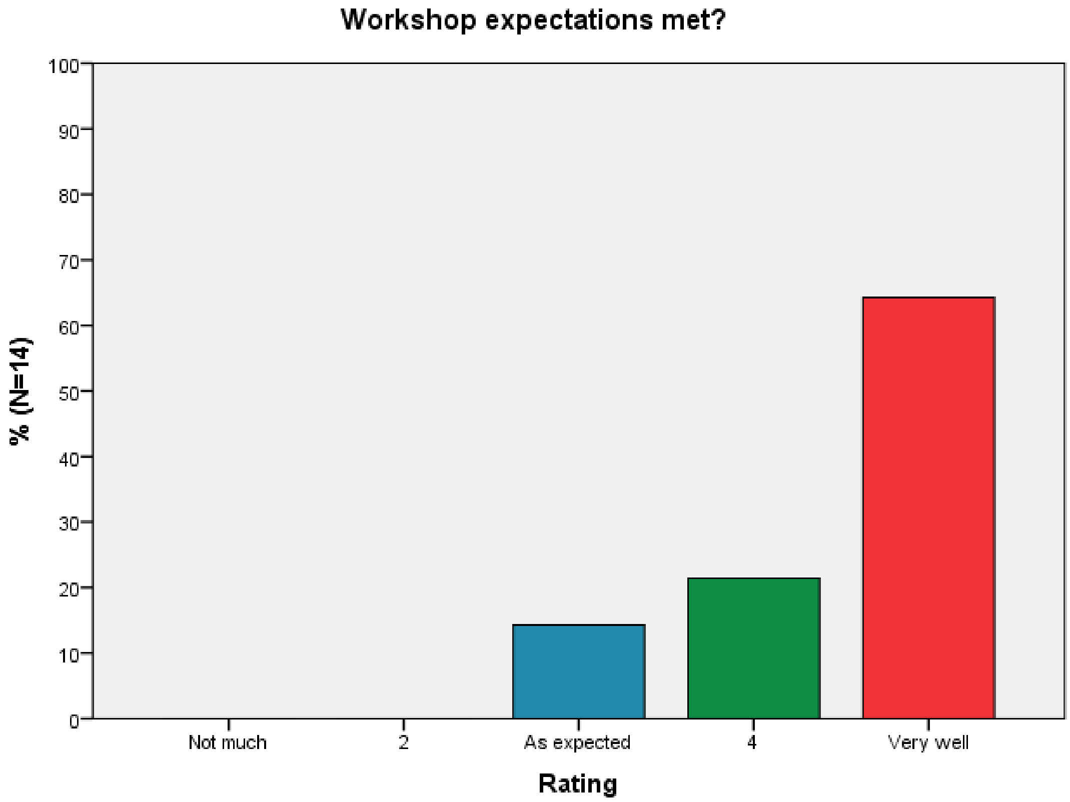

Figure 19 Graph of extension workshop expectations.

6.2 Team Debriefs

The GNS StIRRRD team had a debrief of the visit one week following, and in addition a further debrief was held as part of a joint team project management meeting, two weeks after the visit. Feedback was also sought from Janet George and Sylvia Riches (GNS Science — StIRRRD), the event organisers for the tour.

In general, Comparative Study Visit 2 was extremely successful. Having the Visit in April rather than June meant longer daylight hours and more pleasant weather and tolerable temperatures for the delegates.

In general, Districts that had parliamentary delegates had stronger discussions and input into Action plans.

The Indonesian Embassy functions and Marae visit in Gisborne were well appreciated by the delegates. The Indonesian singing was excellent and they formed an affinity with iwi members.

The time for some delegates to get approval to attend the visit and then get visas and passports, meant that despite identified early candidates there were late visas applications and travel booking difficulties. Some delegates were only given approval for 1 week and therefore had to cut short their participation in the programme

There was less concern about translation and translators this visit compared with the first visit. UGM did much of the written translation of presentations prior to visit and the two translators providing simultaneous and consecutive translation on the tour were experienced with the material being presented.

UGM staff with good English also presented in Bahasa Indonesian as appropriate and provided translation in the sessions, and translation on field trips to convey technical content, as required. Only one translator was retained for the extension training as many of the University delegates have good English, and the programme was relatively short.

The hotel and workshops venues in Auckland and Wellington were good but the delegates thought the catering could be better.

Fieldtrip lunches were only just adequate. Toilet stops and breaks need to be better planned into the field trips. It was difficult to provide hot drinks on the field excursions as recommended from previous visits. The hats and fleece vest were far more appropriate and adequate for the time of the year for the Indonesians

Where possible, overnight flights to Singapore/Jakarta were booked so that the participants didn't have to spend a night in Jakarta to get back to home districts. However, this wasn't possible for all.

APPENDICES

APPENDIX 1: LIST OF ATTENDEES

StIRRRD NZ Comparative Study Programme: 3-16 April 2016

List of Participants

No	Name	Sex	Institution	Position
Government				
1	Medi Herlianto	M	BNPB	Director of Preparedness
2	Aryo Wicaksono	M	KEMENDESA	Head of Data and Information sub-Division Management
3	Yoga Wiratama	M	MOHA	Head of the Disaster Management Section,
4	Bambang Warsito Saroji	M	BPBD of Agam District	Head of BPBD
5	Yunelimeta Asman Djannas	F	BPBD of Agam District	Head of Preparedness, BPBD
6	Azwardi Binap Pangkuak	M	BPBD of Seluma District	Head of BPBD
7	Husni Thamrin	M	Parliament of Seluma District	
8	Julian Zuherwan Dain	M	BAPPEDA of Seluma District	Head of Spatial Planning
9	Yosar Kardiat	M	BPBD of Morowali District	Head of BPBD
10	I Wayan Sugita	M	Spatial Planning Agency of Morowali	
11	Ambo Dalle Side Abbas	M	Parliament of Morowali District	
12	Mukmin	M	BPBD of Sumbawa District	Head of BPBD
13	Lalu Budi Suryata	M	Parliament of Sumbawa District	
14	Didi Sumardi Hamdan	M	Parliament of Mataram City	
Universities				
15	Yudhy Harini Bertham	F	Universitas Bengkulu	Center for Natural Disaster
16	Ade Sri Wahyuni	F	Universitas Bengkulu	Lecturer, Faculty of Engineering
17	Tesri Maideliza	M	Universitas Andalas	Lecturer, Faculty of Biology
18	Eko Pradjoko	M	Universitas Mataram	Lecturer, Faculty of Engineering
19	I Ketut Sulendra	M	Universitas Tadulako	Lecturer, Faculty of Engineering
20	Ida Sri Oktaviana	F	Universitas Tadulako	Lecturer, Faculty of Engineering
UGM				
21	Faisal Fathani	M	UGM	)
22	Iman Satyarno	M	UGM	)
23	Wahyu Wilopo	M	UGM	)
24	Agung Setianto	M	UGM	) StIRRRD Team
25	Esti Anantasari	F	UGM	)
26	Arry Retnowati	F	UGM	)
27	Fransisca Ediningtyas Mahanani	F	UGM	)
28	Gumbert Maylda Pratama	M	UGM	)
29	Zamira Eliana Tatapamang	F	UGM	Translator

National Agencies
BNPB = Badan Nasional Penanggulangan Bencana (National Disaster Management Agency)
BAPPENAS = Badan Perencanaan Pembangunan Nasional (State Ministry for National Development Planning)
Kemendesa = Pembangunan Daerah Tertinggal dan Transmigrasi (State Ministry for Rural Development of Disadvantaged Regions and Transmigration)
MoHA = Ministry of Home Affairs

Universities
UGM = Universitas Gadjah Mada, Yogyakarta, Java
UNAND = Andalas University, Padang, West Sumatra
UNTAD = Tadulako University, Palu, Central Sulawesi
UNRAM = Mataram Univeristy, Mataram, Nusa Tenggara Barat
UNIB = Bengkulu University, Bengkulu City, Bengkulu

Location Map

APPENDIX 2: PROGRAMME OUTLINE

StIRRRD New Zealand Comparative Study Programme – Disaster Risk Reduction

Auckland, Wellington, Napier, Gisborne 3—16 April 2016

Overview

Date	*Location*	*Indicative programme*
Friday 1 April - Saturday 2 April 2016	Delegation leaves Indonesia	
Sunday 3 April 2016	Indonesia Delegation arrives Auckland	Arrive at midday on flight from Singapore Transfer to hotel
Monday 4 April 2016	Auckland	Classroom • Introductions/ Objectives • NZ Overview and Introduction to Emergency Management • Indonesian Action Plan presentations Mt Eden summit and Auckland Museum (volcano and Maori displays) Auckland University of Technology (AUT) hosted meeting with Auckland based Indonesian students

Tuesday 5 April 2015	Auckland
	
	Auckland to Wellington
		Classroom
		• NZ and Auckland context continued
		  o Legislation and land use planning
		  o Hazards and risks in Auckland
		• Volcano Hazards
		
		Auckland City Emergency Coordination Centre
		
		Late afternoon flight to Wellington

Wednesday 6 April 2016	Wellington	Classroom • Tsunami (preparedness; evacuation planning; warning system; Wellington case study) • Earthquake (Christchurch; seismic hazards;

		earthquake resistant building construction; earthquake prone building evaluation)
		• Social environment
		  o Gender
		  o Maori and DRM
		• Planning
		  o District plans – dealing with hazards
		  o Alluvial fan hazard – case study
		  o Catchment management
		
		Evening Function

Thursday 7 April 2015	Wellington	Classroom
		• Infrastructure and Insurance
		• Planning
		  o Wellington City Council – Resilient City
		• Coastal erosion processes and management strategies
		• Case studies
		  o Napier EQ and East Coast tectonics
		  o Cyclone Bola (Gisborne)
		
		Parliamentarian's session
		
		Evening function

Friday 8 April 2016	Wellington Half day fieldtrip	Fieldtrip (Seismic Retrofitting - Wellington Hospital; Mt Victoria (vantage point); Island Bay (tsunami – blue line); Te Raekaihau Point (tsunami – planning)) Mosque Te Papa Evening Function
Saturday 9 April 2016	Wellington Wellington to Napier	Action Plan working session Travel (Group 1)
Sunday 10 April 2016	Wellington to Napier Napier	Travel (Group 2)

	Fieldtrip	Fieldtrip (Ahuriri Lagoon; Bluff Hill; Te Awa subdivision; Napier Museum)
Monday 11 April 2016	Napier Fieldtrip	Classroom • Hawkes Bay hazard portal and East Coast Lab • Hawkes Bay Coastal Hazards Strategy Fieldtrip (Haumoana; Tukituki River; Te Mata Peak) Classroom • CDEM Group planning and risk management • Tsunami community response planning • Emergency management
Tuesday 12 April 2016	Napier to Gisborne Gisborne	Fieldtrip (Lake Tutira) Muriwai Marae (Ngāi Tāmanuhiri) (Powhiri and Welcome; walking tour) Gisborne District Council/Ngati Porou Joint Management Agreement
Wednesday 13 April 2016	Gisborne Fieldtrip Gisborne to Auckland or Wellington	Fieldtrip (Kaiti Hill Lookout; Wainui Beach coastal erosion; Tangihanga Stn – farming and hazards; Tarndale slip – erosion and reforestation; Waipoua Station – river aggradation; Te Karaka – Cyclone Bola impacts; McPhail's Bend – river flood control scheme)
		First Group (government) depart Gisborne for Indonesia via Auckland Second Group (university) depart Gisborne for Wellington

Thursday 14 April 2016	Wellington – Extension Session	• Welcome to GNS/ Tour
		• GEONET monitoring network
		• Infrastructure and earthquakes
		  o Building retrofit; seismic design; rockfall; liquefaction
		
		Lunchtime talks (by UGM and GNS staff)
		
		• Risk language
		  o People's beliefs
		  o Communicating science and uncertainties
		  o Risk communication
		
		Reception at JCDR (Joint Centre for Disaster Research)

Friday 15 April 2016	Wellington – Extension Training	• Hazard and Risk Research to Practice
		  o Multi-stakeholder research
		  o Flood research to practice
		  o Eruption detection and lahar warning
		
		Mosque
		
		• RiskScape session (half day)
		  o Advanced tutorials – flood scenario and Tambora volcano eruption
		
		• Action Plan session – university component

	Wellington – Auckland - Indonesia	Second Group (university) depart Wellington for Indonesia via Auckland
Saturday 16 April 2016	Arrive Indonesia	

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Indonesia
Faisal Fathani, StIRRRD Indonesia Programme Director, tfathani@ugm.ac.id, ph: +62 818 02627189
Fransisca Edingtyas, StiRRRD Indonesia Project Manager, fransisca_ediningtyas@yahoo.com, ph: +62 812 2696614

APPENDIX 3: PROGRAMME — LOCAL GOVERNMENT TRAINING

PROGRAMME SCHEDULE

	Date	Agenda
Day 0	Fri. 1 April 2016 & Sat. 2 April 2016	Delegation leaves Indonesia
Day 1	Sun. 3 April 2016	Auckland
	10:50	Indonesian Delegation arrive Auckland
	11:15 - 12:00	Hotel transfer to Mercure Auckland Hotel, 8 Customs St East)
	12:00 - 2:00	Training registration (pack collection) and light lunch (Conference room: Rangitoto & Brown Rooms, level 1)
	2:00 - 7:00	Afternoon free
	7:00 - 9:00	Dinner at hotel at Vue restaurant on level 13
Day 2	Mon. 4 April 2016	*Auckland Hotel Venue = Mercure Hotel, 8 Customs St*
	7:00 - 8:15	*Breakfast*
	8:30 - 8:45	**Welcome, Programme Overview**
		Michele Daly, GNS Science
	8:45 - 9:15	**Breakout - Learning Objectives and Introductions**
		Michele Daly, GNS Science; Faisal Fathani, UGM
	9:15 - 10:00	***Session 1: Indonesian Government Address***
	9:15 - 9:30	BNPB - Ir. Medi Herlianto, CES., M.M.
	9:30 - 9:45	BAPPENAS - Dr. Ir. Arifin Rudiyanto, M.Sc.
	9:45 - 10:00	Kemendesa - Aryo Wicaksono, S.Sos.
	10:00 - 12:30	***Session 2: Indonesian Action Plan Presentations***
		Chair: BNPB
	10:00 - 10:30	Morowali Team (30 mins)
		Yosar Kardiat
		I Ketut Sulendra/Ida Sri Oktaviana (UNTAD)
	10:30 - 11:00	*Morning Tea*
	11:00 - 11:30	Sumbawa Team (30 mins)
		Ir. Mukmin, M.Si.
		Eko Pradjoko (UNRAM)
	11:30 - 12:00	Agam Team (30 mins)
		Bambang Warsito, S.Sos, M.Si,
		Dr. Tesri Maideliza, M.Sc. (UNAND)
	12:00 - 12:30	Seluma Team (30 mins)
		Drs. H. Azwardi
		Ade Sri Wahyuni, Ph.D./Dr. Yudhi Harini Bertham (UNIB)
	12:30 - 1:30	*Lunch*
		Session 3: New Zealand and Auckland Context
	1:30 - 2:00	**NZ Overview - History, Hazards and Socio-Economic Context**
		Michele Daly, GNS Science
	2:00 - 2:30	**Introduction to Emergency Management in New Zealand**
		Richard Woods, GNS Science
	2:30 - 5:30	**Mt Eden and Auckland Museum**

	Date	Agenda
		(transfer by bus to Auckland Museum via Mt Eden)
		** Mt Eden summit = Richard Woods*
		** Volcano display = Mary-Anne Thompson (Auckland University)*
		** Maori display = Guide: Adam Taylor-Eruera*
	5:30 - 6:00	Transfer to Auckland University of Technology (AUT)
	6:00 - 7:00	Presentations by AUT and AU Indonesian students
	7:00 - 9:00	*Dinner with Indonesian students at Four Seasons Restaurant, AUT*
Day 3	Tues. 5 April 2016	*Auckland Hotel Venue = Mercure Hotel, 8 Customs Street East*
	7:00 - 8:30	*Breakfast and Check-Out*
	8:30 - 8:45	**Summary of Key Learnings from Previous Day**
		UGM - Dr Wahyu Wilopo
		Session 3 cont./: NZ Context and Auckland
	8:45 - 9:15	**NZ Legislative context for Risk Reduction**
		Wendy Saunders, GNS Science
	9:15 - 9:45	**Recent Natural Hazards in Auckland**
		Richard Woods, GNS Science
	9:45 - 10:15	**Land-Use Planning for Natural Hazards**
		Wendy Saunders, GNS Science
	10:15 - 10:45	*Morning Tea*
		Session 4: Volcano Hazards
	10:45 - 11:15	**Monitoring Volcanoes and Science Advice to Government**
		Nico Fournier, GNS Science
	11:15 - 11:45	**Managing Volcanic Ash**
		Tom Wilson, Canterbury University
	11:45 - 12:15	**Auckland Volcanic Contingency Plan**
		Richard Woods, GNS Science
	12:15 - 1:15	*Lunch*
		Session 5: Field Visit - Emergency Coordination Centre
	1:15 - 2:40	**Auckland Emergency Coordination Centre, 24 Wellesley St West**
		** Tour and explanation of facility*
		** Auckland work programme*
	2:40 - 3:00	**Auckland tsunami hazard: Orewa and Community engagement**
		Emma Hunt, Auckland CDEM
	3:00	*Transfer to Auckland Airport*
	4:30	*Flight to Wellington - NZ0449 4:30pm*
	6:00 - 7:00	*Transfer to Mercure Wellington Abel Tasman, 169 Willis Street*
	7:00 - 9:00	*Dinner at Mercure Wellington*
Day 4	Wed. 6 April	*Mercure Wellington Abel Tasman, 169 Willis St*
	7:00 - 8:30	*Breakfast*
	8:30 - 9:00	**Summary of Key Learnings from Previous Day**
		UGM - Dr Agung Setianto
		Session 6: Tsunami Hazard
	9:00 - 9:30	**Tsunami Preparedness and Warnings**
		Graham Leonard, GNS Science

	Date	Agenda
	9:30 - 10:00	**Tsunami - Island Bay Community Case Study**
		Alex Buckley, WEMO
	10:00 - 10:30	**Improving Tsunami Preparedness: Samoa Case Study**
		Michele Daly, GNS Science
	10:30 - 11:15	*Morning Tea*
		Session 7: Earthquake Hazard
	11:15 - 11:45	**Christchurch Earthquake - Seismic Hazards and Impacts**
		Kelvin Berryman, GNS Science
	11:45-12:15	**Earthquake resistant building construction/retrofitting**
		Iman Satyarno, UGM and UNRAM (Materials)
	12:15 - 1:15	*Lunch*
	1:15 - 1:45	**Earthquake prone building evaluation and building performance**
		Andrew King, GNS Science
		Session 8: Social Environment
	1:45 - 2:15	**Role of Women in DRR - Indonesian Focus Group Results**
		Esti Anantasari, UGM
	2:15 - 2:45	**Maori and Disaster Risk Management**
		Cassie Kenney, Joint Centre for Disaster Research
	2:45 - 3:15	*Afternoon Tea*
		Session 9: Planning 1
	3:15 - 3:45	**Incorporating Natural Hazards into Development Plans**
		James Mathieson, GNS Science
	3:45 - 4:15	**Alluvial Fan Hazard: Risk Reduction measures**
		Michael Goldsmith, Otago Regional Council
	4:15 - 4:45	**Catchment Management - a holistic approach to managing flood risk**
		James Flanagan, Greater Wellington (Regional Council)
	5:30 - 8:30	***NIWA Reception and UGM/StIRRRD Presentations***
Day 5	Thurs. 7 April	*Mercure Wellington Abel Tasman, 169 Willis St*
	7:00 - 8:30	*Breakfast*
	8:45 - 9:15	Summary of Previous Day
		UGM - Dr Arry Retnowati
		Session 10: Infrastructure and Insurance
	9:15 - 9:45	**Lifelines Groups - Reducing Infrastructure Vulnerability**
		Dave Brunsdon, Kestrel Group Ltd
	9:45 - 10:15	**Insurance in NZ**
		Richard Smith, EQC
	10:15 - 10:45	*Morning Tea*
		Session 11: Planning 2
	10:45 - 11:15	**LG-SAT Results - Indonesia**
		Esti Anantasari, UGM
	11:15 - 11:45	**Group Discussion - LG-SAT Results - Indonesia**
		Esti Anantasari, UGM
	11:45 - 12:15	**Resilient City - Wellington**
		Mike Mendonca, Resilience Officer, Wellington City Council

	Date	Agenda
	12:15 - 1:15	*Lunch*
		Session 12: Napier and Gisborne - Background to Fieldtrip
	1:15 - 1:45	**Napier Earthquake and East Coast Tectonics**
		Kelvin Berryman, GNS Science
	1:45 - 2:15	**Cyclone Bola**
		Mike Page, GNS Science
	2:15 - 2:45	**Coastal Erosion Processes and Management Strategies**
		Associate Professor Karin Bryan, University of Waikato
	2:45 - 3:15	*Afternoon Tea*
	3:15 - 5:00	**Observations and Reflections**
		UGM - Dr Faisal Fathani
	3:15 - 5:00	***Parliamentarians and Heads of Districts Session***
		Local Government Leadership and DRR Governance
		Mayor and Deputy Mayor, Wellington City Council
	7:00 - 9:30	***Indonesian Embassy Reception (Dinner)***
Day 6	Fri. 8 April	*Mercure Wellington Abel Tasman, 169 Willis St*
	7:00 - 8:30	*Breakfast*
	8:30 - 9:00	**Summary of Key Learnings from Previous Day**
		UGM - Dr Esti Anantasari
	9:00 - 12:15	***FIELDTRIP***
		** Seismic Retrofitting - Wgtn Hospital (Richard Sharpe, Beca)*
		** Mt Victoria vantage point - city and Wellington Fault (Phil Glassey, GNS)*
		** Island Bay - tsunami blue line (Michele Daly, GNS)*
		** Island Bay - tsunami notice boards (Michele Daly, GNS)*
		** Island Bay - coastal erosion (Kate Crowley, NIWA and Nicci Woods WCC)*
		** Te Raekaihau Point (tsunami planning - Kate Crowley)*
	12:15 - 1:30	Friday Prayers Mosque - Wellington Islamic Centre, Kilbirnie
	1:30 - 3:00	Te Papa (Museum of New Zealand) and Free Time
	3:00 - 5:00	*Free afternoon*
		[UGM-GNS Project Team meeting]
	5:30 - 7:00	*Dinner at Siem Reap at 7.00pm*
Day 7	Sat. 9 April	*Mercure Wellington Abel Tasman, 169 Willis St*
	7:00 - 8:30	*Breakfast and check-out (Group 1)*
	8:45 - 9:15	**Summary of Previous Day**
		UGM - Dr Agung Setianto
		Session 13: Action Plans
	9:15 - 10:15	**Breakout Session - Action Plan Revision**
	10:15 - 10:45	*Morning Tea*
	10:45 - 12:00	**Action Plan Presentations**
		Dr Esti Anatasari
		1. Morowali (30 mins)
		2. Sumbawa (30 mins)
	12:00 - 1:00	*Lunch*
	1:00 - 2:00	**Action Plan Presentations**
		Dr Arry Retnowati

	Date	Agenda
		3. Agam (30 mins)
		4. Seluma (30 mins)
	2:00 - 3:00	**Group Session - Action Plan Discussion**
	3:00 - 3:30	*Afternoon Tea*
	3:30 - 4:00	**Outline of tomorrow's fieldtrip and logistics**
		Mike Page and Brenda Rosser, GNS Science
	4:00 - 6:00	*Group One travel to Napier - NZ8448 13 Seats - 5:30 pm - 6:25 pm*
		Accommodation: The Nautilus Napier, 387 Marine Parade
	6:00 - 8:00	*Dinner in Napier (Nautilus) & Wellington (venue TBC)*
Day 8	Sun. 10 April	Accommodation: split between, The Nautilus Napier, 387 Marine Parade & the Beach Front Motel, 373 Marine Parade
	7:00 - 8:00	*Breakfast*
	8:00 - 12:00	*Group Two travel to Napier - NZ8104 25 Seats - 9:20am-10:15am*
		Accommodation: Beach Front Motel, 373 Marine Parade
	12:00 - 1:00	*Lunch*
	1:00 - 5:30	***FIELDTRIP (Napier)***
		** Ahuriri Lagoon (tectonics/geo-setting; subsidence/uplift; earthquakes and 1931 earthquake; liquefaction project)*
		** Bluff Hill (Landslide) (Jon Kingsford, Napier City Council)*
		** Te Awa subdivision (liquefaction), (Jon Kingsford, Napier City Council)*
		** Napier Museum - Visit to 1931 display (Brenda Rosser, GNS Science)*
	6:00 - 8:00	*Dinner - Restaurant Indonesian (Marine Pde)*
Day 9	Mon. 11 April	*Accommodation: split between, The Nautilus & The Beach Front Motel*
	7:00 - 8:30	*Breakfast*
	8:30	*Bus from Accommodation to Hawkes Bay Business Hub*
		Session 14: Hawkes Bay Council Planning
	9:00 - 9:30	**Hawkes Bay Hazard Portal**
		Lisa Pearce, Hawkes Bay Regional Council
	9:30 - 10:00	**East Coast LAB**
		Lisa Pearce, Hawkes Bay Regional Council
	10:00 - 10:30	*Morning Tea*
	10:00 - 11:00	**Hawkes Bay Coastal Hazards Strategy**
		Mike Adye, Hawkes Bay Regional Council
	11:00 - 2:00	***FIELDTRIP (Napier)***
		** Haumoana (Mike Adye, HBRC)*
		** Tukituki River - rockfall hazard (Brenda Rosser, GNS Science)*
		** Te Mata Peak (lunch)*
	12:30 - 1:15	*Lunch*
		Boxed lunch on top of Te Mata Peak
	2.00 - 3.00	**CDEM Group Planning and Risk Management**
		Ian MacDonald (CDEM Group Controller)
	3.00 - 3.30	**Tsunami community response plans**
		Jae Sutherland, Hawkes Bay Regional Council
	3.30 - 4.30	**Emergency Management – adaptable emergency response**
		Marcus Hayes Jones, Napier City Council

	Date	Agenda
	6:00 - 9:00	*Dinner venue TBC*
Day 10	Tues. 12 April	
	7:00 - 8:30	*Breakfast and checkout*
	8:30 - 1:30	***FIELDTRIP (Napier- Gisborne) Drive to Gisborne via SH2***
		** Lake Tutira - record of natural hazards (Mike Page, GNS Science)*
		** Lunch @ Gisborne Lookout*
	1:30 - 7:00	**Muriwai Marae (Ngai Tamanuhiri)**
		**Powhiri (Welcome) (Indonesians and GNS to respond)*
		** Afternoon tea*
		** Introductions*
		** Iwi ppt presentation on land use and relationship with their land*
		** Indonesian ppt pres on natural hazards and issues in Indonesia (Faisal)*
		** GNS Science ppt presentation on StIRRRD programme (Michele)*
		** Walking tour of important sites (floods, changed river course, tsunami)*
		** Dinner (5:30)*
	7:15	*Hotel: Quality Hotel Emerald, 13 Gladstone Rd, Gisborne*
	8:00-9:00	**Joint Management Agreement between Ngati Porou and Gisborne District Council**
		Pia Pohatu/Tui Warmenhoven/Dave Wilson, GDC
Day 11		*Gisborne*
	Wed. 13 April	*Breakfast and checkout*
	7:00 - 8:00	***FIELDTRIP (Gisborne)***
	8:00 - 4:00	** Kaiti Hill Lookout - overview/ landuse/natural hazards*
		(Mike Page, GNS Science/Louise Bennett, Gisborne District Council)
		** Wainui Beach - coastal erosion and management strategy (Dave Peacock)*
		** Tangihanga Stn - Wi Pere Trust/ farming/hazards (iwi/Dave Peacock)*
		** Tarndale Slip - erosion/reforestation (Mike Marden, Landcare Research)*
		** Waipaoa Station - river aggradation/lunch (Mike Marden/Dave Peacock)*
		** Te Karaka - Bola impacts/ flooding/ soil conservation*
		(Mike Page/Dave Peacock/Kerry Hudson, Gisborne District Council)
		** McPhail's Bend - Waipaoa river flood control scheme (Dave Peacock)*
		Local Government Group depart for Auckland NZ8654 6:10 pm
	4:00 - 6:00	*University Group depart for Wellington NZ2237 4:40 pm*

APPENDIX 4: PROGRAMME — EXTENSION TRAINING

StIRRRD - NZ Comparative Study Visit 2
University Extension Programme, Wellington, 14 - 15 April 2016

Day 1 - Thursday 14 April

Date	Time	Agenda	Speaker	Venue
Thursday 14 April	*8:30 - 9:00*	*Travel to GNS Science, Avalon*		
	9:00 - 10:00	***Introduction to GNS Science***		**Lounge**
	9:00 - 9:30	GNS Science - Who, why, what and where?	Kelvin Berryman, GNS Science	
	9:30 - 9:40	Health 'n Safety, logistics etc	Sylvia Riches/Phil Glassey	
	9:40 - 10:00	Tour of building ending at morning tea	Sylvia Riches/Phil Glassey	
	10:00 - 10:30	Morning Tea		
	10:30 - 12:00	***GeoNet***		**GeoNet**
	10:30 - 11:30	Virtual tour of the GeoNet Monitoring	Caroline Little, GeoNet	
	11:30 - 12:00	Tsunami modelling	William Power, GNS Science	
	12:00 - 13:00	Lunch and Lunchtime seminar	Phil Glassey, Prof Iman Satyarno and Dr Wahyu	**Lounge**
	13:00 - 15:00	***Infrastructure and earthquakes***		**Lounge**
	13:00 - 13:30	Building retrofit techniques	Richard Sharpe, Beca	
	13:30 - 14:00	Hazard Input for Seismic Design	Graeme McVerry, GNS Science	
	14:00 - 14:30	Earthquake induced rockfall	Chris Massey, GNS Science	
	14:30 - 15:00	Don't forget about Liquefaction	Sally Dellow, GNS Science	
	15:00 - 15:30	*Travel to JCDR*		
	15:30 - 17:00	***Risk Language***		**JCDR, Wellington**
	15:30 - 16:00	People's beliefs: How these can influence preparedness	Julia Becker, GNS Science	
	16:00 - 16:30	Communicating Science: Uncertainties, Forecasts, & Probabilities	Emma Husdon Doyle, JCDR	
	16:30 - 17:00	Understanding Risk Communication	David Johnston, JCDR/GNS Science	
	17:00 - 18:00	Reception JCDR		**JCDR, Wellington**
	18:00 - 19:00	"Bridging the communication divide: Disaster Risk Communication for Local Government in Indonesia."	Dr Esti Anantasari and Dr Arry Retnowati, UGM.	**JCDR, Wellington**
	19:00 - 21:00	Dinner		**Tussock Cafe - JCDR Massey, Wellington Campus**

DAY 2 - Friday 15 April

Date	Time	Agenda	Speaker	Venue
Friday 15 April	*8:30 - 9:00*	*Travel to GNS*		
	9:00 - 10:00	***Hazard and Risk research to practice***		**Lounge**
	9:00 - 9:30	Multi-stakeholder Hazard and Risk research - Devora, Hawkes Bay Liquefaction, ECLab, IOF	Hannah Brackley, GNS Science	
	9:30 - 10:00	Flood research to practice	Kate Crowley, NIWA	
	10:00 - 10:30	Eruption Detection and Lahar Warning Systems	Nico Fournier, GNS Science	
	10:30 - 11:00	Morning Tea		
	11:00 - 12:00	***Riskscape***		**Lounge**
	11:00- 11:45	Introduction to risk modelling & RiskScape as a multi-hazard risk modelling tool	Kate Crowley, NIWA	
	11:45-12:00	Discussion: How might risk modelling results support DRR planning	Kate Crowley, Sheng-Lin Lin & Mostafa Nayyerloo (GNS Science)	
	12:00 - 13:30	Lunch and prayers	Salman Ashraf	**Lower Hutt Muslim Center, 14-20 Hunter St, Taita**
	13:30 - 15:00	***Riskscape (Continued)***		**IT Room**
	13:30 - 14:00	Introductory RiskScape Tutorial - Flood scenario in Palu, Central Sulawesi	RiskScape team	
	14:00 - 15:00	Advanced RiskScape Tutorials - Tambora volcano eruption	RiskScape team	
	15:00 - 15:30	Afternoon Tea		
	15:30 - 16:40	***StIRRRD and University involvement***		**Lounge**
	15:30 - 15:45	Developing Indonesian Risk Modelling	Phil Glassey, Kate Crowley	
	15:45 - 16:00	Contribution to DRR Action Plans	Phil Glassey/Nico Fournier	
	16:00 - 16:15	Disaster Risk Reduction Network	Phil Glassey	
	16:15 - 16:30	Expert Training	Phil Glassey	
	16:30 - 16:40	Implementation of Community projects	Phil Glassey	
	16:40 - 17:00	***Presentations and Photos***		**Lounge**
	17:00 - 20:00	Dinner or travel to Airport		**TBC**
	17:00	*Travel to Wellington Airport*		
	19:35	*Fly to Auckland NZ0490*	Faisal, Iman, Wahyu, Esti, Arry, Sisca, Gumbert	
	23:50	*Fly to Singapore NZ0282*	Faisal, Iman, Wahyu	

DAY 3 - Saturday 16 April

Date	Time	Agenda	Speaker	Venue
		Travel to Indonesia		
	12:10	*Fly to Singapore*	Tesri, Ade, Ketut, Ida, Eko, Yudhy, Agung	

APPENDIX 5: FIELDTRIP GUIDE — AUCKLAND

Auckland natural hazards risk and preparedness

Field Trip Guide

4 & 5 April 2016

4 April - Mt Eden Volcano
4 April - Auckland Musuem
5 April - Auckland Emergency Coordination Centre

Contents

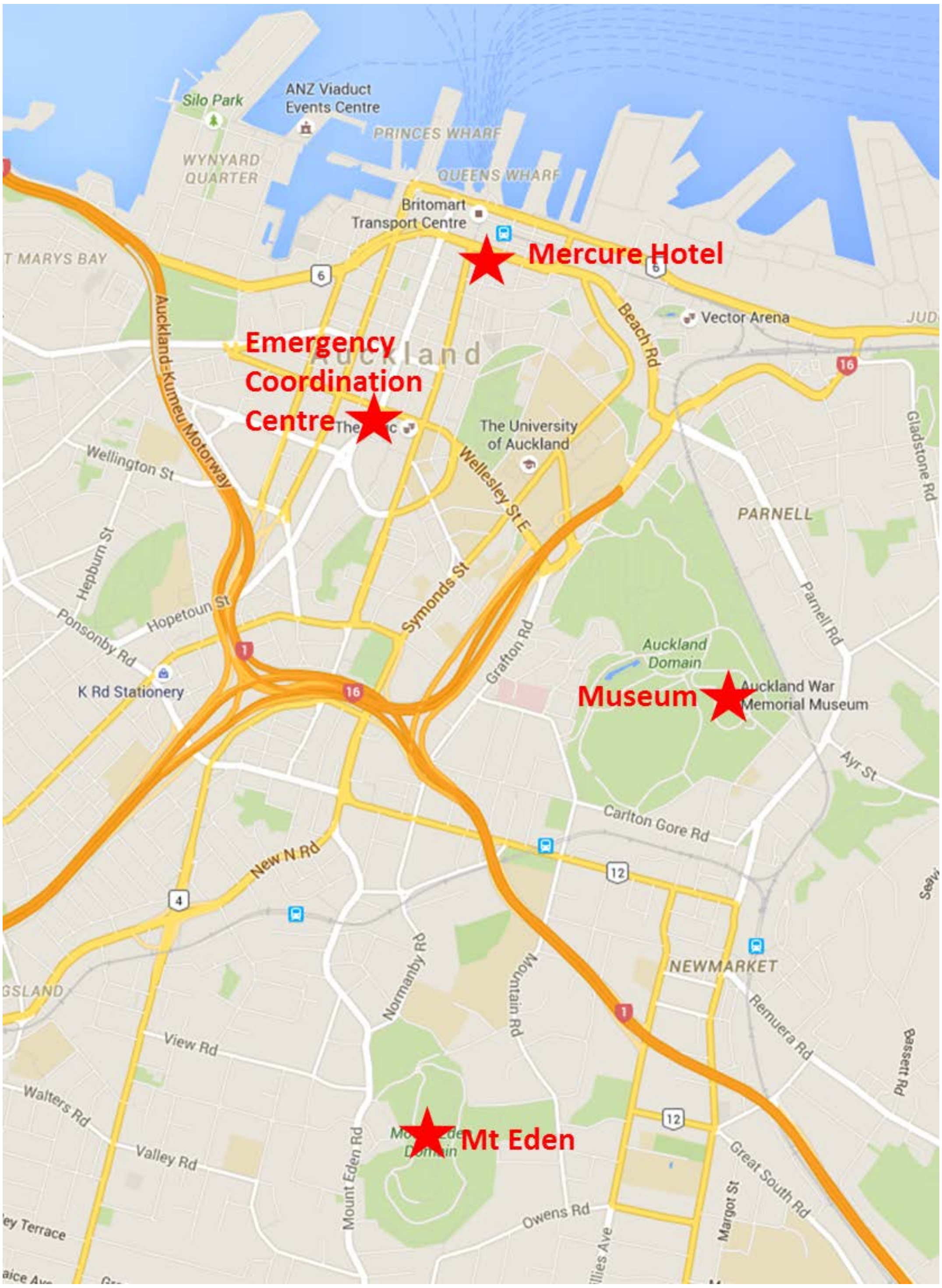
Introduction

On Monday 4 April we will undertake a field excursion to explore many aspects of emergency management planning, land-use planning and options for hazard mitigation in Auckland. We will give an overview of the Auckland Volcanic Field, Auckland's likely hazards and the Auckland Museum volcanic and Maori displays. On Tuesday 5 April, we will visit the Auckland Emergency Coordination Centre where we will have a tour of the centre and hear how Auckland is preparing for future emergencies. There will also be a short presentation on how communities are preparing for tsunami risk in North Auckland.

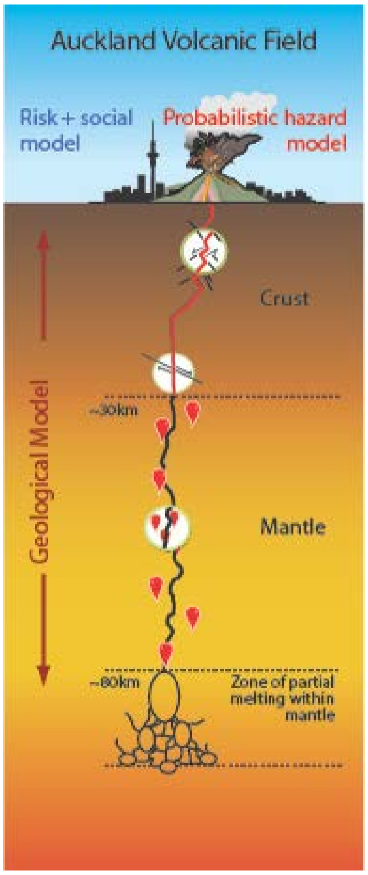
Schedule

Location	Topic	Time	Comments
Monday 4 April			
Start – Mercure Hotel		2.30 pm	Bus
Mt Eden	Auckland Volcanic Field and potential hazards	arrive 2.45 pm, (leave 3.45)	Bus, Afternoon Tea
Auckland Museum	Auckland Volcanic Display	arrive 4.00 pm	Bus
Auckland Museum	Maori Display	Leave 5.00pm	Bus
Finish – Travel to AUT			Bus
Tuesday 5 April			
Auckland Emergency Coordination Centre	Tour of Facility and work programme discussion	1.15pm	Bus
Auckland Emergency Coordination Centre	Orewa tsunami risk – community activities	2.40pm	
Finish – Transfer to Airport		3.00pm	Bus

Route map


Mercure Hotel
Emergency Coordination Centre
Museum
Mt Eden
Silo Park
ANZ Viaduct Events Centre
PRINCES WHARF
QUEENS WHARF
WYNYARD QUARTER
Britomart Transport Centre
Vector Arena
The University of Auckland
Auckland Domain
Auckland War Memorial Museum
PARNELL
NEWMARKET
K Rd Stationery
Auckland-Kumeu Motorway
Wellesley St E
Symonds St
Grafton Rd
Beach Rd
Carlton Gore Rd
New N Rd
Mountain Rd
Normanby Rd
Mount Eden Rd
Owens Rd
Great South Rd
Remuera Rd
Parnell Rd
Gladstone Rd
View Rd
Valley Rd
Walters Rd
Hopetoun St
Ponsonby Rd
Wellington St
Hepburn St
Ayr St
Bassett Rd
Margot St

The Auckland Volcanic Field



The Auckland Volcanic Field is monogenetic meaning each volcano usually only erupts once. The field is still active and there is no way to predict where or when the next 'bubble' of magma will rise to the surface and create a new volcano. The size and length of each eruption depends on how big the 'bubble' of magma was.

If the basalt magma mixes with water (seawater or groundwater) super heated steam blows it apart. This causes a pyroclastic eruption that produces fall and flow deposits and has created the low rings of pyroclastic rock (called tuff) around the craters of many Auckland volcanoes such as Lake Pupuke.

When the magma has no contact with water, lava can fountain out less explosively and build a cone of tephra. Basalt tephra is called scoria so the cones are commonly called scoria cones (e.g. One Tree Hill).

When did they last erupt?

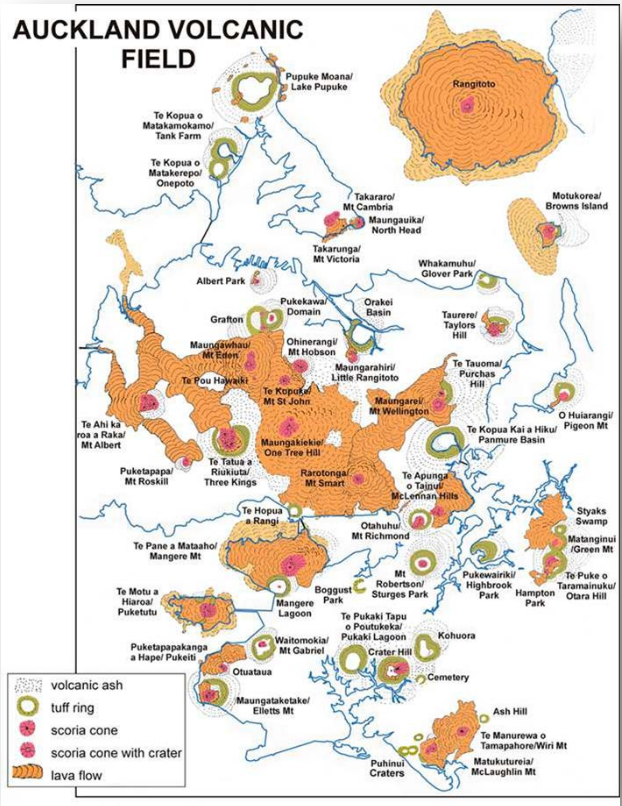
Auckland's volcanoes vary in shape, size and character. The earliest volcanic eruption in the AVF was an estimated 250,000 years ago. The last occurred about 600 years ago and formed Rang itoto. Māori living on Motutapu Island witnessed it.

Past eruptions have sometimes started with a large explosion because of either ground or sea water coming in contact with rising magma. An eruption of this type is more likely to recur in Auckland due to the close proximity of many water sources. These eruptions can form large craters, which can subsequently fill with water such as Lake Pupuke, Orakei Basin and Onepoto Reserve.

Continued eruptions often create volcanic or scoria cones such as Mt Wellington, Mount Eden, Browns Island and Three Kings. As the volcano continues to erupt it may produce extensive lava flows. Many have been mapped within the city, extending up to 10km from the source.

Likely hazards and effects of the next Auckland eruption depend on what type of eruption occurs and for how long.

When and where future eruptions will occur is unknown. Based on the number and frequency of past eruptions it is estimated there is about a 1 in 1000 (0.001 per cent) chance an eruption could occur in any one year.



The youngest volcano: Rangitoto Island

Rangitoto means ‘Bloody sky’ and is thought to refer to the serious injury of a Māori chief during a battle.

Rangitoto is a volcanic island in the Hauraki Gulf visible from most parts of Auckland City. It is the most recent, largest and least altered volcano in the Auckland Volcanic Field. This is made up of around 50 small volcanoes that have formed over the last 250.000 years. Rangitoto makes up nearly 60% of the total volume of material erupted. It was formed by at least 2 eruptions 600-700 years ago and is now about 260 m above sea level and 5.5 km wide.

Roads and tracks allow visitors to walk over lava fields and through lava caves (tubes left behind by the passage of liquid lava). Vegetation varies from ‘raw’ lava fields to scrub and sparse forests including the largest pohutukawa forest in NZ.

It is an intra-plate or hot spot volcano (these occur away from plate boundaries and are not related to subduction). A mantle hot spot exists about 100 km below Auckland. When rock is melted by this extra heat, it will separate from the surrounding solid rock and rise to the surface. The melted rock is basalt magma which has a low viscosity (flows easily) and may rise to the surface at speeds of up to 5 km/hour.

Rangitoto consists of scoria cones on top of a broad ring of lava flows. A moat like ring around the summit is due to subsidence of the mountaintop as underlying lava flows cooled and shrank. When it erupted 600-700 years ago over an unknown time span, the sequence of events was likely to have been:

- a violent pyroclastic eruption as cold sea water met molten rock, creating an explosion crater and a tuff ring.
- ongoing fire fountaining built scoria cones once water could no longer reach the magma
- lava flows from the base of the scoria cone

Volcano Fact Sheet

Rangitoto Volcano

Description

• Rangitoto is a volcanic island in the Hauraki Gulf visible from most parts of Auckland City.

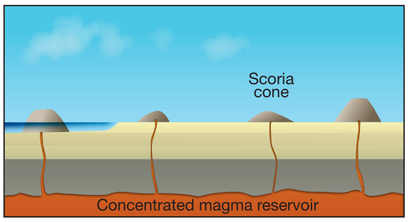
• It is the most recent, largest and least altered volcano in the Auckland Volcanic Field which is made up of around 50 small volcanoes.

• It was formed by at least 2 eruptions 600-700 years ago.

• The highest part is 260m, and it is 5.5km wide.

• The island is part of the Hauraki Gulf Maritime Park and is administered by the Department of Conservation.

• Past activities include scoria quarries, military installations and at one time it had a small permanent population.



▲ Rangitoto can be seen from most parts of Auckland City.

◀ Rangitoto is in the Auckland **volcanic field** - an area that has a concentration of lava flows, from which magma bubbles sporadically surface, creating scoria cones.

Maori Name

• *Rangitoto* means ‘Bloody sky’ and is thought to refer to the serious injury of a Maori chief during a battle on the island.

Features

• Roads and tracks allow visitors to walk over lava fields and through lava caves (tubes left behind by the passage of liquid lava).

• Vegetation varies from ‘raw’ lava fields to scrub and sparse forests, including the largest pohutukawa forest in NZ.

• A moat like ring around the summit is due to subsidence of the mountaintop as underlying lava flows cooled and shrank.

Type

• It is an intra-plate or hot spot volcano. These occur away from plate boundaries and are not related to subduction.

• The volcano consists of scoria cones on top of a broad ring of lava flows.

Cause

• A mantle hot spot exists about 100 km below Auckland. When rock is melted by this extra heat it will separate from the surrounding solid rock and rise to the surface. The melted rock is basalt magma which has a low viscosity (flows easily) and may rise to the surface at speeds of up to 5 km/hour.

Eruptive history

• The Auckland Volcanic Field is monogenetic, meaning each volcano usually only erupts once. Approximately 50 volcanoes have formed over the last 250.000 years. The field is still active and there is no way to predict where or when the next ‘bubble’ of magma will rise to the surface and create a new volcano.

• The size and length of each eruption depends on how big the ‘bubble’ of magma was, so Rangitoto was a comparatively large ‘bubble’ of magma.

Eruptive material

• If the basalt magma mixes with water (seawater or groundwater) super heated steam blows it apart. This causes a pyroclastic eruption that produces fall and flow deposits and has created the low rings of pyroclastic rock (called tuff) around the craters of many Auckland volcanoes, eg Lake Pupuke.

• When the magma has no contact with water, lava can fountain out less explosively and build a cone of tephra. Basalt tephra is called scoria so the cones are commonly called scoria cones eg, One Tree Hill.

• Rangitoto makes up nearly 60% of the total volume of material erupted by all volcanoes in the Auckland Field.

Last eruptive activity

• Rangitoto erupted 600-700 years ago over an unknown time span.

• The sequence of events was likely to have been:

- A violent pyroclastic eruption as cold sea water met molten rock, creating an explosion crater and a tuff ring.
- Ongoing fire fountaining built scoria cones once water could no longer reach the magma
- Lava flows from the base of the scoria cone

Monitoring

• 8 seismographs are operated jointly by GeoNet and the Auckland Regional Council.

www.gns.cri.nz

GNS SCIENCE TE PŪ AO

Mt Eden Volcano

Mt Eden (Maungawhau) is one of the most prominent volcanic cones remaining in the Auckland region. Erupting about 15,000 years ago from three overlapping scoria cones, it formed a huge scoria mound with a central crater from the last eruption. Lava flowed out from the base of the mound, and in some places the lava is more than 60 metres thick.

Maungawhau was a significant fortified pā, large enough to provide refuge for several hundred people. Extensive earthworks modified the steep upper slopes of the cone.

Auckland Museum & Domain Volcano

The Auckland War Memorial Museum is located in the Auckland Domain. The Auckland Domain is Auckland's oldest park, and at 75 hectares one of the largest in the city. Located in the central suburb of Grafton, the park contains all of the explosion crater and most of the surrounding tuff ring of the Pukekawa volcano.

The park is home to one of Auckland's main tourist attractions, the Auckland War Memorial Museum, which sits prominently on the crater rim (tuff ring). Several sports fields occupy the floor of the crater, circling to the south of the cone, while the rim opposite the Museum hosts the cricket pavilion and Auckland City Hospital. The Wintergarden, with two beautiful glass houses, lie on the north side of the central scoria cone. The fernery has been constructed in an old quarry in part of the cone. The duck ponds lie in the northern sector of the explosion crater, which is breached to the north with a small overflow stream.

The Auckland Domain volcano, Pukekawa, is one of the oldest in the Auckland Volcanic Field, and consists of a large explosion crater surrounded by a tuff ring with a small scoria cone (Pukekaroro) in the centre of the crater. Its tuff ring, created by many explosive eruptions, is made of a mixture of volcanic ash, lapilli and fragmented sandstone country rock. Its eruption followed soon (in geological terms) after the neighbouring Grafton Volcano was created, destroying that volcano's eastern parts and burying the rest.

Originally, the crater floor was filled with a lava lake, the western half collapsed slightly and became a freshwater lake which later turned into a swamp and slowly filled up with alluvium and sediment, before being drained by Europeans for use as playing fields and parkland. These origins are still somewhat visible in that the Duck Ponds are freshwater-fed from the drainage of the crater.

Auckland Museum Volcano Display

Auckland Museum Maori Display

Auckland Emergency Coordination Centre

Provides emergency management and rural fire services pursuant to the Civil Defence Emergency Management Act 2002 and the Forest and Rural Fires Act 1977.

Emergency Management:

Emergency management is the discipline and profession of applying science, technology, planning and management to deal with extreme events that can injure or kill large numbers of people, do extensive damage to property, and disrupt community life. Comprehensive emergency management is a term used to describe a planned approach to reducing the effect of, being ready for, responding to and recovering from emergencies and disasters. The Co-ordinated Incident Management System (CIMS) is used as a framework for emergency response.

Rural Fire Management:

Rural fire management includes the measures and tasks carried out to meet the legislative requirements with respect to suppression, extinction, prevention, detection, control and restriction of fire. Rural fire legislation now encompasses the same four phases as emergency management of reduction, readiness, response and recovery in the Fire Plan requirements. The Co-ordinated Incident Management System (CIMS) is an integral tool used at rural fires.

Auckland Tsunami Risk – Orewa Example

Local source tsunamis in Auckland

There is a low likelihood of a local source tsunami affecting Auckland, if one did, the effects would be significant due to the limited warning time – less than one hour.

Auckland is one of the lowest seismically active parts of New Zealand. While large earthquakes aren't common, the chance of a large tsunami-generating earthquake is possible. The Kerepehi Fault, in the Firth of the Thames, is possibly active offshore and could generate earthquakes up to magnitude 7.1. Research suggests this fault does not represent a major tsunami threat to Auckland.

An underwater volcanic eruption in the Hauraki Gulf or harbours surrounding Auckland could create a local source tsunami. If magma from a volcano suddenly comes into contact with water it can generate an explosive eruption called a phreatomagmatic eruption which can send large waves towards shore.

Regional source tsunamis in Auckland

Regional source tsunami are created in locations where the wave will come ashore one to three hours after generated. The most common source is subduction zones, where tectonic plates collide. The most common source concerns those in the southwest Pacific.

The Tonga-Kermadec trench to the east and northeast of Auckland could generate earthquakes greater than magnitude 9.0. Auckland Council has modelled the effects. The most susceptible to tsunami are coastal communities in the north. At coast wave heights for other parts of Auckland vary considerably.

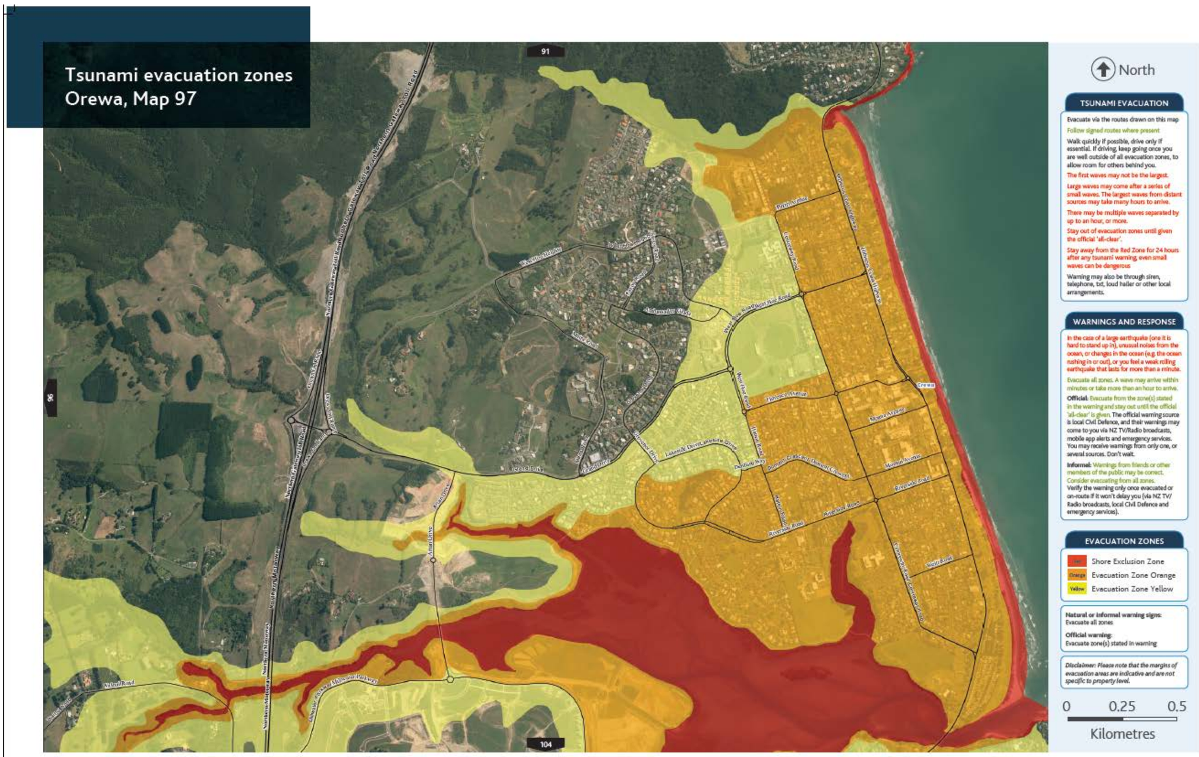
The South New Hebrides Trench, Vanuatu and Samoa are among areas in the southwest Pacific that could generate tsunami to New Zealand. Travel time to Auckland would be 2 to 3 hours.

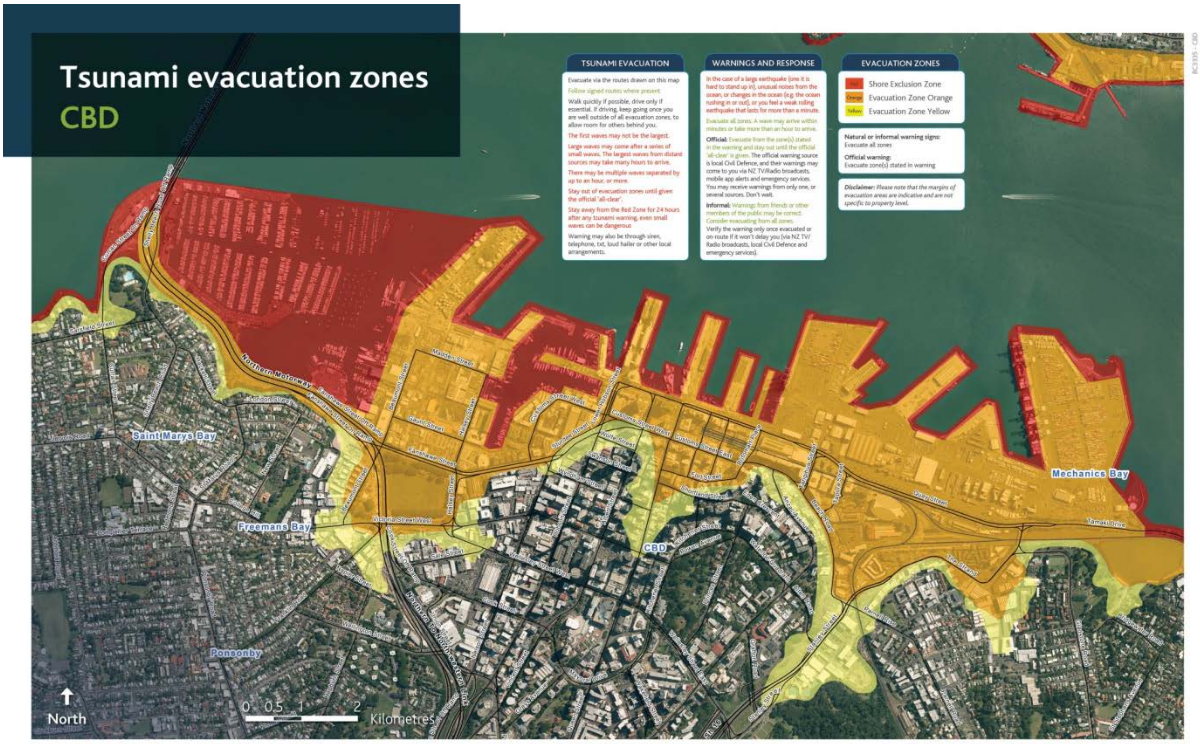
Distant source tsunamis in Auckland

Distant source tsunami generally have travel times between three and 15 hours. Large earthquakes occurring anywhere around the Pacific Rim have the potential to generate tsunami that can affect Auckland. Distant source tsunami from Alaska, Russia and most commonly South America have all been observed in Auckland.

The most frequent distant source of tsunamis affecting Auckland is the west coast of South America. Tsunamis generated here generally take around 12 to 15 hours to arrive and can affect both coasts, depending on the size and location of the earthquake. In August 1868, a large earthquake generated a tsunami that took 15 hours to reach Auckland and reached up to 2.9m on Great Barrier Island's east coast. In May 1960, the largest earthquake ever recorded, magnitude 9.5, occurred in Chile and created a tsunami that reached 1.5m on Great Barrier Island.

The Krakatau volcanic eruption of May 1883 in Indonesia generated a tsunami of about 1.8m in Auckland. This event was rare as it is one of only a few tsunami to occur in Auckland not created by earthquakes.


Tsunami evacuation zones
Orewa, Map 97
North
TSUNAMI EVACUATION
Evacuate via the routes drawn on this map
Follow signed routes where present
Walk quickly if possible, drive only if essential. If driving, keep going once you are well outside of all evacuation zones, to allow room for others behind you.
The first waves may not be the largest.
Large waves may come after a series of small waves. The largest waves from distant sources may take many hours to arrive.
There may be multiple waves separated by up to an hour, or more.
Stay out of evacuation zones until given the official 'all-clear'.
Stay away from the Red Zone for 24 hours after any tsunami warning, even small waves can be dangerous
Warning may also be through siren, telephone, txt, loud hailer or other local arrangements.
WARNINGS AND RESPONSE
In the case of a large earthquake (one it is hard to stand up in), unusual noises from the ocean, or changes in the ocean (e.g. the ocean rushing in or out), or you feel a weak rolling earthquake that lasts for more than a minute.
Evacuate all zones. A wave may arrive within minutes or take more than an hour to arrive.
Official: Evacuate from the zone(s) stated in the warning and stay out until the official 'all-clear' is given. The official warning source is local Civil Defence, and their warnings may come to you via NZ TV/Radio broadcasts, mobile app alerts and emergency services. You may receive warnings from only one, or several sources. Don't wait.
Informal: Warnings from friends or other members of the public may be correct. Consider evacuating from all zones. Verify the warning only once evacuated or on-route if it won't delay you (via NZ TV/Radio broadcasts, local Civil Defence and emergency services).
EVACUATION ZONES
Shore Exclusion Zone
Evacuation Zone Orange
Evacuation Zone Yellow
Natural or informal warning signs: Evacuate all zones
Official warning: Evacuate zone(s) stated in warning
Disclaimer: Please note that the margins of evacuation areas are indicative and are not specific to property level.
0 0.25 0.5
Kilometres


Tsunami evacuation zones
CBD
TSUNAMI EVACUATION
Evacuate via the routes drawn on this map
Follow signed routes where present
Walk quickly if possible, drive only if essential. If driving, keep going once you are well outside of all evacuation zones, to allow room for others behind you.
The first waves may not be the largest.
Large waves may come after a series of small waves. The largest waves from distant sources may take many hours to arrive.
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Disclaimer: Please note that the margins of evacuation areas are indicative and are not specific to property level.
Saint Marys Bay
Freemans Bay
CBD
Ponsonby
Mechanics Bay
Northern Motorway
North
0 0.5 1 2
Kilometres

APPENDIX 6: FIELDTRIP GUIDE — WELLINGTON

Wellington earthquake and tsunami risk and preparedness

Field Trip Guide

8 April 2016

Tour guides: **Phil Glassey[1], Richard Sharpe[2]**
Michele Daly[1], Kate Crowley[3], Nicci Wood[4]

1: GNS Science, Lower Hutt
2: Beca Wellington
3: National Institute of Water and Atmosphere (NIWA)
4: Wellington City Council

Contents

Introduction

During this day we will undertake a field excursion to explore many aspects of emergency management planning, land-use planning and options for hazard mitigation in Wellington City. We will give an overview of the Wellington Fault, visit the base isolated Wellington Hospital, view tsunami hazard zones, discuss tsunami warnings, look at land-use planning for tsunami and coastal erosion issues, and examine community-based engagement for preparedness and risk mitigation.

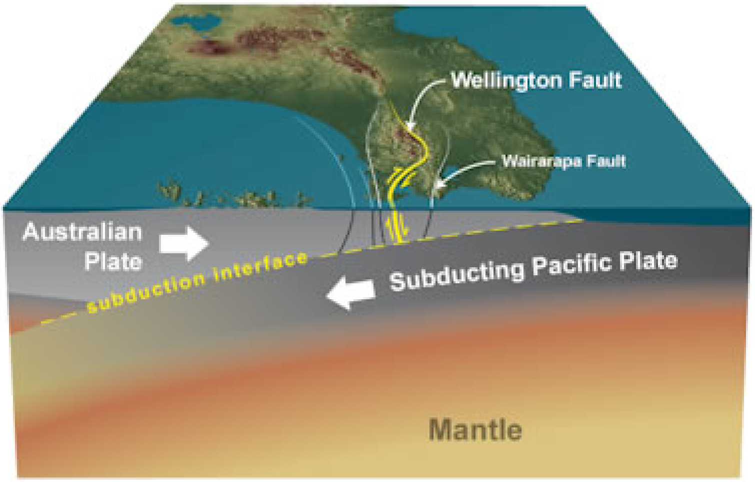
Schedule

Location	Topic	Time	Comments
Start – Mecure Wellington Hotel, Willis St		09:00 am	Bus
Stop 1 – Wellington Hospital	Base isolation	arrive 09:15 leave 09:45	Bus
Stop 2 – Mt Victoria	Geological and tectonic Environment	Arrive 09:55 leave 10:25	Bus
Stop 3 – Ribble St, Island Bay	The tsunami blue line	Arrive 10:40 Leave 11:10	Bus
Stop 4 – Island Bay	Tsunami hazard Coastal erosion	arrive 11:15 leave 11:45	Bus
Stop 5 – Te Raekaihau Point	Tsunami Hazard	arrive 11:55 leave 12:05	Bus
Stop 6 – Wellington Mosque Kilbirnie	Friday Prayers	Arrive 12:15 Leave 13:15	Bus. Those not praying – Boxed Lunch at Lyall Bay
Stop 7 – Te Papa	Te Papa (also Base isolated)	Arrive 13:30 Leave - Optional	Bus via Evans Bay. Boxed lunch
Finish – Walk back to Mecure Wellington Hotel, Willis St	Free Time Shopping etc.		Walk - 20 minutes

Route map


Legend
SymbolID
(1) Stop
Wellington Fault
(7) Te Papa
(0) Mecure Wellington Willis St Hotel
(2) Mt Victoria Lookout
(1) Wellington Hospital
(6) Mosque
(3)Tsunami Blue Line - Ribble St
(4) Island Bay
(5) Te Raekaihau Point
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Wellington's Shaky Foundations



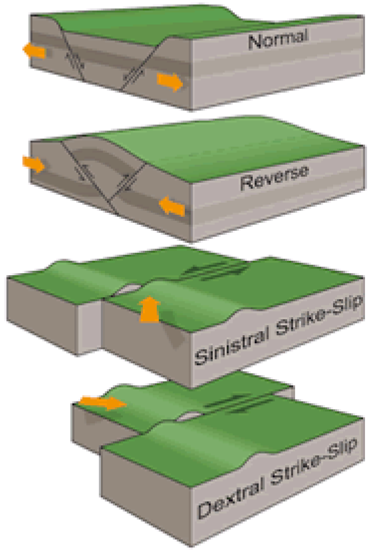
Wellington is sitting on the relatively light continental crust of the Australian Tectonic Plate which is riding over the dense oceanic crust of the Pacific Plate. The main boundary between the two plates (the subduction interface) slopes westward down beneath the North Island and is about 25-30 km below Wellington City. At Wellington the two plates are moving against each other at a rate of about 3.5 cm per year. This slow collision puts immense pressure on the crust and has broken it up into several large pieces, separated along fault lines – including the Wellington and Wairarapa faults, and the subduction interface. When the strain between these blocks of crust overcomes the resistance that locks them together, they move relative to each other and we experience the jarring, shaking jolt of a large earthquake!

How often do earthquakes occur?

The last time the Wellington Fault ruptured through the Wellington region, causing a major earthquake, was around 200 - 450 years ago. Geoscientists estimate the Wellington Fault will cause a major earthquake every ~1000 years. However other faults around the Wellington region are also active and capable of generating a major earthquake, for example the Ohariu Fault and the Wairarapa Fault which last ruptured in 1855 causing a great earthquake that severely affected Wellington. The frequency of large earthquakes affecting the Wellington Region is therefore much higher, with an average return time for very strong shaking of every few hundred years or so.

How much do our fault lines move?

Major faults in the Wellington Region move mainly sideways, with some up or down displacement as well. Scientists describe them as 'oblique dextral strike-slip' faults, which means that if you look across the fault the ground on the far side will move to the right, as well as a bit up or down!



In New Zealand's biggest historic 'quake in 1855, The Wairarapa Fault moved about 15 metres sideways and about 6 metres vertically! As a result of this great earthquake, the whole Wellington region was severely shaken, uplifted and tilted to the west. In fact, the land and sea floor near the harbour rose up about 1 - 1.5 metres!

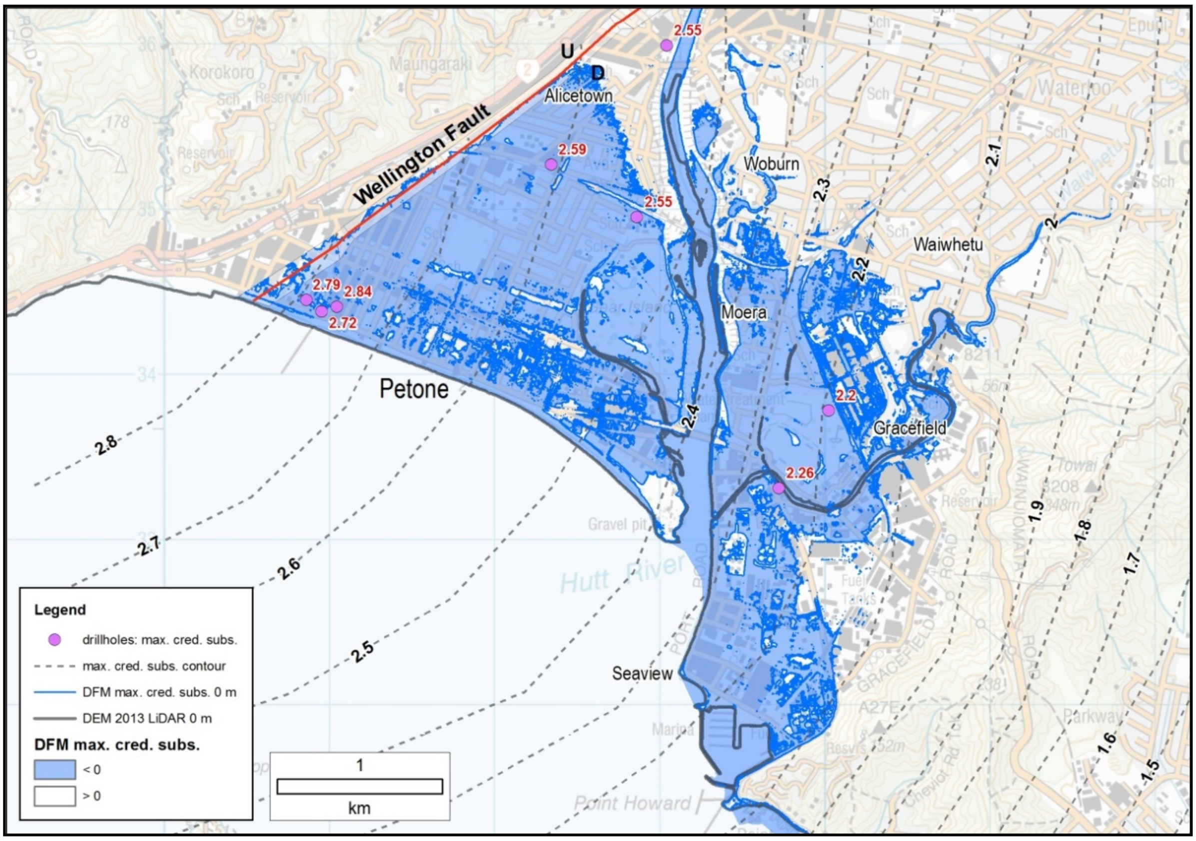
When the Wellington Fault next ruptures it is expected to cause about 4 – 6 m of dextral strike-slip, as well as a variable but lesser amount of vertical displacement – some areas will experience uplift, but others, like the Hutt Valley, may subside (sink) by about 1 metre.

What would a major Wellington earthquake be like?

Rupture of the Wellington Fault, (as well as the many other active faults in the Wellington region, including the Wairarapa Fault, the Ohariu Fault and the subduction interface) would cause a variety of major earthquake hazards. The most severe and damaging effect will be the strong ground shaking. The impacts of the ground shaking will vary around the region depending on:

- the size and depth of the earthquake - this determines the frequency and amplitude (strength) of the seismic waves as they travel through the earth's crust.
- the bedrock geology – for example, the soft and less consolidated sand and gravel sediments underlying much of the lower Hutt Valley will behave differently to the hard greywacke hills surrounding Wellington City.
- the type of building you are in. Fortunately, New Zealand has a state-of-the-practice and strongly enforced building code that makes our structures well designed to cope with earthquake shaking. We have also invented effective technologies for increasing building safety.

There will be other damaging effects of a large Wellington earthquake: many slips will occur throughout the region, especially if the hill slopes are already saturated by recent rainfall. In flat areas underlain by unconsolidated sediments the ground can liquefy, tilting buildings and causing buried pipelines and other structures to float to the surface! Up to 2.0 m of subsidence may occur in the Hutt Valley/Petone shoreline area inundating a significant part of the town.



Many of the coastal areas of the lower North Island will be at risk of a tsunami, caused by the Wellington fault displacing the seafloor or triggering a submarine slump. Within Wellington harbour and on rivers and lakes in the region there may also be 'seiche', as was observed in Harbour after the 1855 Wairarapa earthquake. A seiche occurs when seismic waves passing through the water body set up standing waves that can then inundate the surrounding shorelines.

The Wellington Fault passes under significant infrastructure such as the ferry terminal, motorway, railway, and several bridges along the Hutt Valley, which could be put out of action when the fault next ruptures. Transport routes throughout the region may also be affected by landslides and liquefaction, this means people could be stuck at work or at school or somewhere in between. Water supplies, electricity and phone lines may also be disrupted so it is a good idea to have an emergency action plan!

Stop 1: Wellington Regional Hospital

Wellington Hospital is the biggest of three public hospitals in the Wellington region. This main block (48,000 m^2, 400+ beds) was opened in 2008 to replace an older building. There is a nation-wide requirement for all public hospitals to be operational after a major earthquake, and this is achieved here by base isolation (lead-rubber bearings invented in Wellington), including under the adjacent Accident & Emergency Centre to the south. In addition, considerable work has gone into ensuring a resilient water supply (reservoir/tanks), and there are standby electricity generators on the site. Big flexible connections in the basement ensure water and sewage service is not disrupted by horizontal movement of the building on the bearings. The same system worked well under the Christchurch Women's Hospital in the 2010-11 earthquakes there.

Stop 2: Mt Victoria

Geological and tectonic environment

Mount Victoria provides a vantage point from which to appreciate the broader plate boundary environment of Wellington and the Hutt Valley. The scarp of the Wellington Fault, a surface expression of strain along the plate boundary, stands out prominently as the northwestern margin of Port Nicholson (**Figure 1**). To the southwest, Triassic greywacke lies on both sides of the fault. Greywacke underlies upstanding, flat-topped hills on the northwestern side of the harbour and Hutt Valley basin. Similarly, greywacke underlies hills on the eastern side of the harbour as well as Somes and Ward islands within the harbour. The harbour and Lower Hutt Valley forms a wedge-shaped, low-lying area between the Wellington Fault scarp and the eastern hills. Wellington City forms the southern boundary to this basin, the greywacke hills southeast of the city rising gently from beneath the basin.

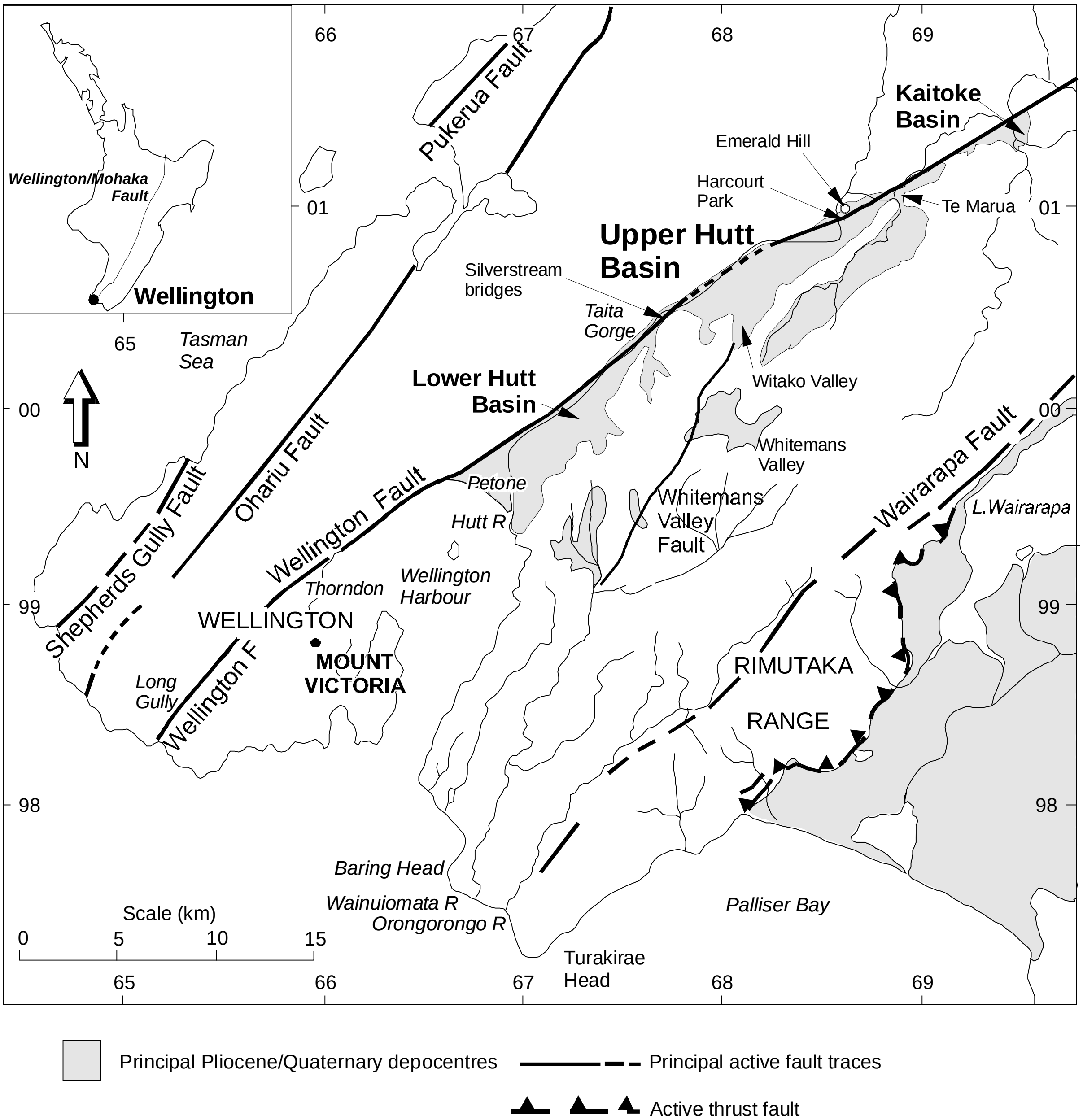


Figure 1 **a)** Location and continuity of the Wellington/Mohaka Fault through the North Island.
b) Major Quaternary depocentres (shaded) in the region east of the Wellington Fault, including the Lower Hutt, Upper Hutt and Kaitoke basins. The New Zealand metric grid is shown.

<u>Stop 3</u>: Ribble Street, Island Bay

The Tsunami thin Blue Line?

In 2010, Wellington City Council's Emergency Management team (a predecessor to WREMO) worked with the residents of Island Bay to develop an effective public education campaign to show where the largest tsunami might reach. After seven months of planning, a community-driven tsunami awareness plan was developed which included the innovative 'blue line' concept.

Wellington City Council painted blue lines across the streets at the maximum possible run-up heights. These lines are based on modelling by GNS Science and Greater Wellington Regional Council.

Tsunami Blue Line painted on street in Island Bay to indicate safe evacuation zone.

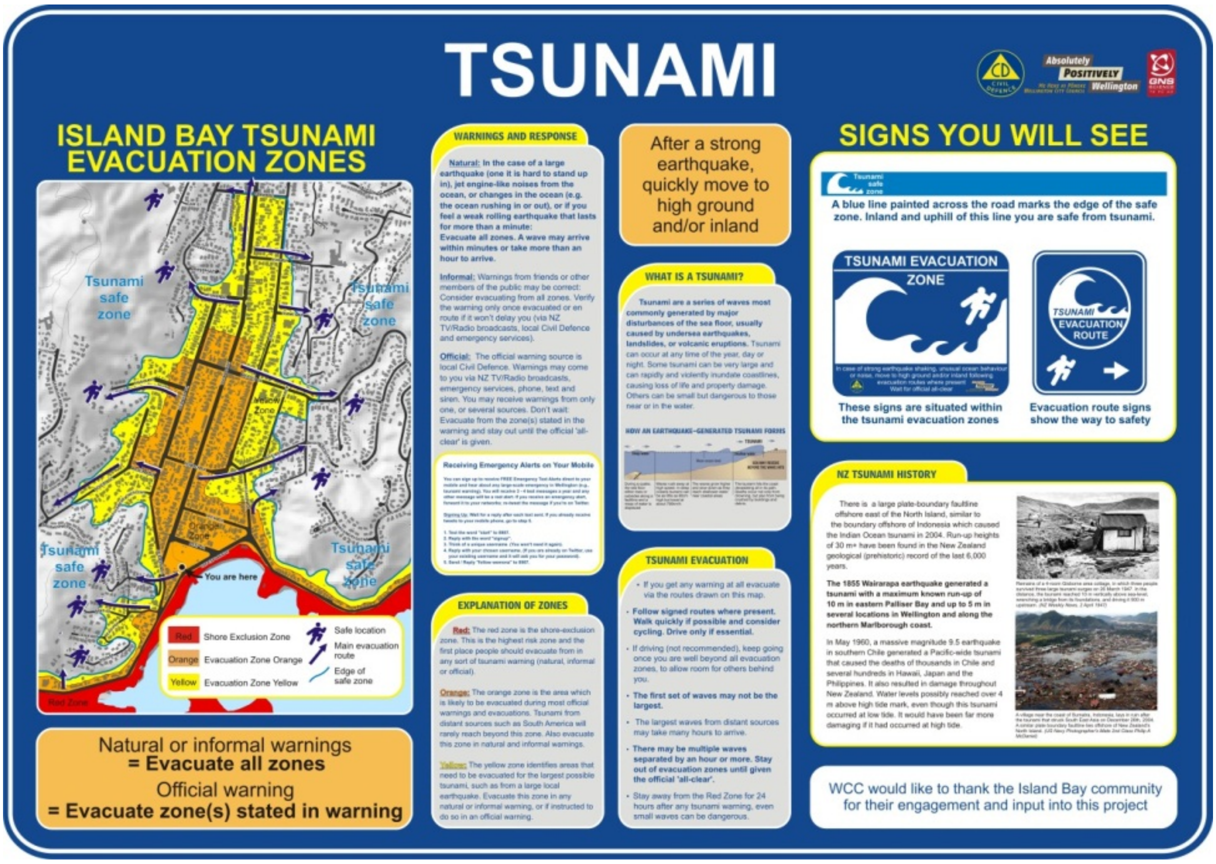
Suburbs along Wellington's south coast have a blue line painted across roads. The blue lines show the safe places to evacuate to if there is a long or strong earthquake. That is an earthquake that lasts longer than a minute or makes standing difficult. If you live, work or visit the coast, know where the blue lines are and how fast you can get there by foot.

The initial blue line project won the Global and Oceania awards for Public Awareness by the International Association for Emergency Managers in 2012 and assists with both building awareness of the tsunami risk hazard, and education of where to get to in order to be safe after an earthquake.

<u>Stop 4</u>: Island Bay

Tsunami hazard and Coastal erosion issues?

As part of the tsunami aware community project in Island Bay, there are tsunami hazard notice boards which have evacuation rotes marked and information about natural and official warnings.



Island Bay Seawall

Huge swells generated by a severe southerly storm that lashed Wellington in June 2013 caused widespread damage along the south coast. The most notable damage was to an 85 m length of historic seawall fronting the Esplanade, opposite Shorland Park in Island Bay. This seawall offered some protection to a busy coastal road, which connects the southern suburbs, the piped assets below the road and the residential buildings within 50 m of the beach.

Island Bay storm damage June 2013. Source NIWA.

After the storm the City Council placed a temporary rock barrier in the broken section of the seawall to protect the footpath and road. They commissioned and engineering firm to undertake a high level assessment of coastal processes operating within Island Bay.

As part of its smart decision making, resilience and adaptation work the Council want to take opportunity to assess the feasibility of not replacing the wall and use a softer engineering approach, closing the road, connecting the beach and park and implementing a more natural coastal edge.

Some of the storm damage to the Island Bay seawall (Source WCC).

They evaluated likely future shoreline evolution and effects on the existing infrastructure, and assessed potential future management options to improve long-term resilience and bring benefits to the community. The engineers produced the following options which were presented to the community for their consideration:

- Retain the seawall in its present alignment;
- Increase the beach size to provide a buffer;
- Relocate the wall and road further inland to the natural contour of the beach;
- Remove sections of the sea wall, close some roads and establish a dune system.

On consultation, people in the community supported the idea improved beach- park amenity which would be a gateway to the Taputeranga marine reserve. Others felt very strongly against options that meant closing roads and losing some of the sea wall. The community felt that this would increase traffic along quiet residential areas and increase journey time. They also felt that those options could be expensive and take time to implement.

Based on the consultation with the community the Councillors agreed to:

- repair the Island Bay seawall in a functional manner in the same style as the existing wall

And because this is a short term solution, offering little long term protection, they will also:

- continue to gather more detailed design information to develop the long-term solution to restore dunes in consultation with the community.
- implement the long- term solution of restoring dunes by 2018-2021.
- develop a resilience strategy including educational initiatives for the South Coast for managing coastal hazards

Source WCC Website:
http://wellington.govt.nz/your-council/projects/island-bay-seawall-replacement.

Stop 5: Te Raekaihau Point

Planning for tsunami evacuations: the case of the Marine Education Centre, Wellington

In 2007, the New Zealand Environment Court (W 082/2007) decided to uphold appeals relating to the effects of a Marine Education Centre proposed to be built on an exposed coastal site, susceptible to tsunami risk, south of Wellington city. This resulted in a significant ruling that applicants seeking resource consents for the establishment and operation of public facilities in areas susceptible to natural hazards should not overlook evacuation planning in their application.

When coming to its conclusion, the Court found that (at para147) "the inundation risk from a tsunami is significant for events with a return period of 50 years and greater, and that measures are required to reduce the risk to an acceptable level". The Court criticised the fact that it was unknown whether safe evacuation sites could be developed, nor if such sites would allow timely and practical evacuation. The Court concluded that such matters were "**a prerequisite for an evacuation plan and possibly even for the granting of a consent**" (at para147, emphasis added). It acknowledged that some tsunami risks had been considered but "without any firm measures to deal with an emergency situation" (at para182). The Court accepted the expert opinion that "if it is not possible to have an effective tsunami warning system and evacuation plan then the risk should be avoided" (at para135).

The implication of this conclusion that contributed to the appeals being upheld by a majority decision of the Court is significant for future applicants seeking resource consents for the establishment and operation of public facilities in areas susceptible to natural hazards, in that an evacuation plan is a necessary consideration of public safety. Indeed, it is also a statutory obligation under s6(e) of the New Zealand Health and Safety in Employment Act 1992 and part of the risk mitigation requirements of the Wellington Regional Policy Statement (Policy 2).

In the light of this judgement, *what is an effective evacuation plan*? All at-risk facilities should have appropriate emergency response planning which would include:

- Warning notification protocols and systems;
- Evaluation and mapping of evacuation routes, with signage to designated assembly points;
- Consideration of evacuation timing; and
- Staff training and evacuation plan exercising.

Not only should the availability of suitable evacuation sites be identified, it is recommended that consideration be made of the practicality of reaching them in a short timeframe under difficult conditions such as darkness and adverse weather by evacuees with different ability and fitness levels.

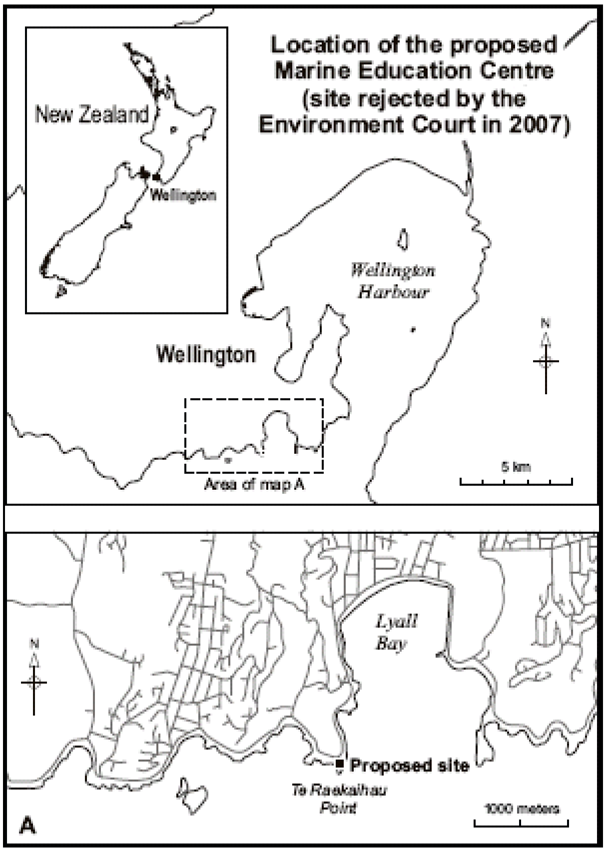
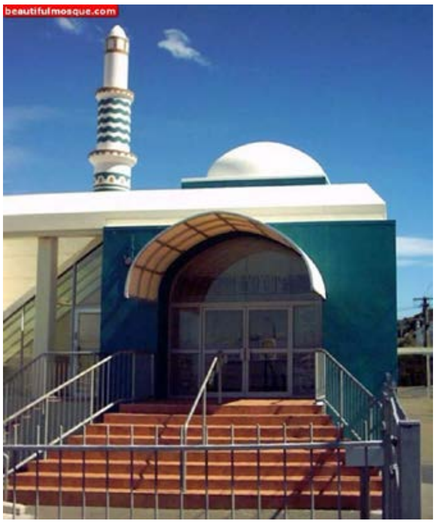


Figure 2 Location map of the proposed Marine Education Centre.

<u>Stop 6</u>: Wellington Masjid, Kilbirnie

Wellington Islamic Centre in Kilbirnie caters for Wellington's growing Muslim community. It is designed in a traditional Islamic style, with domes and a minaret. Prayers are at 12:21 pm.



<u>Stop 7</u>: Te Papa

Te Papa in New Zealand's National Museum. It is located on reclaimed land and had substantial ground improvement, is base isolated and some consideration has been given to tsunami. Some of the base isolators are on display permanently in the "Quake Breaker" exhibition. Other permanent exhibitions to note include.

"Awesome Forces" - Starting with a model of the Earth's interior, the exhibition explains the forces that change the surface of the globe. It shows New Zealand's position astride two mighty tectonic plates, and explains how the movement of the plates is measured. It also has a shake house simulation.

"Mountains to Sea" - presents New Zealand's diverse range of creatures and plants from its high places to the deep underwater off its shores. The exhibition offers you a journey through six major kinds of ecosystem - alpine, bush, freshwater, coastal, open ocean, and deep sea.

In addition there are a number of featured exhibitions which display aspect of New Zealand's culture and natural environment, such as *Gallipoli, The Scale of Our War*, the *Colossal Squid* and *You Called Me What?* (a scientific discovery History of NZ). There is no charge for most exhibitions.

The Museum is open from 10 am to 6 pm on Fridays.

Te Papa is a 20 minute walk to the Wellington Mecure Hotel. There are many shops on the way home.

APPENDIX 7: FIELDTRIP GUIDE — HAWKES BAY/GISBORNE

StIRRRD NEW ZEALAND COMPARATIVE STUDY TOUR PROGRAMME

Field Trip: Napier-Gisborne 10—13 April 2016

Natural Hazards - and the impacts of land use and catchment management

Mike Page, Brenda Rosser, Phaedra Upton, Diane Bradshaw

Storm surge and coastal erosion at Haumoana Beach Photo: stuff.co.nz

HEALTH AND SAFETY ISSUES

PLEASE READ!

There are certain inherent hazards associated with the fieldtrip and participants must heed and observe the warnings and time limitations imposed at certain stops by the trip leaders. Caution must also be exercised when crossing public roads, standing on the road reserve, or on farm tracks or at forestry locations where vehicles or machinery may be in use.

Participants should carry any personal medications, including those for allergic reactions (e.g. insect stings, pollen, food allergies).

The weather in April can be variable, although we hope for warm sunny conditions! Participants need to be prepared for cold, warm, wet, and/or dry conditions. The expectation is that temperatures would be in the range from 10°C (50F) to 20°C (68F), although temperatures as low as 5°C (41F) or as high as 25°C (77F) are possible. Sturdy walking/running shoes or lightweight boots are recommended. A hat, rain and windproof coat, and warm clothing (layers) are essential. If the weather is warm, drink plenty of water to combat dehydration. Please don't underestimate the climatic variations that are possible or the potential to get sunburnt.

An average level of fitness and mobility is required for this trip. While at the Tarndale Slip in the Mangatu Forest (Stop 4), the party is requested to stay clear of the edge of the slip and not to linger on any ground where large cracks have formed. Areas of unstable ground will be taped off. The fieldtrip leaders will point out comparatively safe locations to stand: please keep to these.

In addition, due to the changing nature of the weather in April, we cannot guarantee that conditions will be exactly as we expect them. Conditions change frequently sometimes on a daily if not hourly basis. Circumstances on the day may dictate what is appropriate in terms of access and Health and Safety considerations.

When visiting roadside stops, the fieldtrip leaders will have overall responsibility for the safety of the site and of the participants. Please exit on the verge/left side of your vehicle if safe to do so and wait for a safety briefing for the site before moving away from your vehicle. If you need to go onto the road surface itself ("live lane"), for example to take photos, you must ensure you have a traffic spotter whose full attention is solely to alert you to approaching traffic.

Field trip itinerary

Time	Location
Sunday 10 April	
7:00 - 8:00	Breakfast
8:00 - 12:00	Group Two travel to Napier - NZ8104 25 Seats - 9:20am-10:15am
12:00 - 1:00	Lunch
1:00 - 5:30	**FIELDTRIP (Napier)**
	Stop 1: Ahuriri Lagoon (tectonics/geo-setting; subsidence/uplift; earthquakes and 1931 earthquake; liquefaction project) (Phaedra Upton/Brenda Rosser, GNS Science)
	Stop 2: Bluff Hill (Landslide) (Jon Kingsford, Napier City Council) *
	Stop 3: Te Awa subdivision (liquefaction), (Jon Kingsford, Napier City Council)
	Stop 4: Napier Museum - Visit to 1931 display (Brenda Rosser, GNS Science)
6:00-8:00	Dinner - Restaurant Indonesian (Marine Parade)
Monday 11 April	
7:00 - 8:30	Breakfast
8:30	Bus from Accommodation to Hawkes Bay Business Hub
	Session 10: Hawkes Bay Council Planning
9:00 - 9:30	**East Coast LAB**
	Lisa Pearce, Hawkes Bay Regional Council
9:30 - 10:00	**Hawkes Bay Hazard Portal**
	Lisa Pearce, Hawkes Bay Regional Council
10:00 - 10:30	Morning Tea
10.0 - 11.00	**Hawkes Bay Coastal Hazards Strategy**
	Mike Adye, Hawkes Bay Regional Council
11.00 - 2.00	**FIELDTRIP (Napier)**
	Stop 1: Haumoana (Mike Adye, HBRC)
	Stop 2: Craggy Range - rockfall hazard (Brenda Rosser, GNS Science)
	Stop 3: Te Mata Peak (lunch)
	Lunch Te Mata Peak
2.00 - 3.00	**CDEM Group Planning and Risk Management**
	Ian MacDonald (CDEM Group Controller)
3.00 - 3.30	**Tsunami community response plans**
	Jae Sutherland, Hawkes Bay Regional Council
3.30 - 4.30	**Emergency Management – adaptable emergency response**
	Marcus Hayes Jones, Napier City Council
6:00 - 9:00	Dinner venue TBC
Tuesday 12 April	
7:00 - 8:30	Breakfast and checkout
8:30 - 1:30	**FIELDTRIP (Napier- Gisborne) Drive to Gisborne via SH2**
	Stop 1: Lake Tutira - record of natural hazards (Mike Page, GNS Science)
	Stop 2: Lunch @ Gisborne Lookout
1:30 - 7:00	**Stop 3: Muriwai Marae (Ngai Tamanuhiri)**
	Powhiri (Welcome) (Indonesians and GNS to respond)
	Afternoon tea
	Introductions

	Iwi ppt presentation on land use and relationship with their land
	Indonesian ppt pres on natural hazards and issues in Indonesia (Faisal)
	GNS Science ppt presentation on StIRRRD programme (Michele)
	Walking tour of important sites (floods, changed river course, tsunami)
	Dinner (5:30)
7:15	Hotel: Quality Hotel Emerald, 13 Gladstone Rd, Gisborne
8:00-9:00	**Joint Management Agreement between Ngati Porou and Gisborne District Council**
	Pia Pohatu/Tui Warmenhoven/Dave Wilson, GDC
Wednesday 13 April	
7:00 – 8:00	Breakfast and checkout
8:00	**FIELDTRIP (Gisborne)**
8:00 - 4:00	Stop 1: Kaiti Hill Lookout - overview/ landuse/natural hazards
	(Mike Page, GNS Science/Louise Bennett, Gisborne District Council)
	Stop 2: Wainui Beach - coastal erosion and management strategy (Dave Peacock)
	Stop 3: Tangihanga Stn - Wi Pere Trust/ farming/hazards (iwi/Dave Peacock)
	Stop 4: Tarndale Slip - erosion/reforestation (Mike Marden, Landcare Research)
	Stop 5: Waipaoa Station - river aggradation/lunch (Mike Marden/Dave Peacock)
	Stop 6: Wairere Rd - farming/erosion/ soil conservation
	(Kerry Hudson, Gisborne District Council)
	Stop 7: McPhail's Bend - Waipaoa river flood control scheme (Dave Peacock)
	Local Government Group depart for Auckland NZ8654 6:10 pm
4:00 - 6:00	University Group depart for Wellington NZ2237 4:40 pm

Indonesian Participants

No	Name	Institution
1	Teuku Faisal Fathani	UGM
2	Iman Satyarno	UGM
3	Wahyu Wilopo	UGM
4	Agung Setianto	UGM
5	Esti Anantasari	UGM
6	Arry Retnowati	UGM
7	Fransisca Ediningtyas Mahanani	UGM
8	Gumbert Maylda Pratama	UGM
9	Aryo Wicaksono	KEMENDESA
10	Yoga Wiratama	MOHA
11	Bambang Warsito Saroji	BPBD of Agam District
12	Yunelimeta Asman Djannas	BPBD of Agam District
13	Tesri Maideliza	Universitas Andalas
14	Azwardi Binap Pangkuak	BPBD of Seluma District
15	Husni Thamrin	Parliament of Seluma District
16	Julian Zuherwan Dain	BAPPEDA of Seluma District
17	Ade Sri Wahyuni	Universitas Bengkulu
18	Yosar Kardiat	BPBD of Morowali District
19	I Wayan Sugita	Spatial Planning Agency Morowali
20	Ambo Dalle Side Abbas	Parliament of Morowali District
21	I Ketut Sulendra	Universitas Tadulako
22	Ida Sri Oktaviana	Universitas Tadulako
23	Mukmin	BPBD of Sumbawa District
24	Lalu Budi Suryata	Parliament of Sumbawa District
25	Eko Pradjoko	Universitas Mataram
26	Yudhy Harini Bertham	Universitas Bengkulu
27	Zamira Eliana Tatapamang	UGM

New Zealand Presenters

Name	Organisation
Jon Kingsford	Napier City Council
Lisa Pearse	Hawke’s Bay Regional Council
Mike Adye	Hawke’s Bay Regional Council
Ian MacDonald	CDEM Group Controller
Jae Sutherland	Hawke’s Bay Regional Council
Marcus Hayes Jones	Napier City Council
Louise Bennett	Gisborne District Council
Dave Peacock	Consultant (ex Gisborne District Council)
Mike Marden	Landcare Research
Kerry Hudson	Gisborne District Council

StIRRRD Field Trip Itinerary – Napier

Sunday 10 April

1.00 pm	Depart hotel
Stop 1	Arrive Ahuriri Lagoon @ 1.15 (uplift/subsidence, earthquake records, Liquefaction)
2.00	Depart Ahuriri
Stop 2	Arrive Bluff Hill Lookout @ 2:15 (Landslide hazard)
2.30 pm	Depart Lookout
Stop 3	Arrive Te Awa Subdivision @ 2.45 (Liquefaction
3.00 pm	Depart Te Awa Subdivision
Stop 4	Arrive Napier earthquake museum @ 3:15 (1931 earthquake)

Field trip route – Napier

SUNDAY APRIL 10

Stop 1: Ahuriri Lagoon – Uplift/subsidence and earthquakes (Phaedra Upton)

Ahuriri Lagoon is the site of several stratigraphic and paleoecological studies that have found evidence for coseismic Holocene subsidence (*Hull*, 1986; *Chague-Goff et al*., 2000; *Hayward et al*., 2006). However, the location is also well known because it was uplifted in the 1931 Ms=7.8 Hawke's Bay earthquake. The 1931 earthquake resulted in uplift 1–1.8 m of Ahuriri Lagoon (Figures 1-3). It enabled the area to be farmed and provided a large flat area for the airport. The southern Hawke's Bay region is inboard of the areas of slow slip on the plate interface.

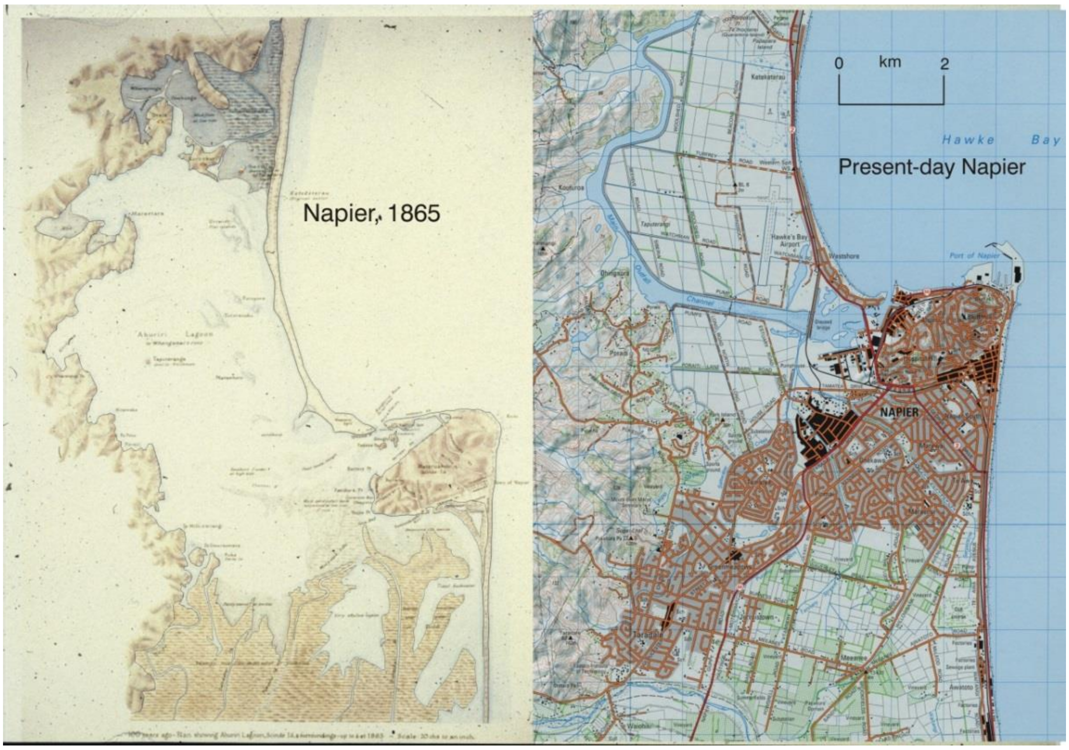


Figure 1 Ahuriri Lagoon before and after the 1931 Hawke's Bay (Napier) earthquake.

Figure 2 View north in 1931 of the western margin of Ahuriri Lagoon. Uplift of about 1 m permanently exposed part of the pre-earthquake lagoon and diverted the Tutaekuri River southward. From Hull (1990).

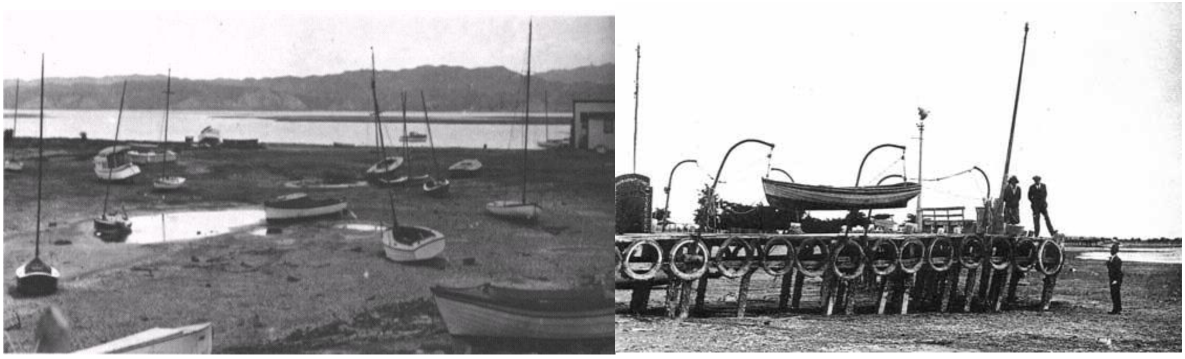


Figure 3 Stranded boats and pier in Ahuriri Lagoon.

Foraminiferal and diatom assemblages and sediment thicknesses in eleven cores (3-7.5 m deep) from the former bed of brackish-marine Ahuriri Inlet (Figure 4) were examined by Hayward et al. (2006). Microfossil-based paleoelevation estimates were combined with sediment thicknesses, age determinations, the New Zealand Holocene sea level curve, and estimates of compaction, to identify the Holocene land elevation record (LER) of each core (Figure 5). *Hayward et al*. (2006) obtained a record of 8.5 m of subsidence followed by 1.5 m of uplift in the last 7200 cal years.

The following earthquake-related vertical displacement events were identified from the LER plots:

- 1931 AD Hawke's Bay Earthquake, +1.5m displacement
- ca. 600 cal yr BP, ~ -1m
- ca. 1600 cal yr BP, ~-1.7m
- ca. 3000 cal yr BP, -1.4 to -1.8m
- ca. 4200 cal yr BP, ~-1.5m
- ca. 5800 cal yr BP, -0.5m+
- ca. 7000 cal yr BP, -0.6 m+.
- A further ~1–2m of tectonic subsidence is inferred to have occurred during smaller earthquake events during the interval 7000–3000 cal yr BP.

The six subsidence events in the last 7000 years have had a return time of 1000–1400 years in central Hawke's Bay. The tectonic structure responsible for the subsidence events at Ahuriri Lagoon is not confidently known, but it is possible that the subsidence relates to subduction earthquakes. The Ahuriri Lagoon earthquakes at ca. 5800 and ca. 7000 yrs BP may correlate to the ca. 5500 and ca. 7100 yrs BP subsidence events in northern Hawkes Bay (Figure 6). If we assume that the subsidence events that occurred at ca. 7000 cal. years BP in northern and central Hawke's Bay were synchronous (although the resolution of radiocarbon dating is not good enough to prove this) and occurred on a single structure, then a plate interface source is likely. Such an event might have affected >100 km of coastline and would have had a magnitude of at least M_W 8.0 (Wallace et al., 2009). Further work is taking place along the Hawkes Bay coastline to constrain the extent of deformation associated with the ca. 5500 and ca. 7000 year events.

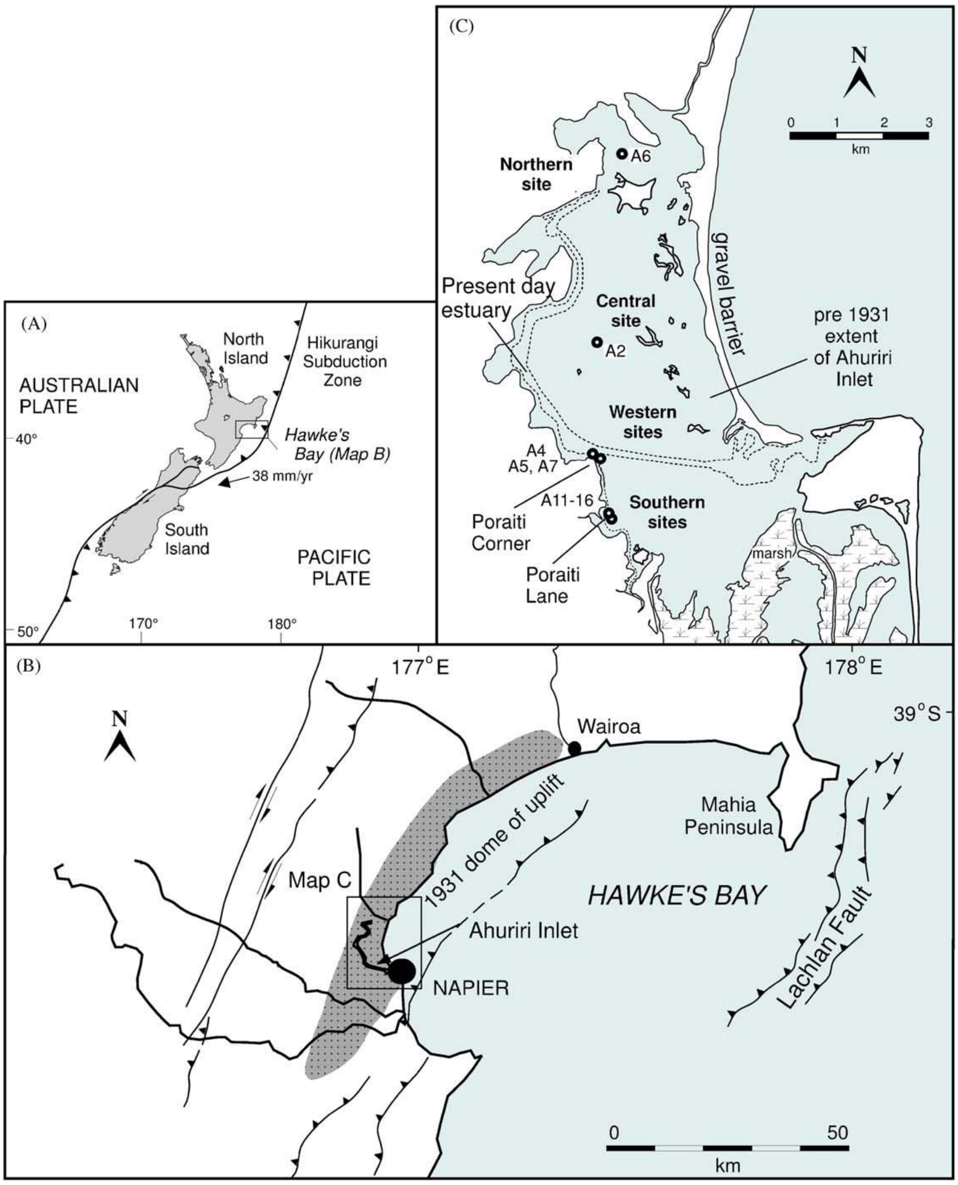


Figure 4 (A) Map of New Zealand showing location of Hawke's Bay above the Hikurangi margin on the Pacific-Australian plate boundary. (B) Map of Hawke's Bay region showing location of major active fault zones (Barnes et al., 2002) and elongate dome of land uplifted during the 1931 Napier Earthquake (Hull, 1990a). (C) Core site locations within the pre-1931 extent of Ahuriri Inlet. The dashed extent of the existing post-1931estuary is also shown. From Hayward et al. (2006)

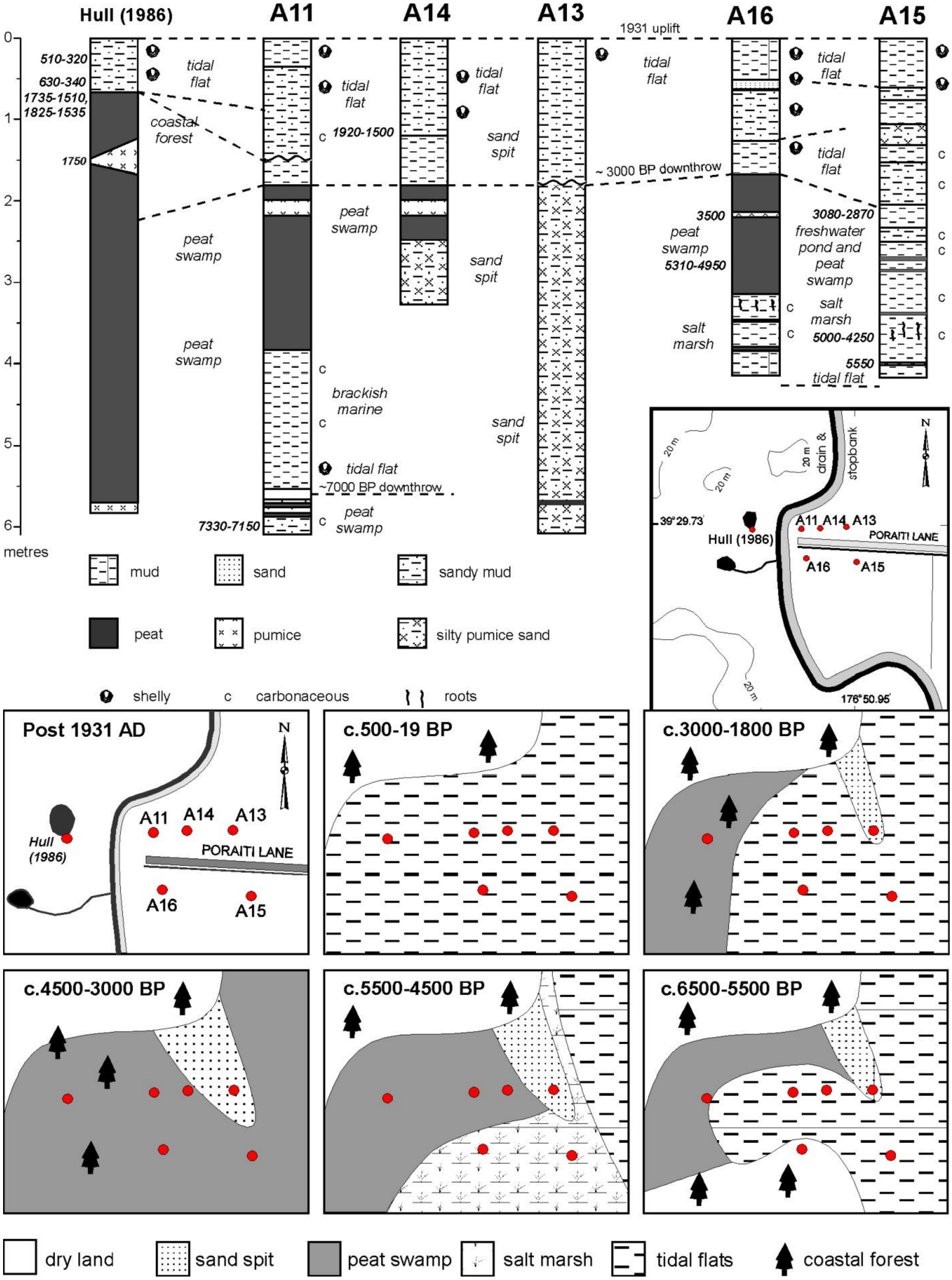


Figure 5 Generalised Holocene lithostratigraphy of five SW Ahuriri Inlet cores plus that recorded in a nearby excavation by Hull (1986). Radiocarbon and tephra ages are shown (in cal yrs BP). Inferred Holocene paleogeographic history of this embayment is shown in six maps at the bottom. From Hayward et al. (2006).

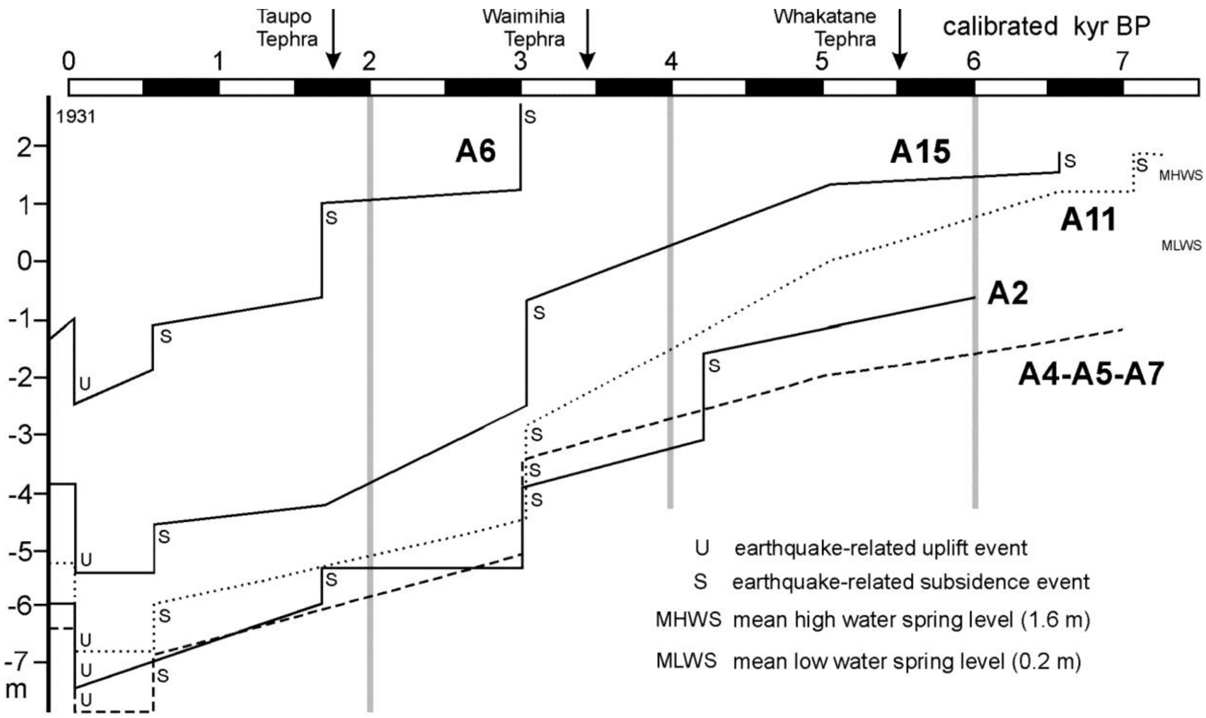


Figure 6 Holocene land elevation history curves for five Ahuriri core sites, based on the indicated elevational record from foraminifera and diatoms, corrected for slight eustatic sea-level change, and adjusted for bedrock depth and lithology-influenced compaction. Accuracy limits on ages assigned to sudden elevational changes have been deleted for simplicity. Adapted from Hayward et al. (2006).

1931 Hawke's Bay Earthquake

At 10.47 am on 3 February 1931 local time (2 Feb, 22h 46m UT), a large (Ms=7.8) earthquake struck Hawkes's Bay and was felt throughout most of New Zealand (Figure 7). Within minutes, the business districts of Napier and Hastings lay in ruins and were engulfed by fire. The death toll of 256, mostly in Napier and Hastings, makes this earthquake New Zealand's greatest disaster.

Bullen (1938) judged the earthquake to have been a multiple event, comprising the initial shock, followed by two large events, 6 seconds and 14 seconds later. There were no major foreshocks, and no earthquakes had been felt at Napier for 30 days prior to the February 2 shock (*Adams et al*., 1933). Bullen (1938) located the earthquake at 39.33°S, 176.67° E (±0.2°), 32 km northwest of Napier.

The earthquake had a focal depth between 15-20 km and a surface wave magnitude of 7.8 (*Smith*, 1978). Aftershocks continued throughout 1931, the largest being a M_s 7.3 event on February 13, which appeared to have a similar epicentre but shallower focus than the mainshock (*Bullen*, 1938).

Post-earthquake geological investigations and re-levelling of the Wellington-Gisborne railway, revealed uplift of a >90 km-long, 17 km-wide asymmetric dome, from southwest of Hastings to northeast of the Mohaka River mouth, and a total of 15 km of surface rupture on several faults at the southwestern end of the dome.

Coseismic slip was probably in the order of 6-8 m dip-slip and a 4-8 m strike-slip, but after 60 years only the uplift of Napier's former harbour-Ahuriri Lagoon-remains well preserved in the geological record. Present geological techniques for recognising prehistoric earthquakes would therefore fail to identify the magnitude of deformation associated with this event (*Hull* 1990).

Fault modelling from the observed elevation changes and retriangulation data suggest that the 1931 earthquake occurred on a dextral-reverse fault that dips steeply to the northwest (*Haines and Darby*, 1987), within rocks of the most inboard part of the accretionary prism beneath central Hawke's Bay. Their work suggests that the rupture probably extended upward from the subducted plate interface into rocks of the accretionary prism, but without involving rupture of the interface itself, which is about 20 km beneath the region (*Reyners*, 1980).

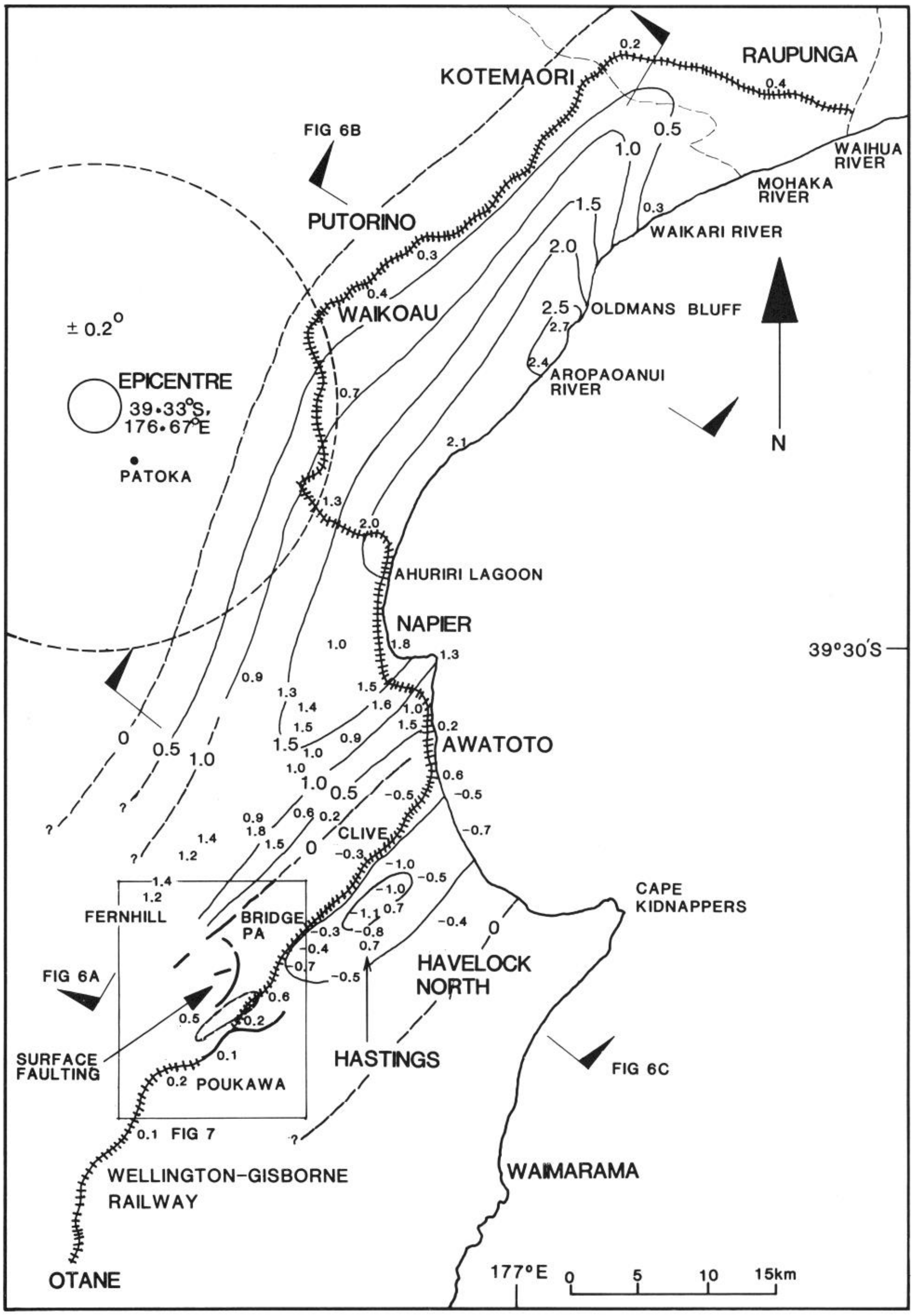


Figure 7 Contours of height change as a result of the 1931 Hawke's Bay earthquake. From Hull (1990).

Hawke's Bay Liquefaction Risk Project (Brenda Rosser, GNS)

GNS Science and the Hawke's Bay Civil Defence Emergency Management Group are coordinating a joint project to review liquefaction risks for Hawke's Bay, including the development of a geotechnical database following the success of the Canterbury Geotechnical Database (CGD).

Previous liquefaction mapping in Hawke's Bay (in 1997) assigned liquefaction susceptibility classes to geological units, based on historical liquefaction occurrences. Regional liquefaction susceptibility maps were produced from a geological map, for various earthquake scenarios. Very limited geotechnical data (boring logs, and SPT data) was available for the study area, and these were evaluated to correlate subsurface materials to the Quaternary geologic map units. The maps provide a general indication of where liquefaction will occur, and the relative extent of the liquefaction.

This new project will update existing liquefaction hazard mapping and provide refined and improved liquefaction susceptibility and hazard information due to the recent availability of a number of important digital datasets, including LiDAR topographic coverage, soil maps, the HBRC drillhole database, and new geotechnical data. Areas more susceptible to liquefaction will be identified using geomorphologic and soil maps along with geotechnical information on subsurface ground conditions. In addition, a 3D urban geology model of Napier and Hastings cities will be developed and will provide the geological framework on which liquefaction susceptibility will be based. A risk-based planning assessment will be used to address the effects of liquefaction ensuring that the economic, environmental, social and cultural consequences of development are explored and quantified as part of future planning decisions.

In New Zealand, historical precedent evidence indicates that at least MM7 shaking is generally required for liquefaction. Since 1840, at least ten earthquakes have generated a Modified Mercalli shaking intensity of 7 or greater in parts of the Hawke's Bay. The reported ground damage effects include sand boils and water ejection, subsidence and settlement, fissuring and lateral spreading.

Quantification of ground damage

We are using an index called the Liquefaction Severity Number (LSN), that has been developed by Tonkin and Taylor (Tonkin and Taylor, 2013) using building and infrastructure damage data collected from Christchurch following the September 2010 Darfield and February 2011 Christchurch earthquakes. It is calculated using geotechnical data derived from CPT's, as well as information on the earthquake shaking intensity and groundwater depth. The LSN number allows us to quantify the expected ground damage at a site, for different earthquake scenarios, eg. sand boils, lateral spreading, ground cracking etc., and also predict the amount of vertical and horizontal ground displacements due to liquefaction and lateral spreading (Figure 8). A range of LSNs have been assigned to each geotechnical/geomorphological mapping unit for various earthquake scenarios (Figure 9). When combined with data in the asset database, it allows us to quantify damage from liquefaction for different earthquake magnitudes (Table 1).

Table 1 Quantification of liquefaction ground damage with LSN

LSN Range	Typical effects	Vertical Displacement	Horizontal Displacement
0 – 10	Little to no expression of liquefaction, minor effects	0	0
10 – 20	Minor liquefaction expression, some sand boils	0-10 mm	0-5 mm
20 – 30	Moderate expression of liquefaction, with sand boils and some structural damage	10-50 mm	5-10 mm
30 – 40	Moderate to severe expression of liquefaction, structural settlement and damage	50-200 mm	10-30 mm
40 – 50	Major expression of liquefaction, undulations and damage to ground surface, severe total and differential settlement of structures	200-500 mm	30-50 mm
>50	Severe damage, extensive evidence of liquefaction at surface, severe total and differential settlements affecting structures, damage to services.	>500 mm	>50 mm

Figure 8 Examples of modearte to severe land damage (LSN >30) in Christchurch following the M6.3 February 22, 2011 earthquake.

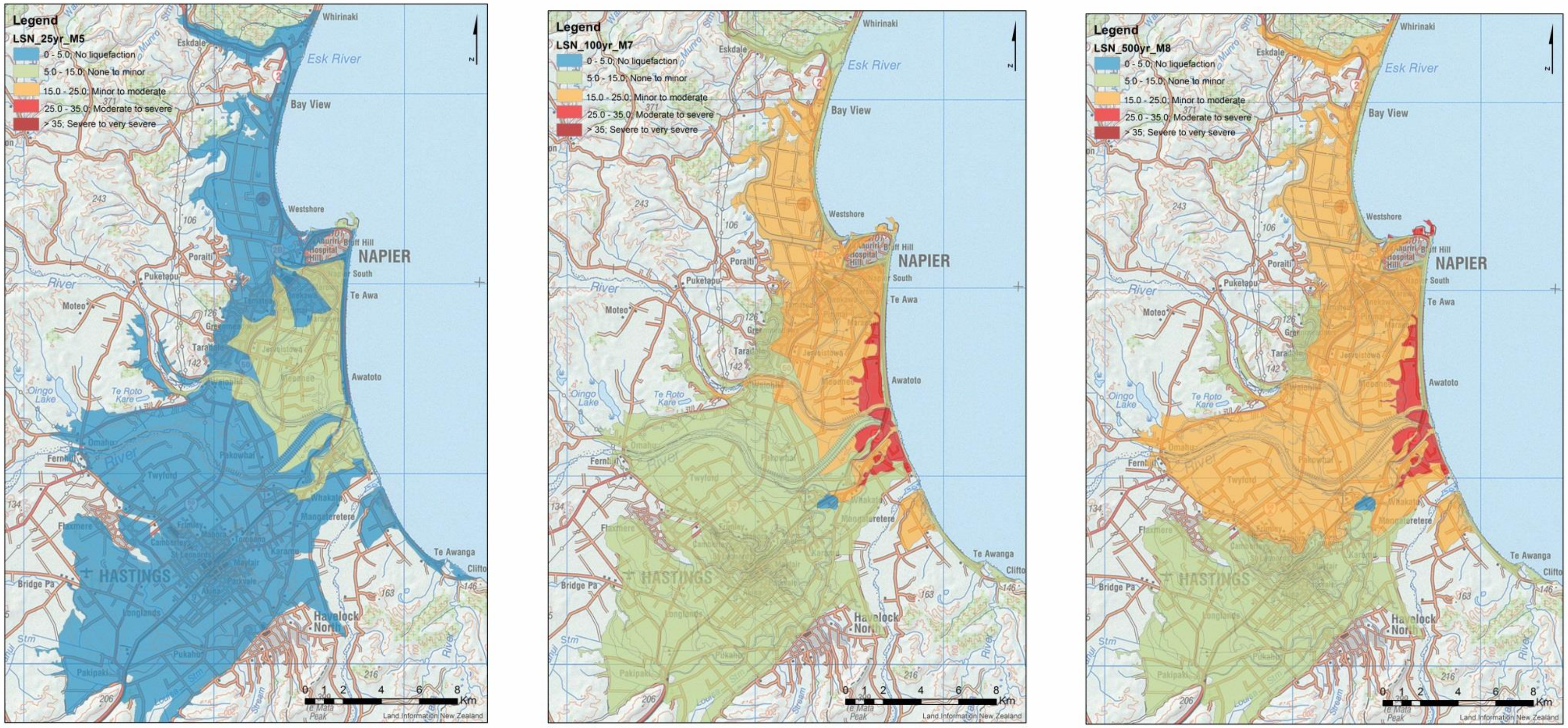


Figure 9 Distribution of different levels of liquefaction ground damage expected to be caused by earthquakes of increasing magnitude and return period. As the earthquake return period of interest, and the earthquake magnitude increases, both the level of damage, and the area affected increases.

Assessment of liquefaction risk

GNS Science (and NIWA) are developing RiskScape, a natural hazard risk assessment tool for analysing risks and impacts from multiple hazards. It converts hazard exposure information into the likely impacts for a locality or region, for example, damage and replacement costs, casualties, economic losses, infrastructure and business disruption, and number of people affected. An asset database for Napier and Hastings has been developed for this project (Figure 10).

The asset database contains information on:

- Buildings (commercial, residential, industrial)
    - Earthquake prone buildings (address, age, %National Building Standard)
    - Critical facilities/lifelines (hospitals, port etc.)
    - building footprint layers, building height
    - address, age, floor area, footprint, use category, etc
    - Construction costs
- Infrastructure
    - Water – supply, waste, storm
    - Transport – Roads, Rail, Port, Airport
    - Cables – telcos, electricity, gas
- Population
    - Day and night time distribution
    - Deprivation index
    - Schools (students, teachers, staff)

Using RiskScape, we will determine the extent and distribution of damage to buildings and infrastructure and the direct replacement costs, casualties, and number of people affected by liquefaction for earthquake scenarios that represent ground shaking at serviceability and ultimate limit states (25, 100, 1000 and 2500 yr earthquake return periods). The risk associated with these earthquake scenarios will be assessed by overlaying the building and infrastructure database in Riskscape. We are using RiskScape to evaluate combined losses (from shaking plus liquefaction) for the various earthquake recurrence interval motions for the region. We will then be able to evaluate the risk profile by evaluating the impacts on buildings, infrastructure and communities when subjected to the selected shaking scenario events. Examples of RiskScape outputs for liquefaction damage in Napier and Hastings are shown in Figures 11 and 12.

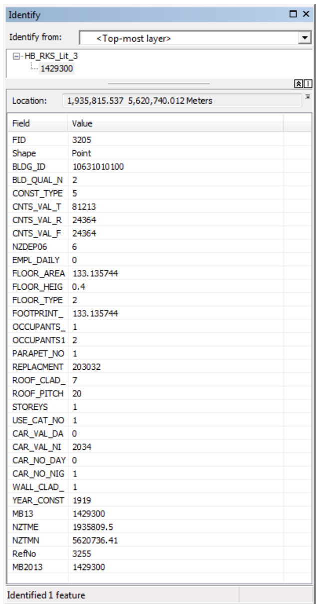


Figure 10 Building information stored in RiskScape

Figure 11 Damage distribution in Napier for earthquake generated shaking and associated liquefaction with a 500 year return period. The height of the stack indicates the number of buildings within the suburb and each colour band a different state of damage, the upper three being buildings unsafe to occupy and the lower stack being light or no damage.

Figure 12 Damage distribution in Hastings District for earthquake generated shaking and associated liquefaction with a 500 year return period. The height of the stack indicates the number of buildings within the suburb and each colour band a different state of damage, the upper three being buildings unsafe to occupy and the lower stack being light or no damage.

Stop 2: Bluff Hill Landslides (Jon Kingsford, Napier City Council)

A landslide is the movement of a mass of rock, debris or earth down a slope. Landslides can occur on land or under water. A combination of steep terrain and weak rock and soils makes Hawke's Bay prone to both deep-seated and shallow landslides. Landslides are a threat to infrastructure, property and assets and life.

Landslide Types and Processes

In Hawke's Bay, landslides come in a variety of shapes speeds and sizes, from small rapid surface slips that are of 1 to 10 cubic metres, to huge slow-moving regional slumps.

Most landslides are caused by a combination of several factors which create the potential for movement, and then an event which triggers the movement.

The important factors in determining the potential for landsliding are soil/rock strength and type, subsurface water levels and slope angles. The common triggering factors are rainfall, burst pipes, melting ice, earthquakes and making slopes steeper, either by natural means such as stream erosion or man-made means such as cutting into a slope.

The following factors are important factors making Hawke's Bay prone to landslides:

- Active tectonics which disturb the bedrock and create steep terrain;
- Rocks that are geologically young and weak because they haven't had time to become cemented by normal rock forming processes. In engineering terms much of Hawke's Bays so called "rock" is in fact more like soil.

The following are the main triggers for landslides in Hawke's Bay:

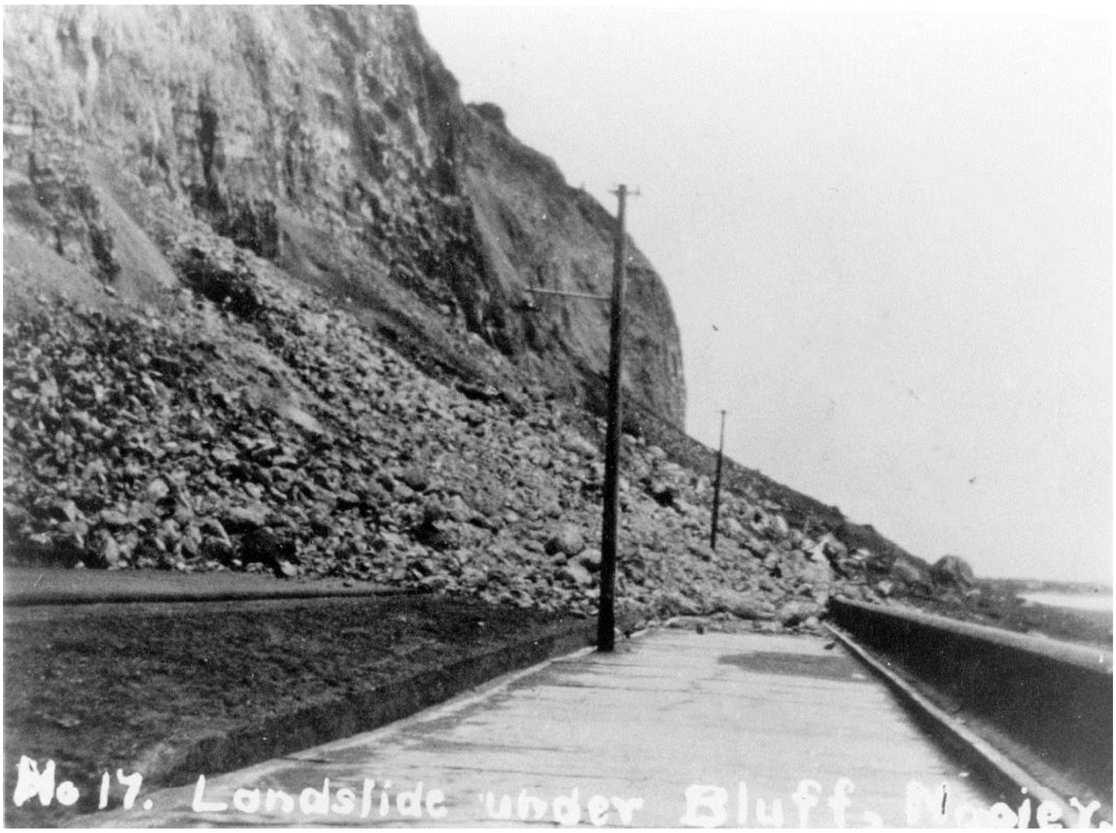
- Intense cyclonic rainfall. Although Hawke's Bay is relatively dry compared to other parts of the country, it has a history of intense cyclonic rainfall events such as Cyclone Bola;
- Earthquake shaking. Hawke's Bay is close to a plate boundary and one of the most seismically active areas in New Zealand.

Landslides Triggered by Earthquakes

Landslides are often triggered by strong earthquakes. There are many spectacular examples of this from the 1931 Hawke's Bay and 1932 Wairoa Earthquakes. The damage from these events includes:

- Large rock falls off the Bluff Hill cliffs in Napier (Figures 1 - 3);
- Numerous rock falls that blocked rivers around the region. One of the biggest blockages was on the Te Hoe River near where it meets the Mohaka River. Rock fell from 300 m high cliffs and formed a debris dam 30m in height, that created a lake 5 km long and 200 ha in area;
- Landslides pouring from high coastal cliffs into the sea. One cliff failure near the Mohaka River carried away 80 ha of farmland and formed a ridge jutting 700 m into the sea.
- A large rockfall from Te Mata Peak, near Havelock North.

Figures 1 – 3 Examples of landslides from Bluff Hill triggered by the 1931 Napier earthquake:



Rainfall Induced Landslides

In Hawke's Bay, rainfall of more than 200 mm in a day can cause landslides on some hill country. Rainfall of more than 250 mm per day is likely to cause widespread landslide damage.

Landslides triggered by rainstorms are frequent and widespread. They cause different kinds of damage which affects people, assets, infrastructure and the environment. In I988, the damage caused by Cyclone Bola in the Hawke's Bay and East Coast regions was estimated at about $150 million. Rainfall of similar magnitude occurred in Hawke's Bay in June I9I7, March I924, and April 1938. A large storm also occurred in April 2011.

Economic costs of Hawke’s Bay storm April 2011 (Page 2015)

Heavy rain on 25-28 April 2011 caused widespread landsliding along a 250 km length of Hawke’s Bay coastline from Mahia to Porangahau, and extending 10 km inland. In the area from Cape Kidnappers to Porangahau storm rainfalls ranged from ~200-650 mm, and in some areas were the highest ever recorded. Rainfalls north of Napier were ~200-400 mm. The area is underlain mainly by Tertiary and Quaternary mudstones, sandstones and limestones, and in some areas south of Waimarama by older Cretaceous and Tertiary sediments (where gullying and reactivated earthflow erosion also occurred). A study by Jones et al. (2011) using RapidEye satellite imagery (5 m spatial; resolution) calculated an area of 43 km^2 of bare ground from a total study area of 5900 km^2 (See following poster).

Costs to infrastructure, land, and personal and commercial property damage claims were estimated at **$39.7 M**. This included $10.16 M damage to local roads, $2.54 M to state highways, $61 K in benefits and allowances and $508 K in labour assistance for farms. Insurance Council of NZ figures show $6.66 M was paid out, with EQC paying $17.73 M to 339 claimants (Dominati et al. 2014, Dominati and Mackay 2013).

Dominati et al. (2014) carried out a study of the cost of lost ecosystem services from erosion caused by the storm (excluding cultural services). Until recently such evaluations have rarely been carried out. Eleven ecosystem services were evaluated (food quantity, food quality, support for human infrastructures, support for farm animals, flood mitigation, filtering of nutrients and contaminants, decomposition of wastes, net carbon accumulation, nitrous oxide regulation, methane oxidation, regulation of pest and disease populations). The net present value of lost ecosystem services from loss of soil was estimated to be **$10.4 M** from the 43 km^2 of eroded ground ($2418/ha/yr). This is approximately 26% of the estimated cost associated with infrastructure damage and immediate loss of primary production. The combined cost from physical damage and lost ecosystem services is **$50.1 M (@ 90% = $45. 09 M)**.

If, however, the ongoing ecosystem services costs are calculated for the following 20 years (using a 3% discount rate), the loss in net present value equates to $146 M. When added to the $39.7 M for immediate infrastructure, land and personal and commercial property damage, this gives a total cost of **$185.7 M (@ 90% = $167.13 M)**.

Figure 4 A farmer surveys the damage near Aramoana, near. He reckons the 1200ha station has lost about 30 per cent of its pasture and has been set back 10 years. (Photo: LYNDA FORREST/ The Dominion Post)

Figure 5 Landslide on Breakwater Road in Napier in April 2011 storm. Landslides on Bluff Hill forced the evacuation of 18 houses. (Photo: EVA BRADLEY/Dominion Post)

Processing and classifying satellite imagery to assess landsliding storm damage in the April 2011 storm, Hawke's Bay, New Zealand

Katie Jones[1], Shaun Levick [1], Mike Page[1], Barry Lynch[2]

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April 2011 storm event

- Heavy rains on 25-28th April 2011 led to widespread landsliding in the Hawke's Bay region (see Figs. 1 & 2). In the area from Cape Kidnappers to Porangahau storm rainfalls ranged from ~200-650 mm and north of Napier were ~200-400 mm.
- Storm damage extended up to 10 km inland over 250 km of the coastline from Mahia to Porangahau. The areas affected by landsliding, gulling and earthflow erosion are underlain mainly by Tertiary and Quaternary sediment and in some areas south of Waimarama by older Cretaceous and Tertiary sediments.
- GNS Science undertook the processing, classification and analysis of satellite imagery to assess the proportion of land affected by bare ground (representing mass movement erosion) for the Hawke's Bay Regional Councilon a property basis.
- Satellite imagery provided the best source of information to assess storm damage in a spatially explicit manner. RapidEye imagery from 18-19th May 2011 was obtained for a 5,900 km^2 region of interest which provides 5 m resolution in 5 spectral bands. The level 3A orthorectified product was ordered and supplied in 25 km by 25 km tiles in GeoTiff format.

Figure 1. Widespread landsliding in the Hawke's Bay region as a result of the April 2011 storm.

Figure 2. Sedimentation and debris on the floodplain due to erosion on the upper hill slopes.

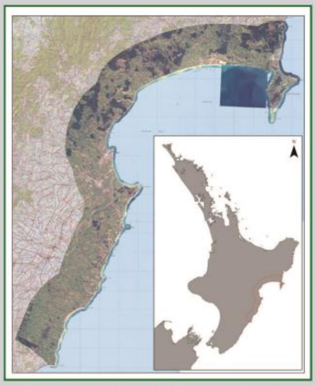


Figure 3. RapidEye coverage collected 18-19th May 2011. Red polygon delineates the areas purchased for this project. Includes material © (2011) RapidEye AG, Germany. All rights reserved.

Processing and classifying satellite imagery

- All the imagery was imported into ENVI 4.8 image processing software, and the 31 tiles were mosaicked into a single dataset with colour balancing applied (see Fig.4).
- Conversion of the Digital Number (DN) of a pixel to radiance required multiplying the DN value by the radiometric scale factor.
- Turning radiance into reflectance required relating the radiance values (the pixel DNs) to the radiance the object was illuminated with.
- The Normalized Difference Vegetation Index (NDVI) was calculated to create a single-band dataset that mainly represents vegetation.

Figure 4. Natural colour image from RapidEye (321 band combination). 1:20 000 scale. Includes material © (2011) RapidEye AG, Germany. All rights reserved.

Figure 5. Colour infrared image from RapidEye (432 band combination). 1:20 000 scale. Includes material © (2011) RapidEye AG, Germany. All rights reserved.

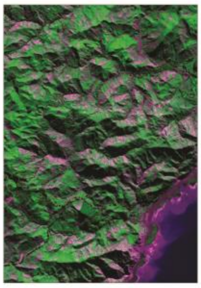


Figure 6. Colour composite image from RapidEye (352 band combination). 1:20 000 scale.Includes material © (2011) RapidEye AG, Germany. All rights reserved.

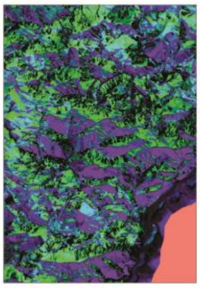


Figure 7. Principal Components transformation of the 5-band RapidEye Imagery. 1:20 000 scale. Includes material © (2011) RapidEye AG, Germany. All rights reserved.

- A statistical mathematical technique called the Principle Components (PC) transformation was run on the 5 bands of the RapidEye imagery to differentiate noise components, and reduce the dimensionality of data sets (see Fig.7)
- The Spectral Angle Mapper (SAM) tool within ENVI was used to conduct supervised spectral classification.
- Object-based image analysis was conducted within the eCognition 8.64 software environment and a hierarchical approach was adopted whereby the remotely sensed imagery (5 RapidEye), derived products (NDVI, PC and SAM) and ancillary data (DTM) were segmented at 3 different scales.
- Training data (i.e. known bare ground) were loaded into the object-based environment and fuzzy logic membership rules were generated to classify fresh bare ground using object values of the RapidEye spectra, NDVI, PC, SAM rules and slope data.
- Interactive Supervised Classification in ArcGIS 10 refined the selected areas to reduce the overclassification of bare ground.

April 2011 landslides

- The 2011 RapidEye imagery represents the bare ground visible from 18-19th May 2011.
- 43 km^2 (with 93 % accuracy) of bare ground was classified from over 80,000 polygons in the post-event imagery within the 5,900 km^2 study area (see Fig. 10). Compared to the pre-event KiwImage imagery, 37 km^2 of bare ground was assumed to have been generated in the April 2011 storm event.
- The 5 m spatial resolution provided by the RapidEye imagery was insufficient to differentiate between the scar and debris tail components of landslides with the required accuracy. However, deriving the scar:debris ratios should be possible using WorldView-2 imagery (<1m resolution) which has been ordered for the area between Cape Kidnappers and Porangahau for the April 2011 event.

Figure 8. Half of the Kairakau Beach Camping Ground was washed away.

Figure 9. Damage to Aramoana Woolshed. Photo courtesy of CHBDC.

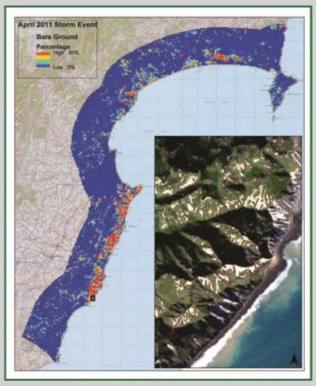


Figure 10. Overview of the most impacted areas in the April 2011 storm - each 0.5km^2 pixel displays the percentage of bare ground. Inset: Example of landslides (black outline) classified from the RapidEye Imagery. Includes material © (2011) RapidEye AG, Germany. All rights reserved.

Reference: Jones, K.E.; Levick, S.R.; Page, M.J. 2011. Processing and classifying satellite imagery to assess the April 2011 storm induced landsliding in Hawke's Bay. GNS Science Consultancy Report 2011/265. 24p.

Stop 3: Te Awa Subdivision (Jon Kingsford, Napier City Council)

Department of
Building and Housing
Te Tari Kaupapa Whare

Guidance on using NZS3604 construction on ground with potential for liquefaction

BACKGROUND

The latest version, NZS 3604:2011, was published by Standards New Zealand in February 2011, and is now referenced, with some modifications about reinforcing concrete slabs on ground and foundations, as an Acceptable Solution (B1/AS1) in the B1 Structure Compliance Document. With the modifications, the construction details in NZS 3604:2011, are suitable where there is "good ground" as defined in that Standard.

The referencing of NZS 3604:2011 with modifications as an Acceptable Solution applies to all regions in New Zealand. The modification to the definition of good ground made for the Canterbury Earthquake Region (to exclude ground subject to liquefaction or lateral spread) still applies, but only to that region.

It is clear that the issue of amending the definition of good ground to include consideration of potential loss of structural support due to liquefaction or lateral spread is both complex and not sufficiently well defined to incorporate in the B1 Compliance Document for the whole country at this point in time.

There is considerable work to be done to: properly specify the performance requirements expected; the conditions under which they apply; how to assess those conditions in a practical and cost effective manner; and to provide cost effective construction solutions. Lessons are still being learnt from Christchurch, and work needs to be done with other Councils to provide some certainty, so that individual engineering investigations are not required for every property.

The Department is researching this, and will develop proposals that would provide robust and effective support for an amended definition of good ground in locations other than the Canterbury Earthquake region and will consult on these proposals.

In the interim, the Department is issuing the following guidance.

GUIDANCE

The Department recommends to building designers and property owners that where the ground they are building on has potential for liquefaction and/or lateral spread, they seek advice from a chartered professional engineer about using foundation details that provide enhanced performance over those in NZS 3604:2011 (including as it is modified in B1/AS1).

Ground with a potential for liquefaction and/or lateral spread may already have been identified by the Territorial Authority or Regional Council, and may be identified on the LIM (Land Information Memorandum) for the property.

The Department also recommends to Building Consent Authorities that they advise building designers and owners to seek advice from a chartered professional engineer if the property is situated in an identified liquefaction hazard zone on a regional hazard map.

There is potential for liquefaction and/or lateral spread when all of the following conditions occur:

- loose non-cohesive saturated soils that lose a large percentage of their shear resistance under seismic shaking (loose fine sands and many loose silt-sand mixtures), and
- ground saturation – where the liquefaction susceptible material lies below the ground-water table, and
- sufficient shaking to trigger liquefaction (the level of seismic shaking to trigger liquefaction can vary significantly from site to site).

Where there is the potential for minor liquefaction, and provided anticipated lateral spreading across the property is limited to 50mm maximum, chartered professional engineers may advise the use of enhanced house foundations based on the Department's 'Guidance on house repairs and reconstruction following the Canterbury Earthquake', published in December 2010 (available from http://www.dbh.govt.nz/earthquake-reconstruction-guidance).

Following the on-going Canterbury earthquake sequence, and particularly the damaging 22 February 2011 Christchurch earthquake, the Department is reviewing the house repair and reconstruction guidance document. The enhanced raft slab options without deep piles are not appropriate on land where there is the possibility of significant settlement during liquefaction. This is likely to occur in areas where the crust (the depth between the ground surface and the water table) is thin, generally occurring in low-lying coastal and estuarine areas.

In areas with major liquefaction potential (lateral spread exceeding the 50mm limit or where there is likely to be significant overall settlement from liquefaction), site specific geotechnical investigations and specific engineering designs using chartered professional engineers are strongly advised.

Designers should refer to the B1/AS1 Acceptable Solution for Structure for full details of the modifications to NZS 3604:2011.

Further information about liquefaction may be found at http://www.nzgs.org/wp-content/uploads/GeoEarthquakeEngineer.pdf (NZ Geotech Society guidelines)

Published in August 2011 by

Department of Building and Housing
PO Box 10-729, Wellington, New Zealand.

Stop 4: Napier City and Earthquake Museum

Within minutes of the earthquake, fire began in three Napier chemist shops in the business district. Firefighters were almost helpless — water pressure faded to a trickle as the reservoir emptied. By mid-afternoon Napier's business area was ablaze and almost 11 blocks of central Napier were gutted (Figures 1 - 2). Napier was reconstructed largely in the Art Deco style, popular in the 1930's. This is now a big tourist attraction for Napier. The Art Deco style was at the height of its popularity for buildings in 1931 (Figure 3 - 4). Its clean simple lines and base relief decoration suited the needs of the new city:

- **Art Deco was fashionable**. With its past destroyed, Napier looked ahead and chose a style associated with Manhattan, the movies and modernism.
- **Art Deco was safe**. With its emphasis on low relief surface decoration, Art Deco forsook the elaborate applied ornament that had fallen from the buildings in the earthquake and caused so many deaths and injuries.
- **Art Deco was cheap**. Its relief stucco ornament was an economical way to beautify buildings during the lowpoint of the Great Depression (www.artdeconapier.com).

New Zealand's art-deco gem that grew from disaster.

Nigel Tisdall, The Observer, Sunday 25 October 2009

If you believe clouds have silver linings, Napier's is surely rimmed with neon and chrome, the shiny new materials of the art-deco age. For this was an earthquake that also gave back, tilting the coast up by a couple of metres and draining a huge lagoon that is now filled with fertile farmland, the city airport, and some choice stretches of 30s and 40s suburbia.

Downtown Napier, meanwhile, was quickly rebuilt in a colourful, confidence-raising art-deco style that married symbols of renewal — sunbursts, fountains, flowers — with robustly quake-proof buildings limited to two storeys. Out went brick parapets, gables and heavy facades; in came chrome speed-lines, ziggurats and naked women reaching for the stars.

What's remarkable is that it is still all there. Lovers of art deco will find plenty of individual gems to swoon over in metropolises such as Paris, New York and Shanghai, but Napier is exceptional because it offers such an engaging and strollable concentration of provincial 30s edifices.

According to the local Art Deco Trust, which arranges guided walks and bus tours and produces excellent background literature, the city has 147 art-deco buildings, decorated in styles that include Egyptian, Mayan and Maori. Many have been restored and repainted in cheery pastels, and star turns include the still-thriving 1938 Municipal Theatre, which has its original chrome and neon fittings, and a cubist carpet faithfully recreated from a pre-earthquake scrap found in the manager's office.

Walk down Tennyson Street and you meet one 1932 joy after another. Here is the curious Scinde Building, once a Masonic lodge; there are the former offices of the Daily Telegraph newspaper with its lotus flower capitals — it's now an estate agent.

Some buildings quietly tell tales about their owners' origins: there are sweet little shamrocks on the Munster Chambers, Scottish thistles on Parker's menswear store. A German national flag, in stucco, flutters above Hildebrandts, the chiropodist.

For many, the most engaging sight is the ASB Building, a 1934 bank adorned with a union of art-deco style with Maori motifs. Look above the modern counters and you see stylised hammerhead sharks, curling fern fronds and whales' tails dancing around the ceiling. In the flamboyant National Tobacco Building in the port of Ahuriri, roses and citrus fruits twirl around its stained glass dome as if to dispel the odium of smoking.

Figure 1 Damage in Napier city following the 1931 earthquake. From Alexander Turnbull Library collection http://www.natlib.govt.nz/collections/highlighted-items/hawkes-bay-earthquake-1931

Figure 2 Fire at the Masonic Hotel. It was later rebuilt in the art deco style. From http://www.teara.govt.nz/en/historic-earthquakes/

Figure 3 Emerson Street after the Napier earthquake. From http://christchurchcitylibraries.com/Heritage/Photos/Disc4/IMG0041.asp

Figure 4 Four examples of Napier Art Deco architecture.

StIRRRD Field Trip Itinerary – Haumoana and Te Mata Peak

Monday 11 April

11.00 am	Depart HB Business Hub
Stop 1	Arrive Haumoana @ 11.15 (Coastal erosion)
11.45 am	Depart Haumoana
Stop 2	Arrive Craggy Range @ 12.00 (Landslide hazard)
12.15 pm	Depart Craggy Range
Stop 3	Arrive Te Mata Peak @ 12.30 (lunch)
1.15 pm	Depart Te Mata Peak
Stop 4	Arrive HB Business Hub @2.00 pm

MONDAY APRIL 11

Stop 1: Haumoana coastal hazards (Mike Adye, HBRC)

Residents may have to quit Haumoana homes

MARTY SHARPE

Last updated 05:00 27/10/2011

RENE FISCH

ADVANCING TIDE: A policy of "managed retreat" could leave residents about $20 million out of pocket.

Coastal residents would have to walk away from their properties at a total cost to them of about $20 million under a recommendation being considered by Hastings District Council.

The council today decides the shape of "managed retreat" from the eroding coastline at Haumoana.

Sixty-six properties in the area are expected to be lost to erosion by 2100.

A managed retreat is one of three options that will be put to ratepayers in next year's 2012-22 Long-Term Plan, alongside an option of building groynes to prevent erosion and an option of retaining the status quo.

Managed retreat, which sees residents vacate their properties as they become inundated, has not been properly explained until now.

Council staff have recommended that an erosion "trigger point" be established on the coast. When land eroded to this point residents would be required to vacate their properties before conditions became too hazardous.

All loss of land and assets would be borne by private owners and the council would not rezone any additional land for these owners to relocate.

However, the council may offer to buy affected properties for a "nominal amount" before demolishing or moving buildings.

The total cost of this option to the council would be about $4.3 million.

This includes $3.7m to replace council infrastructure such as roads and water mains, plus $638,000 in site-cleanup costs

Council staff considered, but did not recommend, offering affected residents small cash grants and contributing $100,000 in council time and costs towards rezoning of residential land in the area.

A paper before the council today says private costs to landowners is difficult to calculate as it will depend on what individuals or families choose to do. Staff arrived at a cost of $20m, based on averages and assumptions for land purchase, house relocation, abandonment and site cleanup. The paper also noted there were social costs, such as distress, which could never be quantified.

Further studies into the effectiveness of a groyne field along the coast are under way.

The groyne proposal was put forward by a group of residents opposed to managed retreat.

The group has proposed building seven groynes and two strongpoints along a 2km strip of coast between the mouth of the Tukituki River and a point 200m south of East Rd.

The groynes would cost about $24.6m over 50 years. The groynes and managed retreat options would be presented in the draft Long Term Plan with the range of costs and how they would be split between ratepayers.

After public submissions the council will choose its preferred option in June next year.

- The Dominion Post

Clifton to Tangoio Coastal Hazard Strategy 2120

Hazard Information

The Clifton to Tangoio Coastal Hazards Strategy 2120 will consider the following hazards:

- *Coastal erosion (storm cut, trends, effects of sea level rise)*
- *Coastal inundation (storm surge, set-up, run-up, overtopping and sea level rise)*
- *Tsunami*

All hazards, and their severity, are influenced by climate change which will bring increased 'storminess' and sea level rise. The latest information from the Parliamentary Commissioner for the Environment outlined in their November 2014 report 'Changing climate and rising seas: Understanding the science' notes that:

"Over the last century, the average sea level around the world has risen by about 20 centimetres. The International Panel on Climate Change (IPCC) expects it to rise another 30 centimetres or so by the middle of the century and up to a metre or more by the end of the century."

With a planning horizon of 100 years, the Strategy must consider significant potential sea level rise and factor this in when considering the effects of erosion, inundation and tsunami.

Further information on each of the hazards to be considered by the Strategy are outlined below.

Coastal erosion

Within the study area, there are a few discrete parts of the coastline where measured shoreline movement is relatively stable (e.g. Marine Parade beach). However, much of the coastline has recorded an erosion trend. These historic trends are unlikely to continue at similar rates. In the next century, sea level rise in combination with increased wave heights and storm intensities is expected to significantly impact on the gravel barrier ridge protecting the Tangoio to Clifton coastline.

Solely as a result of rising sea levels, the Komar report anticipates that there will be a 10 – 15 metre retreat of the gravel barrier ridge by 2100. Accounting for more intense storms and higher wave heights, Komar advises that the shoreline between Westshore and Tangoio could retreat 15 to 20 m, with the northern end of the Haumoana 'Cell' potentially retreating 30 m.

The following points will also need to be taken into account when making future decisions:

- Erosion rates will continue to accelerate past 2100 if sea level rise occurs at the predicted rate. It will not stop.
- The local extent of erosion (or accretion) also depend on the budget of beach sediments, the net gains or losses in the total volumes of sand and gravel contained within that beach

As part of preparing the Strategy, reassessment of the areas at risk of coastal erosion and storm surge inundation ought to be done. This would update earlier assessments and incorporate contemporary understanding of shoreline movements, recent investigations and improved projections of sea level rise. The reassessed hazard areas may, if necessary, be incorporated into the Regional Coastal Environment Plan and/or district plans. Erosion risks over at least 100 years should be considered. This Hazard Information timeframe is directed by Policy 24 in the 2010 New Zealand Coastal Policy Statement ('NZCPS').

Coastal inundation

The Hawke's Bay coastline between Clifton and Tangoio is defined by a gravel barrier ridge which provides a vital defence from the sea. Without it, large areas of Napier City and some of Hastings District would be regularly inundated and potentially be uninhabitable.

Due to a changing climate, there is increased likelihood of 'over wash' events during major storms which could occur along the southern shores the Haumoana Cell. Here the total water levels could potentially exceed the low elevations of the gravel barrier ridge leading to flooding of low lying inland properties and infrastructure.

The Strategy must consider the changing nature of the barrier ridge over time, as climate change drives sea level rise, and the extent to which the barrier ridge will continue to protect from inundation.

Extreme inundation extents will be determined taking into account storm surge, wave set-up and wave run-up. If wave run-up levels exceed the barrier ridge crest (which will be likely for future climate change), a zone of influence of significant run-up effects will be established.

Tsunami

The Hawke's Bay Regional Council has been developing tsunami hazard maps to help communities prepare for a large tsunami. Much of this work has been initiated by the Hawke's Bay Civil Defence Emergency Management Group based on tsunami wave height research recently completed by GNS Science. HBRC has completed two-dimensional tsunami hazard mapping for the coastline between Tangoio and Clifton. This mapping shows two tsunami scenarios:

1. a distant tsunami – starting across the Pacific Ocean (eg. South America) when there will be time for an official warning and evacuation;
2. a near source tsunami – starting near the coast (e.g. Hikurangi Trough 120 km east offshore) when there will be no time for an official warning.

In the case of a distant tsunami, the mapping applied a 5 metre wave – being the highest credible wave height generated from a distant source. A 5 m wave height has a statistical probability of occurring approximately once every 500 years). For a near source tsunami, the mapping applied a 10 metre wave (having a statistical probability of occurring approximately once in 2,500 years).

The Strategy will consider and review this information and incorporate it into strategy development.

Figure 1 Storm surge and coastal erosion at Haumoana Beach Photo: stuff.co.nz

Stop 2: Te Mata Peak – Landslide hazard (Brenda Rosser, GNS)

Geological hazards on the eastern face of Te Mata Peak, 8 km south-east of Hastings (Figure 1) have been assessed in a desk-based study by GNS Science using existing geological information and stereoscopic interpretation of aerial photos. The principal hazards from a geotechnical point of view are landslides and the suite of earthquake-related hazards - amplified ground shaking, liquefaction, landslides and fault rupture of the ground surface.

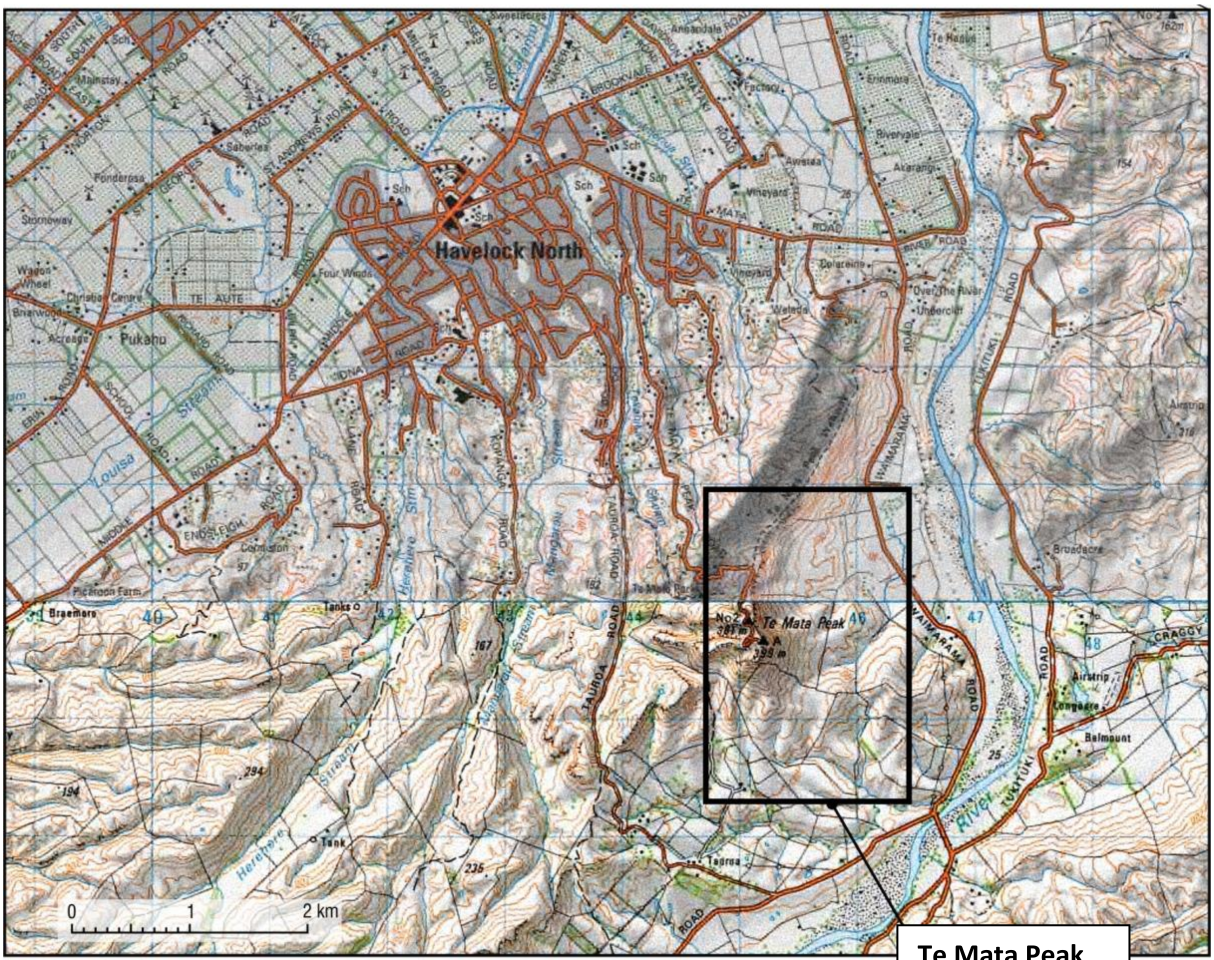


Figure 1 Location map for the Te Mata Peak

Geological Units

The eastern face of Te Mata Peak and the hill country between Te Mata Peak and Waimarama Road (Figure 2) is formed in bedrock of Middle-Eocene to Pliocene age (42 - 3.03 Ma (Ma = million years)) and consists of two distinct sequences (Figure 3). The hill country in the south and east and on the lower slopes of the eastern face of Te Mata Peak consists of a bedded sequence of Eocene – Miocene age (42 - 16 Ma) calcareous sandstones, siltstones and mudstones forming the north-west limb of the Elsthorpe anticline. Resting unconformably on these rocks and forming the upper part of the eastern face of Te Mata Peak are the lower units of the Pliocene age (5.28 - 3.03 Ma) Te Aute Group including the Kairakau Limestone, the Mokopeka Sandstone and the Awapapa Limestone. Cover deposits in the area include loess and tephra blankets, rock-fall debris (scree), soil-flow debris, stream and fan alluvium and colluvial aprons.

Figure 2 View from Te Mata Peak looking north along the western limb of the Elsthorpe Anticline: *Photo S.Henrys*.

Holocene Landslide Deposits

Four Holocene geological units are recognised on the eastern face of Te Mata Peak. These are rock-fall debris, colluvium, stream alluvium and fan alluvium. The colluvium, stream alluvium and fan alluvium are grouped together as they represent varying degrees of displacement of slope-derived materials.

1. **Rock-Fall Debris:** below the steep eastern face of the Te Mata Peak ridgeline is an apron of rock-fall debris composed primarily of blocks of Awapapa Limestone. Kingma (1971) maps an area of rock-fall debris (scree) below the entire length of the Te Mata Peak ridgeline which obscures the contact between the Eocene-Miocene sequence and the Pliocene Te Aute Group rocks.

2. **Colluvium - Stream Alluvium - Fan Alluvium:** are derived from shallow regolith soil flows probably developed primarily in the loess and tephra cover deposits on the hill country but possibly including residual soils developed on the Eocene-Miocene bedrock and lower parts of the rock-fall debris apron. Colluvium can be found on the lower parts of the steeper slopes. Where the colluvium/soil-flow debris has reached the small stream valleys it has been deposited as stream alluvium or transported down through the valleys to be deposited as fan alluvium on the Last Glacial age Tukituki River terrace.

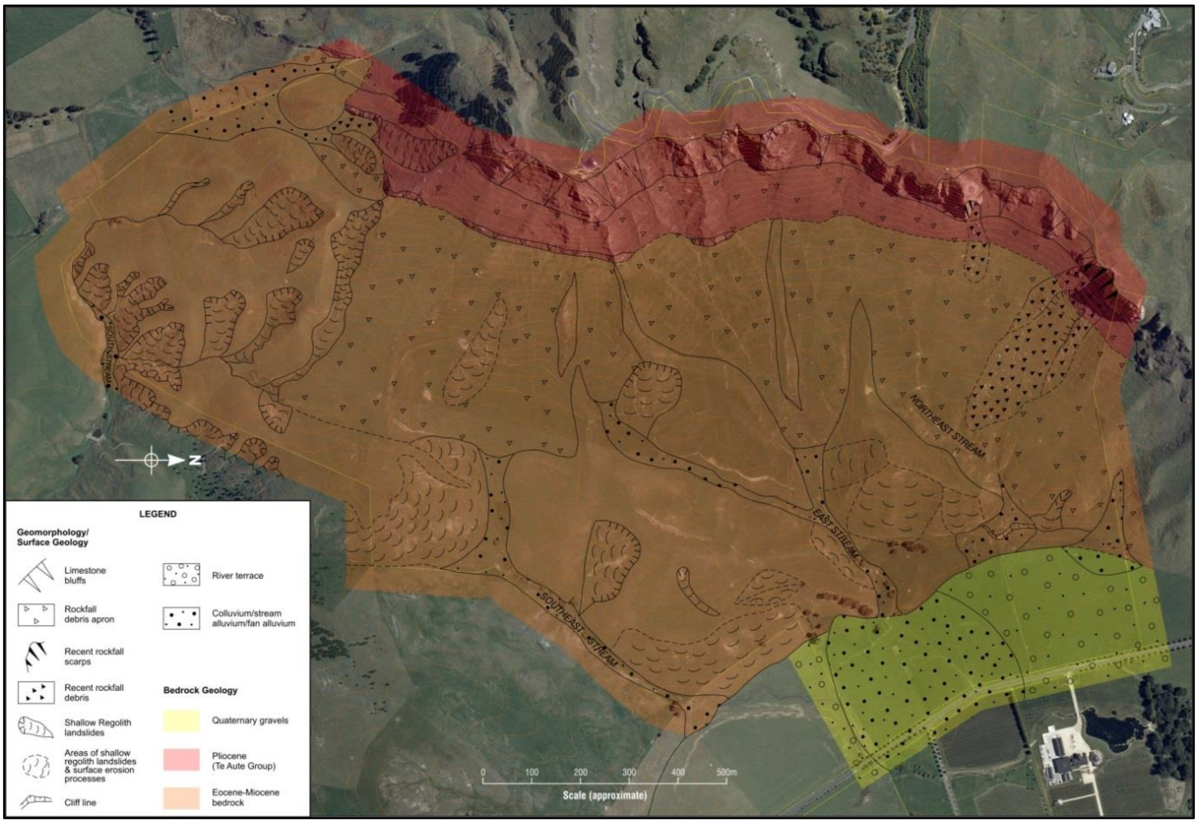


Figure 3 Engineering Geological plan

Historical Hazard Events

The eastern face of Te Mata Peak has been affected by at least one significant hazard event during the 20th century. This was the 1931 Hawke's Bay earthquake which subjected the area to a Modified Mercalli (MM) shaking intensity of MM8-9 (Hancox *et al*, 1997). Two landslides have been mapped in the GNS Landslide Inventory and is shown on Figure 3. There is a large rock fall event triggered by the 1931 Hawke's Bay earthquake attributed to the MM8-9 shaking, and a smaller one to the south.

Geomorphic evidence of shallow regolith landslides in the southern part ridge suggest that a significant rainstorm event may also have affected the area since deforestation and this may be the 1938 rainstorm that severely affected the Esk Valley to the north of Napier. However, this correlation is tentative as the earliest aerial photos available for the site were taken in 1950 some 12 years after the storm allowing sufficient time for the scars to re-vegetate. No reports of landslides have been recorded in this area since 1996.

Landslide Hazard Evaluation

Two types of landslides have been recognised on the eastern face of Te Mata Peak: (Figure 3):

1. Rock falls from the limestone bluffs of the Te Mata Peak ridgeline; and

2. Soil flows developed in surficial soils (including loess, tephra and residual soils).

Rock Fall: Kingma (1971) maps rock-fall debris (scree) below the entire length of the Te Mata Peak ridgeline on the Wellwood Farm property. This debris obscures the contact between the Eocene-Miocene sequence and the Pliocene Te Aute Group rocks. The rock-fall debris is composed primarily of blocks of Awapapa Limestone. At least two separate rock-falls can be recognised below the ridgeline, with the largest of these attributed to the 1931 Hawke's Bay earthquake (Hancox *et al*, 1997). The debris from this rock-fall extends almost to the bed of the northeast stream and indicates that the entire length of slope below the ridgeline escarpment is at risk from future rock-falls as is shown on Figure 3.

The size and extent of recent rock-falls on this slope indicate it is likely to be affected by similar rock-falls in the future. Development of this slope is likely to be uneconomic as the cost of designing and implementing mitigation measures will probably exceed the value of the building assets being protected.

Soil Flows: A large number of shallow soil-flows can be seen in aerial photos (Figure 3). Soil flows generally involve mass movement of highly mobile, very wet slurries of soil and vegetation and probably originate in the loess, tephra and residual soils mantling the bedrock units on steep slopes. Soil-flows can travel a long distance on slopes and downstream courses. Where the soil flow debris has reached the small stream valleys it has been deposited as stream alluvium or transported down through the valleys to be deposited as fan alluvium on the Last Glacial age Tukituki River terrace.

Two strategies are available for dealing with the hazard of future soil flows:

1. The avoidance of susceptible areas, or

2. Engineering geological/geotechnical investigations to design appropriate remedial measures to mitigate the hazard and risk to an acceptable level.

Summary: A large number of shallow landslides (soil-flows) can be seen in aerial photos on the eastern face of Te Mata Peak. Soil-flows generally involve mass movement of highly mobile, very wet slurries of soil and vegetation and probably originate in the loess, tephra and topsoils mantling the bedrock units on steep slopes. Two strategies are available for dealing with the hazard of future soil flows: either the avoidance of susceptible areas, or engineering geological/geotechnical investigations to design appropriate remedial measures to mitigate the hazard and risk to an acceptable level.

Rock-falls have occurred recently (last 100 years) from the limestone escarpment that forms the Te Mata Peak ridgeline. Kingma (1971) maps rock-fall debris (scree) composed primarily of blocks of Awapapa Limestone, below the entire length of the Te Mata Peak ridgeline on the Wellwood Farm property. The debris from the rock-falls extends the entire length of slope below the ridgeline escarpment.

This study indicates that it is feasible to develop the eastern face of Te Mata Peak as there are many areas where the level of hazard is such that residential development could occur without undue constraint provided that the findings of this report are confirmed during field investigations.

Stop 4: Te Mata Peak Lookout (Lunch stop)

Te Mata Peak (elevation 399 m) lies above the fertile Heretaunga plains of Hawke's Bay. It is part of a prominent dip slope of outcropping mid-Pliocene limestone on the west flank of the Elsthorpe Anticline. On a clear day from the lookout at the summit, the Ruahine, Kaweka, Tewaka, and Maungaharuru ranges from the western horizon, with the volcano Ruapehu visible in the distance. Beyond the sweep of mountains and across the curve of Hawke Bay, Mahia Peninsula and Portland Island jut into the Pacific. Southwards lie the coastal hills, while meandering across the plains flow the Tutaekuri and Ngaruroro rivers, and around the base of the Peak, the Tukituki River flows along the crest of Elsthorpe Anticline.

Prior to European times, vegetation in the park was fire-induced bracken and manuka with native grasses in clearings. Today the predominant vegetation is short tussock grassland with a wide variety of introduced trees and shrubs in the valleys and on the lower ridges. Since 1927, thousands of native and exotic trees and shrubs have been planted throughout the area.

Te Mata Peak offers an excellent vantage point to view the main elements of deformation of the upper plate at the latitude of Hawke's Bay. To the west the Axial Ranges from the spine of the North Island and reflect uplift associated with reverse slip at depth on faults that bound their eastern margin. The main oblique slip faults of the North Island Dextral Fault System (NIDFS), which can be mapped for 100s of kilometres, lie within the ranges and in places bound their eastern margin (Beanland, 1995). East of the ranges in the region that encloses Te Mata Peak the structures are dominated by steep reverse faults and associated folds, while still further east offshore thrusts and folds dominate. Deformation that produced the structures that we see in the landscape today is primarily post 2 Ma (e.g., Nicol et al., 2007). Pre 2 Ma structures are mainly contractional.

The Legend of Te Mata (from http://www.maori.org.nz)

Legend has it that the hill is the body of Maori Chief, Te Mata O Rongokako (the face of Rongokako). Looking from Hastings, the gargantuan bite can be seen, as can the body of the powerful Chief forming the skyline. Many centuries ago the people living in pa (fortified villages) on the Heretaunga Plains were under constant threat of war from the coastal tribes of Waimarama. At a gathering at Pakipaki (5 km south of Hastings) to discuss the problem, the solution came when a wise old woman (kuia) sought permission to speak in the marae. "He ai na te wahine, ka horahia te po, " she said. (The ways of a woman can sometimes overcome the effects of darkness). Hinerakau, the beautiful daughter of a Pakipaki chief, was to be the focal point of a plan. She would get the leader of the Waimarama tribes, a giant named Te Mata, to fall in love with her, turning his thoughts from war into peace. The plan succeeded, but she too fell in love.

The people of Heretaunga, however, had not forgotten the past and with revenge the motive, demanded that Hinerakau make Te Mata prove his devotion by accomplishing seemingly impossible tasks. The last was to bite his way through the hills between the coast and the plains so that people could come and go with greater ease. Te Mata died proving his love and today his half-accomplished work can be seen in the hills in what is known as The Gap or Pari Karangaranga (echoing cliffs).

Legend has it that his prostrate body forms Te Mata Peak. At sunset one can often see, in the mists that stretch from the crown of Kahuraanake, the beautiful blue cloak with which the grieving Hinerakau covered the body of her husband before leaping to her own death from the precipice on the Waimarama side of the peak. The gully at the base of the cliff was formed when her body struck the earth.

StIRRRD Field Trip Itinerary – Napier to Gisborne

Tuesday 12 April

8:30 am Depart Napier (pass Ahuriri Lagoon – earthquake record)

Stop 1 Arrive Lake Tutira @ 9:15 (storm, landslide, earthquake, volcanic records)

10:00 Depart Lake Tutira (pass Whaakaki Lagoon – tsunami record)

Stop 2 Arrive Gisborne Lookout @ 12:00 and Lunch

Depart Lookout @ 1:00

Stop 3 Arrive Muriwai Marae at 1.15

Collect koha from delegates (a gift from the heart)

1.30 **Pōwhiri at Muriwai Marae**

Kai karanga - (first call onto the marae) - tangata whenua

- (response) – females delegates follow Diane

Note: Paeke - All of the kaikōrero (speakers) on the tangata whenua (host) side speak first, after which, all of the kaikōrero on the manuhiri side respond.

1. *Kaikōrero (speakers) hau kainga home people*
2. *Manuhiri (visitors) Bevan Hunter - waiata Purea nei*
   Joe McLeod - Waiata Tāku Rākau e
3. *Indonesia delegate (Indonesian song choice)*

Waiata (song relishes the speech-making) and is performed after each speech

Whakatau Afternoon tea

2.00 **Te Poho o Tamanuhiri Wharenui**

Whakawhanautanga (Introduce ourselves to each other, noting your mountain, river, tribe) Indonesians and GNS to respond

Explanation of the Wharenui

World War 1 Memorial Hall – power point presentations (10 min/Q 5min)

1. Iwi ppt presentation on land use and relationship with their land

   Tamanuhiri overview of post settlement activities

   Ko te orange o te iwi, kei Tutu, kei Poroporo

   The prosperity of Tamanuhiri is in our whenua, moana and whanau

   Questions

2. Indonesian ppt presentation on natural hazards and issues in Indonesia (Faisal) StIRRRD delegates

   Questions

3. GNS Science ppt presentation on StIRRRD programme (Michele)
   Questions

3.00 Te Wherowhero walk about

Papatewhai the Pa of Hinehakiriranga, Te Wherowhero resting place of Horouta,

Pakirikiri Pa, Oneroa, Waipaoa river, Awapuni Moana, Turanga

Iwi relocation from Papatewhai due to Muriwai due to Waipaoa cause and effect from intensive land clearing, and redefine of river flood control schemes

Personal reflection of 1962 Tsunami

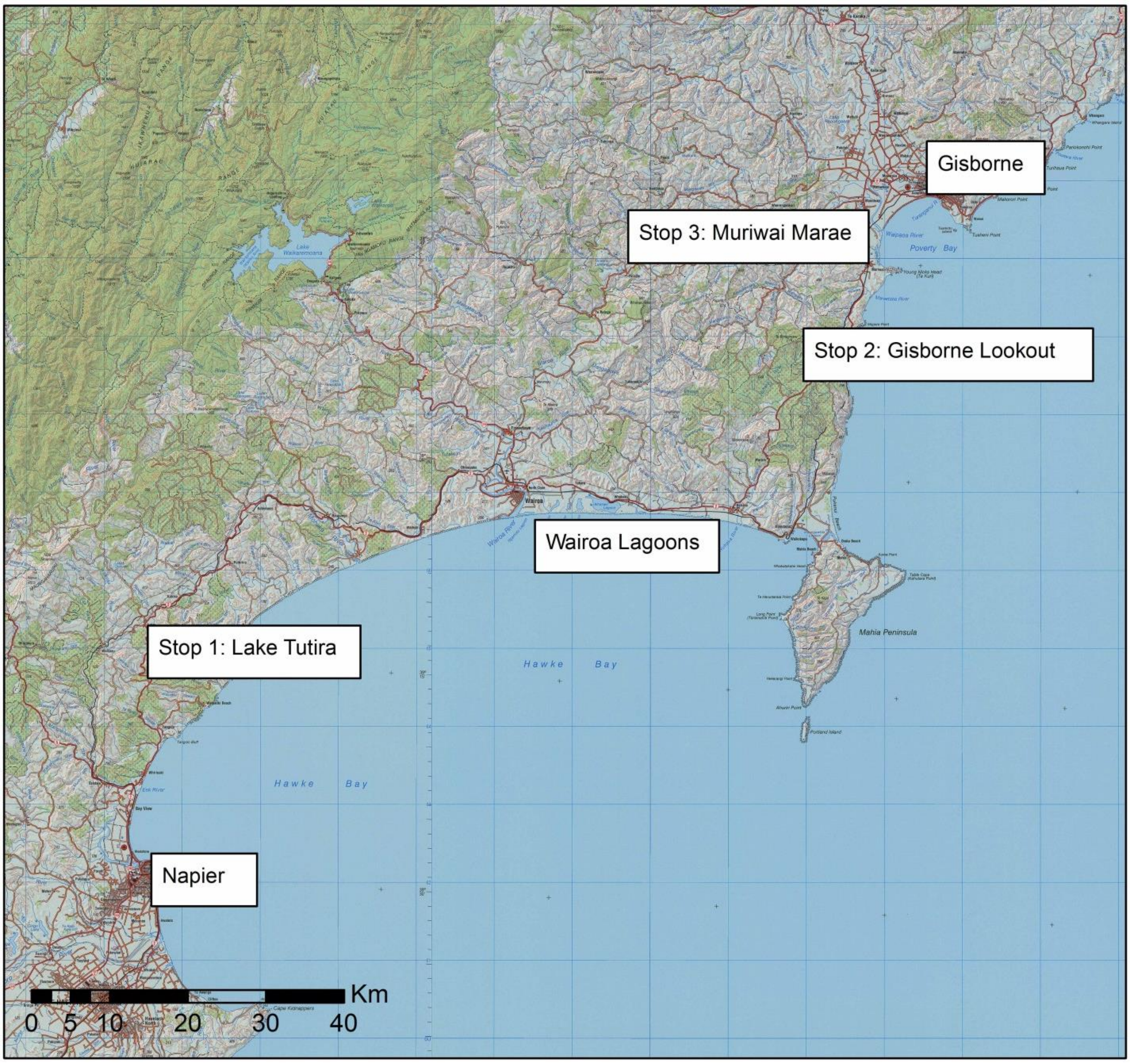
5.30 Maungarongo Dining Room – Muriwai Marae for Dinner

7.00 Depart Marae

7.15pm Arrive Hotel

8:00-8:45 Presentation by Ngati Porou/GDC on JMA

Field trip route – Napier to Gisborne



Stop 1: Lake Tutira - A record of natural hazard events (Mike Page GNS)

Lake Tutira is a special lake. This is because it contains a high resolution record of environmental change and hazard events in its sediments. The catchment characteristics, and the morphometry and thermal stratification of the lake, are conducive to the formation and preservation of laminated sediments. These include the erosion products of natural events such as individual storms (Figure 1), earthquakes, and volcanic eruptions, and also the impacts of land use change. Sediment eroded from the hills is washed into the lake to form layers on the lake bed that are buried and preserved by subsequent layers. These layers are stacked one on top of another, recording a sequence of events, like tree rings or pages in a book. We have drilled into the lake bed to recover a series of sediment cores. We then analysed these to construct a number of records.

Knowledge of the magnitude and frequency of hazardous events, their cumulative impacts, and the effects of land use are important for hazard management and for assessing sustainable land use. While there is a very small population within the catchment, the Lake Tutira sediment record is important because this landscape is representative of ~20% of New Zealand.

Lake Tutira is one of a number of landslide-dammed lakes on the east coast of the North Island. The surrounding 32 km^2 catchment is prone to landsliding. These steep, erodible hills are underlain by soft siltstones and sandstones (1.6-2.4 Myr), and have been mantled by a number of tephras that proved valuable time lines of landscape change. The 179 ha lake was formed 7,200 yrs ago when a very large landslide blocked the valley at what is now the southern end of Lake Waikopiro. It is likely the landslide was triggered by a very large subduction earthquake. The lake bathymetry shows the meandering nature of the stream between hill spurs of this drowned valley. The present lake has a maximum depth of 42m and an average depth of 21m (Figure 2).

Figure 1 Lake Tutira several months after Cyclone Bola – (note landslides, sediment deposition, and water colour)

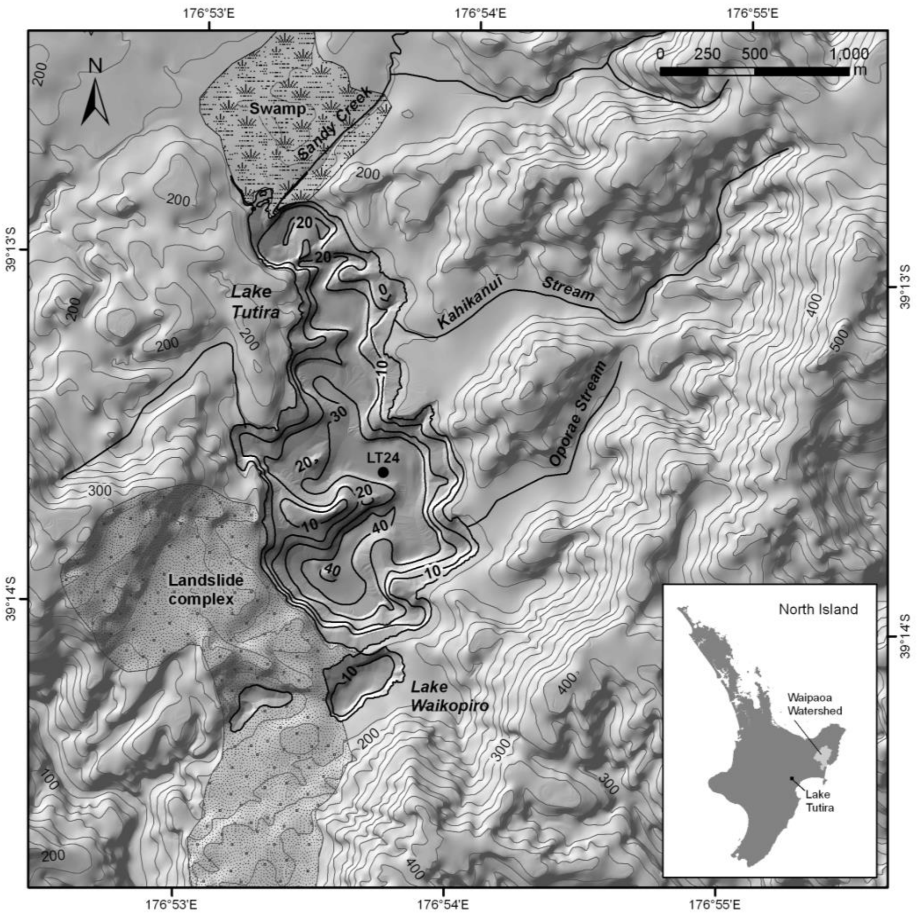


Figure 2 Lake Tutira: location, geographic setting, stream entry points, bathymetry and core site

Land use and record of land use impacts

Maori arrived ~1460 and during the next several centuries the forest was repeatedly burnt. By 1873, when the first Europeans arrived to begin pastoral farming, much of the catchment was in fern and scrub. Major natural hazard events recorded in the lake sediments include the 1931 Napier earthquake, a major storm in 1938 and Cyclone Bola in 1988.

Sedimentation rates in the lake increased by about 60% under the fern and scrub cover that was established by repeated burning following Maori arrival. However, following European conversion to pasture, sedimentation rates increased by an order of magnitude (~10 fold increase). This increased rate in sedimentation or lake in-filling, is due to an increase in landslides and the increase in delivery of sediment to the lake that has resulted from construction of drainage channels across the alluvial valleys. Over 50% of this sediment has been generated by just the two largest recorded storms, in 1938 and 1988 (Figures 1 and 3). This illustrates how the impact of a hazard (in this case storm-induced landsliding) can be increased by a change of land use (in this case from forest to pasture).

This increase in landsliding has led to concerns about the sustainability of pastoral landscapes on these landscapes. Recently, pine plantations have been planted on some steep areas around the lake. A new initiative has seen planting trials of Manuka on 150 ha of steep hills. This is an early colonising indigenous shrub/tree that yields high quality honey with high antibacterial properties (Figure 4). The purpose of the trials is to measure Manuka growth rates and honey production to establish whether these are sufficient to provide an economic yield (Figures 5 and 6). There is an irony here, in that Manuka has been regarded as a weed by farmers, and is regularly sprayed and burnt. It now seems likely that not only will it provide an economic crop, but it will also help reduce landslide, sedimentation and flooding hazards. NZ Honey exports in 2014 rose 30% over the previous year. The lake and its surrounds are now a regional park managed by the Hawkes Bay Regional Council for activities such as camping, hiking, fishing and boating. An Outdoor Education Centre for school students is also located beside the lake.

Figure 3 State Highway south of Lake Tutira after Cyclone Bola - 753 mm rainfall in 4 days (>50% of annual average)

Figure 4 Manuaka bush in flower

Figure 5 Trial plot to measure manuka growth rates and honey production

Figure 6 Field day for farmers: note both naturally established and recently planted manuka

Historic storm record – how variable have storms been in the past?

To prepare for and mitigate the impact of storms we need knowledge of their magnitude and frequency. There is growing international evidence that past climate variability included periods of rapid change, resulting in equally rapid landscape and societal impacts. Studies at Lake Tutira began with a sediment budget for Cyclone Bola, which occurred in 1988 and is the largest storm on record (753 mm rain in 4 days). A sediment budget is a catchment-scale accounting of the quantity/amount of sediment generated (erosion), the quantity/amount transferred and stored on the landscape (deposition) and the quantity/amount exiting the catchment (yield). As part of the budget, location and processes were identified. Results show that:

- sediment was generated at a rate of ~49000 t/km^2
- 90% of sediment from landslides
- 56% of sediment entered lake

Correlation of storm-generated sediment layers with storm history has identified the threshold for generation of sediment, and the relationship of between sediment thickness and storm rainfall (Figure 7). Potential magnitude of pre-historic rainfall events under a forest cover were estimated using a landscape sediment yield factor for forest versus pasture.

Freeze-box core

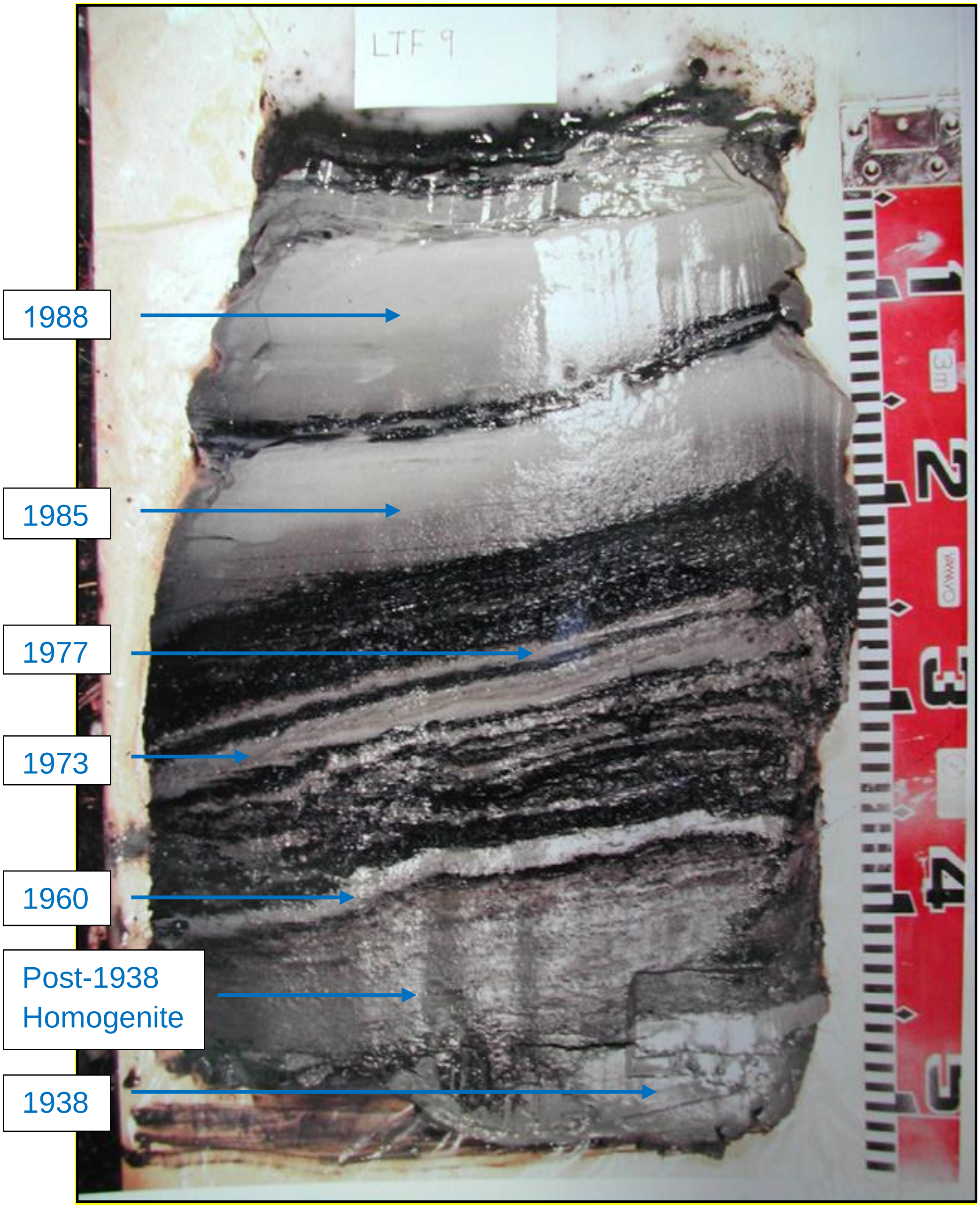


Figure 7 Freeze-box core with dated storm sediment layers interspersed with organic layers

Climate record

The lake sediments also contain a high resolution record of natural climate variability and landscape response for ~7000 years, as expressed by the magnitude and frequency of paleostorms (Figure 8). Results show:

- 1400 storm sediment layers (frequency of 1 every 5 years)
- Variability in magnitude and frequency
- Periods (25) of increased frequency of large storms, of decadal to centennial duration often with sudden onset and cessation
- Some periods when storm magnitude/frequency were greater than at present
- ~53 storms similar in magnitude to Cyclone Bola, and 7 even larger

- Storm record reflects interplay between the drivers of regional climate – ENSO and SAM

Earthquake record

The lake sediments also contain a record of earthquakes. As sediment accumulates on the steep, drowned hill slopes within the lake, earthquake shaking can cause this sediment to fail (subaqueous landslide), resulting in re-suspension, mixing and re-deposition of the sediment to form a homogenite at the base of the drowned slope. The record of homogenite layers has been used to construct a record of moderate to large earthquakes. The National Seismic Hazard Model (NSHM) predicts moderate (MW ≥5.0) earthquakes, causing ground shaking of MMI 7, have an average recurrence of one every 39 years. Results from Lake Tutira indicate:

- 119 homogenites related to earthquakes
- An average recurrence interval of 57 years
- Homogenite recurrence interval is less frequent than NSHM because subaqueous slope stability is governed by the rate of sediment accumulation after the last failure
- The rate of sediment accumulation also means there is no simple relationship between earthquake magnitude and homogenite thickness

Volcanic ash record

There are twelve macroscopic tephra (and several microscopic ones), erupted from the Taupo Volcanic Zone, 100 km to the northwest. These have known ages which, together with ^{14}C dates, provide a chronology to linearly interpolate the ages of events. Pollen analysis shows that the largest of these tephras caused fires and canopy damage to the forests due to the weight of the tephra, with a subsequent increase in colonising species such as grasses and ferns. However, forests recovered fairly rapidly. In the case of the Taupo eruption (1717 cal. yr BP) recovery was complete within 100-150 years.

Figure 9 illustrates the various sediment-generating processes that operate within the catchment, and their contribution to the lake sediment record.

Figure 8 Drilling rig on Lake Tutira, used to obtain a 27m sediment core from the lake bed (~7000 year record)

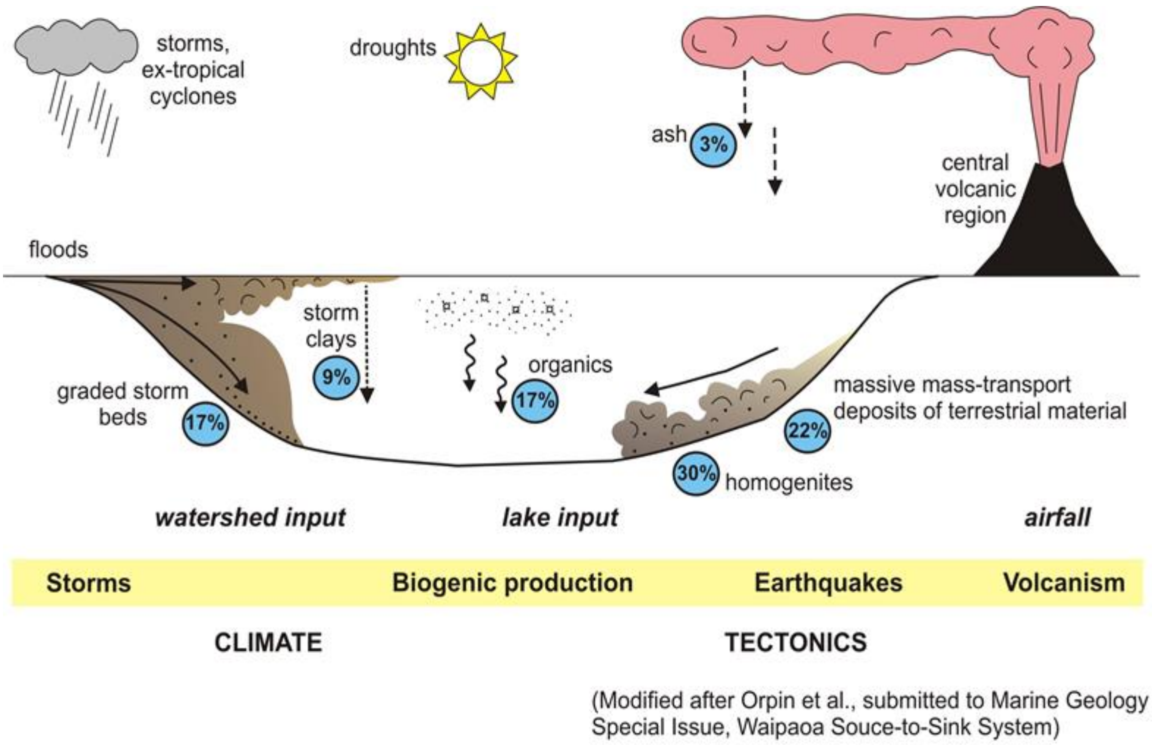


Figure 9 Cartoon summary of sediment sources and proportions, and modes of sediment deposition in Lake Tutira. ~60-70% of total sediment is derived from catchment sources

And the weather for tomorrow is …………………..

Wairoa Lagoons – a subduction earthquake and tsunami record (Mike Page GNS)

The coastline from Wairoa to Mahia Peninsula has been subsiding throughout the Holocene. Deposits along the coast provide evidence of tsunamis and sudden subsidence events, with a likely source being a large subduction earthquake on the plate boundary between the Australian and Pacific Plates. Evidence for sudden subsidence includes tsunami deposits overlain by chaotically mixed, reworked sediment that appears to have been deposited rapidly at tidal inlet sites 10 km apart at Te Paeroa and Opoho Lagoons (Figures. 1 and 2). We will be driving past both of these lagoons on our way between Wairoa and Mahia (however they may be difficult to see from the road).

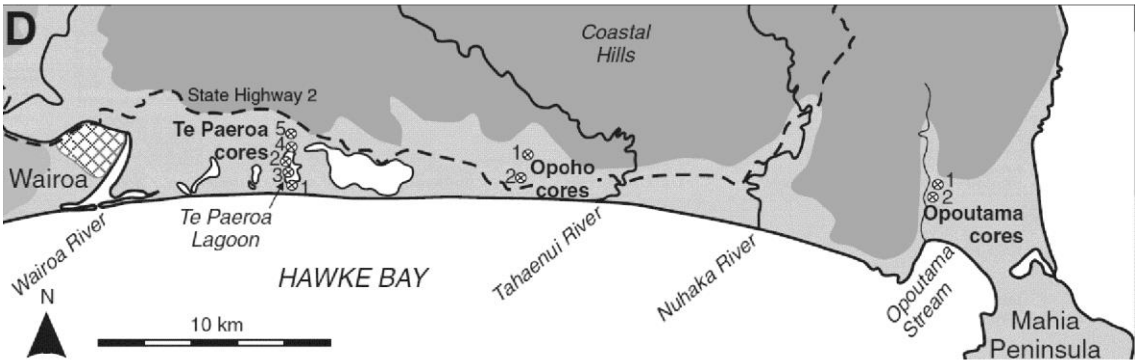


Figure 1 Location of cores collected to study paleotsunami and cosiesmic subsidence along Northern Hawke's Bay coastline

One subsidence event (at about 7000 cal yrs BP) has been correlated between northern and southern Hawke's Bay, indicating either a single long rupture or two or more ruptures that occurred within decades of each other. This event (or pair of events) also coincides with the formation of Lake Tutira and another landslide-dammed lake in Northern Hawke's Bay. It is likely that this event was a subduction earthquake affecting >100 km of coastline, and having a magnitude of at least M_W 8.0.

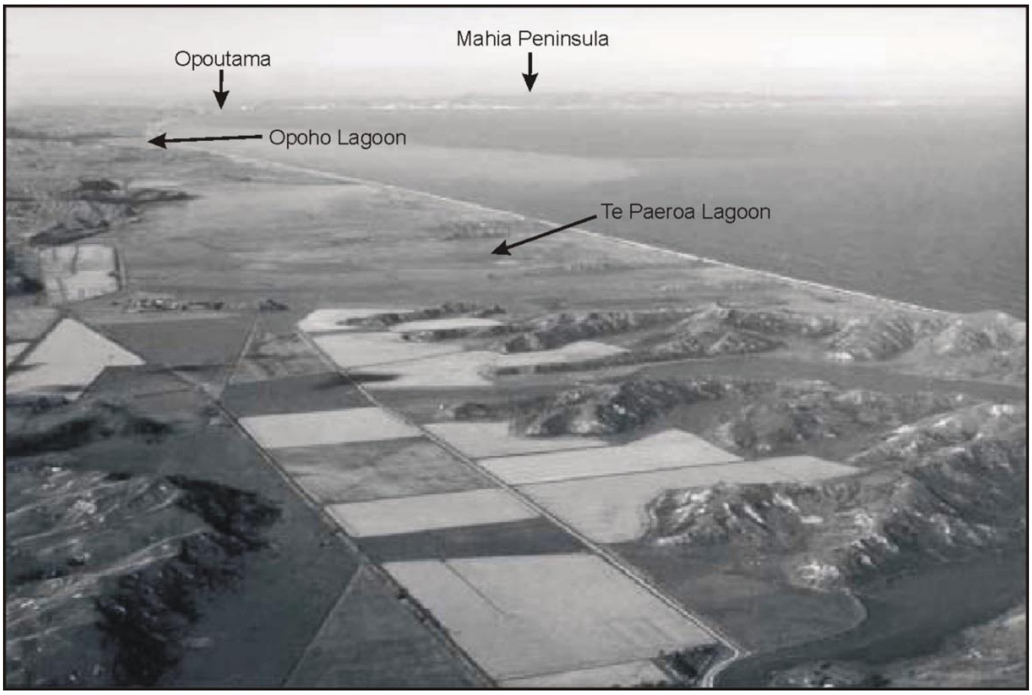


Figure 2 Oblique aerial view of coastal plain, looking east from Wairoa towards Mahia

Stop 3: Muriwai Marae - Waipaoa River mouth

Waipaoa River mouth – November 1988

Waipaoa River mouth – February 2011

StIRRRD Field Trip Itinerary – Waipaoa Catchment (Gisborne)

Wednesday 13 April

8.00am Depart Gisborne

Stop 1 Arrive Kaiti Hill Lookout @ 8:15 - overview of Gisborne/land use/hazards
Depart Lookout @ 8:45

Stop 2 Arrive Wainui Beach @ 9:00 - coastal erosion
Depart Wainui Beach @ 9:30

Stop 3 Arrive Waituhi/Tangihanga Stn @ 10:00- Wi Pere Trust/farming/hazards
Depart Tangihanga @ 10:45

Stop 4 Arrive Tarndale Slip @ 11:30 - land use history/erosion/reforestation
Depart Tarndale Slip @ 12:30

Stop 5 Arrive Waipaoa Station @ 12:45 - river aggradation/S2S/lunch
Depart Waipaoa Station @ 1:45

Stop 6 Arrive Wairere Rd @ 2:00 - farming/erosion/soil con
Depart Wairere Rd @ 2:30

Stop 7 Arrive McPhail's Bend/Ormond @ 3:00 - Waipaoa RFCS/sedimentation
Depart McPhail's Bend @ 3:45

4.00pm Arrive Gisborne airport

0.50 hr Stop 1	Mike Page/Louise Bennett/planning person
0.50 hr Stop 2	Dave Peacock
0.75 hr Stop 3	Iwi/Dave Peacock
1 hr Stop 4	Mike Marden
1 hr Stop 5	Mike Marden/Dave Peacock
0.50 hr Stop 6	Kerry Hudson/MikePage
0.75 hr Stop 7	Dave Peacock/Brenda Rosser/Louise Bennett

5.0 hrs total
+ 3 hr travel time (return)

Field trip route – Waipaoa Catchment

Stop 1 Kaiti Hill Lookout (Mike Page, GNS)
Natural hazard overview and Gisborne District Council CDEM activities (Louise Bennett, Gisborne District Council)

The main Kaiti Hill Lookout offers views across the Pacific Ocean, Poverty Bay, the lower Waipaoa River floodplain, and the coastal ranges. On a clear day, Mahia Peninsula can be viewed off in the distance to the south. The coastlines north and south of Kaiti Hill are marked by generally steep cliffs and are prone to coastal landsliding. Gisborne City is situated at the eastern corner of the triangular-shaped coastal plain, called the Poverty Bay Flats (Figure 1). The Waipaoa catchment has an area of 2200 km^2.

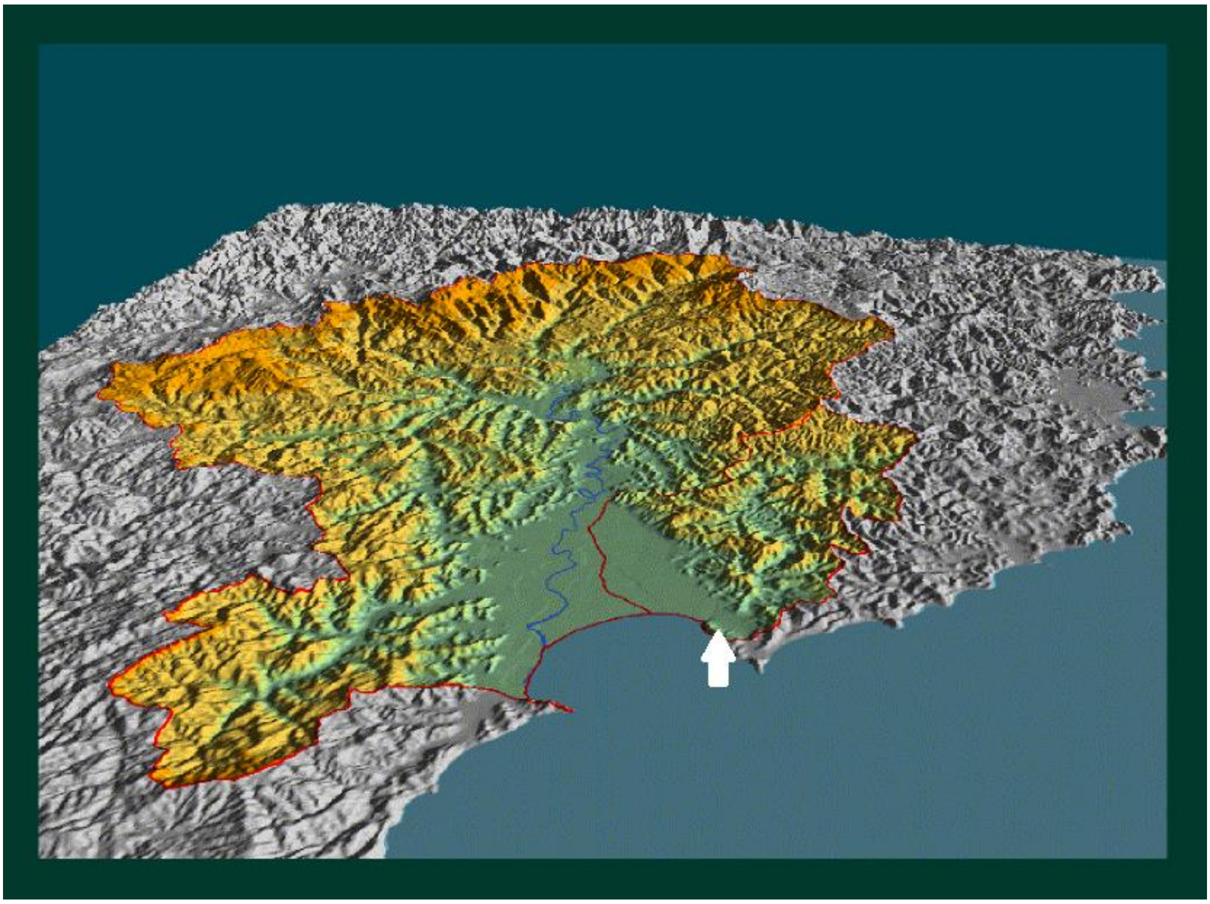


Figure 1 Oblique DEM view of Waipaoa Catchment (looking north-west). Location of Gisborne City shown by arrow

The shoreline bordering the Poverty Bay Flats has been pro-grading for ~7000 years, and the flats have been undergoing tectonic tilting to the southwest (in the area of the current Waipaoa River mouth). The Waipaoa River mouth has changed position several times since European settlement. Before 1841 it was near present day Gisborne City. By 1868 it was in its present position, and then it migrated further south to near the cliffs of Young Nick's Head from 1925-1946. This movement of the river mouth was a reason why the Muriwai meeting house we visited yesterday was moved in 1916 from the edge of the Te Wherowhero Lagoon to its present site. The mouth of the river then moved back north to its present position by 1946, where it has been maintained by stopbanking and construction of groynes.

The hill country surrounding the floodplain is composed predominantly of weak and erodible Miocene and Pliocene sedimentary rocks (massive and interbedded sandstones, siltstones, mudstones and some limestones) with localised early to middle Quaternary lake, estuarine, fluvial and beach deposits. In the headwaters of the Waipaoa River catchment are highly erodible Paleogene and Late Cretaceous sediments (sandstone, argillite, mudstone, marl, melange and limestone), most of which have been part of the East Coast Allochthon (large block of rocks which has been moved from its original site of formation). Regional uplift rates are 1-3 mm/yr, with rates being greatest in the upper Waipaoa catchment (Litchfield et al. 2007), however the southwest of the Poverty Bay Flats is an area of net subsidence of ~2 mm/yr. Figure 2 shows onshore active faults in the Gisborne-East Coast area.

The subduction interface between the Austrialian and Pacific Plates is about 100 km offshore to the east. Other offshore faults that generate earthquakes are the Gable End, Ariel Bank and Lachlan Faults (Figure. 2). These inner shelf faults are predicted to be responsible for much of the coastal uplift. At Pakarae River mouth, ~20 km northeast of Gisborne 7 marine terraces record an uplift rate of 3.2 ± 0.8 mm/yr, which matches well with the slip rate on the likely causative fault, the offshore, northwest-dipping reverse Gable End Fault, situated 5-10 km to the southeast.

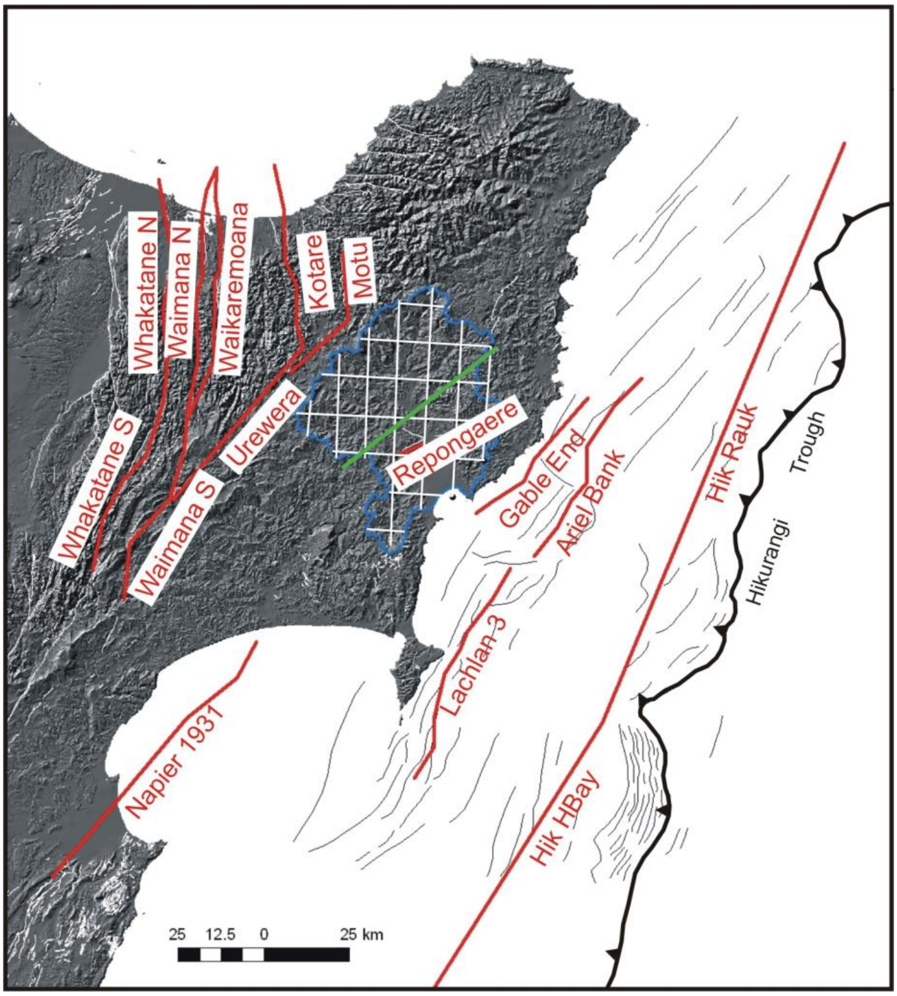


Figure 2 Active fault earthquake sources (red lines) analysed in the Gisborne-East Coast region, derived from the National Seismic Hazard Model (Stirling et al., 2007, unpubl.). The sources were initially selected by distance from the Waipaoa catchment (≤ ~50 km from the boundary), and sources were then added or subtracted depending upon whether the calculated MM7 contour overlapped the catchment. Note the subduction interface sources (Hik Rauk and Hik HBay) are projected to the surface from 5 km depth, whereas the remainder are their surface positions. The onshore active faults (thin white lines) are from the GNS Science New Zealand Active Fault Database (http://data.gns.cri.nz/af/) and the offshore faults (black lines) from Lewis et al. (1997), which are currently undergoing revision (J. Mountjoy and P. Barnes, pers. comm. 2008). The Waipaoa River catchment is outlined in blue. The green line shows the boundary between the NW and SE halves of the catchment for the ground shaking return time calculations (Table X). The thick white lines inside the catchment define the grid squares for the calculations of return times for strong ground shaking.

Climate

The climate is strongly influenced by El Niño-Southern Oscillation (ENSO) and Southern Annular Mode (SAM) (Ummenhofer and England, 2007). While rainfall varies from <1000 mm p.a. near Gisborne to >2500 mm p.a. in the headwaters of the catchment, both high intensity rainstorms (extra-tropical cyclones) and droughts are a feature of the weather. Erosion-generating storms have a recurrence interval of 3 years in the headwaters and 4-6 years elsewhere.

Based on the IPCC climate change scenario of a 2°C increase in temperature, by the end of this century time spent in drought will double, and the frequency and intensity of extreme rainfall will increase.

Vegetation and land use history

Maori settlement in the catchment is recorded from 12th century, with earliest occupation occurring on the coastal floodplain (Jones 1988). During the following ~800 years, small areas of forest were burnt on the floodplain and adjacent foothills. European settlement began in the 1830s, major deforestation occurred after 1880, and by the 1920s ~95% of the forest had been burnt or logged. Exotic reforestation began in the Waipaoa headwaters in 1960 in response to severe erosion. Today, >20% of the catchment has been reforested (Marden et al. 2008b). Extensive areas of erosion-prone pastoral land have also been treated with soil conservation plantings (poplars, willows, pines).

Ongoing aggradation and the associated risk to the Poverty Bay Flats/Waipaoa floodplain, together with the large 1948 flood, led to the Waipaoa River Flood Control Scheme (WRFCS), which involved construction of 63.4 km of stopbanks and several diversion cuts, and was completed in 1969. In the ensuing decades land use on the floodplain has developed, from largely pastoral farming to intensive arable and horticultural cropping. The scheme, currently valued at $38.77M, now protects 10 000 ha of fertile floodplain, over $1 billion of floodplain assets, and a population of ~42 000 (Peacock and Philpott 2009). The Poverty Bay Catchment Board, formed in 1944, and latterly its successor the Gisborne District Council, have administered the WRFCS and carry out farm plans involving the planting of trees for soil conservation purposes.

Reforestation for erosion control was begun by the New Zealand Forest Service in ~1960, targeting gullies in the headwaters that are the major source of sediment. Successive Government reforestation schemes to address the erosion problem on a regional basis have been set up, and the current scheme established in 1992, is the East Coast Forestry Project (ECFP) (Ministry of Agriculture and Forestry, 2005), which provides grants for establishment of tree cover on erosion-prone farmland and is due to end in 2020.

Earthquakes

Litchfield et al. (2009) describe the characteristics and impacts of eight historic (last 160 years), moderate to large earthquakes that have affected the North Island East Coast. The majority of these earthquakes have occurred on or within the subducted Pacific Plate. Several have resulted in high levels of ground shaking in Gisborne and have produced landslides. The most intense landsliding was associated with the 1914 Mw6.6 East Cape (≤ MM9), 1931 Mw7.8 Hawke's Bay (Napier) (≤MM10), and 1932 Mw6.8 Wairoa (≤MM9) earthquakes.

Litchfield et al. (2009) have calculated return times for high levels of strong ground shaking (≥ 7 Modified Mercalli Intensity MMI) for the Waipaoa and Waimata catchments (Table 1)[1]. For relatively small areas (~90 km^2), return times are ~26 yrs (MM7), ~96 yrs (MM8), and ~420 yrs (MM9), while for ground shaking over large areas (~750 km^2), return times are ~130 yrs (MM7), ~620 yrs (MM8), and ~10,000 yrs (MM9). The NW and SE halves of the catchment have different return times due to the different contributions of the following active fault sources: the northern part of the North Island Dextral Fault Belt, normal faults in the central and eastern Raukumara Range, offshore thrust faults, and the subduction interface.

Table 1 Mean ground shaking return time estimates (years) for the Waipaoa and Waimata catchments (from Litchfield et al. 2009).

Area	MM7	MM8	MM9
Waipaoa ~90 km^2	26	96	420
Waipaoa ~750 km^2	130	620	10 000
NW Waipaoa ~90 km^2	34	150	790
SE Waipaoa ~90 km^2	37	150	630
NW Waipaoa ~750 km^2	260	2100	
SE Waipaoa ~750 km^2	350	1600	

[1] Calculated via a four-step process: (i) compilation of earthquake source data, including historical or distributed seismicity and active fault geologic data, (ii) calculation of Mw and Recurrence Interval (RI), using Gutenberg-Richter relationships for distributed seismicity, and a combination of field data and regressions from historical earthquakes for the active faults,
(iii) calculation of levels and maps of MMI using attenuation functions, (iv) combining all the results to calculate return times of various levels of MMI for parts or all of the river catchments.

Tsunamis

1947 Gisborne tsunami

On 25 March 1947, a large tsunami occurred along the coast north and south of Gisborne. Up to 13-meter tsunami elevations were observed along a 100 km length of coastline. Impacts of the tsunami are shown in Fig. X. The Tatapouri Hotel, shown in Figure 3a, was located ~200 m south of Dive Tatapouri. The tsunami followed an M_W 7.1 earthquake, located about 50 km offshore. Considering the magnitude, the tsunami was surprisingly large. Tsunami modelling was carried out to identify the faulting mechanism in the event (Appendix 1). Results suggest that the earthquake was a typical tsunami earthquake with unusually slow average rupture velocity of 150m/s.

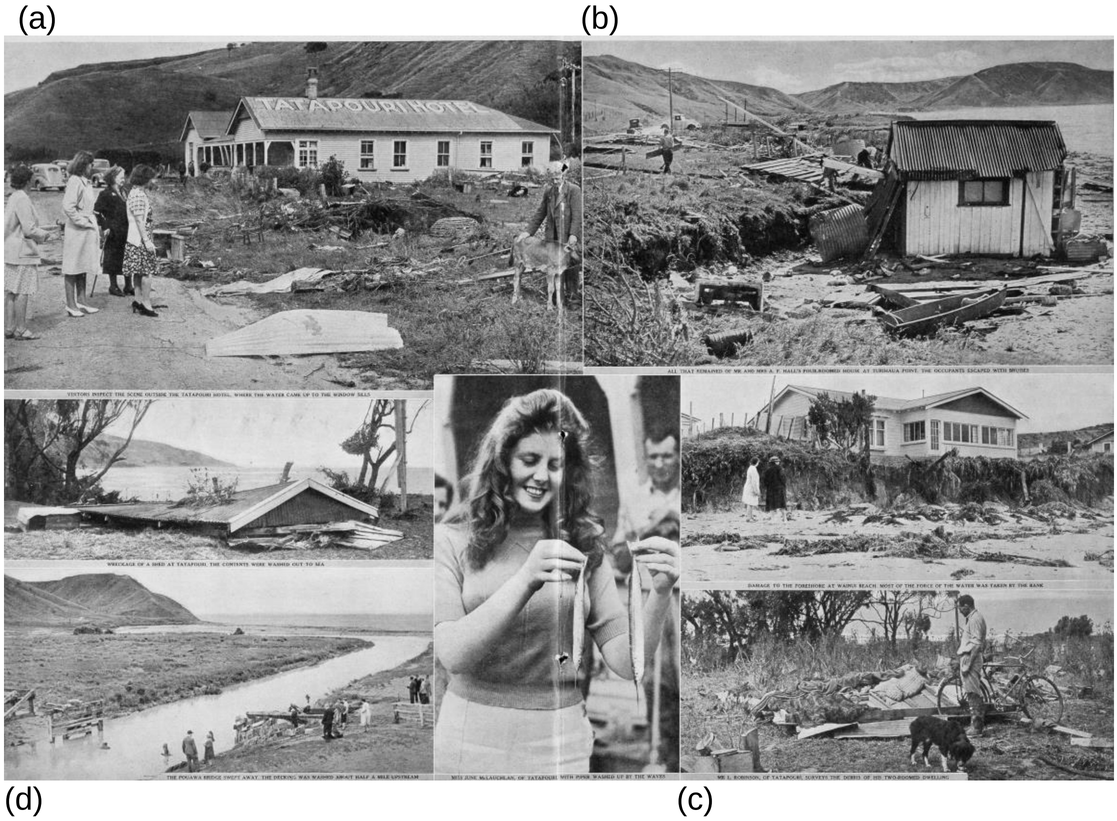


Figure 3 The photo album from the Weekly News (April 2, 1947) shows the damages at several locations along the east coast. (a) Relics and debris left outside Tatapouri Hotel and the water came up to the window sills. (b) Remaining section of the damaged 4-bedroom house at Tourihaua Point. (c) Damage to the foreshore at Wainui Beach. (d) The Pouawa bridge was swept away and the remaining part of the deck was carried about ½ miles upstream of the Pouawa River.

Flooding

Flooding is a major hazard in the region. The main risk is to Gisborne City and the Poverty Bay Flats, although there are smaller susceptible floodplains and townships at Tolaga Bay, Tokomaru Bay, Ruatorea and Hicks Bay. In the last hundred years large floods occurred on the Poverty Bay Flats in 2005 (Labour Weekend), 2002 (Muriwai), 1988 (Cyclone Bola) (Figure 4), 1985 (Ngatapa), 1977, 1950, 1948 and 1906.

The Waipaoa River Flood Control Scheme (WRFCS) protects the Poverty Bay Flats and Gisborne City, although the scheme has been losing capacity through aggradation of the river bed and berms, and a review considered it only provides protection from a “one in 70 year event”.

More information is given on flooding and the WRFCS at Stops 3 and 7.

Figure 4 Waipaoa River in flood during Cyclone Bola

Deep-seated landslides

Deep-seated landslides are a characteristic feature of much of the sedimentary hill country of the East Coast of the North Island, and are particularly common in the Waipaoa catchment (mostly pre-historic). They are typically bedrock failures which range in depth from several to tens of meters, and are >2-100s ha in area. The main landslide triggers are earthquakes, rainfall and stream incision. A total of 1026 have been mapped (yellow areas in Figure 5). In combination with the area of the East Coast Allochthon (white area), the majority of which is affected by deep-seated landsliding, a total of 46,400 ha or 18.5% of the entire Waipaoa catchment is affected by deep-seated landslides. Thirteen deep-seated landslides are known to have been triggered by rainfall between 1988 and 2006. The hazards associated with these landslides include, slope instability, debris run-out, flooding upstream of channel blockages (Figures 6 and 7), and downstream flooding following breaching of blockages.

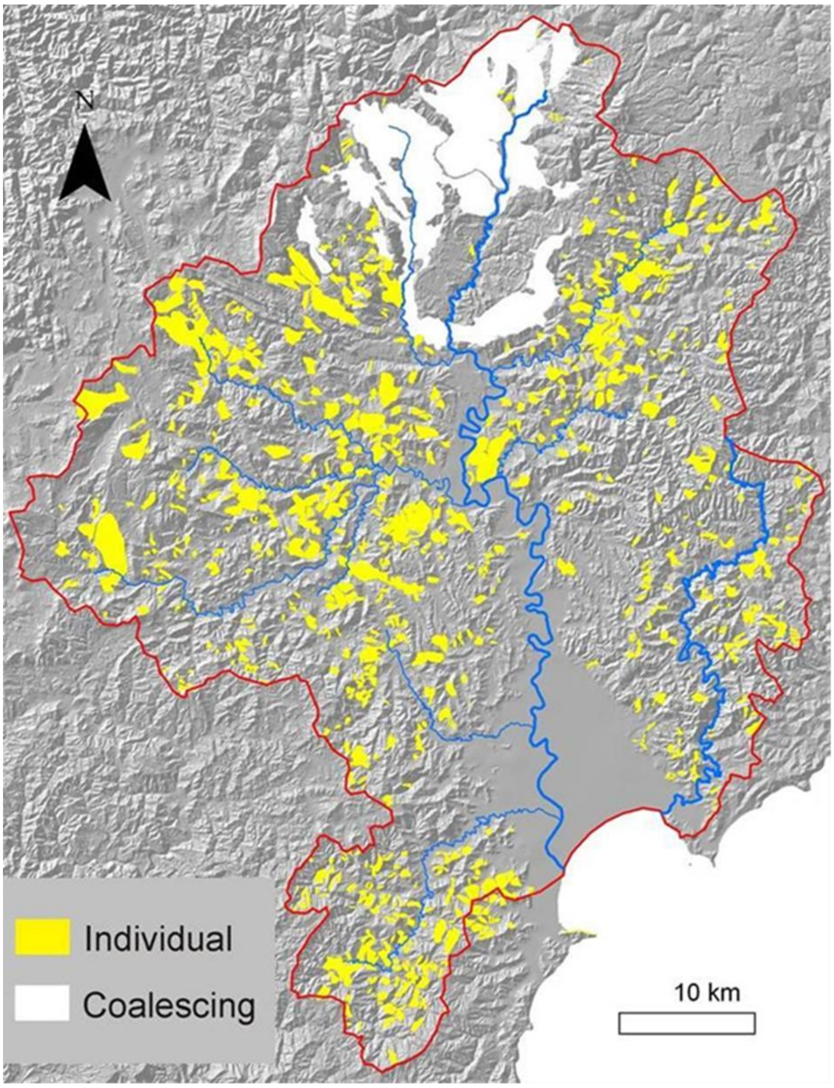


Figure 5 Distribution of deep-seated landslides in the Waipaoa catchment. Area of coalescing landslides equates to the East Coast Allochthon

Figure 6 Waerengaokuri Valley after Cyclone Bola (March 1988). A large landslide blocked the valley outlet, forming a lake that flooded the valley which required draining by mechanical removal of the landslide debris

Figure 7 Mangakiore Station following Cyclone Bola. The lake formed by the large landslide was subsequently drained by construction of an outlet channel through the landslide debris

Hancox et al. (1997, 2002), defined relationships between landslide distribution and earthquake magnitude, epicenter, MM isoseismals, fault rupture zone, topography and geology, and identified threshold levels for landsliding. The magnitude threshold level for shallow landsliding is about M 5, with large, deep-seated landsliding occurring at M 6 or greater. For the New Zealand MM intensity scale, the threshold for shallow landsliding is MM6, while large deep-seated landsliding can be expected at MM7-MM8 (Hancox et al. 2002, Dowrick et al. 2008) (Appendix 2). These thresholds are slightly higher than those determined for overseas earthquakes (Keefer 1984). In addition to ground shaking intensity, factors such as shaking duration, lithology and structure, topography, and groundwater conditions will also influence landslide generation.

Gisborne District Civil Defence Emergency Management (CDEM)

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Our area runs from just north of Morere in the south to Potaka in the North and is separated from the Bay of Plenty Region to the west by the Raukumara Ranges. The region has a coastline of 270 kilometres that consists of sandy beaches, rocky mudstone shores and headlands.

The regional population was 46,570 at the last census. The majority live in Gisborne City and its environs and the major townships of Tolaga Bay, Tokomaru Bay, Te Puia, Ruatoria, Tikitiki, Te Araroa, Te Karaka and Matawai.

The Gisborne Region coastline lies between 70 - 90kms from one of the earth's crustal plates. The region is being uplifted at the rate of 4mm a year resulting in complex folding and faulting of the sedimentary mudstones that prevail throughout the region.

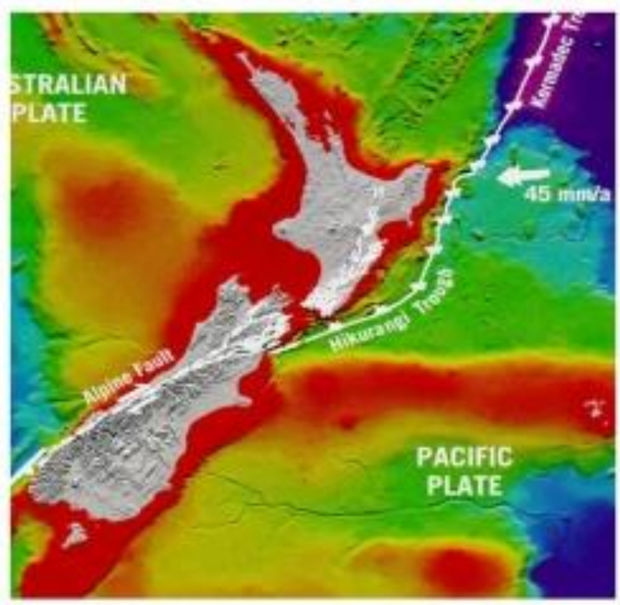
The clear felling of native bush by early settlers has contributed to widespread erosion and silting and river channel changes.

The region is also down-wind of some of the most active volcanoes. The coastline is subject to both distant and local Tsunami events generated from the unstable geology that makes up the sea floor.

Meteorological events are also a key threat to the region with periodic remnants of decaying tropical cyclones and storms from the south causing or contributing to flooding, erosion, coastal erosion and general land instability.

Natural Hazards

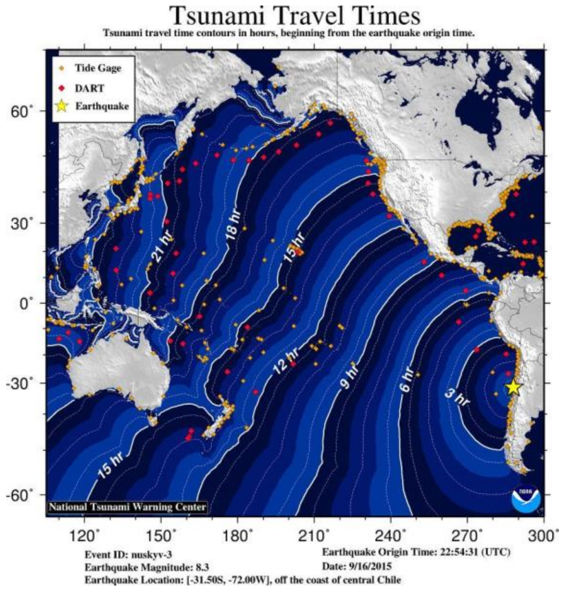
Earthquakes



The Gisborne Region sits just west of the Hikurangi trench where the Pacific Plate is sub-ducting under the Australian. Earthquakes occur when pressure from these colliding plates is suddenly released and the earth's crust ruptures and moves.

In recent years, the most damaging earthquakes in the region were in 1966 (magnitude 6) and 2007 (magnitude 6.8). Three buildings collapsed in the 2007 earthquake in Gisborne City and 23 more were barricaded and closed. Damage to commercial buildings was $50 million and homeowners made more than 6,000 insurance claims.

Distant Tsunami



Tsunami generated from parts of Chile and Peru are also a major contributor to the tsunami hazard in our region but have much longer arrival times of over twelve hours.

In Sept 2015 after an earthquake in Chile a tsunami and beach threat was received- this impacted beaches, rivers and harbours. The Guidelines now have tsunami mapping for tsunami risk area in three categories – red, orange and yellow – GDC has to update their maps

Local Tsunami

The largest tsunami in New Zealand's recorded history occurred in the region. On 26 March 1947, a seemingly minor earthquake was followed 30 minutes later by a tsunami that swamped the coast from Muriwai to Tolaga Bay. The Tatapouri Hotel and a cottage at Turihaua were destroyed by a 10-metre wave and the Pouawa River bridge was carried 800 metres upstream. Less than two months later, on 17 May 1947, another tsunami hit the coast between Gisborne and Tolaga Bay. At its maximum, north of Gisborne, this wave was about 6 metres high.

For us here we educate the public that live or work in the affected areas to be aware of the warnings- an earthquake (that makes it hard to stand) or a long earthquake (45 seconds or more) and to evacuate or of this is not possible to stay indoors or go higher in a building.

LONG OR STRONG
BE GONE

Flooding

Flooding has been a significant hazard in the region, due to the large floodplains which support human settlement and intensive farming. The Poverty Bay Flats, which includes the Gisborne Urban Area, is the most intensively settled and developed floodplain. In the last hundred years large floods occurred on the Poverty Bay Flats in 2005 (Labour Weekend), 2002 (Muriwai), 1988 (Cyclone Bola), 1985 (Ngatapa), 1977, 1948 and 1906.

Flood control works give some protection but the floodplains are still vulnerable beyond the design of the protection works or if the protection works are breached. The Waipaoa stopbanks, the major flood control asset, is designed to handle the same water levels as experienced during Cyclone Bola.

Other significant areas at risk are the Mangatuna/Wharekaka area near Tolaga Bay(3 people died here during Cyclone Bola) and the Waiapu River Valley. Flooding can also occur in other flat or low lying areas

Private Residence September 2015

Gladstone Rd Bridge September 2015

Anaura Bay Flooding – September 2015

Poverty Bay Flats 2002

Landslides – Rainfall Induced

In New Zealand about 90% of all landslides are triggered by rainfall and different rainfall patterns produce different types of landslides.

Cyclone Bola in 1988 provides a good historical analogue for the 100 year ARI storm, which affected most of the region. During such an event it is expected that up to 50% of slopes greater than 30^{o} will be affected; up to 20% of slopes 20-30^{o} and less than 10% of slopes of less than 20^{o}.

Landslides can have serious health and safety consequences. The locations with the highest health and safety risk are roads adjacent to steep slopes or road cuttings and buildings located above or below steep slopes. Landslides are a primary cause of damage to roads and road closures.

The photo on the left is a landslide that caused the failure of the City water pipeline

Volcanic

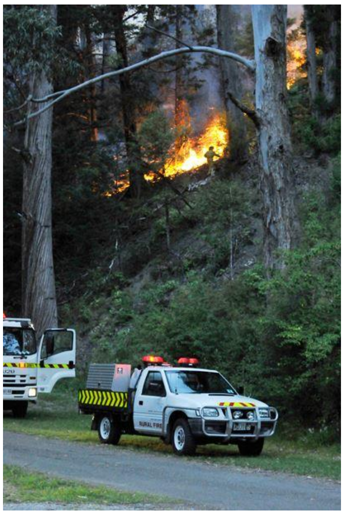
Potential volcanic hazards include: ash falls, pyroclastic flows, lava, lahar, landslide, electrical storm, volcanic gases, tsunami and hydrothermal eruption. Ash fall is the most likely phenomena to affect the region. Other phenomena could also be experienced in larger eruptions.

The prevalent wind directions are from the west and south, so the Gisborne Region is often downwind of volcanic centres (Ruapehu, Okataina, Taupo, Taranaki). Due to these prevalent wind directions, White Island infrequently impacts the region.

Small eruptions in New Zealand are unlikely to result in any ash fall in the Gisborne Region. Every 20 to 50 years larger eruptions occur, which may deposit ash in the Gisborne Region with favourable wind conditions.

Rural Fires

Rural fires can be caused by numerous activities including the burn off of agricultural waste that gets out of control, arson, careless activities such as burning rubbish, as well as natural causes such as lightning strikes. Weather contributes significantly to the risk of wildfire as prolonged dry weather and strong winds mean rural fires can spread easily.



Infrastructure Failure

An infrastructure failure is the failure of any lifeline utility service that affects a significant part of the region. Failures may occur in water supply systems, wastewater systems, stormwater, electrical supply, gas supply, telecommunications (including radio), transportation centres or routes (port, airport, highways), fuel supply, roading, information technology or financial systems. Community reliance on technology e.g. telecommunications can increase vulnerability when failure occurs.

Marine Oil Spills

Eastland Port on a busy summer day

We deal with approximately 6 oil spills in two Coastal Marine Environment – these differ from spills from land into rivers but the cleanup methods are usually the same.

Our training consists of two exercises per year funded by the Oil Pollution Fund and Maritime New Zealand

While most of these are minor in 2002 we had the grounding of the Jody F Millennium and 25 tonnes of oil was spilt. I was also involved with the Rena grounding in 2011 in Tauranga.

Jody F Millennium Grounding in 2002

Philip V Ground November 2011

Exercise at the Port and Cut/Waikanae Creek

4 Rs of Civil Defence and Emergency Management

Reduction
Promoting robust reduction activities that reduce the risks from hazards to Tairāwhiti.

Recovery
Enhancing the CDEM Group's ability to recover from emergencies in Tairāwhiti

Readiness
Communities that understand are prepared and participate in Civil Defence emergency management.

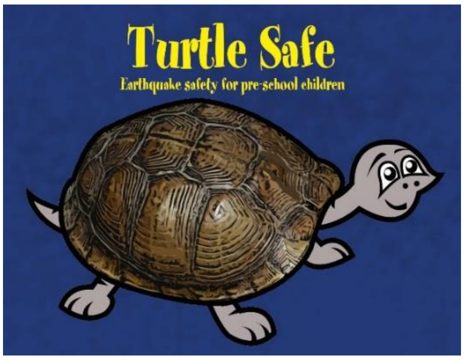
Response
Enhancing the CDEM Group's capability to manage emergencies in Tairāwhiti

Reduction

Individuals and communities understand the risks they face and do what they can to reduce the impacts

Readiness

Tairāwhiti individuals and communities are ready and prepared to react when an event occurs.



Crouch on the ground and cover your head

Like a turtle tucked up in bed

What's the Plan Stan

LONG OR STRONG BE GONE

GET READY GET THRU

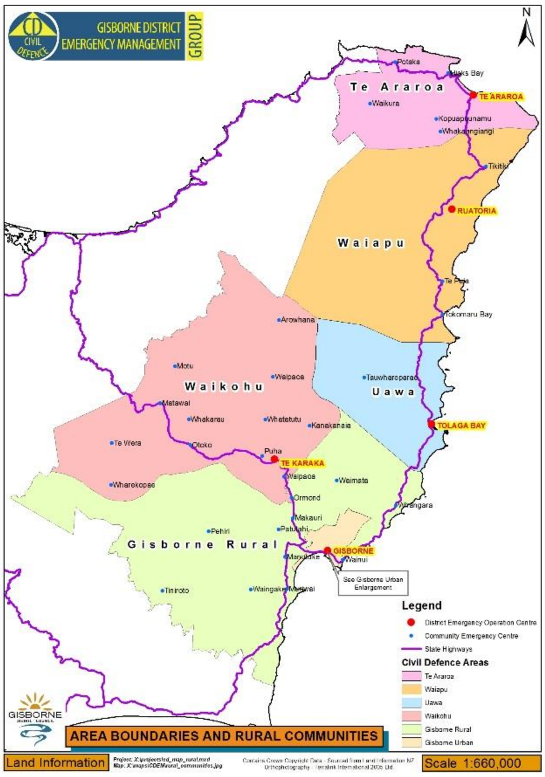
Social Media can be used to

- Provide information and advice
- Share preparedness tips
- Build trust and strong relationships with the community
- Quickly share information about potential or occurring emergencies
- Request and confirm information from the public
- Build situational awareness for the community and responders

Media has an important part to play in any emergency event

- Informing the public that something is happening and they need to pay attention so they can receive additional information
- Direct the public to sources of additional information so they can protect themselves from potential risk.

Community Link Volunteers



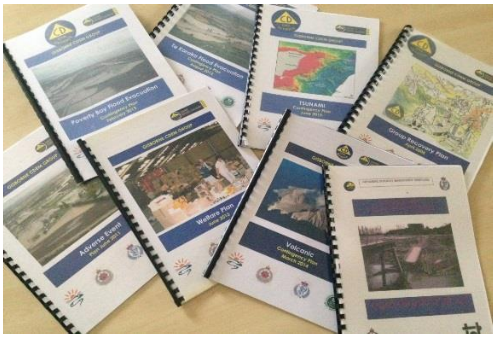
The Area Co-ordinators, Community Emergency Managers and their teams provide the link between the affected communities and the Controller through the GEOC Operations Managers.

The Community Link's main functions include: information management, response activity coordination and the welfare of isolated or displaced families. The Community Link personnel are instructed not to get involved in the 'doing' of response activities so as to remain free to maintain an overview of all activities happening in their community.

Their priorities are children, especially preschools, the elderly whether in care or at home and those less able to care for themselves.

All area headquarters are provided with two base sets, one link to the EOC, the other to link to the Communities within their area.

Plans and SOPs



Contingency Plans deal with the issues surrounding a specific threat. All contingency plans incorporate procedures for Civil Defence and the emergency services.

Functional Plans detail the actions to be taken relating to a specific activity

Standard Operating Procedures deal with specific processes that are used, the people involved and the structures that need to be put in place

Response

Resilience means communities managing their own response with coordinated support

While it is recognised that large parts of the rural communities will be self-supporting and to some extent urban communities, there are some 12,000 (more than 26%) people on a benefit in the Gisborne District. This does not include those that are dependent on the beneficiary and this also does not mean that they will all need assistance. For a number of reasons this group of people may need more 'organisational' support than the general community.

Community Emergency Centres/Welfare Centres

These are centres that are established by CDEM to during an emergency to support individuals, whanau and the community. They may be used for public information evacuation, welfare or recovery.

Spontaneous Volunteers

Spontaneous volunteers are community minded people that are generally not affiliated to any CDEM or partner organisation. These volunteers are not specifically trained in emergency management.

Such volunteers often have a wide range of skills and experience but still require direction, management and leadership

Emergency Services

Civil Defence and Emergency Managements key partners during readiness, response and recovery

Emergency Services which include the New Zealand Police, the New Zealand Fire Service, The National Rural Fire Authority, the rural fire authorities and health and disability services, have duties under Section 63 of the CDEM Act 2002.

Welfare

Preparing and Ensuring the Wellbeing of Individuals and the Community During and After an Event

The welfare services function is to carry out activities across the 4Rs to provide for the needs of the people affected by an emergency and to minimise the consequences of the emergency for individual, families and whanau and communities

Recovery

Resilience means that individuals and communities get back to normal as soon as possible

Build Back Better

Good recovery planning can increase the speed by which communities can resume daily activities. Communities that can restore the everyday functions of life, with people returning to their homes, businesses reopening and children going back to school, will recover more quickly. The importance of reducing the long-term consequences of emergencies through sound recovery planning cannot be overstated

Stop 2 Wainui Beach - Coastal Erosion (Dave Peacock, Consultant)

Wainui beach is well known as one of New Zealand's foremost surf beaches. However it is also subject to episodes of erosion, the last major episode being over the winter of 1992, when up to 8 metres of foredune was eroded at the south end of the beach. There was a sense of panic at this time when houses were being threatened by the sea, with local residents dumping rock in front of their properties as a temporary erosion protection measure. This resulted in a "stand-off" between beach front property owners and the Gisborne District Council, and litigation between the two parties continued over the following eight years. (See the attached summary of the litigation and other actions over this period).

Figures 1 and 2 show the same section of Wainui Beach (south of Lloyd George Road) during the summer when beach levels are high, and during the winter when sand has been stripped off the beach by heavy southerly swells, (showing the heavy rock protection works constructed after the 1992 storms).

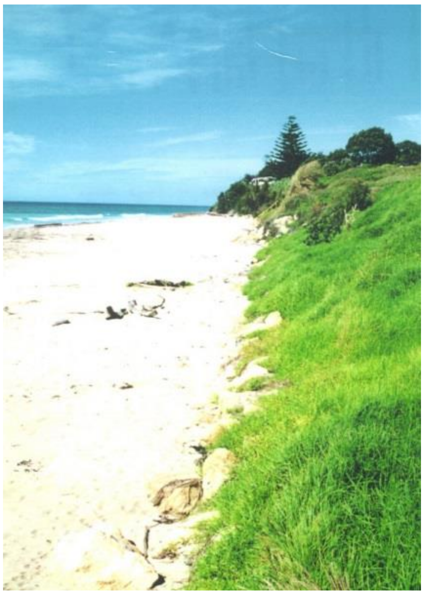


Figure 1 South Wainui Beach, 2nd March 2001

Figure 2 South Wainui Beach, 23rd July 1994

The erosion of the foredune in 1992 was not unexpected however, as there had been a number of erosion episodes in the past, and a number of (unsuccessful) coastal protection measures built to protect the foredune. Also New Zealand's first coastal hazard zone (CHZ), was put in place by the (former) Cook County Council in 1982. This coastal hazard plan was subsequently incorporated into the Gisborne District Council Combined Regional and Land District Plan, (CRLDP), and has been reviewed and updated at regular intervals since. An example of the CHZ is shown in Figure. 3.

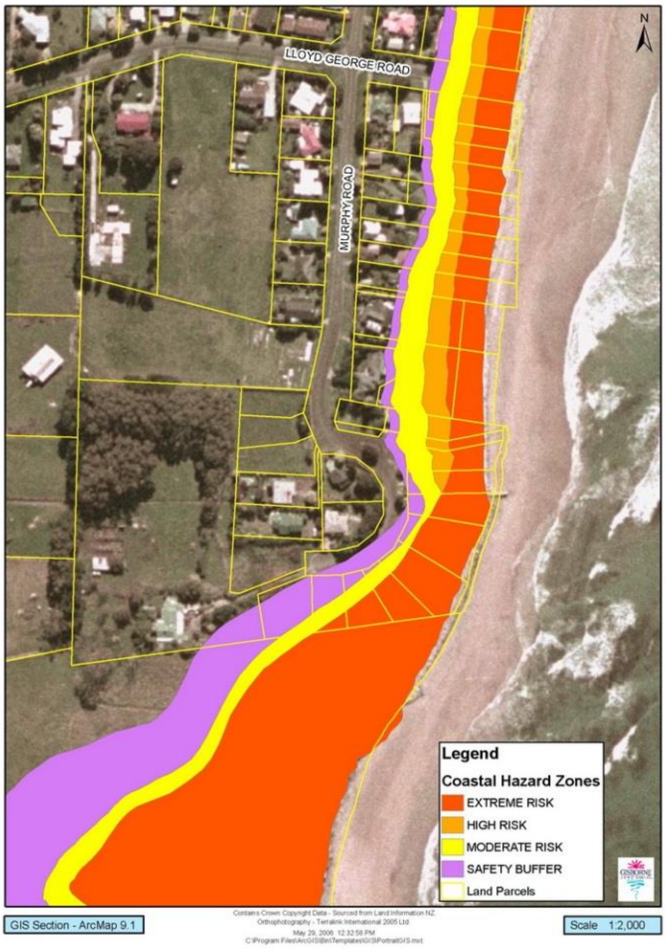


Figure 3 Coastal hazard zone, south Wainui Beach

While the CHZ has been effective in preventing the establishment of new houses in vulnerable locations, particularly the extreme and high risk zones, it has no effect on the many houses along the beach front which were existing prior to the first coastal hazard zone. To address this issue the first *Wainui Beach Management Strategy* (WBMS), was prepared in 2003, with long term values in mind, ie; the growing status of Wainui as an international surf beach, the value of the beach to the local and wider communities and the potential effects of sea level rise.

The WBMS recognises that "full protection" from the sea is neither practical nor affordable; and that beneficiaries of future protection works will have to recognise and accept that there will be a continuing “residual risk” to their properties, which is shown graphically by the coastal hazard maps.

The WBMS has since been superceded by a later version named *Wainui Beach Erosion Management Strategy* (WBEMS), in August 2014. While focussing on the management of coastal erosion, the strategy is intended to sit within a broader vision, principles and goals of the management of the beach provided by the Key Stakeholder Forum. The vision, broad goals and key principles are as set out on page 4 of the WBEMS.

Wainui Beach; an Edited Summary of legal and other actions since the 1992 storms.

Storms at Wainui Beach between May and October 1992 caused significant damage to the foredune at the south end of the beach, and resulted in a number of coastal protection works being hastily constructed by both Council and beach front residents.

Resource consents were not obtained prior to the construction of the works, but were required retrospectively. Resource consent applications were subsequently lodged over the following years for both retrospective and further proposed protection works. This set off a series of appeals between 1995 and 1999; to the High Court, the Planning Tribunal and the Environment Court.

As a result of the Environment Court action, the Court recommended mediation between the two parties (Gisborne District Council and the Wainui Property Protection Committee).

Since 1999 the following actions took place:

- Year 2000: A "Working Party" set up with representatives from Council and the WPPC.

- March 2001: An "Open Day" display on Wainui Beach set up at Wainui School.

- June 2001: A "Steering Group' set up to guide a beach management strategy. (This had wider
- representation than the working group it replaced).

- August 2002: First formal consultation process undertaken for the (first) Wainui Beach Management Strategy (WBMS).

- August 2003: The WBMS adopted by Council.

- April 2007: First new coastal protection works at Wainui beach constructed since 1992.
- This was the removal of 150m of old log/rail wall south of Tuahine accessway, and replacement with a sloping rock revetment. (This was the WBMS recommended option for this section of the beach).

- August 2014; The Wainui Beach Erosion Management Strategy (WBEMS) completed and adopted by Council, after extensive consultation with stakeholders and the community.
- While focussing in the management of coastal erosion, the strategy is intended to sit within a broader vision, principles and goals of the management of the beach provided by the Key Stakeholder Forum.

Stop 3 Tangihanga Station - Farming and Flooding (Iwi and Dave Peacock)

In 2004 the Wi Pere Trustees applied for a resource consent to construct a large irrigation pond in a former loop of the Waipaoa River at Tangihanga (Figure 1). This pond was proposed to store water pumped from the nearby Waipaoa River while there was plenty of water available during the winter and spring, and then to use it to irrigate the lower Tangihanga (river) terrace over the summer months. This would greatly reduce the risk to crops grown there and be of major economic benefit to the owners.

To increase the volume of stored water a stopbank was constructed around the perimeter of the pond up to 1.4m above the level of the upper terrace, but as such it would act as an obstruction to floodwaters over the upper terrace during a major flood event (Figure 2).

Figure 1 Tangihanga Station irrigation pond (outlined in white)

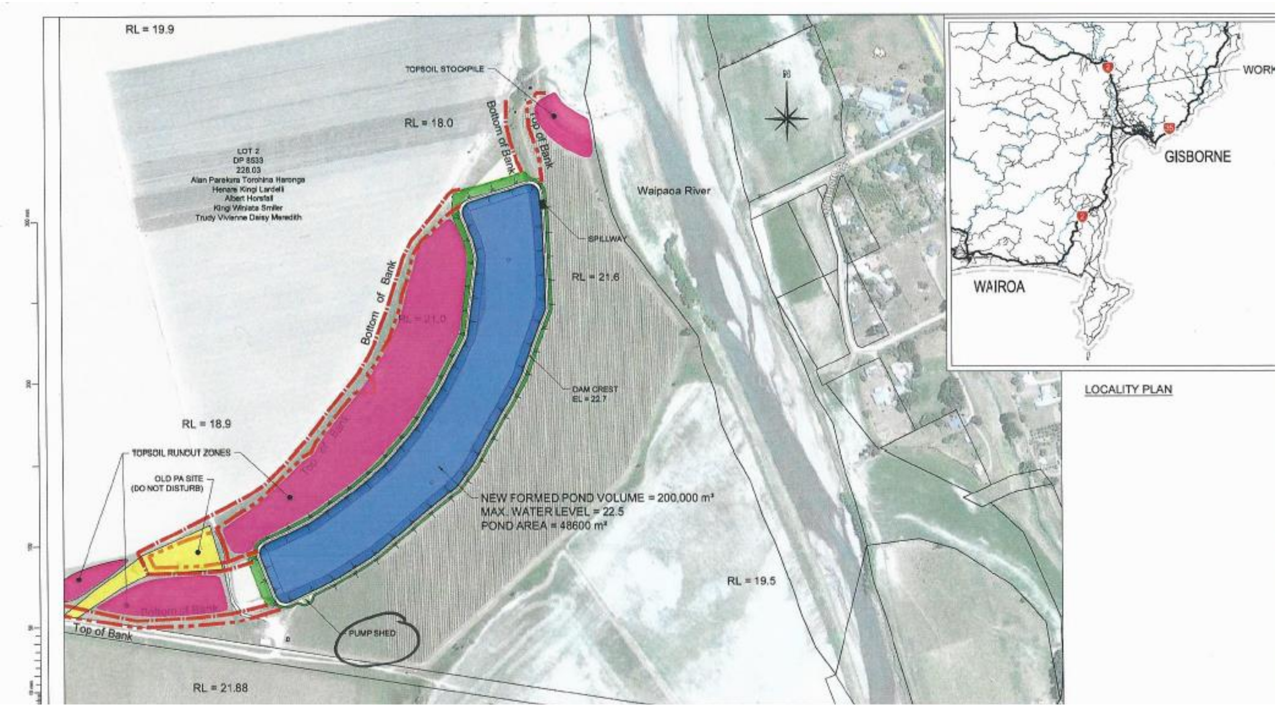


Figure 2 Plan showing irrigation pond (blue) and Waipaoa River to right

The upper and lower Tangihanga terraces are shown in the Gisborne District Council Combined Regional and Land District Plan, (CRLDP) as an F2 (High Hazard) flood overlay area. The only recorded flood to date to have completely inundated the upper terrace was the Cyclone Bola flood of March 1988. However, the CRLDP provides for a "design standard flood" in the Waipaoa River 10% greater in magnitude than the Cyclone Bola flood.

Hence the raised stopbank could potentially divert floodwaters during the "design standard flood" event. This in turn could have an impact on flood levels on the Waipaoa River Flood Control Scheme stopbanks on the opposite side of the river upstream of Ormond (Figure 3). This was confirmed by hydraulic modelling which showed that flood levels are likely to rise up to 200 mm on the Waipaoa River Flood Control Scheme (WRFCS) stopbanks just upstream of the Ormond School.

Figure 3 Waipaoa River and position of WRFCS stopbank (blue line)

While the flood risk to the irrigated cropping area would be reduced considerably by the proposed stopbank around the perimeter of the irrigation pond, the risk to properties in and upstream of Ormond would be increased, albeit by a fairly small amount. The Resource Management Act (RMA) requires that adverse effects of any works are mitigated, and in this case the Gisborne District Council required the applicant (the Wi Pere Trust) to raise the WRFCS stopbank up to 200mm over a 800 metre length upstream of Ormond.

Stop 4 Mangatu Forest - Landuse history, erosion and reforestation (Mike Marden, Landcare Research)

Historical background

Within historic times the chronology of the early stages of erosion in the upper reaches of Waipaoa Catchment is obscure but anecdotal evidence suggests that mass movement and gullying, including Tarndale Gully (Figure 1), was initiated in the winter of 1915 in response to the removal of the indigenous forest cover with subsequent loss of root strength lowering the threshold for erosion. The earliest available photographs (late 1930s) confirm that the pre-deforestation landscape had been produced predominantly by mass wasting agencies. By 1906-1912, gully-derived sediment had begun to impact on the river system, and in headwater streams the cobble-sized bed material had been replaced by fine gravel and sand. By 1910 the effects of forest removal were blamed for a sharper peak in flood discharge, and by the late 1920s channel aggradation and widening was noticeable and widespread, giving further support to the view that the onset of significant acceleration of mass wasting and associated gullying in the upper Waipaoa basin took place in the first decade of the 20th century.

A reforestation programme that would eventually encompass the entire upper watershed of the Waipaoa basin (140 km^2), and comprise Mangatu Forest, commenced in 1961. By 1963 the slopes surrounding Tarndale Gully were replanted in *Pseudotsuga menziesii* (Douglas fir). While reforestation, through a combination of reduced runoff and a shortened period of soil moisture surplus, ameliorated erosion on the lower slopes surrounding Tarndale Gully, the large area of bare gully-head was far too steep and active to be mitigated by afforestation and it remains active today (Figure 1-lower photo). At the peak of gully development (~1960s) gullies within Mangatu Forest occupied c. 4% of the upper Waipaoa watershed area and likely accounted for c. 17% of the Waipaoa River's average annual suspended sediment load. Within the wider Waipaoa catchment, gully erosion likely contributed >50% of this river's suspended load during the pre-reforestation period, and 43% for the 40-year (1957-1997) reforestation period. Multiple attempts at fascine construction across Tarndale fan (mid-fifties to early 1960s) were inevitably damaged during phases of fan aggradation followed by incision (Figure 1, 1956 photo).

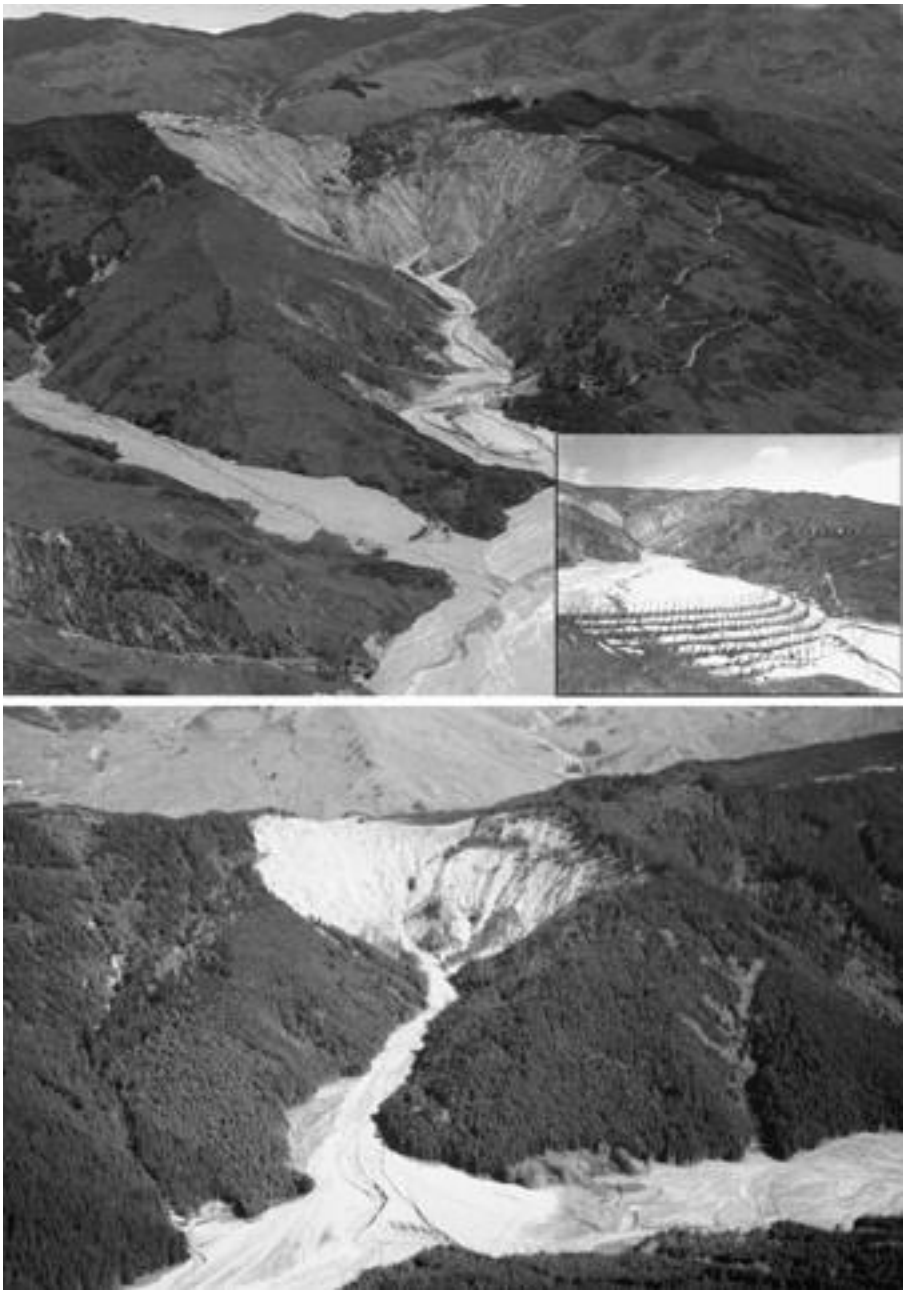


Figure 1 Tarndale Gully (pre-reforestation) with inset showing a fascine constructed with live poplar and willow materials in an attempt to retain sediment near its source, and post-reforestation with exotic pines (lower photo).

In May 1960 sediment emanating from Tarndale Gully completely destroyed all existing fascines (INSET ON Figure 1) and buried survey benchmarks established to measure changes in bed level across Tarndale fan. This signalled the end to any further attempts to restrain sediment generated from Tarndale Gully being delivered to Te Weraroa Stream and ultimately to the Waipaoa River.

Dominant Erosion Processes

Different parts of the headwall scarp are affected by different processes (Figure 2), the main ones are debris flow (Figure 3), rills and gullies (Figure 4), and rotational slumps (Figure 5).

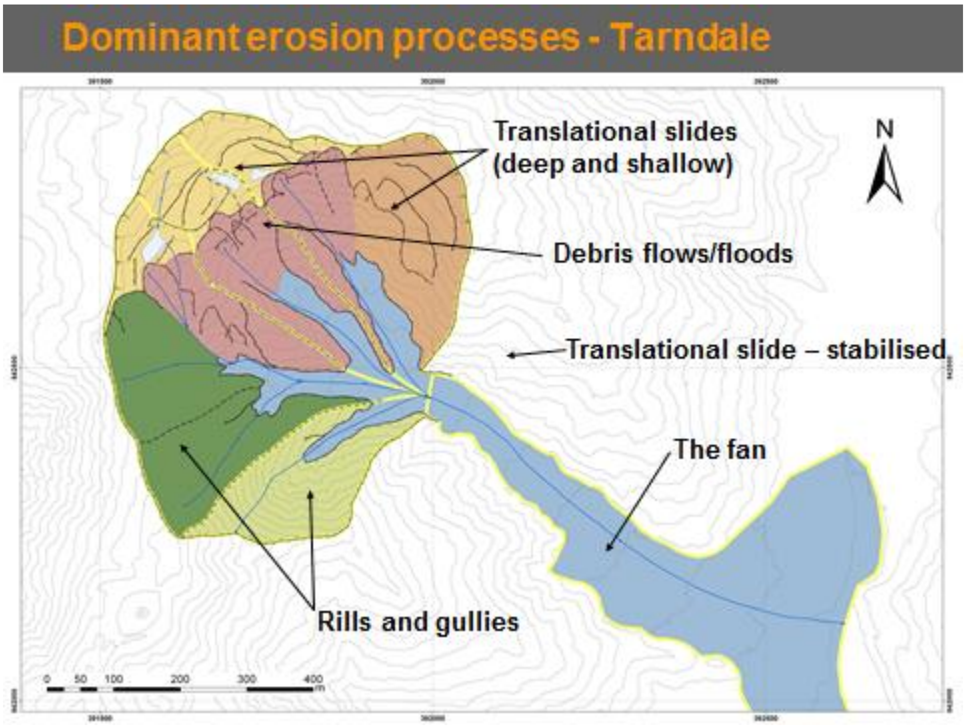


Figure 2 Plan view of Tarndale Gully showing the distribution of the dominant erosion processes.

Figure 3 A typical debris flow resulting from the collapse of a section of the headwall.

Figure 4 Rills and small gullies erode material from the headwall to the stream channel.

Figure 5 Large scale rotational slump failure of a section of the headwall.

The location and rate at which sediment is eroded from the head wall varies spatially and with time. Using repeat ground-based, laser scanning to generate differencing models (Figure 6) it is possible to see which parts of the headwall scarp have eroded (i.e. generated sediment) and where sediment is accumulating.

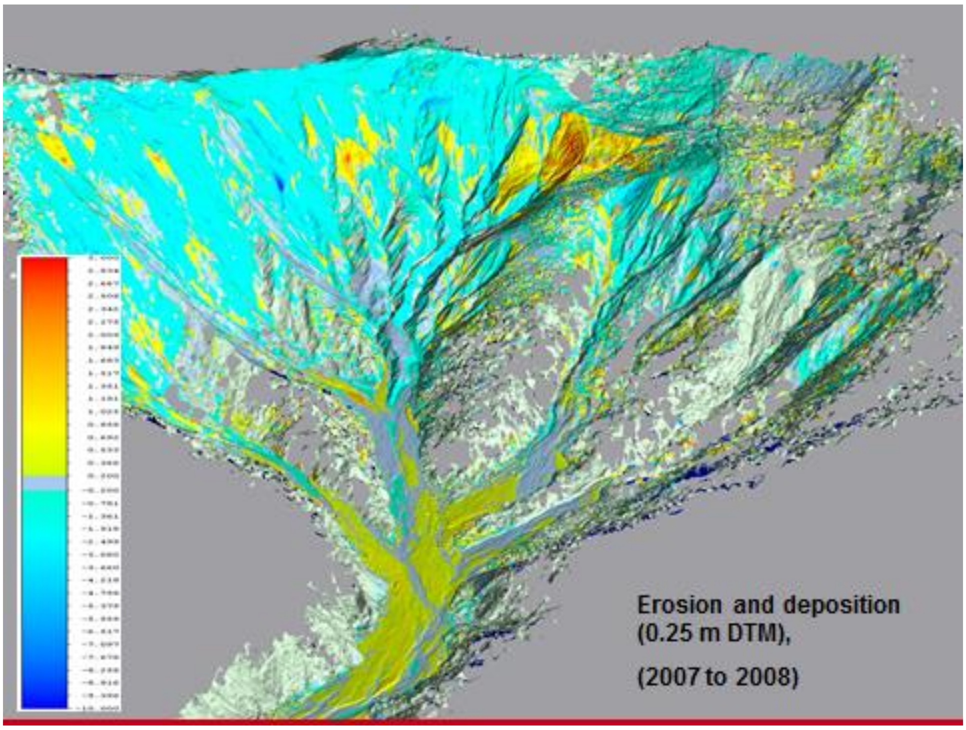


Figure 6 An elevation differencing model showing areas of erosion versus deposition between 2007-2008.

By process, rilling and gullying on the headwall scarp generated 77% of the total sediment generated during the period 2007-2008, debris flows 13% and translational slides 10% (Figure 7).

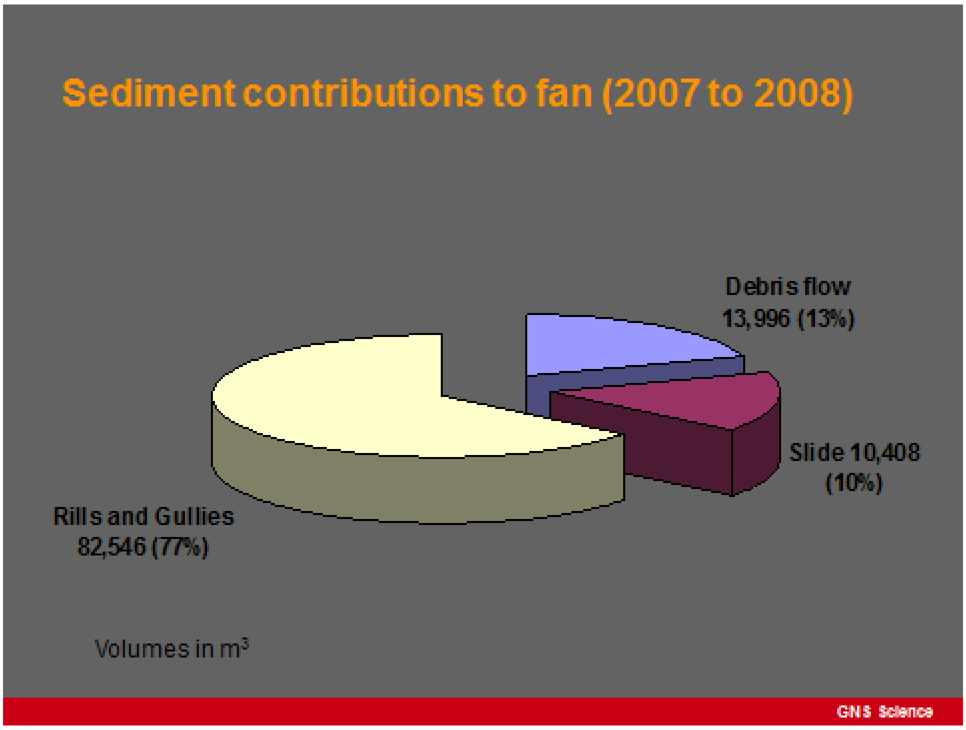


Figure 7 Process-based sediment contributions for the period 2007-2008.

Fan/Channel aggradation

Seasonal aggradation / incision cycles have been recognised on the Tarndale Fan since 1983, based on biannual channel cross-section surveys. Channels were generally infilled during winter (Figure 8). and cut during summer (Figure 9). This pattern of cutting and filling is driven by seasonal variation in sediment supply from a fluvio-mass movement gully complex (the Tarndale Gully. Cutting and refilling of well-developed channels may involve excavation or deposition (respectively) of some 15,000 m3 of sediment in an active fan area of ~11 ha. Between July and August 2005, 2 m deep channels were cut in the mid- reaches of the fan, but these had been completely infilled by November 2005, probably by sediment mobilised from the Tarndale Gully during a severe storm at the end of October. This suggests a highly sensitive channel system which responds rapidly to sediment supply variability from the Tarndale Gully. Discrete severe rainstorm or wet weather periods may be significant in controlling sediment supply here. Wetter weather enhances mass movements in the fluvio-mass movement gully complex, which contributes large quantities of sediment to the fan in the form of debris flows (Figure 8) and landslides, infilling channels on the fan. During drier periods, mass movement activity is inhibited and runoff incises channels (Figure 9).

Figure 8 Fresh failures on headwall scarp (top of photo) resulting in a debris flow and infilling of the channel floor during a prolonged period of heavy rainfall.

Figure 9 Channel incised during a period of low flow (summer) following a period of valley-floor infilling (to the level on which the person is walking) which occurred during the previous rainy season (winter).

Channel aggradation in the upper Te Weraroa River

Anecdotal evidence suggests that prior to 1948 there had been in excess of 30 m of aggradation where Tarndale Gully joins the Te Weraroa River. Stream cross-section measurements and digital terrain modelling indicate that since 1948 there has been a further 16 m of aggradation at this site but no change since Cyclone Bola (March 1988). The total thickness of accumulated gravel at this site is therefore estimated at about 50 m. A recent seismic survey (1996) confirmed that the depth to bedrock at this locality was between 47-50 m.

Though spectacular, rates of aggradation have declined with time. The initial period of rapid aggradation at 0.7 m/year between 1900 and 1948 was in response to deforestation and increased storm frequency. However, aggradation slowed during the1948-1988 period to 0.4 m/year largely in response to reforestation of the catchment. Overall, and for the period over which aggradation has occurred at this site, (1900-1988), the rate of aggradation has been about 0.6 m/year.

How effective has reforestation been in healing and preventing erosion?

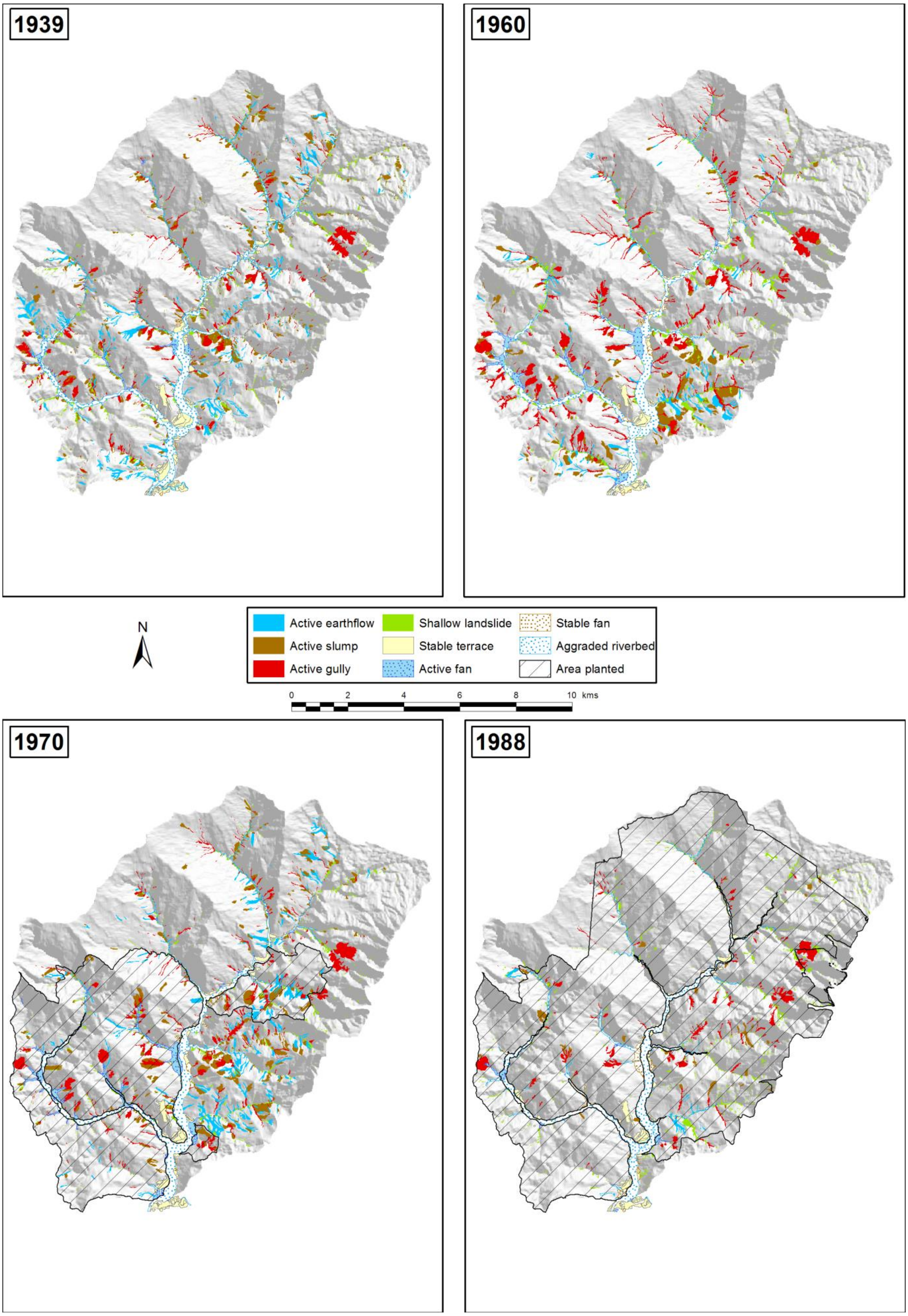


Figure 10 Extent of erosion, by erosion type, during the pre-reforestation (1939 & 1960) period, 10-years after the commencement of reforestation (1970), and at the completion of reforestation (1988). Hachured areas show the extent of planting as at 1970 and 1988.

In 1960, just prior to the commencement of reforestation at Mangatu, the combined area of active gully, earthflow, surface erosion, and slumping was about 1250 ha, comprising about 10% of the total area, with a combined erosion rate of ~ 28000 ± 4000 t km^{-2} y^{-1} during the early planting period (45% of study basin planted). At this time gullies, 315 of them, accounted for 50% of the total area of active erosion and contributed ~ 59% of the total sediment load. Slumps contributed~ 34%, shallow riparian landslides ~ 6%, and earthflows >1%. Although reforestation proved effective in stabilising earthflows and shallow landslides the resultant reduction in their contribution to basin sediment load, and to overall catchment yield, was minimal because their respective specific erosion rates are naturally low. The greatest reduction in sediment load occurred during the latter part of the reforestation period (1970–88) as the numerous small- to medium-sized gullies stabilised — coincident with canopy closure ~ 8–10 years after planting (Figure 10). However, the larger gully-mass movement complexes failed to stabilize in response to reforestation and with naturally high specific erosion rates they remained the dominant source of sediment — contributing an order of magnitude more than slumps, and two orders of magnitude more than shallow landslides and earthflows (Figure 11).

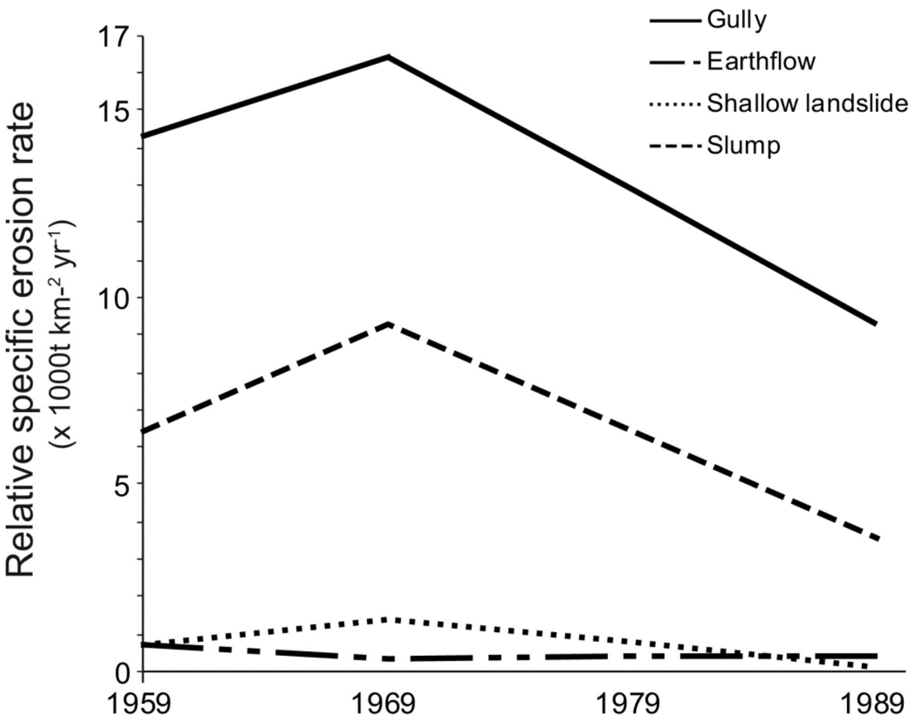


Figure 11 Trends in relative specific erosion rates for gullies, earthflows, shallow landslides and slumps before and after reforestation with exotic pines.

Overall, and within the time taken to grow a single rotation of pines (28 years), there has been an overall ~ 62% reduction in the erosion-affected area and a ~ 51% reduction in the erosion rate — potentially equivalent to an estimated ~ 12% reduction in sediment yield of the Waipaoa River.

Stop 5 Mangatu River Bed (Mike Marden and Dave Peacock)

River bed aggradation

Within Te Weraroa stream, aggradation has slowed subsequent to planting. However, the continued supply of large volumes of sediment from Tarndale Gully tends to mask this trend with reaches nearest to Tarndale Gully aggrading while reaches further downstream show signs of degrading.

At the junction of Te Weraroa Stream and Waipaoa River the rate of aggradation between about 1900 and 1970 was 0.2 m/year. Where woolsheds and homesteads once stood on flights of elevated step-like terraces high above river level, the rising river bed gradually overwhelmed and buried many surfaces. Today, some of these former paddocks and house sites may be as much as 12 m below the current river level. The width of the river channel too has increased dramatically from 60 m in 1896 to 400 m in 1939 but in later years remained relatively unchanged. Following reforestation of the catchment, the aggradation rate decreased to 0.11 m/year in response to a reduction in sediment supply.

Within the upper reaches of the Waipaoa River there is evidence that the river bed is currently degrading, again a delayed response to reforestation reducing the sediment supply. Thus parts of the river bed have been abandoned, and newly-formed terraces are in the process of being colonised by vegetation (Figure 1).

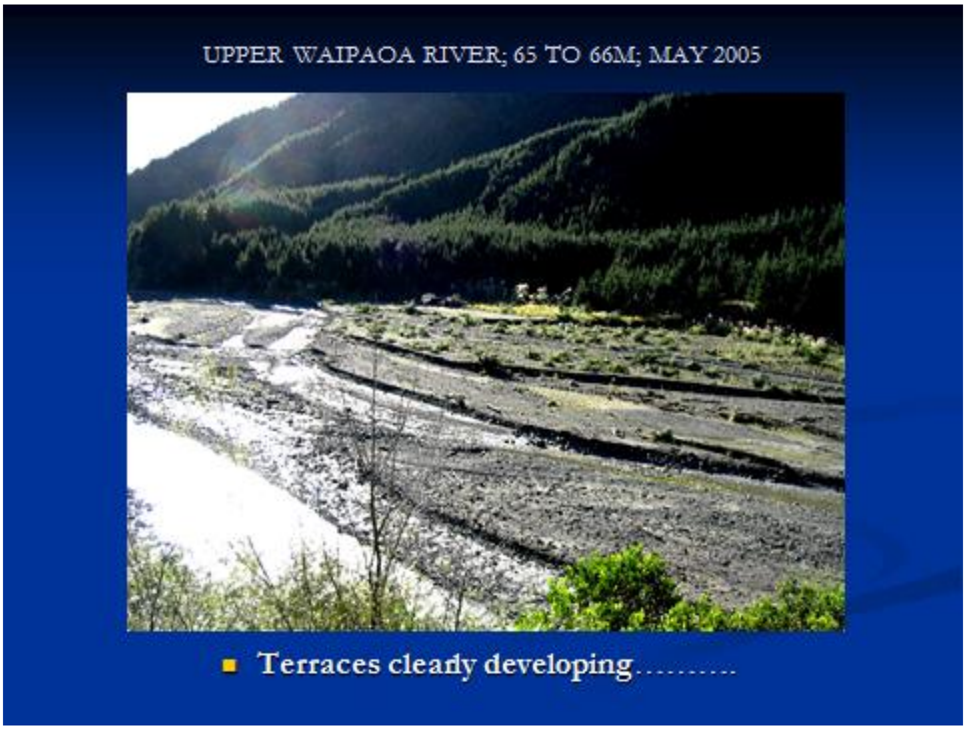


Figure 1 A degrading reach of river bed located in the upper reaches of Waipaoa River. Note the sequence of abandoned (well vegetated), and partially abandoned (scattered vegetation) terraces.

The following graph (Figure 2) shows that when the area was farmland (1950-1969) mean bed levels increased sharply. During the early reforestation period (1960-1970) bed levels continued to rise until a significant proportion of the catchment had been reforested. Only then did bed levels stabilise with minor degradation occurring during a period of increased storm frequency (1980's), culminating in a major cyclonic event in 1988 (Cyclone Bola) which once again increased the supply of sediment, predominantly from gullies.

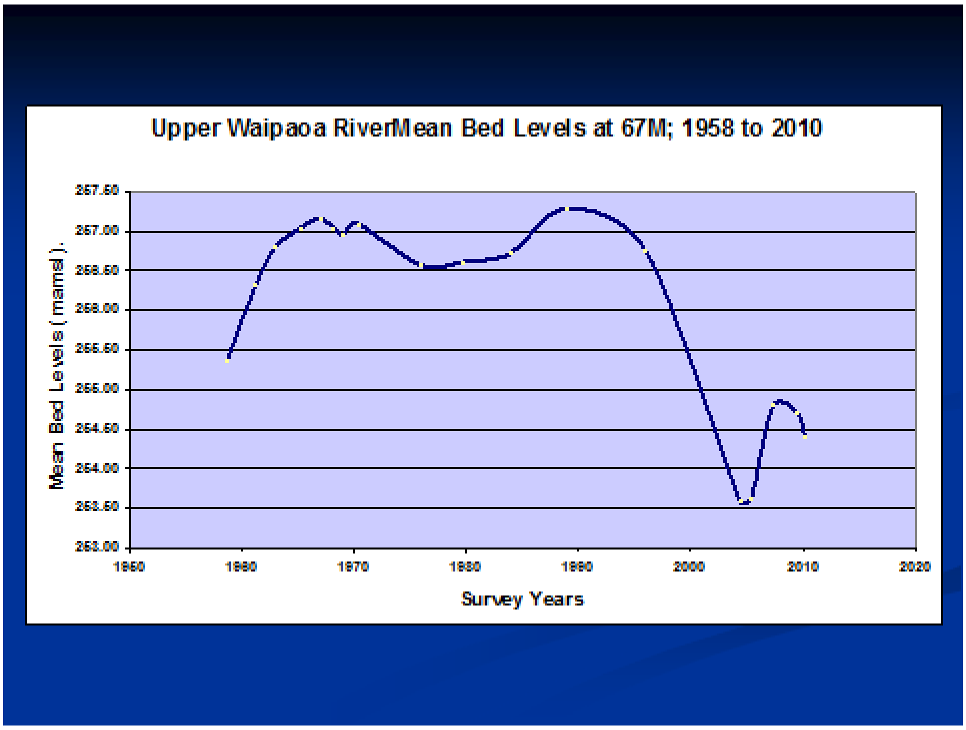


Figure 2 Changes in mean bed level before and after reforestation.

Did harvesting the trees have any negative impacts?

Harvesting commenced in 1990 and only a few remnants of the first rotation remain. Harvested areas were replanted within a year. While slumps and earthflows failed, and a few of the major gullies (e.g. Tarndale Gully) continued to supply sediment to the river channels, these features were generally small-scale, and the supply of sediment was episodic and minimal. Thus during the deforestation period, and until 2005, with only minor volumes of new sediment entering stream channels in the upper reaches of the Waipaoa River, the channel degraded by about 4 m (Figure 2). It is thought that a significant storm in 2005 remobilised bedload from stream reaches upstream of the cross-section shown in Figure 2, resulting in aggradation in this reach by ~1.5 m after which degradation resumed.

Where does the sediment end up?

The bulk of the bedload sediment component is currently stored within the upper reaches of the Waipaoa and Mangatu Catchments. However, repeated cross-sectional surveys of the middle reaches of Waipaoa River show that increasing volumes of this bedload material are transported some considerable distance downstream, and that in the middle reaches near Kanakanaia, the bed level is aggrading but only by about 2 cm/year.

The suspended load concentration of water flowing down the Waipaoa during floods has at times been measured at 30-40 000 milligrams per litre. Based on measurements of water and suspended sediment discharge made since 1960 (at Kanakaniaia), the mean annual suspended sediment load of the Waipaoa is 6750 tons per square kilometre per year, which is high by global standards. During Cyclone Bola (1988) the suspended sediment load of the Waipaoa was nearly 3 times this amount. Not all the sediment transported as suspended load enters Poverty Bay. Some is deposited on the Poverty Bay flats which has been built up (since 1850) at an average rate of vertical accretion within a 44-km long reach of between 4 and 37 mm year^{-1}, and was complemented by a similar amount of aggradation in the channel. During major flood events, the rate of aggradation on the berms between man-made stop banks increases by several orders of magnitude.

The amount of sediment that is disgorged into Poverty Bay as bedload is thought to be less than 1% of the total volume that enters the Bay with 99% being suspended sediment. This is largely because the parent rock materials are mostly fine-grained, are inherently weak and therefore break down (by weathering processes and abrasion) to particle sizes that are able to be transported more readily, and for greater distances, as suspended load.

Stop 6 Wairere Road (Kerry Hudson, Gisborne District Council)

Soil conservation

Soil erosion has been a longstanding problem in the Gisborne District first recognised at the turn of the 19th century after removal of the dense indigenous bush.

Soil erosion is a major issue locally because of the soft sedimentary rock types and local climatic features: namely cyclonic rainfall events and prolonged wet winters.

Several forms of erosion occur:

- Surface slipping: shallow soil movement on steep soils which are very thin in places. Slips typically include a steep scar and a debris tail below.
- Gullying: removal of soil or rock by flowing water, often including large permanent features and formed from channelising of water.
- Earthflow: slow movement on easier sloping soils which are wet due to high clay contents and high water tables
- Slumps: deep-seated mass movements of large blocks of rock and regolith.
- Streambank: removal of material from the banks of a stream or watercourse usually during or after elevated stream flows.

Local Government has been involved in erosion control in the district since the 1940's. This was initially with the Poverty Bay Catchment Board and more recently the East Cape Catchment Board. Gisborne District Council took on the role of the catchment board in 1989, being a unitary authority which has regional and district functions.

Council has a Combined Regional Land and District Plan with a focus on soil conservation (chapter 6) and natural heritage (chapter 4). Rules in chapter 6 place controls on earthworks and vegetation clearance as these may cause soil erosion. The plan focuses on three Land Overlays which are based on Land Use Capability units developed as part of the New Zealand Land Resource Inventory: Gisborne –East Coast region.

Initial on-farm soil conservation works involved poplar and willow planting, various types of debris dams, banks protection works and afforestation on severely eroding areas (Figures 1–7).

Figure 1 Planting of gully erosion with wilow trees

Figure 2 Erosion treated with P radiate on slopes and willow plantings in gullies

Figure 3 Range of soil conservation measures: reversion, afforestation (middle gully system), poplar and willow planting in gullies and on slopes

Figure 4 Willow plantings controlling earthflow erosion.

Figure 5 Poplar and willow plantings controlling earthflow and gully erosion.

Figure 6 Patchworks of afforestation and pole planting works

Figure 7 Poplar and Willow plantings supporting graded banks on earthflow erosion. Slopes were initially cultivated with graded banks constructed to direct runoff water.

The erosion issue was recognised nationally and severe to extremely eroding land was purchased by the state and afforested, beginning with Mangatu Forest in the 1960's followed by the Ruatoria and Tokomaru Forests further up the East Coast.

Since Cyclone Bola in 1988 there have been two afforestation initiatives, a Council administered forestry scheme 1989-93 which was confined to catchments flowing to Tolaga Bay and Gisborne and the Erosion Control Funding Programme (ECFP) (formerly the East Coast Forestry Project (1992 to the present), administered by MPI in full, with a district wide focus.

The ECFP provides four funding options available to landowners to provide for "effective tree cover" on the "worst eroding land" in the district. Options include:

- Afforestation with exotic trees species
- Afforestation with indigenous tree species
- Reversion to indigenous scrub and tree species
- Establishment of poplar and willows trees (to provide for long term grazing)

All four options are effective when correctly targeted.

Adverse effects from soil erosion are both localised (within the property boundary) but also offsite.

Within properties erosion results in soil loss, reduced productivity under all land uses, inundation of valuable easier slopes and alluvial flats, disruption to: boundary and subdivisional fencing /floodgates, buildings and access tracking.

Offsite hazards arising from soil erosion include disruption to road access, bridges and other infrastructure, large scale inundation of flat land, reduced flood capacity and reduced water quality in both freshwater and coastal environments.

Council is finding that road construction and tree felling and removal associated with harvesting of forests established to treat soil erosion under pastoral farming easily reactivates soil erosion. Not only can soil erosion occur again but movement of woody harvesting debris into waterways poses additional risks downstream.

Council also has district responsibilities in assessing building sites for land stability, the effects of earthquake shaking and liquefaction and site suitability for buildings in regard to flooding and coastal erosion.

Cyclone Bola (Mike Page)

In March 1988 Cyclone Bola struck the Gisborne-East Coast region of the North Island. Between 300-900 mm of rain fell in 4 days. This was the most damaging storm to occur in the region in recorded history, causing severe erosion, flooding and sedimentation, and costing an estimated ~$300M. Three people were drowned in floodwaters just north of Tolaga Bay. The township of Te Karaka was evacuated, while over 4000 people had to leave their homes across the district. Hundreds of others were isolated for up to several weeks.

The Waipaoa River overtopped stopbanks in several places, causing flooding and sedimentation of up to 1m across 3600 ha of the floodplain. The suspended sediment yield for the event was ~36 Mt (Hicks et al. 2004) (c.f. mean annual yield of ~15 Mt). The majority of this sediment was derived from shallow landsliding, which caused pasture losses of between 5 and 30% on many hill country farms, in addition to stock losses and damage to fences, dams and tracks (Singleton et al. 1988a, Singleton et al. 1988b, Trotter 1988). Shallow landsliding contributed 57% of the catchment suspended sediment yield for the storm, compared with ~15% of the annual average yield (Page et al. 1999). Horticultural crops on the Poverty Bay Flats were severely damaged.

Gisborne City’s reservoir water supply was disrupted for many months through damage to sections of the 35 km pipeline, and water was supplied from wells, streams and tanks. The State Highway bridge across the Wairoa River in the centre of the township, and the railway bridge across the Waipaoa River were destroyed, and numerous bridges on county roads were also destroyed or damaged. A landslide near Waerengaokuri blocked the Waikoko Stream, forming an 8 km long lake that flooded the valley, which was drained by construction of an outlet channel through the debris. In addition to Civil Defence staff and volunteers, over 300 Army, Air Force and Navy personnel were involved in the emergency response. The Government responded with a number of disaster-relief packages. An inquiry into the effectiveness of flood mitigation policies and measures following Cyclone Bola was carried out by the Parliamentary Commissioner for the Environment (Boshier et al. 1988).

A review of the WRFCS was carried out in 2009 (Peacock and Philpott 2009) to identify options to improve the level of protection to the Poverty Bay Flats/Waipaoa floodplain and Gisborne City. The existing scheme has been losing capacity through aggradation of the river bed and berms, and the review considered it only provides protection from a “one in 70 year event”. Three options, involving mixes of raised and widened stopbanks, and hydraulic improvements were identified; “one in 100 years”, “one in 150 years” and “one in 200 years” levels of protection. The review recommended the “one in 150 year” option currently valued at $26.1M, together with a new rating classification over the whole catchment based on contribution to the need for, and benefit from the scheme. Previously assessed as a “one in 70 year event”, a NIWA review of the level of protection of the Waipaoa Scheme in 2011 (Henderson and Smart 2011), reassessed Cyclone Bola as a “one in 100 year event” (100 years ± 20%).

Stop 7 McPhail's Bend (Dave Peacock)

Waipaoa River Flood Control Scheme

As a result of a number of disastrous floods up to and including the July 1950 flood, the former Poverty Bay Catchment Board was instrumental in designing and financing this flood control scheme, which was constructed between 1953 and 1973, although substantially complete by 1961. The Poverty Bay Catchment Board and its successors, the East Cape Catchment Board, and (since 1989) the Gisborne District Council, have been by statute the local authorities charged with administering and maintaining this scheme for the benefit of ratepayers and taxpayers who made a substantial investment in the original scheme.

The key stake holders are the Gisborne District Council and the public, particularly members of the public who reside on the Poverty Bay floodplain, which is protected by the Waipaoa River Flood Control Scheme (Figure 1). Residents of Gisborne City are also indirectly stakeholders, insofar as the economic activity of the city is dependent on the continued development and protection of the floodplain.

The Waipaoa River Flood Control Scheme consists of 63.1 kilometres of stopbanks, 239 metres of concrete retaining walls, 638.5 hectares of floodway land, two major diversion cuts, 92 culverts outlets, seven major outlet structures, and associated bank protection works. The Scheme protects some 10,000 hectares of the Poverty Bay flats, contrary to its name is one of the most fertile floodplains in New Zealand; used for intensive horticulture.

Figure 1 The Waipaoa River Flood Control Scheme near Patutahi

In March 1988, the Scheme was severely tested by the most damaging ex-tropical cyclone to reach New Zealand in the 20th century. Named cyclone "Bola", the peak river flow exceeded the Scheme capacity at the upstream end, leading to a number of overflows. At the downstream end near the sea, the main trunk line railway bridge (Figure 2), was outflanked by the river, leaving about 70 metres of track in mid-air.

Now the Scheme capacity is considered to be approximately equal to 95% of the Cyclone "Bola" peak flow as measured at Kanakanaia. However, downstream of Kaiteratahi the scheme has a capacity equal to or greater than the "Bola" peak flow (but without freeboard).

The Waipaoa River Railway Bridge following the Cyclone Bola flood of 7 to 9 March 1988

- The Railway Bridge has been outflanked on the right bank by some 70m.
- Depth of water under bridge measured soon after Bola was 13m.
- Design scour depth for the bridge piles only 7m.

Figure 2 North Island Main Trunk Railway Bridge outflanked by the Cyclone Bola flood

Figure 3 shows the various methods used to protect assets on the floodplain. In the yellow shaded area (for river flows up to the Scheme capacity) there are four methods which protect the floodplain, but for floods in excess of the Scheme capacity there are correspondingly less methods which would provide protection. In the blue shaded area only two methods remain, these being floodwarning measures and Civil Defence and Emergency Management (CDEM) procedures. Floodwarning is an important component of the protection measures; and the upper catchment has a number of river and/or rainfall telemetered sites, the most important site being beside the Kanakanaia bridge.

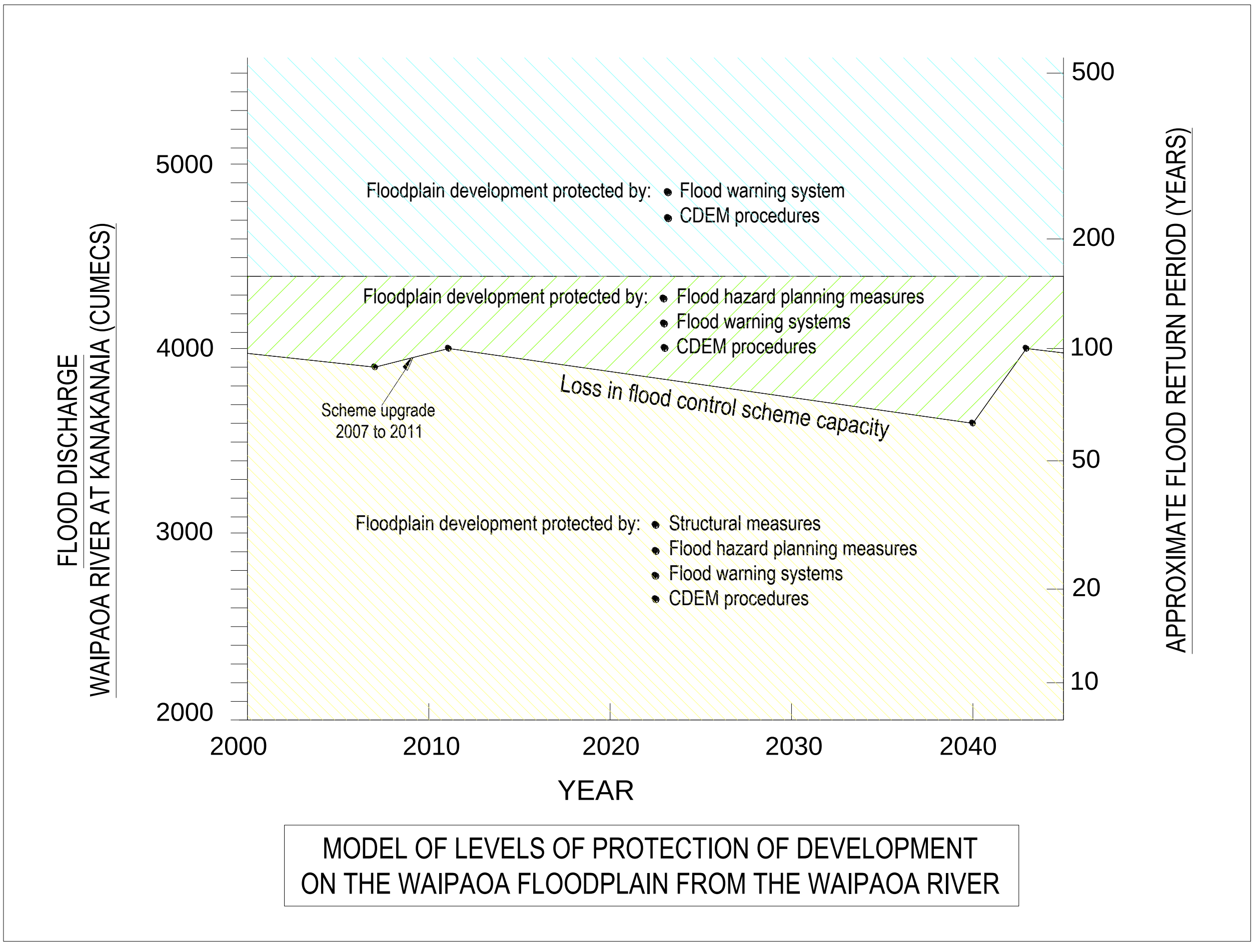


Figure 3 Model of levels of protection of the Waipaoa floodplain

Conclusion

Appendix 1

Slow Rupture of the March 1947 Gisborne Earthquake Suggested by Tsunami Modelling

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The Gisborne 1947 Earthquake and Tsunami

On 25 March 1947, an unusually large tsunami swept the east coast of Gisborne region in the North Island. Up to 13-meter tsunami elevations were observed along a 100 km stretch of the coastline. This tsunami followed an Mw7.1 earthquake, located about 50 km offshore. Considering its magnitude, the tsunami was surprisingly large. Tsunami modellings were carried out in order to find out clues of the faulting mechanism in this event.

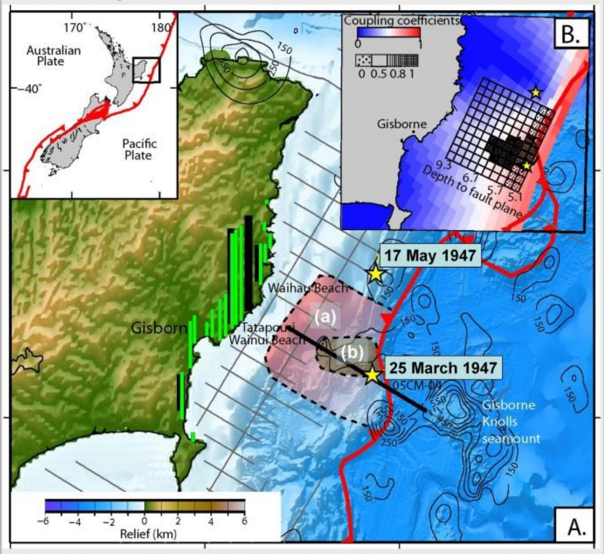

Figure 2: Green and Black bars illustrate maximum water levels observed during the 1947 tsunami event. Area enclosed by dashed lines represent the estimated rupture area during this earthquake. Area (a) associates with low coupling coefficients and Area (b) denotes asperity with high coupling coefficients over a seamount. A simplified fault model is shown in B, including 110 5km-by-5km sub-fault segments (Bell et al., 2009).

Source Models

Both uniform slip and variable slip (proportional to coupling coefficients) were implemented together with sub-fault segment configuration shown in Figure 2. Uplift time of each segment is determined by the velocity of the rupture starting from the epicenter. For variable slip distribution, different rupture velocities were applied to model tsunami elevations in the coastal areas.

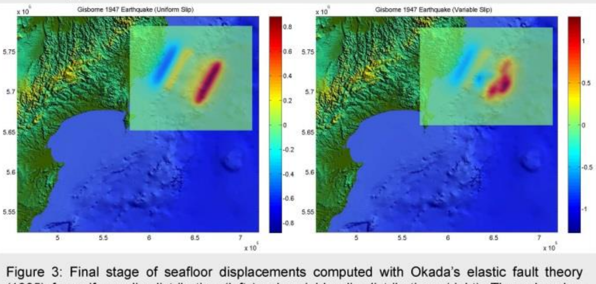

Figure 3: Final stage of seafloor displacements computed with Okada's elastic fault theory (1985) for uniform slip distribution (left)and variable slip distributions (right). The colour bar scale is in meters.

References

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[2]. Wang, X. and Liu, P.L.-F., (2006). An analysis of 2004 Sumatra earthquake fault plane mechanisms and Indian ocean tsunami. J. Hydraulic Res., 44(2):147–154, 2006.

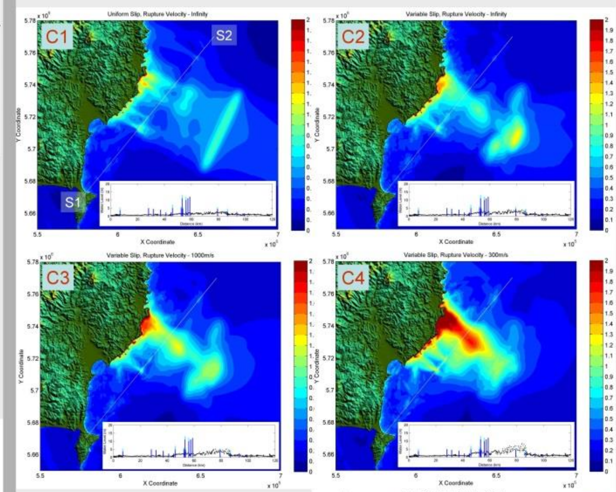
[3]. Okada, M. (1985). Surface deformation due to shear and tensile faults in a half-space. Bull. Seism. Soc. Am., 75(4):1135–1154, 1985.

Acknowledgement: the authors gratefully acknowledge the support of GNS Science and also wish to thank Gegar Prasetya in GNS Science for many sparkling discussions.

Figure 1: The photo album from the Weekly News (April 2, 1947) shows the damages at several locations along the east coast. (1) Relics and debris left outside Tatapouri Hotel and the water came up to the window sills. (2) Remaining section of the damaged 4-bedroom house at Tourihaua Point. (3) Damage to the foreshore at Wainui Beach. (4) The Pouawa bridge was swept away and the remaining part of the deck was carried about ½ miles upstream of the Pouawa River.

Numerical Modelling

Tsunami propagation and runup model – COMCOT (Wang and Liu, 2006) was used to simulate tsunamis generated by the source models with different rupture velocities. 250m and 50m grid spacing were implemented offshore and nearshore, respectively.



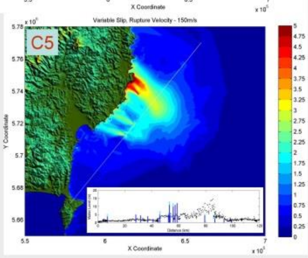


Figure 4: C1-C5 show the max water level distribution (colour bar scale in meters) and max tsunami elevations along coastal line (projected onto line S1-S2). Blue bars represent the observed max elevations (Downes, 2009). Numerical results indicate that fast rupture cannot produce tsunamis comparable to the observations (C1-C3). In contrast, as the rupture slows down, the computed tsunamis match better with the observations (C4-C5), especially when the rupture velocity close to wave speed (C5) because the uplift of seafloor is able to keep stacking up water at the wave front.

Conclusion

Tsunami Modelling suggests that the March 1947 Gisborne earthquake is a typical tsunami earthquake and the average rupture velocity was unusually slow. The source model with rupture velocity 150m/s gives tsunami amplitudes similar to the observed. However, it still needs further adjustments to be in agreement with the observations.

Appendix 2 Landslide and environmental criteria for the Modified Mercalli Intensity Scale – NZ 2007

MM5	■ Loose boulders may occasionally be dislodged from steep slopes.
MM6	■ Trees and bushes shake, or are heard to rustle. ■ Loose material may be dislodged from sloping ground, e.g. existing slides, talus and scree slopes. ■ A few very small (≤10^3 m^3) soil and regolith slides and rock falls from steep banks and cuts. ■ A few minor cases of liquefaction (sand boil) in highly susceptible alluvial and estuarine deposits.
MM7	■ Water made turbid by stirred up mud. ■ Small slides such as falls of sand and gravel banks, and small rock-falls from steep slopes and cuttings common. ■ Instances of settlement of unconsolidated, or wet, or weak soils. ■ A few instances of liquefaction (i.e. small water and sand ejections). ■ Very small (≤10^3 m^3) disrupted soil slides and falls of sand and gravel banks, and small rock falls from steep slopes and cuttings are common. ■ Fine cracking on some slopes and ridge crests. ■ A few small to moderate landslides (10^3 –10^5 m^3), mainly rock falls on steeper slopes (>30˚) such as gorges, coastal cliffs, road cuts and excavations. ■ Small discontinuous areas of minor shallow sliding and mobilisation of scree slopes in places. ■ Minor to widespread small failures in road cuts in more susceptible materials. ■ A few instances of non-damaging liquefaction (small water and sand ejections) in alluvium.
MM8	■ Cracks appear on steep slopes and in wet ground. ■ Significant landsliding likely in susceptible areas. ■ Small to moderate (10^3-10^5 m^3) slides widespread; many rock and disrupted soil falls on steeper slopes (steep banks, terrace edges, gorges, cliffs, cuts etc). ■ Significant areas of shallow regolith landsliding, and some reactivation of scree slopes. ■ A few large (10^5-10^6 m^3) landslides from coastal cliffs, and possibly large to very large (≥10^6 m^3) rock slides and avalanches from steep mountain slopes. ■ Larger landslides in narrow valleys may form small temporary landslide-dammed lakes. ■ Roads damaged and blocked by small to moderate failures of cuts, slumping of road-edge fills. ■ Evidence of soil liquefaction common, with small sand boils and water ejections in alluvium, and localised lateral spreading (fissuring, sand and water ejections) and settlements along banks of rivers, lakes, and canals etc. ■ Increased instances of settlement of unconsolidated, or wet, or weak soils.
MM9	■ Cracking of ground conspicuous. ■ Landsliding widespread and damaging in susceptible terrain, particularly on slopes > 20˚. ■ Extensive areas of shallow regolith failures and many rock falls and disrupted rock and soil slides on moderate to steep slopes (20˚-35˚ or greater), cliffs, escarpments, gorges, and man-made cuts. ■ Many small to large (10^3-10^6 m^3) failures of regolith and bedrock, and some very large landslides (10^6 m^3 or greater) on steep susceptible slopes. ■ Very large failures on coastal cliffs and low-angle bedding planes in Tertiary rocks. Large rock/debris avalanches on steep mountain slopes in well-jointed greywacke and granitic rocks. Landslide-dammed lakes formed by large landslides in narrow valleys. Damage to road and rail infrastructure widespread with moderate to large failures of road cuts and slumping of road-edge fills. Small to large cut slope failures and rock falls in open mines and quarries.

	■ Liquefaction effects widespread with numerous sand boils and water ejections on alluvial plains, and extensive, potentially damaging lateral spreading (fissuring and sand ejections) along banks of rivers, lakes, canals etc). Spreading and settlements of river stop-banks likely.
MM10	■ Landsliding very widespread in susceptible terrain. ■ Similar effects to MM9, but more intensive and severe, with very large rock masses displaced on steep mountain slopes and coastal cliffs. Landslide-dammed lakes formed. Many moderate to large failures of road and rail cuts and slumping of road-edge fills and embankments may cause great damage and closure of roads and railway lines. ■ Liquefaction effects (as for MM9) widespread and severe. Lateral spreading and slumping may cause rents over large areas, causing extensive damage, particularly along river banks, and affecting bridges, wharfs, port facilities, and road and rail embankments on swampy, alluvial or estuarine areas.
Notes: (1) "Some or 'a few' indicates that threshold for response has just been reached at that intensity. (2) Environmental damage (response criteria) occurs mainly on susceptible slopes and in certain materials, hence the effects described above may not occur in all places, but can be used to reflect the average or predominant level of damage or MM intensity in an area. (3) Environmental criteria not defined for MM11 and 12, as those intensities have not been reported in New Zealand. Earlier versions of the MM intensity scale suggest that environmental effects at MM11-12 are similar to MM9- 10, but are possibly more widespread and severe. (4) This appendix is based on Hancox et al. 1997, 2002, and Dowrick et al., 2008. A summary of the full MM Intensity Scale is given below (A1c).	

APPENDIX 8: MOROWALI ACTION PLAN

PENGUATAN KETAHANAN INDONESIA MELALUI PENGURANGAN RISIKO BENCANA
Strengthened Indonesian Resilience: Reducing Risk from Disasters (StIRRRD)

DRAFT

DISASTER RISK REDUCTION ACTION PLAN
MOROWALI DISTRICT

Calendar Year: April 2016 - December 2019

Name of City/District	Morowali
Province	Central Sulawesi
Output Target	Morowali Disaster Resilient Community and Organization
Focal Point	*BPBD, UNTAD* ....

Field: Institutional

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
1	Establish similar/unified perception on disaster and coordination among stakeholders	a. Implementation of workshop for agencies, NGO, and universities	a. Workshop for NGO and universities from district to village level/disaster preparedness group implemented routinely	X	X	X	X	Leader : BPBD Morowali Support : DPRD, BAPPEDA, Legal Bureau, Public Works Agency, Spatial Planning Agency, Water Resources Management Agency, Subdistrict and village, Armed Forces, National Police, Regional and National SAR Agency, UNTAD, Transportation-Communication-Information Agency		
		b. Monitoring and controlling coordination of impact in industrial area	b. Evaluation report from team to head of district to be delivered to province and central government	X	X	X	X			

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
2	Establish DRR volunteer group	Inventory of volunteer, especially skilled volunteer	List of trained volunteers ready to be deployed	X	X	X	X	Leader : BPBD Morowali Support : BAPPEDA, Health Agency, Education Agency, Public Works Agency, Spatial Planning Agency, Social-Labor-Transmigration Agency, Forestry Agency, Marine and Fisheries Agency, Armed Forces, National Police, Subdistrict and village		
3	Draft legal ground for DRR activity planning in planning document	a. Coordination among agencies, NGO, academics, disaster preparedness group, village to draft planning	a. Planning documents existed: Strategic planning, assessment		X	X		Leader : BPBD Morowali Support : DPRD, Legal Bureau, BAPPEDA, Public Works, Spatial Planning Agency, Water Resources Management Agency, Subdistrict and village, Armed Forces, National Police, UNTAD, Transportation-Communication-Information Agency		
		b. Draft head of province, district, and village decrees	b. Documents availability for land ready to develop (kasiba)/ zone ready to develop (lisiba) regulation available, RDTRK (Detail City Spatial Planning), disaster prone area, head of district decree, head of village decree		X	X	X			
		c. Draft regulation to establish MoU among related institutes in Morowali District, local university (UNTAD), industry/business sector in/out Morowali and foreign	c. Established MoU among related stakeholders: local university (UNTAD) and business sectors		X	X	X			
4	Establish DRR Forum	Provide resources data in each agency, district, subdistrict, village, and disaster preparedness group	Established Morowali DRR Forum	X	X			Leader : BPBD Morowali, Support: Health Agency, Education Agency, Public Works Agency, Spatial Planning Agency,		

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
								Transportation-Communication-Information Agency, Social-Labor-Transmigration Agency, Forestry Agency, Marine and Fisheries Agency, Armed Forces, National Police, Subdistrict and village, Red Cross, NGO , UNTAD		

Field: Budget

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
1.	Optimize community budget in village level	a. Conduct activity in village level by community self-fund for DRR: flood, tsunami, landslide, earthquake, tornado	a. Established DRR activities in village with its own budget	X	X	X	X	Leader : BPBD Morowali Support : BAPPEDA, Social-Labor-Transmigration Agency, Morowali District Office, Civil Registry and Demography Agency, Subdistrict and village, Local NGO		
		b. Using ADD (village budget allocation) for vulnerable group capacity building	b. Availability of alternative fund for DRR initiatives from business sector in district/subdistrict level		X	X	X			
2	Collect funding from business sector	Increase collaboration with business sector in DRR initiative	Routine budget allocated from CSR/business sector for DRR initiatives	X	X	X	X	Leader : BPBD Morowali Support : Industry-Trade-Cooperatives Agency, Chamber of Commerce and Industry, Indonesia Young Entrepreneur Association, UNTAD, NGO, National Electricity Company, Regional Water Supply Company		
3.	Develop collaboration with foreign sector	Propose collaboration with foreign countries in	Established collaborative activities for DRR		X	X	X	Leader : BPBD Morowali, Province BPBD, BNPB		

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
		DRR initiatives						Support: DPRD, Related agencies, INGO, Local NGO		
4	Propose procurement for DRR facilities and infrastructure	Drafting procurement proposal for facility and infrastructure	Constructed DRR facilities and infrastructures		X	X	X	Leader : BPBD Morowali , Province BPBD, BNPB Support: DPRD, Related agencies, INGO, Local NGO		

Field: Program

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
1	Increase of community knowledge and understanding of DRR: flood, landslide, tsunami, earthquake, tornado	a. Dissemination of hazard early symptom identification in village/subdistrict level: flood, landslide, tsunami, earthquake, tornado	a. Community (members of village, disaster preparedness group, etc.) understand early symptom, detection, and recovery: flood, landslide, tsunami, earthquake, tornado	X	X	X	X	Leader : BPBD Morowali Support : UNTAD, Social Agency, BAPPEDA, Central Statistics Agency, Health Agency, Civil Registry and Demography Agency, Education Agency, Transportation-Communication-Information Agency, Marine and Fisheries Agency, Public Works Agency, Spatial Planning Agency, Mineral Resources and Energy, Center of Volcanology and Geological Disaster Mitigation, Meteorological-Climatological-Geophysics Agency		
		b. Dissemination of DRR initiatives in archipelagic area	b. Community member in archipelagic area understands the importance of DRR initiatives	X	X	X	X			
		c. Disaster recovery dissemination in village/subdistrict level: flood, landslide, tsunami, earthquake, tornado	c. Community/disaster preparedness group/village/subdistrict representatives understand recovery activity: flood, landslide, tsunami, earthquake, tornado	X	X	X	X			
		d. Compose DRR module: safe from earthquake	d. Established DRR module: safe from earthquake	X	X	X	X			
2	Increase community capacity: disaster	a. Training on DRR in village/subdistrict level	a. Group representative trained in DRR	X	X	X	X	Leader : BPBD Morowali Support : UNTAD, Education		

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
	preparedness group, village, school	(women group, disaster preparedness group, Islam group, youth group, and other groups)						Agency, Transportation-Communication-Information Agency, Marine and Fisheries Agency, Public Works Agency, Center of Volcanology and Geological Disaster Mitigation, Meteorological-Climatological-Geophysics Agency, Environmental Agency		
		b. Inclusion of disaster in school curriculum through local content or extracurricular activity	b. DRR initiative included in the school curriculum and textbooks			X	X			
		c. Conduct capacity building for community in archipelagic area with mining impact	c. Community member in archipelagic area understands DRR initiatives, increase knowledge on alternative livelihood and its training after grass and fish production decrease due to mining	X	X					
3	Establish district database on disaster hazard and risk assessment	a. Geological mapping	a. Geological mapping to support creating hazard mapping	X	X	X	X	Leader : BPBD Morowali Support : UNTAD, Social Agency, BAPPEDA, Central Statistics Agency, Health Agency, Civil Registry and Demography Agency, Education Agency, Transportation-Communication-Information Agency, Marine and Fisheries Agency, Public Works Agency, Mineral Resources and Energy, Center of Volcanology and Geological Disaster Mitigation, Meteorological-Climatological-Geophysics Agency, Environmental Agency		
		b. Mapping or revision of current hazard district map along with its prohibited zonation in flood, landslide, earthquake, tsunami, coastal erosion, and tornado prone areas	b. Hazard map revision: flood, landslide, earthquake, tsunami, tornado, and coastal erosion		X	X	X			
		c. Conduct disaster risk assessment and microzonation map	c. Analysis result in risk map and microzonation of Matano Fault		X	X	X			
		d. Create evacuation route and map	d. Evacuation route map		X	X	X			

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
		e. Perform structural or non-structural mitigation	e. Safe route zone from disaster, river improvement, gabion/embankment, mangrove planting, EWS		X	X	X			
4	Preparation of facility and infrastructure for emergency response	Building temporary shelter	Availability of area ready to be temporary shelter	X	X	X	X	Leader : BPBD Morowali Support : BNPB, UNTAD, BAPPEDA, Public Works and Housing Agency, Agrarian and Spatial Planning, Transportation-Communication-Information Agency, Environmental Agency		

Field: Human Resources

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
1	Increase the resources of disaster-related institution	a. Youth preparedness group training in village-level	a. Village Tagana in every subdistrict participated in training	X	X	X	x	Leader : BPBD Morowali Support : UNTAD, Social-Labor-Transmigration Agency, Health Agency, Armed Forces, National Police, Marine and Fisheries Agency, Training Center, Transportation-Communication-Information Agency, Civil Defense, Public Works Agency, Water Resources Management Agency, Local NGO		
		b. Earthquake-resistant building training for construction labor	b. Trained construction labor	X	X	X	X			
		c. Recruit supervising instructor for earthquake-resistant building construction	c. Availability of instructor and construction supervisor for earthquake-resistant building		X	X	X			
		d. Education and training for consultant and contractor	d. Availability of consultant and contractor service for earthquake-resistant construction	X	X	X	X			
2	Increase university role through its LPPM	a. Prepare village data in Morowali from BPBD for	a. Village data collected in Morowali District	X	X	X	X	Leader : BPBD Morowali Support : UNTAD,		

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
	(Research and Community Service Institute)	student community service placement						Education Agency, Health Agency, Social-Labor-Transmigration Agency, Environmental Agency, Marine and Fisheries Agency, Planned Parenthood-Community and Women Empowerment Agency, Armed Forces, National Police, Red Cross, SAR Agency, Civil Defense, Local NGO		
		b. DRR-related research by lecturer and student	b. Conducted DRR-related research	X	X	X	X			
		c. DRR thematic student community service	c. UNTAD students conducted community service in village level within Morowali District	X	X	X	X			
		d. Prepare module/teaching tool/pamphlet	d. Availability of teaching tool/module and pamphlet with simple and clear language for the community	X	X					

Case example: Newmont in Sumbawa. Government has to make sure that company will comply with the regulation before they operates.
Richard:
1. Approach mining company, make a good relationship with the mining company, and try to make them understand
2. Using university simple resource to educate
Michele:
3. Rise issue to the parliament and ministry of natural resource: it will take a long time; try to use direct approach to the company
Pak Medi:
1. If needed, communicate issue to the central government

APPENDIX 9: SUMBAWA ACTION PLAN

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PENGUATAN KETAHANAN INDONESIA MELALUI PENGURANGAN RISIKO BENCANA
Strengthened Indonesian Resilience: Reducing Risk from Disasters (StIRRRD)

UPDATE-2

DISASTER RISK REDUCTION ACTION PLAN
SUMBAWA DISTRICT

Calendar Year: January 2016 - December 2019

Name of City/District	Sumbawa
Province	West Nusa Tenggara
Output Target	Disaster Resilient Community and Organization of Sumbawa District
Focal Point	*Drs. Mukmin (Head of BPBD Mataram)* *Dr. Eko Pradjoko (Teaching Staff at Universitas Mataram)*

Field: Institutional

NO.	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TARGET YEAR				PEOPLE IN CHARGE	ACTION/ACTIVITY (UNTIL 2015)	ACTION PLAN (2016)	BUDGET PLAN (IDR)	PRIORITY SCALE
				2016	2017	2018	2019					
1	Obtaining legal standing for DRR activities	▪ Drafting Local Regulation on disaster management ▪ Arranging regulatory explanations such as Head of District Decree	▪ Establishment of Local Regulation on disaster management	X	X	X	X	Leader: BPBD Support: legislative team of the local government, related agencies	Local district regulation already formulated in 2015		15,000,000 (APBD-P)	
2	The community and agencies understand and implement the regulations on disaster management	Conducting dissemination on the regulations on disaster management to the community and agencies.	▪ The community understands the regulations on disaster management. ▪ Agencies understand the regulations on disaster management.	X	X	X	X	Leader: BPBD Support: related agencies			25,000,000,-	

2	Improving cooperation among disaster-related stakeholders	Establishing DRR Forums at sub-district and city/district levels	▪ Establishment of DRR Forums at district level. ▪ Establishment of DRR Forums at sub-district level. ▪ 24 target sub-districts, 5 sub-districts/year. ▪ Conducting coordination meetings: 3x a month	X	X	X	X	Leader: BPBD Support: related agencies, sub-districts, village, NGOs, the community (RT/neighborhood association, RW/community association, TSBD/Village Disaster Prepared Team), UNRAM	▪ Already established in 4 sub-districts. 20 sub-districts to go. ▪ Forum's members are from villages		Budget for Resilient Village: 35 million (Central), 15 million (Reg) DRR Forum budget: 15 million	
		Planning joint action plans among DRM organizations	▪ Action plans among DRR organizations with related agencies and communities. ▪ Meeting 1x in a month	X	X	X	X	Leader: BPBD Support: related agencies, sub-districts, village, NGOs, the community			35,000,000	
3		Meetings among agencies to conduct joint activities on DRR Minimum 2x per year	▪ Establishment of coordination teams ▪ Carrying out coordination meeting in Improving Preparedness and Togetherness in Disaster Mitigation	X	X	X	X	Leader: BPBD Support: Bappeda, district secretary, all agencies			30,000,000	
4		Drafting of MoU between UNRAM and BPBD of Sumbawa District for cooperation in DRR activities	▪ Signing of MoU between UNRAM and BPBD of Sumbawa District	X				Leader: BPBD Support: UNRAM			15,000,000	
			▪									

Field: Budget

NO.	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TARGET YEAR				PEOPLE IN CHARGE	ACTION/ACTIVITY (UNTIL 2015)	ACTION PLAN (2016)	BUDGET PLAN (IDR)	PRIORITY SCALE
				2016	2017	2018	2019					
1	Mapping alternative potentials of DRR activity funding	Initiate the possibilities of joint funding for DRR activities among agencies	• Implementation of joint activities on DRR • Establishment of coordination forum with all	X	X			Leader: BPBD Support: district secretary, all agencies, Supreme Audit Agency			20,000,000	

			agencies									
		Identification of potential funding sources outside of the government -> CSR Hotels/companies, NGO organizations	• List of potential sources willing to be involved in CSR in the form of disaster-related activities • Commitment from the entrepreneur to contribute	X	X			Leader: BPBD Support: district secretary, Chamber of Commerce and Industry, Indonesian Young Entrepreneurs Association/Entrepreneurs				
2	Facilitating DRR budgets to mitigate hazards of flooding, landslide, earthquake, tsunami, and tornado	Identification of DRR activity needs against hazard of coastal erosion and tsunami	• Preparing funding proposals from central (BNPB) and regional • Drafting of budget for simulation activities • Drafting of budget for rapid reaction teams' training	X				Leader: BPBD Support: BNPB, Provincial BPBD, Bappeda, district secretary				
		Identification of DRR activities budgeting needs for the establishment of Disaster Prepared Village (KSB) and Village Disaster Prepared Teams (TSBD)	• A document of the establishment of Disaster Prepared Village (KSB) and Village Disaster Prepared Teams (TSBD)					Leader: BPBD Support: BNPB, Provincial BPBD, Bappeda				
		Drafting of budget for the construction of coastal protection embankment, revetment/drainage	• A document on the proposal of the construction of coastal protection embankment, revetment/drainage					Leader: BPBD Support: Bappeda, Public Works Agency				
		Drafting of budget for EWS devices	• A proposal for the provision of EWS devices.					Leader: BPBD Support: Bappeda, Public Works Agency				
		Drafting of budget for equipment and facilities for disaster mitigation and DRR activities	• A document on the proposal of equipment and facilities for disaster mitigation and DRR activities					Leader: BPBD Support: Bappeda, Public Works Agency				

Field: Program

NO.	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TARGET YEAR				PEOPLE IN CHARGE	ACTION/ACTIVITY (UNTIL 2015)	ACTION PLAN (2016)	BUDGET PLAN (IDR)	PRIORITY SCALE
				2016	2017	2018	2019					

1	Improving information service on disaster to reduce disaster risk .	Identifying areas vulnerable to flooding, landslide, earthquake, tsunami, and coastal erosion with relevant stakeholders and the local community	• There is a document on areas vulnerable to flooding.	X				Leader: BPBD Support: Provincial BPBD, BNPB, Energy and Mineral Resources Agency, Public Works Agency, Environment Agency, UNRAM, local community	Mapping already finished			
			• There is a document on areas vulnerable to landslide.	X					Mapping already finished			
			• There is a document on areas vulnerable to earthquake.	X					Mapping already finished			
			• There is a document on areas vulnerable to tsunami.	X					Mapping already finished			
			• There is a document on areas vulnerable to tidal waves (coastal erosion).	X					Mapping already finished			
		Disaster exposure data are always updated following physical and social changes in the environment.	• Hazard map periodically updated	X	X	X	X	Leader: BPBD Provincial BPBD, BNPB, SKPD Sumbawa District Energy and Mineral Resources Agency, Public Works Agency, Environment Agency, UNRAM, local community			15,000,000	
		Dissemination of disaster hazard maps to members of the parliament, agencies, and community Minimum 3x per year	• Target understand on information of hazard in Sumbawa	X	X	X	X	Leader: BPBD Support: Parliament, all agencies, sub-districts			45,000,000	
2	Improving the community's capacity in DRR	Dissemination of the concept of earthquake-resistant housing to people of Sumbawa Minimum 3x per year	• Dissemination of the concept of earthquake-resistant housing in 24 sub-districts	X	X	X	X	Leader: BPBD Support: Public Works Agency, Urban Planning Agency			45,000,000	
		Evacuation drill for all hazards with considerably great impact	• 1x simulation in one year	X	X	X	X	Support: related agencies, the community			50,000,000	
		Installation of evacuation signs: - Fire evacuation	Creation and installation of evacuation signs involving the community	X	X	X	X	Leader: BPBD Support: related agencies, sub-district	Already installed in several government		20,000,000	

								community representatives	buildings			
		Installation of evacuation signs: - Flood evacuation Target 4 villages	Creation and installation of evacuation signs involving the community	X	X	X	X	Leader: BPBD Support: related agencies, sub-district community representatives	Already installed in several villages		20,000,000	
		Installation of evacuation signs: - Tsunami evacuation Target Lunyuk sub-district	Creation and installation of evacuation signs involving the community	X	X	X	X	Leader: BPBD Support: related agencies, sub-district community representatives	Already installed in several government buildings		20,000,000	
		Involvement of the community in reforestation	Implementing activities of planting seeds for reforestation in ………	X	X	X	X	Leader: Forestry Agency Support: related agencies, sub-district community representatives	Currently on going and under the coordination of Forestry Agency.			
			Reforestation activities held in ……..									
		Establishment of Disaster Prepared Schools Target 2 schools in each year	8 schools have implemented Disaster Prepared School program	X	X	X	X	Leader: BPBD Support: Education Agency, schools			30,000,000	
		Provision of EWS devices for flooding, landslide, and tsunami	Installation of early warning system devices in several flood-prone locations Number of locations: 24 sub-districts	X	X	X	X	Leader: BPBD Support: BNPB, Provincial BPBD, Meteorological, Climatological and Geophysical Agency, SAR Sumbawa, Indonesian Amateur Radio Organization/Inter-population Radio, NZ Aid	3 units already installed			
			Installation of early warning devices in several landslides-prone locations Number of locations:16 sub-districts (South Sumbawa)		X	X	X					
			Installation of early warning devices in several tsunami-prone locations. Numbers of locations: Sumbawa Besar, Lunyuk		X	X						
		Training for construction labors in building earthquake- and tornado-resistant housing	30 construction labors have understood the concept of earthquake-resistant housing	X	X	X	X	Leader: BPBD Support: Labor and Transmigration Agency, Public Works Agency, NZ			60,000,000	
			30 construction labors have	X	X	X	X					

			understood the concept of tornado-resistant housing					Aid				
		Conducting studies on planning and construction of groin/breakwater for beach protection	Documents of analysis and planning of the construction of groin/breakwater for beach protection	X	X	X		Leader: BPBD Support: Public Works Agency			90,000,000	
		Establishing Operation Control Centre teams	Establishment of Operation Control Centre Teams	X	X			Leader: BPBD Support: BNPB			50,000,000	
3	Finding out the target achievement and obstacles of DRR activities	Conducting DRR program monitoring and evaluation	Documents of DRR Activity monitoring and evaluation	X	X	X	X	Leader: BPBD			30,000,000	

Field: Human Resources

NO.	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TARGET YEAR				PEOPLE IN CHARGE	ACTION/ACTIVITY (UNTIL 2015)	ACTION PLAN (2016)	BUDGET PLAN (IDR)	PRIORITY SCALE
				2016	2017	2018	2019					
1	Improvement of DRM Human Resources capacities for DRR	Improving the capacity of volunteers (Tagana/ Disaster-Prepared Youth, Rapid Response Team, Disaster-Prepared Village)	Trainings for 30 volunteers were conducted.	X	X	X	X	Leader: BPBD Support: Provincial BPBD, BNPB, Health Agency, National Police, Armed Forces, UNRAM			60,000,000	
		Improvement of BPBD and agencies staff' capacity in Disaster Risk Analysis	Independently-drafted documents on DRR, contingency, etc.		X	X	X	Leader: Sumbawa BPBD Support: Provincial BPBD, BNPB, UNRAM			60,000,000	

TOTAL: 750,000,000,-

APPENDIX 10: AGAM ACTION PLAN

PENGUATAN KETAHANAN INDONESIA MELALUI PENGURANGAN RISIKO BENCANA
Strengthened Indonesian Resilience: Reducing Risk from Disasters (StIRRRD)

DRAFT

DISASTER RISK REDUCTION ACTION PLAN
AGAM DISTRICT

Calendar Year: April 2016 - December 2019

Name of City/District	Agam
Province	West Sumatra
Output Target	Natural Disaster Resilient Community and Organization
Focal Point	*BPBD, Universitas Andalas* …………………………………………………………

Field: Institutional

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
1	Establishment of disaster SOP in nagari, jorong, and subdistrict level	Prepare supporting materials on disaster SOP establishment (earthquake, tsunami, flood, landslide, volcano)	Established SOP in nagari, jorong, and subdistrict according to its respective hazard	X	X	X	X	Leader : BPBD Agam Support : DPRD, Legal Bureau, BAPPEDA, UNAND, NGO, Subdistrict/nagari		
2	Establishment of Rapid Response Team in government agencies,	Prepare resources data in every agency, subdistrict,	Established rapid response team in related agencies and district government	X				Leader : BPBD Agam Support : BAPPEDA, Health Agency, Education Agency,		

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
	district, subdistrict/nagari level	village/nagari level	Established rapid response team in subdistrict Established youth group (Karang Taruna) in subdistrict/nagari level		X	X	X	Public Works Agency, Social-Labor-Transmigration Agency, Forestry Agency, Marine and Fisheries Agency, Armed Forces, National Police, Subdistrict, Nagari		
3	Establishment of district-level Disaster Management Operation Control Center (data processing, Indonesia data and information center training)	Collect data in every agency related to disaster	Established Agam District disaster management operation control center	X	X			Leader : BPBD Agam Support : BAPPEDA, Legal Bureau, Public Works Agency, Water Resources Management Agency, Subdistrict and village, Armed Forces, National Police, SAR Agency, UNAND, Transportation-Communication-Information Agency		
4	Establishment of target groups along with district level red cross and conduct joint exercise with related agencies	Identify community groups/organizations related to health/aid	Established target groups and conducted routine joint training/drill along with red cross and related agencies	X	X			Leader : BPBD Agam, Red Cross Support: Health Agency, Education Agency, Public Works Agency, Social-Labor-Transmigration Agency, Forestry Agency, Marine and Fisheries Agency, Armed Forces, National Police, Subdistrict, Nagari		
5	Establishment of district level Youth Disaster Preparedness Group	Gather human resources and conduct skill and disaster	Established Agam District youth disaster preparedness group	X	X			Leader : BPBD Agam, Social Agency Support: Health Agency,		

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
	(Tagana)	knowledge training						Education Agency, Public Works and Housing Agency, Forestry Agency, Marine and Fisheries Agency, Armed Forces, National Police, SAR Agency, Subdistrict, Nagari		
6	Establishment of Agam DRR Forum	Provide resources data in every agencies, district, subdistrict, village, nagari	Established Agam District DRR Forum	X	X			Leader : BPBD Agam, Support: UNAND, Health Agency, Education Agency, Public Works Agency, Forestry Agency, Marine and Fisheries, Armed Forces, National Police, Social-Labor-Transmigration Agency, SAR Agency, Subdistrict, Nagari, NGO (local), Red Cross, National Electricity Company, Regional Water Supply Company		
7	Capacity building for vulnerable groups	Establish disaster prepared SME and agriculture groups Establish disaster resilient women group Coastal and land community have different culture in their approach so they each	Established disaster prepared SME and agriculture groups Established disaster resilient women group in subdistrict/nagari level		X X	X X	X X	Leader : BPBD Agam Support: Community Empowerment Agency, Industry-Trade-Cooperatives Agency, SME, Social-Labor-Transmigration Agency, Horticulture and Crops Agriculture, NGO		

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
		need different treatment (local wisdom)								
8	Establishment of legal ground for disaster management in district level	Establish Head of District Decree on disaster management of: flood, landslide, earthquake, volcanoes, tsunami	Ratification of Head of District Decree on disaster management (after when disaster management law also ratified)			X	X	Leader : BPBD Agam, Support: Legal Bureau, Parliament, UNAND, Related Agencies, NGO		
			Established building code for disaster prone areas		X	X				
9	Strengthen disaster prepared press	Establish disaster prepared press community	Established disaster press corps network	X	X			Leader : BPBD Agam Support: Transportation-Communication-Information Agency		
	Establishment of collaboration effort with higher education/university	Compose MoU between UNAND and BPBD	Established MoU between BPBD and UNAND	X	X			Leader: BPBD, UNAND		

Field: Budget

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
1.	Funding from business sector (CSR PT Semen Padang, Palalu Raya, Mutiara Agam, ANP)	Mapping the potential alternative funding for DRR activities from business sector in district and province	• Available list of CSR potential source for DRR initiative activities • Commitment from entrepreneur to contribute in DRR		X	X	X	Leader : BPBD Agam Support : BAPPEDA, Industry-Trade-Cooperatives Agency, Chamber of Commerce and Industry, Indonesia Young		

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
								Entrepreneur Association , UNAND, NGO, National Electricity Company, Regional Water Supply Company		
2	Maximize self-fund by the community for DRR effort	Introduction and real action of DRR activities through social and religion activities (gotong royong, santapan rohani, majelis taklim)	Established routine activities from community self-funding	X	X	X	X	Leader : BPBD Agam Support : Social-Labor-Transmigration Agency, Religious Affairs Office, Civil Registry and Demography Agency, Subdistrict/Nagari, NGO (local)		
3.	Collect support from newcomers (infrastructure, post-disaster effort)	Dissemination to newcomers association related to disaster	List of people/groups potential for DRR initiatives funding	X	X			Leader : BPBD Agam Support : Civil Registry and Demography Agency, Kesbangpolinmas/Civil Defense, LSM		
4	Optimization of university budget	Institution grant	University budget for research and community development					Leader: BPBD, UNAND		
5	Fund preparation for social assistance	Identify budget sources for emergency response	Budget provision for social assistance	X	X	X	X	Leader : BPBD Agam, Social Agency Support: Red Cross, Indonesia Young Entrepreneur Association, Industry-Trade-Cooperatives Agency		
6	Propose procurement for facility and infrastructure of heavy equipment and shelter	Compose heavy equipment procurement proposal to central government	National budget provision for heavy equipment and shelter in Agam District					Leader : BPBD Agam, Public Works Agency Support: BNPB, BPBD West Sumatra		

Field: Program

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
1	Compile district database on disaster hazard and disaster risk assessment	a. Mapping disaster prone areas: flood, landslide, earthquake, volcano, tsunami	a. Hazard Map: flood, landslide, earthquake, volcano, tsunami	X	X	X	X	Leader : BPBD Agam Support : UNAND and UGM, Social Agency, BAPPEDA, BPS, Health Agency, Central Bureau of Statistics, Education Agency, Regional Water Supply Company, Centre of Volcanology and Geological Hazard Mitigation, National Electricity Company		
		b. Conduct disaster risk assessment	b. Disaster risk map and analysis		X	X	X			
		c. Establish evacuation map and route	c. Established evacuation route map	X	X	X	X			
		d. Perform structural and non-structural mitigation, e.g. mangrove plantation in coastal erosion prone areas	d. Buildings and safe path from disaster		X	X				
2	Community understanding of disaster	a. Dissemination on hazard, vulnerability, risk, and DRR initiatives	Dissemination programs for community groups in every nagari and jorong	X	X	X	X	Leader : BPBD Agam Support : UNAND, Education Agency, Transportation-Communication-Information Agency		
		b. Dissemination in areas with disaster potential		X	X	X	X			
		c. Simulation/drill for all elements in agencies, community, and business sector	Representatives from community groups has drill experience		X		X			
3	Increase of early	Inventory of existing	Inventory for early warning	X	X	X		Leader : BPBD Agam		

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
	detection capacity	equipments EWS procurement for flood, landslide, tsunami	devices Devices installed in disaster prone spots			 X	 X	Support : BNPB, UNAND, Public Works Agency, Meteorological, Climatologi cal and Geophysics Agency, Transportation-Communication-Information Agency		
4	Establishment of disaster mitigation information system	Increase IT and data processing staff capacity Establish IT network	Increase of staff capacity related in utilizing digital technology for DRR initiatives Established digital application system for disaster mitigation	X	X	X X	 X	Leader : BPBD Agam Support: Transportation-Communication-Information Agency, UNAND		
5	Equip emergency facility and infrastructure	Moveable kitchen facilities	Established moveable kitchen facilities	X	X			Leader : BPBD Agam Support: BNPB, BPBD West Sumatra		
6	Increase coordination among agencies and community elements	Meeting/coordination for DRR initiatives (budget and logistics)	Established agenda for routine meeting among agencies, community representatives, and subdistrict/nagari/jorong disaster preparedness group	X	X	X	X	Leader : BPBD Agam Support: All Agencies, Parliament, UNAND, NGO, Disaster Preparedness Group		
7	Socialization of BPBD action plans and programs to university/higher education	Dissemination of activities to universities	Result of cooperative relation between BPBD and universities	X	X	X	X	Leader: BPBD, UNAND		
8	Build collaboration system with experts	Establish district research council	Established district DRR research council	X	X	X	X	Leader: BPBD, UNAND/University		

Field: Human Resources

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
1	BPBD, related agencies, and community manpower/HR mapping	Identify human resources in every agency and community	Established human resources potential map in every agencies and community	X	X			Leader : BPBD Agam Support : UGM, UNAND, Social-Labor-Transmigration Agency, Health Agency, Armed Forces, National Police, Marine and Fisheries Agency, Transportation-Communication-Information Agency, Civil Defense, Public Works Agency, Water Resources Management Agency, Regional Water Supply Company, National Electricity Company, District Hospital, Red Cross, Early Alertness Forum		
		Comparative study to DRR related institution	Participating agencies and disaster preparedness group		X		X			
2	Increase capacity of disaster preparedness group and rapid response team in subdistrict/nagari level	Training for disaster preparedness group members	Increase of capacity and skill of disaster preparedness group members	X	X	X		Leader : BPBD Agam Support : Health Agency, Social-Labor-Transmigration Agency, KLH, Marine and Fisheries Agency, Planned Parenthood-Community and Women Empowerment Agency, Armed Forces, National Policy, Red Cross, SAR, Civil Defense, Local NGO		
		Training for rapid response team members	Increase of capacity and skill of rapid response team members	X	X	X				

NO	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PERSON IN CHARGE	BUDGET (IDR)	PRIORITY SCALE
				2016	2017	2018	2019			
3	Increase human resources capacity in operation control center and disaster prepared press community	HR training for operation control center and disaster prepared press community	Established reliable human resources to manage operation control center and disaster prepared press along its role and function		X	X		Leader : BPBD Agam Support : BAPPEDA, Education Agency, UNAND, Social-Labor-Transmigration Agency, Community Empowerment Agency		
4	Increase of disaster knowledge of teacher and student	Training and education for elementary and middle school students	In each elementary and middle school in Agam District have teachers and students with experience of participating in disaster dissemination and drill program	X	X	X	X	Leader : BPBD Agam Support : BAPPEDA, Education Agency, UNAND, Red Cross, Local NGO		
5	Increase trained professional staff in disaster mitigation: earthquake, flood, landslide, tsunami	Invite professional instructor to train disaster preparedness group, rapid response team, operation control center, and disaster prepared press community staff and members	Increase of professional staff in each groups			X	X	Leader : BPBD Agam Support: Training Center, Planned Parenthood-Community and Women Empowerment Agency, Armed Forces, National Police, Red Cross, SAR, UNAND		

APPENDIX 11: SELUMA ACTION PLAN

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PENGUATAN KETAHANAN INDONESIA MELALUI PENGURANGAN RISIKO BENCANA
Strengthened Indonesian Resilience: Reducing Risk from Disasters (StIRRRD)

DRAFT

DISASTER RISK REDUCTION ACTION PLAN
SELUMA DISTRICT

Calendar Year: January 2016 - December 2019

Name of City/District	Seluma
Province	Bengkulu
Output Target	Disaster Resilient Community and Organization of Seluma District
Focal Point	*Drs. H. Azwardi, MH (Head of Seluma BPBD)* *Dr. Ade Sri Wahyuni (Teaching Staff at Universitas Bengkulu)* *Prof. Dr. Ir. Yudhy Harini Bertham, M.P (Teaching Staff at Universitas Bengkulu)* *Dr. Moch. Farid (Teaching Staff at Universitas Bengkulu)* *M. Husni Thamrin, SH, MH (Head of Seluma DPRD/District Parliament)* *Drs. Julian Zuherman, M. Si. (Head of Seluma BAPPEDA/Regional Development Planning Agency)*

Field: Institutional

NO.	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PEOPLE IN CHARGE	ACTION/ACTIVITY (UNTIL 2015)	ACTION PLAN (2016)	BUDGET PLAN (IDR)	PRIORITY SCALE
				2016	2017	2018	2019					
1	Building cooperation among disaster-related stakeholders	Training of management of DRM organizations in the community	▪ Training and management of DRM organizations together with relevant stakeholders and the community.	X				Leader: BPBD Support: Related agencies, Sub-districts, NGOs, Village, Community		Dissemination of DRM to community organizations	150,000,000	APBD P

NO.	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PEOPLE IN CHARGE	ACTION/ACTIVITY (UNTIL 2015)	ACTION PLAN (2016)	BUDGET PLAN (IDR)	PRIORITY SCALE
				2016	2017	2018	2019					
		Involvement of religious/community figures in disseminate roles in disaster reduction	▪ Dissemination of roles as well as religious/community figures in disaster reduction along with related stakeholders.	X				Leader: BPBD Support: Muspida/Local Consultative Forum, Kesbangpoldagri, Pol PP/Public Order Agency), Religious/Community Figures, Village, Sub-districts		DRM advocacy for religious/community figures and stakeholders	150,000,000	APBD P
		Meetings among agencies to make it possible to conduct joint DRR activities	▪ Establishment of a Coordinating Team ▪ Coordination meeting to improve preparedness and togetherness in disaster management	x	x	x	x	Leader: BPBD Support: Bappeda, District Secretary, All agencies		Coordination meeting and DRM facilitation	100,000,000	Purely APBD
		Meetings with private stakeholders to support DRR activities in Seluma District	▪ Routine meetings to encourage participation of private sector	x	X	x	x	Leader: BPBD Support: Bappeda, Entrepreneur Association		MoU signing between BPBD and companies	75,000,000	APBD P
		Meetings with higher education stakeholders to support DRR activities in Seluma District	▪ Routine meetings with higher education to encourage participation of academia in DRR activities	X	X	X	X	Leader: BPBD Support: Bappeda, UNIB, Universities/ Polytechnics in Seluma		MoU signing between BPBD and UNIB	110,000,000	APBD P
	Regulation of DRR-related use of village funding	Drafting district head decree on the allocation to DRR in village budget	▪ 5% of village budget goes for DRR activities	X				Leader: Head of Seluma District, DPRD Support: Bappeda, UNIB, Universities/ Polytechnics in Seluma				

Field: Budget

NO.	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PEOPLE IN CHARGE	ACTION/ACTIVITY (UNTIL 2015)	ACTION PLAN (2016)	BUDGET PLAN (IDR)	PRIORITY SCALE
				2016	2017	2018	2019					
1	Mapping alternative funding potentials for DRR activity	Starting collaboration among agencies to fund joint DRR activities	• Implementation of DRR joint activities • Establishment of coordinating forum among all agencies	X				Leader: BPBD Support: District Secretary, All Agencies, BPK/Supreme Audit Agency		Establishment of DRM coordinating forum of Seluma District	50,000,000	APBD P
		Identification of potential funding sources outside of the government -> CSR from hotels/companies	• List of potential sources willing to be involved in CSR in the form of disaster-related activities • Commitment from the entrepreneur to make a contribution	X				Leader: BPBD Support: District Secretary, Chamber of Commerce and Industry, Indonesian Young Entrepreneurs Association)/ Entrepreneurs	Support in the form of landslide mitigation equipment	Identification of funding support from hotels/ companies	50,000,000	APBD P
		Identification of potential international funding sources as well as from central, provincial, and district governments	• Collection of funding to support BPBD's activities	X				Leader: BPBD Support: BNPB,Provincial BPBD, Bappeda, Financial and Asset Management Agency	Coordination meetings and consultation, out-of-town official trips	Coordination meetings and consultation, out-of-town official trips	300,000,000	Purely APBD
		Identification of potential funding sources from the community	• List of participants who will donate for the implementation of DRR activities	X				Leader: BPBD Support: Banks, Private Sector, etc.		Identification of funding potentials from the community	50,000,000	APBD P
2	Facilitating DRR budgets to mitigate flooding, landslide, earthquake, tsunami, and coastal erosion hazards	Identification of DRR activity needs against hazards of flooding, landslide, earthquake, tsunami, and coastal erosion	• Drafting of proposed budget at the regional and central levels (BNPB) • Drafting of budget of simulation activities • Drafting of budget for training activities of rapid response team	X	X	X	X	Leader: BPBD Support: BNPB, Provincial BPBD, Bappeda, District Secretary	Construction of embankment and gabions for abrasion control	Listing and mapping of disaster-prone areas	350,000,000	Purely APBD
		Drafting of budget for EWS equipment	• Proposal for the provision of EWS equipment		X			Leader: BPBD Support: Bappeda, Public Works Agency	Installation of EWS to detect soil movement	Drafting of budget for EWS equipment	50,000,000	APBD P

		Drafting of budget for facilities and infrastructure of disaster mitigation and DRR activities	• Proposal for the provision of facilities and infrastructure of disaster mitigation and DRR activities		X	X		Leader: BPBD Support: Bappeda, Public Works Agency		Drafting of budget for facilities and infrastructure of disaster mitigation and DRR activities	50,000,000	APBD P

Field: Program

NO.	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PEOPLE IN CHARGE	ACTION/ACTIVITY (UNTIL 2015)	ACTION PLAN (2016)	BUDGET PLAN (IDR)	PRIORITY SCALE
				2016	2017	2018	2019					
1	Improving information service on disaster to reduce disaster risk	Identifying areas vulnerable to flooding, landslide, earthquake, tsunami, and coastal erosion with related stakeholders and the local community	• There is a document on areas vulnerable to flooding	X				Leader: BPBD Support: Provincial BPBD, BNPB, Mineral Resources and Energy Agency, Public Works Agency, Environment Agency, UNIB, local community		Inventory and identification of damage and losses due to disaster	154,886,000	Purely APBD
			• There is a document on areas vulnerable to landslide									
			• There is a document on areas vulnerable to earthquake									
			• There is a document on areas vulnerable to tsunami									
		Disaster vulnerability data are always updated following physical and social changes in the environment.	• Disaster hazard maps are updated periodically.		x			Leader: BPBD Support: Provincial BPBD, BNPB, Mineral Resources and Energy Agency, Public Works Agency, Environment Agency, UNIB, local community				
		Dissemination of flooding hazard in flooding-prone areas	• Dissemination in … sub-districts vulnerable to flooding.	X	X	X	X	Leader: BPBD Support: Related Agencies, community				
		Dissemination of disaster hazard maps to members of the parliament, agencies, and community	• Targets are aware of the information on disaster hazard in Seluma.	X	X	X	X	Leader: BPBD Support: Parliament, Related Agencies, Sub-districts				

2	Improving the community's capacity in DRR	Disseminate the concept of earthquake-resistant housing to people of Seluma	• Dissemination of the concept of earthquake-resistant housing in 14 districts		X			Leader: BPBD Support: Public Works Agency, STIRRRD, community		Dissemination of the concept of earthquake-resistant housing in Seluma District	150,000,000	APBD P
		Disaster simulation for all hazards that have potentially large impact	• …. Disaster simulation ………	X	X	X	X					
NO.	**OBJECTIVE**	**ACTION/ACTIVITY**	**INDICATOR**	**TIME FRAME**				**PEOPLE IN CHARGE**	**ACTION/ACTIVITY (UNTIL 2015)**	**ACTION PLAN (2016)**	**BUDGET PLAN (IDR)**	**PRIORITY SCALE**
				2016	**2017**	**2018**	**2019**					
		Dissemination on the advantages of DRR activities to the community, government, and legislative	• Dissemination in 2 sub-districts, 5 *villages*, 6 agencies, and DPRD	X	X	X	X	Leader: BPBD Support: Related Agencies, the Community		DRR dissemination to the community, government, and legislative	150,000,000	APBD P
		Starting the establishment of DRR forum with members: the government, the community, and private sector	• Establishment of DRR forum in the district	X				Leader: BPBD Support: Related Agencies, the Community, Private Sector		Establishment of Seluma District DRR Forum	50,000,000	APBD P
		Installing evacuation signs actively Constructing roads and bridges to the evacuation site	Installation of evacuation signs involving the community	X	X	X	x	Leader: BPBD Support: Related Agencies, the Community		Coordination of the plans to make evacuation signs	50,000,000	APBD P
		Facilitating the establishment of Disaster-Prepared Schools	14 schools have implemented Disaster-Prepared School program		X			Leader: BPBD Support: Education Agency, Schools	Joining Disaster-Prepared School competitions	Coordination meeting for the establishment of Disaster-Prepared Schools	50,000,000	APBD P
3	Improving the involvement of vulnerable groups in decision-making	Identification of disaster-vulnerable groups	There is information on the number, location, and condition of the vulnerable groups.	X				Leader: BPBD Support: UNIB, Social Agency				

	process	DRM planning of Seluma District involves vulnerable group, which includes women, elderly people, people with disabilities, and children.	10 representatives of vulnerable groups are involved in disaster management planning process.	X				Leader: BPBD Support: District Secretary, All Agencies, Bappeda, UNIB, Social Agency	Dissemination of DRR to vulnerable groups in Disaster Resilient Villages	Drafting of DRM plans for vulnerable groups	50,000,000	APBD P
4	Structural disaster mitigation	Providing EWS equipment for flooding, landslide, and tsunami	Installation of EWS equipment in several flooding-prone areas Locations: 4	X				Leader: BPBD Support: BNPB, Provincial BPBD, Meteorological-Climatology-Geophysics Agency, SAR, Indonesian Amateur Radio Organization)/Inter-population Radio, NZ Aid	UGM's support in EWS installation	Drafting of EWS budget plans	50,000,000	APBD P
			Installation of EWS equipment in several landslide-prone areas Locations: 4		X	X	X					
5	Mitigation of flooding and landslide	Planting trees for forest protection against flooding and landslide	Planting trees in critical/deforested lands	X	X	X	X	Leader: Environment Agency, BPBD Support: Local govt., Provincial Forest Agency, Natural Resources Conservation Agency, NGOs		Drafting of tree planting program in areas vulnerable to flooding and landslide	50,000,000	APBD P

NO.	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PEOPLE IN CHARGE	ACTION/ACTIVITY (UNTIL 2015)	ACTION PLAN (2016)	BUDGET PLAN (IDR)	PRIORITY SCALE
				2016	2017	2018	2019					
			Installation of EWS equipment in several tsunami-prone areas Locations: …									
		Training of construction labor to build earthquake- and tornado-resistant houses	30 construction labors are aware of the concept of earthquake-resistant housing.	X	X	X		Leader: BPBD Support: STIRRRD, Public Works Agency, NZ Aid		Drafting of budget and laborer training	150,000,000	APBD P
			30 construction labors are aware of the concept of tornado-resistant housing.									
		Planning and constructing embankment for coastal protection	There is a planning document for embankment construction.		x	x	x	Leader: BPBD Support: Bappeda, Public Works Agency				
		Reparation or construction of road or bridge for evacuation route	There are good and fast evacuation routes.	X	X	X	x					
		Slope control to anticipate landslide (by making drainages and slopes)	There are activities of making drainages and slopes.		X	x	X					
		Relocating population from disaster-prone areas	Some lands are prepared as relocation sites.		x	x	X					
5	Finding out the target success and constraints of DRR activities	Monitoring and evaluation of DRR activities	There is a Monev document of DRR activities	X	X	X	X	Leader: BPBD Support: Local government, Bappeda,		Monitoring and evaluation of DRR activities	125,000,000	APBD P

Field: Human Resources

NO.	OBJECTIVE	ACTION/ACTIVITY	INDICATOR	TIME FRAME				PEOPLE IN CHARGE	ACTION/ACTIVITY (UNTIL 2015)	ACTION PLAN (2016)	BUDGET PLAN (IDR)	PRIORITY SCALE
				2016	2017	2018	2019					
1	Capacity building of DRM HR in DRR effort	Dissemination for DRR HR capacity building	Socialization in 14 sub-districts	X	x	x	x	Leader: BPBD Support: Sub-district, Village, NGOs, Tagana	DRM coordination meetings in district	Socialization for DRR HR capacity building	100,000,000	APBD P
		Volunteer capacity building (Tagana/ Disaster-Prepared Youth, Rapid Response Team, Disaster-Prepared Village)	There is training for … volunteers (Tagana, Rapid Response Team, Disaster-Prepared Village)	X	x	x	x	Leader: BPBD Support: BNPB, Provincial BPBD, Related Agencies, UNIB	DRM training for Rapid Response Team	Assistance for Rapid Response Team	75,000,000	Fixed Budget
		Training for volunteers	There are meetings and training for disaster volunteers.	X	x	x	x	Leader: BPBD Support: Related Agencies, UNIB		DRR facilities for volunteers	75,000,000	Fixed Budget

Fixed Budget 2016	**Rp1,054,886,000**
Changeable APBD 2016	**Rp1,660,000,000**
Total	**Rp2,714,886,000**

DYNAMIC QUESTIONNAIRE of operational budget of BPBD Office for StIRRRD Program and its benefits

District	Seluma
Year of BPBD establishment	2010
Informant	Drs, H. Azwardi, MH

1. How much is the operational budget of BPBD since its establishment?

Funding Sources	Budget (in rupiah)					
	2011	2012	2013	2014	2015	2016
BNPB	13,555,869,000	0	0	198,000,000	708,000,000	0
Provincial APBD (regional budget)	0	0	0	0	0	0
District APBD (regional budget)				3,225,511,500	7,472,700,000	4,498,266,000
KDPDTT (Ministry of Village, Disadvantaged Regions and Transmigration) Dep PU (Public Works Agency)					900,000,000 14,000,000,000	1,000,000,000

2. How is BPBD operational budget allocated for DRR activities?

Allocation of district budget (APBD) for DRR activities
1. Dissemination of disaster risk reduction
2. Facilitation of the establishment of Resilient Village
3. Management of logistics and DRM equipment
4. Coordination meeting and DRM facilitation
5. Listing and mapping disaster-vulnerable areas
6. Listing and identification of damage and losses due to disaster

7. Rapid Response Team training and assistance
8. Installation of evacuation signs and assembly point signs
9. Construction of shelters by the Ministry of Public Works, the Republic of Indonesia
10. Drafting of DRM contingency plans
11. Drafting of fire prevention guidelines
12. Inventory and management of logistics and DRM equipment

Activities	Budget (in rupiah)					
	2011	2012	2013	2014	2015	2016
1. Dissemination of disaster risk reduction				198,000,000		
2. Facilitation of the establishment of Resilient Village					610,000,000	75,000,000
3. Management of logistics and DRM equipment				50,000,000		200,000,000
4. Coordination meeting and DRM facilitation				-	100,000,000	100,000,000
5. Listing and mapping disaster-vulnerable areas				-		350,000,000
6. Listing and identification of damage and losses due to disaster						154,886,000
7. Rapid Response Team training and assistance				-	125,000,000	
8. Installation of evacuation signs and assembly point signs				516,387,500	198,000,000	75,000,000
9. Construction of shelters by the Ministry of Public Works, the Republic of Indonesia				136,625,000	14,000,000,000	
10. Drafting of DRM contingency plans				50,000,000		
11. Drafting of fire prevention guidelines				200,000,000	100,000,000	
12. Inventory and management of logistics and DRM equipment				75,000,000		
13. Dissemination of early warning of disaster					100,000,000	
14. Training of tsunami mitigation volunteers						

3. What are the factors that contribute to the fluctuation of budget?

a. High frequency of disaster in Seluma District
b. The community's focus is on the implementation of democracy (general and regional elections).
c. There are new disaster mitigation programs, e.g. for house fire.
d. There is still belief among the executive and legislative that disaster mitigation is only for when there is disaster emergency, although there are already law and government's regulation on disaster.
e. There is good coordination between the regional and central governments.
f. Government officials often change places of work, so the understanding of and coordination for the program change and it takes time to make adjustments for the program's sustainability and implementation.

4. Why does the existence of StIRRRD program in the regions have a big role in the increase of BDBD operational budget?

a. Stakeholders are motivated to create a sense of peace from disaster for the interest of the community in general.
b. The local government hopes for support and funding from the central government.
c. The implementation of disaster mitigation in the regions will be more directed and planned.
d. The budget allocated can truly impact the community in disaster reduction.

Thank you
New Zealand April 4, 2016
Head of BPBD Seluma,

DRS. H. AZWARDI, MH

APPENDIX 12: INDONESIAN EMBASSY
GUEST LIST AND FUNCTION PROGRAMME

StIRRRD NZ Comparative Study Programme: 3-16 April 2016

Reception Indonesian Embassy

List of Guests

No	Name		Institution
1	Teuku Faisal Fathani		UGM
2	Iman Satyarno		UGM
3	Wahyu Wilopo		UGM
4	Agung Setianto		UGM
5	Esti Anantasari		UGM
6	Arry Retnowati		UGM
7	Fransisca Ediningtyas Mahanani		UGM
8	Gumbert Maylda Pratama		UGM
9	Medi Herlianto	Director of Preparedness	BNPB
10	Aryo Wicaksono	Head of Data & Information Sub Division Kemendesa	KEMENDESA
11	Yoga Wiratama	Head of Disaster Management Section	MOHA
12	Bambang Warsito Saroji	Head of BPBD	BPBD, Agam District
13	Yunelimeta Asman Djannas	Head of Prevention and Preparedness Division	BPBD, Agam District
14	Tesri Maideliza	Lecturer of Faculty of Biology	Universitas Andalas
15	Azwardi Binap Pangkuak	Head of BPBD	BPBD, Seluma District
16	Husni Thamrin	Head of Parliament	Parliament. Seluma District
17	Julian Zuherwan Dain	Head of BAPPEDA	BAPPEDA, Seluma District
18	Ade Sri Wahyuni	Faculty of Engineering	Universitas Bengkulu

19	Yosar Kardiat	Head of BPBD Morowali	BPBD, Morowali District
20	I Wayan Sugita	Head of Spatial planning	Spatial Planning Agency of Morowali
21	Ambo Dalle Side Abbas	Head of Parliament	Parliament Morowali District
22	I Ketut Sulendra	Lecturer of Faculty of Engineering	Universitas Tadulako
23	Ida Sri Oktaviana	Lecturer of Faculty of Engineering	Universitas Tadulako
24	Mukmin	Head of BPBD	BPBD, Sumbawa District
25	Lalu Budi Suryata	Head of Parliament	Parliament Sumbawa District
26	Eko Pradjoko	Lecturer, Faculty of Engineering	Universitas Mataram
27	Didi Sumardi Hamdan	Head of Parliament	Parliament Mataram City
28	Yudhy Harini Bertham	Center for Natural Disaster	Universitas Bengkulu
29	Zamira Eliana Tatapamang	Translator	UGM
30	Michele Daly		GNS Science
31	Phil Glassey		GNS Science
32	Richard Woods		GNS Science
33	Sylvia Riches		GNS Science
35	Geoff Kilgour		GNS Science
36	Hannah Brackley		GNS Science
37	Kelvin Berryman		GNS Science
38	Mike Page		
39	Celia Wade-Brown	Mayor	Wellington CC
40	Richard Sharpe		Beca
41	Ian Forbes	Translator	
42	James Flanagan		GWRC
43	Kate Crowley		NIWA
44	Duncan Graham + 1		
45	Megan Collins + 7(?)		Gamelan

NZ Comparative Study Programme

Local Government Segment

3- 13 April 2016

Post-Workshop Questionnaire

Name	
Job Title	
Organisation	
Years in Position	<1, 1-3, 3-5, >5 (circle one)
Location (where from)	
Male / Female	M / F (circle one)

Workshop Expectations

Q1. How well did the workshop meet your expectations in the knowledge or information areas/topics that you thought were important? (*Please* ***circle*** *the score that you think is most appropriate)*

1	2	3	4	5
Not Much		As expected		Very Well

Learnings

Q2a. What were the major learnings you gained from the comparative study programme?

1.

2.

3.

Q2b. How much will these learnings help you with your work? (*Please* ***circle*** *the score that you think is most appropriate)*

Don't Know	1	2	3	4	5
	Not much		Some help		Very helpful

Action Plans

Q3a. Did you make changes to your district DRR Action Plan as a result of the comparative study programme? (*Please* ***circle*** *the score that you think is most appropriate)*

Don't Know	1	2	3	4	5
	No changes		Some changes		Many changes

Q3b. If changes were made, what were some of these?

1.

2.

3.

Topic Areas

Q4a. What topic areas did you find the most useful? 1. 2. 3.
Q4b. What topic areas did you find the least useful? 1. 2. 3.
Q4c. What topic areas would you have liked more of? 1. 2. 3.

Discussion

Q5. How good was the opportunity to discuss key topics and issues and obtain answers to your questions? (*Please **circle** the score that you think is most appropriate)*

1	2	3	4	5
Not Good		Good		Excellent

Workshop Logistics

Q6. How good were the workshop logistics? (*Please **√** the score that you think is most appropriate)*

	1	2	3	4	5
Accommodation					
Presentation room					
Course materials					
Translation					

	Catering				
		Not good	Good	Excellent	

Fieldtrips

Q7. How useful was the field visit? (*Please* ***√ or circle*** *the score that you think is most appropriate)*

7a: Auckland

1	2	3	4	5
Not Good		Good		Excellent

7b: Wellington

1	2	3	4	5
Not Good		Good		Excellent

7c: Napier/Gisborne

1	2	3	4	5
Not Good		Good		Excellent

Overall Satisfaction

Q8. Overall how would you rate the quality and usefulness of the visit to NZ? (*Please* ***√ or circle*** *the score that you think is most appropriate)*

1	2	3	4	5
Not good		Good		Excellent

Other comments

Q9. Do you have any other comments that would help us improve future comparative study programmes?

1.

2.

3.

Thank you for completing this questionnaire.

APPENDIX 13: POST-TRAINING EVALUATION SURVEY

StIRRRD

NZ Comparative Study Programme

Extension Segment

13 – 14 April 2016

Post-Workshop Questionnaire

Name		
Job Title		
University		
Years in Position	<1, 1-3, 3-5, >5	(circle one)
Male / Female	M / F	(circle one)

Workshop Expectations

Q1. How well did the *Extension* workshop meet your expectations in the knowledge or information areas/topics that you thought were important? (*Please* ***circle*** *the score that you think is most appropriate)*

1	2	3	4	5
Not Much		As expected		Very Well

Comparison with Local Government Segment

Q2a. Did the *Extension* segment add to the information you learned from the *Local Government* segment? (*Please* ***circle*** *the score that you think is most appropriate)*

1	2	3	4	5
Not Much		As expected		Very Well

Q2b. Has the *Extension* segment been a worthwhile addition to the overall Comparative Study Visit? (*Please* ***circle*** *the score that you think is most appropriate)*

1	2	3	4	5
No		neutral		yes

Learnings

Q3a. What were the major learnings you gained from the *Extension* segment?

1.

2.

3.

StIRRRD

Q3b. How much will these learnings help you with your work? (*Please **circle** the score that you think is most appropriate)*

Don't Know	1 Not much	2	3 Some help	4	5 Very helpful

Action Plans

Q4a. Did you make changes to your *university* DRR Action Plan as a result of any part of the comparative study programme? (*Please **circle** the score that you think is most appropriate)*

Don't Know	1 No changes	2	3 Some changes	4	5 Many changes

Q4b. If changes were made, what were some of these?

1.

2.

3.

Topic Areas

Q5a. What topic areas did you find the most useful?

1.

2.

3.

Q5b. What topic areas did you find the least useful?

1.

2.

3.

Q5c. What topic areas would you have liked more of?

1.

2.

3.

Discussion

Q6. How good was the opportunity to discuss key topics and issues and obtain answers to your questions? (*Please **circle** the score that you think is most appropriate)*

1	2	3	4	5
Not Good		Good		Excellent

Workshop Logistics

Q7. How good were the workshop logistics? (*Please **√** the score that you think is most appropriate)*

	1	2	3	4	5
Accommodation					
Presentation room					
Course materials					
Translation					
Catering					
	Not good		Good		Excellent

Overall Satisfaction

Q8. Overall how would you rate the quality and usefulness of the *Extension training* (*Please **√ or circle** the score that you think is most appropriate)*

1	2	3	4	5
Not good		Good		Excellent

Other comments

Q9. Do you have any other comments that would help us improve any future comparative study and training programmes?

1.

2.

3.

Thank you for completing this questionnaire.

2016 NZ Post workshop questionnaire Local Government Segment tables and graphs

Q1. How well did the workshop meet your expectations in the knowledge or information areas/topics that you thought were important? (*Please circle the score that you think is most appropriate*)

	Count	Table N %
Not much	0	0.0
2	0	0.0
As expected	1	4.3
4	5	21.7
Very well	17	73.9
Total	23	100.0

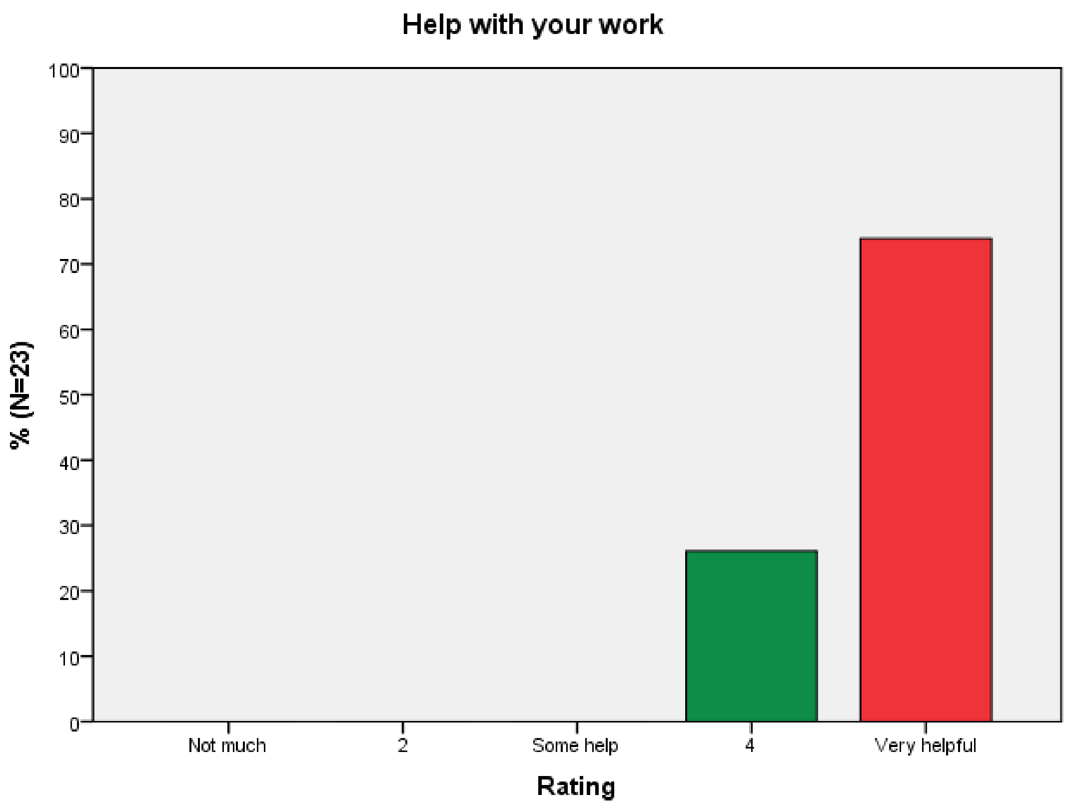
Q2a. What were the major learnings you gained from the *comparative study programme*?

- 1. Building community resilience. 2. Empower communities. 3. Planning a good disaster management.
- 1. Comparison of the disaster management system. 2. Type of disaster in NZ. 3. The relationship of government, communities and researchers.
- 1. Coordination between the government and the community. 2. Skim financing of DM. 3. 3base isolation technology. 4. The application of regulations and structure of the building evacuation.
- 1. Develop the DRR strategic policies perspective. 2. Develop and implement a disaster plan. 3. Strengthening coordination among government agencies.
- 1. Disaster regulation. 2. Disaster budgeting. 3. Disaster management.
- 1. DRR activities in NZ have been integrated very well. 2. All activities related to the public always involves the community.
- 1. DRR cannot be done alone, all parties involved must work together. 2. The corrective action or disaster risk reduction, especially in the construction, needs investigation and calculation of the various risks before it is applied, without calculation it can cause new problems.
- 1. Each program is scalable, systematic and no performance indicators. 2. In terms of the budget is very adequate for each program. 3. Consistency in implementation of the program.
- 1. How does NZ face and implement DRR activities. 2. The implementation of action plans that has been done. 3. Public participation in planning DRR activities.
- 1. How to handle the disaster in NZ. 2. The technology that was used by NZ in DRR. 3. The involvement of local communities in DRR activities.
- 1. Knowing the issue of the DRR. 2. Knowing how to manage the disaster risk mitigation, relief and rehabilitation. 3. With this comparative study on the DRR there were some things that we can implement in Indonesia.
- 1. People were told to understand that natural disasters come closer. 2. Immediately after the disaster everyone had to struggle to survive. 3. The disaster program should be prepared.
- 1. Regulations about DRR. 2. Budgeting about DRR. 3. Community based on DRR.
- 1. Reinforcement of the capacity of local governments within DRR. 2. Build the resilience of governments and communities in disaster management. 3. Strengthen or build collaboration, coordination and relations along with the stakeholders.
- 1. The communication system to engage all stakeholders. 2. The DRR structured handling system. 3. The existence of the involvement of NGO's and other people who care about the disaster.
- 1. The decreasing of disaster risk is an important aspect in handling disasters. 2. Disaster handling needs disaster management which is supported by regulation, community participation and other institutions. 3. It needs to develop a synergy among disaster institutions, universities and other stakeholders.

- 1. The NZ experience in DM. 2. Integration and collaboration among the institutions within DRR. 3. Interaction and communication with local or national, university, GNS etc.
- 1. The researcher and the local government can compromise ina good way to develop better understanding upon DRR. 2. Educating people (community) is challenging yet the key to succeed the DRR agendas.
- 1. The role of researchers from GNS in the DRR efforts. 2. Cooperation with the local government community in the DRR. 3. Seeing examples of the application of mitigation measures and the RR at different locations with different methods.
- 1. Understanding the DRR program. 2. Ability for developing the Action Plan. 3. Got the new knowledge for disaster management.
- 1. Understanding the implementation of the concept of DRR in New Zealand. 2. Learning from the experience of the New Zealand government in involving local communities.
- 1.Disaster Risk Reduction approach has been integrated in policy making process and program implementation. 2. Type of disaster was recognized comprehensively. Both were man-made disaster and natural disaster. e.g. electrical failure (blackout), IT related disaster. 3. The elements of insurance play a vital role in disaster risk reduction or rehabilitation and reconstruction in NZ post-disaster events. 4. Start with the small things. NZ has taken a long period educating its people on disasters. What I see the most related to disaster was, in every new building GNS team always inform to us about safety procedure in case of fire. 5. Constant and regular evaluation was one of the told which is very important to achieve the outcome of the program. For example, NZ has a regular survey for its disaster signage (tsunami Evac. zone). 6. Government has convinced (or in process) the people to strengthen their selves and their family first in case of disaster or emergency arises. The power of people has played a major role in emergency situation anticipation. One helps another. 7. Principles of Build Back Smarter.
- Understanding of DRR.

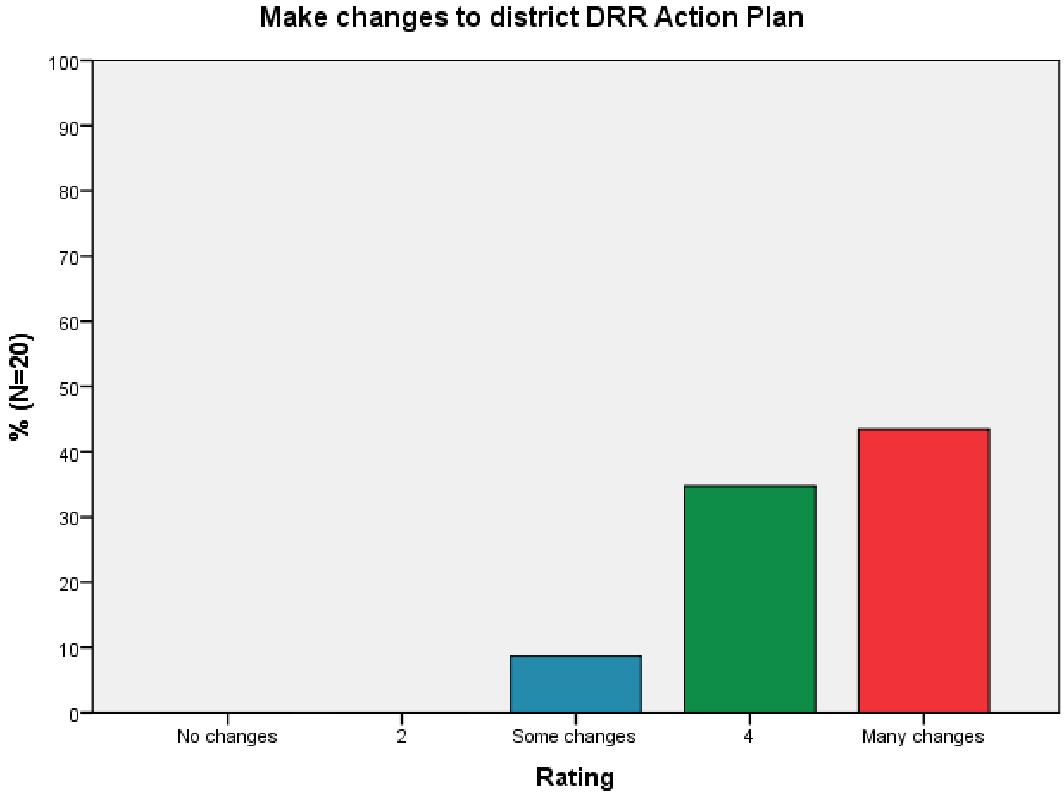
Q2b. How much will these learnings help you with your work? *(Please circle the score that you think is most appropriate)*

	Count	Table N %
Not much	0	0.0
2	0	0.0
Some help	0	0.0
4	6	26.1
Very helpful	17	73.9
Total	23	100.0



Q3a. Did you make changes to your district DRR Action Plan as a result of the comparative study programme? *(Please circle the score that you think is most appropriate)*

	Count	Table N %
No changes	0	0.0
2	0	0.0
Some changes	2	10.0
4	8	40.0
Many changes	10	50.0
Total	20	100.0



Q3b. If changes were made, what were some of these?

- 1. Adjustment of the Action Plan with the National program. 2. Provide opportunities in the business world. 3. Focus on community preparedness.
- 1. Budgeting. 2. Adjustment between central and local programs. 3. Proposed real community projects.
- 1. Building design that considers the base isolation. 2. Evaluate vulnerable buildings
- 1. Disaster handling policy, disaster risk decreasing aspect needs more attention. 2. Potency mapping and disaster handling patterns must be accurate and supported by the result of academic research. 3. Engagement patterns and community participation strengthen in decreasing disaster risk need an innovation that sustainably involves the community.

- 1. Focus on the DRR handling vulnerable communities (small islands). 2. The method of structural mitigation to see and understand the specific natural conditions. 3. The model of community-based disaster management (bottom up).
- 1. Geological mapping before the mapping of disaster-prone areas. 2. procurement EWA for landslides in Morowali district. 3. Training on earthquake-resistant construction rules for consultants and contract.
- 1. Making the regulations about the handling disaster for the local or regional level (Disaster Management in Agam). 2. Always conduct an evaluation.
- 1. Sharpening the multi-hazard disaster risk map. 2. integration of the DRR perspective in planning and budgeting. 3. Expanding the initiative of community participation in the DRR activities.
- 1. Some of the activities in the Action Plan. 2. Implementation of the Action Plan related to society.
- 1. Strengthening the data centre, preparation of maps that integrates the planning maps, spatial, disaster risk and land use maps. 2. Making GIS portal. 3. Increase/improve the working system of Pusdalops. 4. Cooperation with universities.
- 1. System. 2. Coordination. 3. Consistency.
- 1. The kind of cooperation with the community. 2. It can clearly provide input to the executive and legislature in budgeting.
- 1. The strategy for dealing with a recalcitrant society.2. How to invite people or strategies or approaches to community. 3. Coordinate with relevant stakeholders.
- 1. The system needs to be improved coordination and communication. 2. Planning needs to be done in a structured and consistent way. 3. All programs and plans should be proposed at the village, sub-district and district to the national level.
- Action Plan: Implementing DPR in the community.
- Logistics
- Programs and activities that focus on the DRR activities, such as: integration of programs on education; infrastructure planning.
- The relationship between university and local government.
- Understanding of tsunami, earthquakes and landslides.

Q4a. What topic areas did you find the most useful?

- 1. Action Plan of NZ in disaster management. 2. The organization and management of CDEM. 3. Visit CDEM office in Auckland.
- 1. Auckland tsunami hazard. 2. Christchurch earthquake. 3. Napier earthquake and East Coast.
- 1. Base isolation. 2. Reinforcement the building. 3. Making the risk spectrum scape.
- 1. Blue line. 2. Spacial planning
- 1. Community involvement in policy and implementation process. 2. Insurance system in DRR. 3. The conversion of disaster approach into hazard approach. 4. Build Back Smarter. 5. Regulatory aspects of governance (central, local, district)

- 1. Disaster risk decreasing in NZ. 2. CDEM framework in NZ. 3. NZ legislative context for risk reduction and tsunami evacuation plan.
- 1. Earthquake. 2. Volcano. 3. Tsunami.
- 1. Efforts the Napier City CDEM in building the coastal laboratory. 2. Experience of Auckland CDEM. 3. Collaboration between Gisborne CDEM and Maori community.
- 1. Everything is useful, the most interesting was visiting the Museum Te Papa and Auckland Museum. 2. Community engagement within DRR activities.
- 1. Handling of coastal erosion hazard (analogous to the condition of the beach in Morowali). 2. Sharing the use of resources between the District Council with the community. 3. Role of CDEM in the DRR (coordination system).
- 1. Land use planning is very detailed. 2. Watershed management and Catchment areas. 3. The system of information and communication, readiness, mitigation of coastal erosion, and environmental management. 4. Elaboration between the government and GNS.
- 1. Patterns of coordination between central and local governments. 2. The allocation of finding for DRR activities is greater than the budget allocation of emergency response. 3. Formulation of disaster risk map (tsunami and earthquake) that involves the community.
- 1. Planning 2. Empowering communities. 3. Building a community.
- 1. The concept of community preparedness. 2. Resilient Wellington City. 3. Samoa Case Study.
- 1. The involvement of all stakeholders in all program activities the DRR. 2. Tsunami, volcano and abrasion. 3. Base isolation.
- 1. The involvement of all stakeholders in disaster relief. 2. The role of coordination in the DRR. 3. Maximizing the government budget in addressing the DRR.
- All of them.
- Communicating, consultation, and educating people.
- Preparedness, DRR management and recovery efforts.
- Retrofitting construction or infrastructure.
- RiskScape and GeoNet

Q4b. What topic areas did you find the least useful?

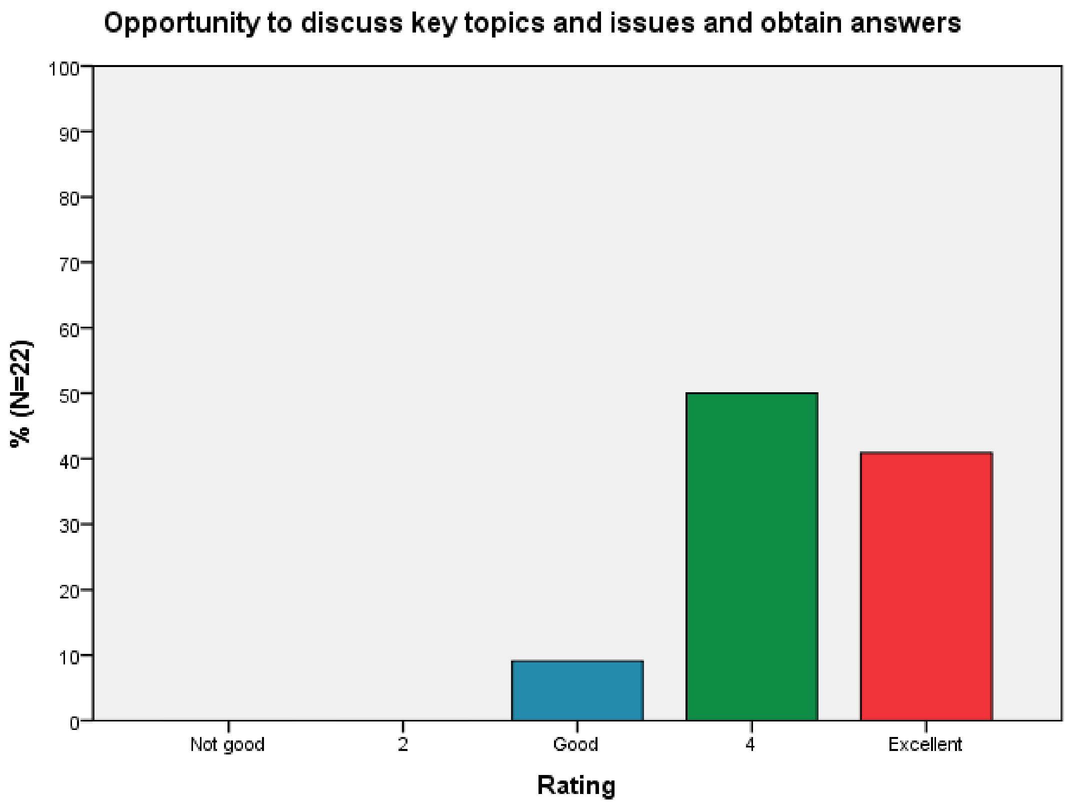
- 1. Coastal abrasion.
- 1. The problems of disaster in Indonesia should be shared between stakeholders. 2. The solution from a community perspective.
- All of the materials are beneficial.
- Coastal erosion processes.
- Disaster regulation.
- None
- Subject of training which is highly technical need to be simplified.

Q4c. What topic areas would you have liked more of?

- 1. Budget planning system of disaster risk index decreasing based. 2. Rehabilitation management and disaster recover. 3. The mapping of disaster handling of risk index decreasing based.
- 1. Community approach on DRR. 2. Insurance. 3. Budget management. 4. Integrating DRR issues through schools (DM curriculum)
- 1. Develop a disaster risk map. 2. Develop Blue Line. 3. Community empowerment program.
- 1. Drafting the disaster risk map. 2. Strengthening the institutional at the community level.
- 1. Early warning to all types of hazard. 2. Analysis of Risk and potential impact of disasters. 3. Strengthen the role of business in disaster relief.
- 1. In-depth discussion of economic issues in disaster management. 2. More application examples of disaster management.
- 1. Learning in the room (40%) and implementation (60%). 2. Each participant was given the opportunity to express their opinions. 3. Opportunities discussion should be reproduced again.
- 1. Lesson learned from private sector participation in DRR activities. 2. Disaster management in the outer islands.
- 1. The more material in the problem of coastal erosion and landslides. 2. Watershed of River. 3. Water catchments.
- Aspects of planning including the DRR, emergency response and planning on recovery.
- Eruption of Mount Merapi, particularly in dealing with the dust of Mount Merapi.
- Handling the small islands/outer.
- More examples on lessons learnt how to reach DRR agendas - the implementation, practice, and including the challenges.
- Seismicity regulatory changes by the latest earthquake.
- The pattern of disaster management in New Zealand.

Q5. How good was the opportunity to discuss key topics and issues and obtain answers to your questions? (*Please circle the score that you think is most appropriate*)

	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	2	9.1
4	11	50.0
Excellent	9	40.9
Total	22	100.0

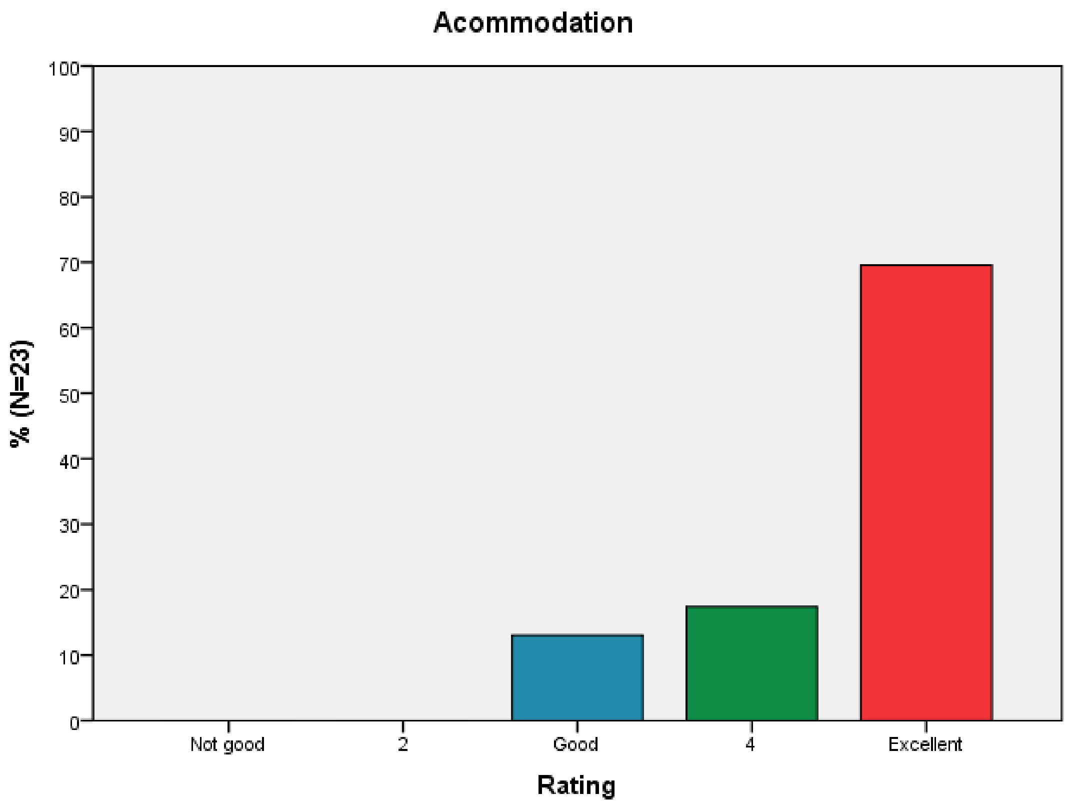


Q6. How good were the workshop logistics? *(Please tick the score that you think is most appropriate)*

		Count	Table N %
Accommodation	Not good	0	0.0
	2	0	0.0
	Good	3	13.0
	4	4	17.4
	Excellent	16	69.6
Presentation room	Not good	0	0.0
	2	0	0.0
	Good	2	8.7
	4	9	39.1
	Excellent	12	52.2
Course materials	Not good	0	0.0
	2	0	0.0
	Good	2	8.7
	4	8	34.8
	Excellent	13	56.5
Translation	Not good	0	0.0
	2	0	0.0
	Good	2	8.7
	4	9	39.1
	Excellent	12	52.2
Catering	Not good	0	0.0
	2	1	4.3
	Good	9	39.1
	4	5	21.7
	Excellent	8	34.8

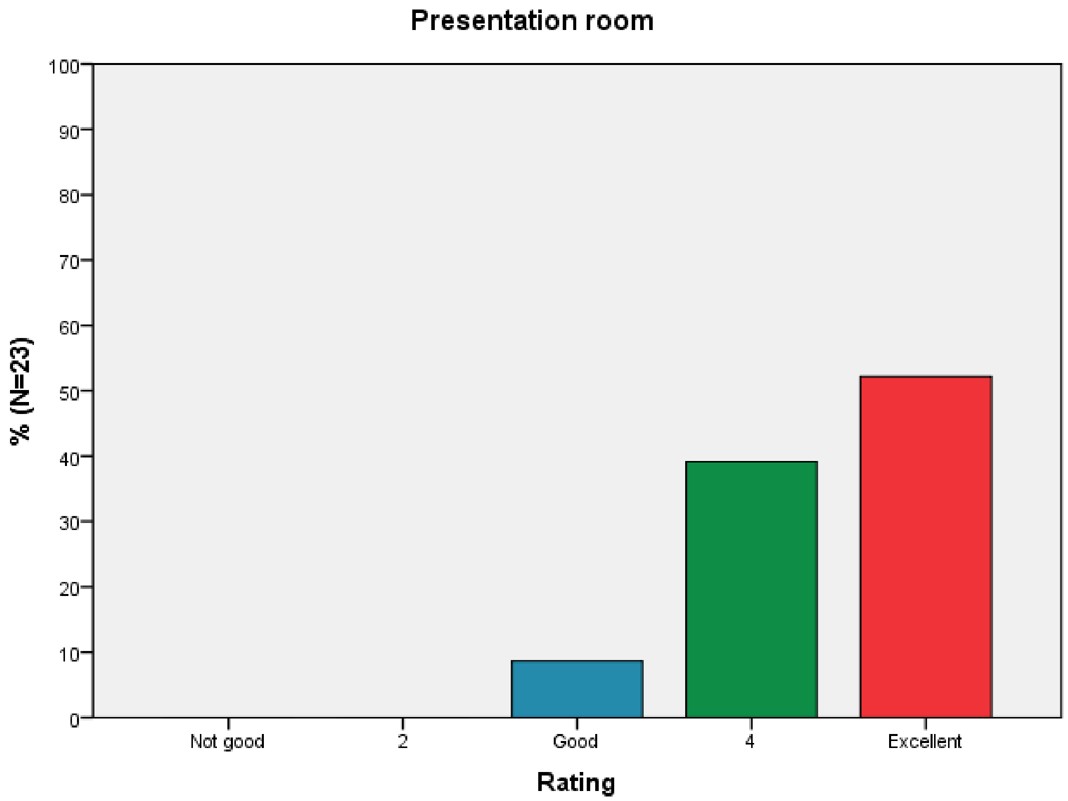
Q6. How good were the workshop logistics? Accommodation (*Please tick the score that you think is most appropriate*)

	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	3	13.0
4	4	17.4
Excellent	16	69.6
Total	23	100.0



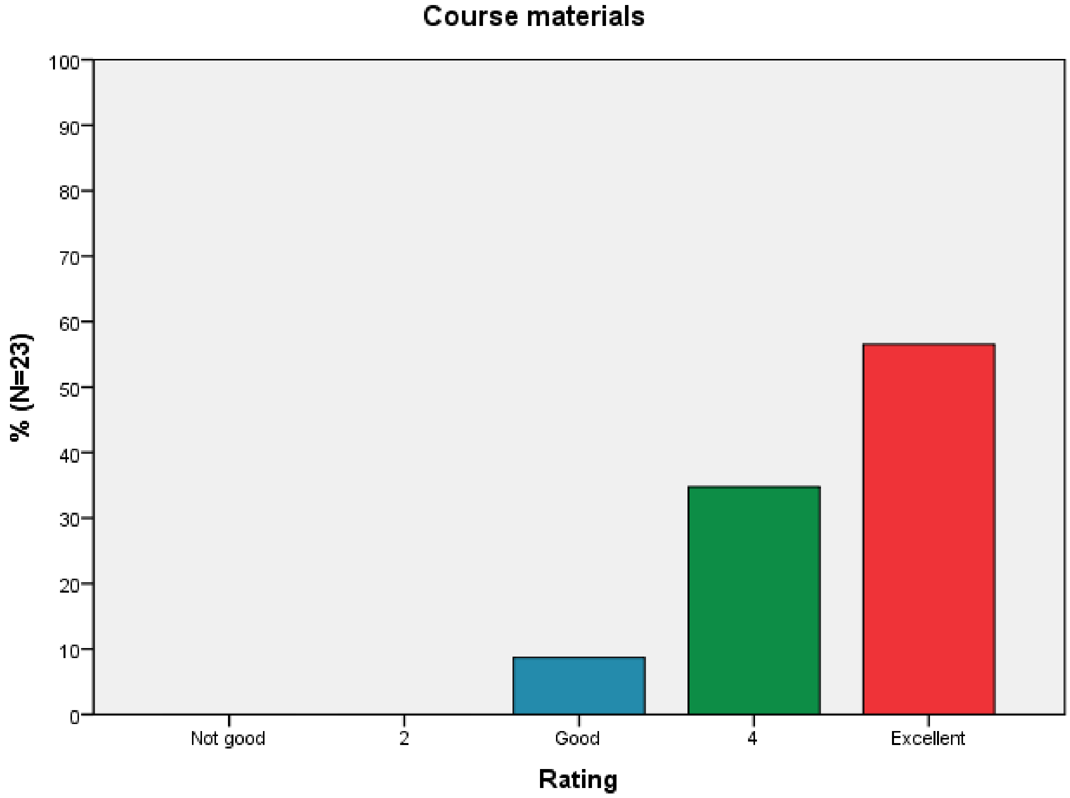
Q6. How good were the workshop logistics? Presentation room (*Please tick the score that you think is most appropriate*)

	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	2	8.7
4	9	39.1
Excellent	12	52.2
Total	23	100.0



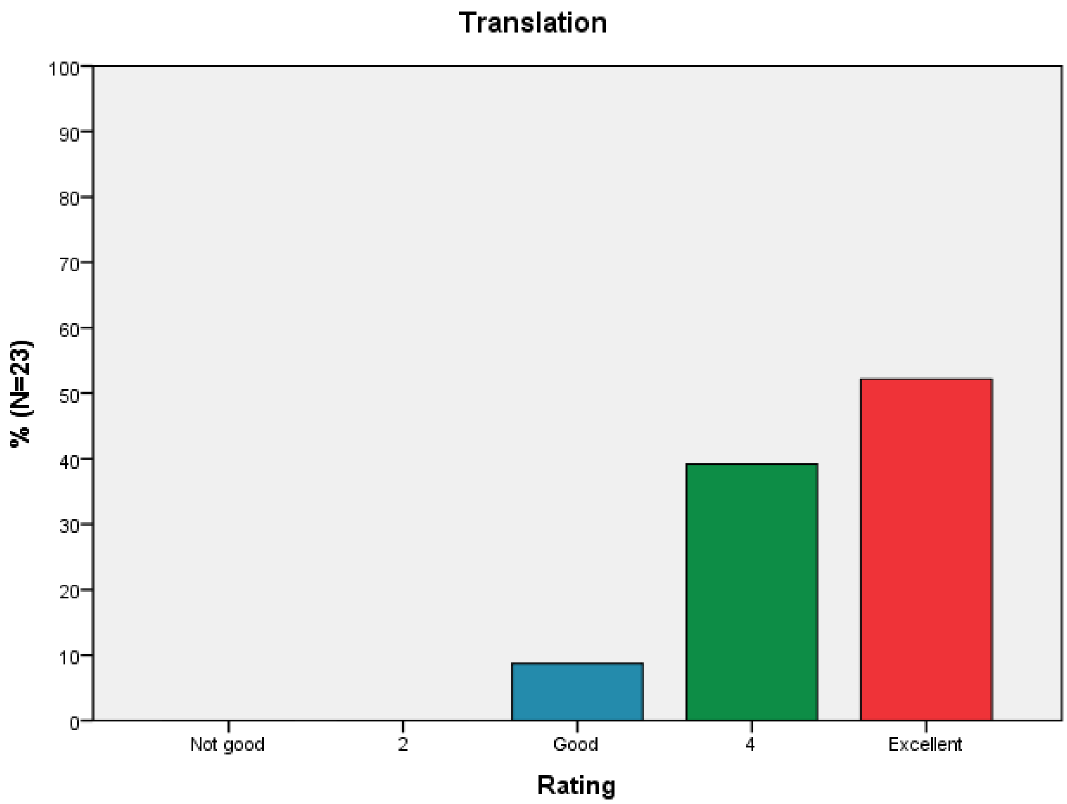
Q6. How good were the workshop logistics? Course materials (*Please tick the score that you think is most appropriate*)

	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	2	8.7
4	9	34.8
Excellent	13	56.5
Total	23	100.0



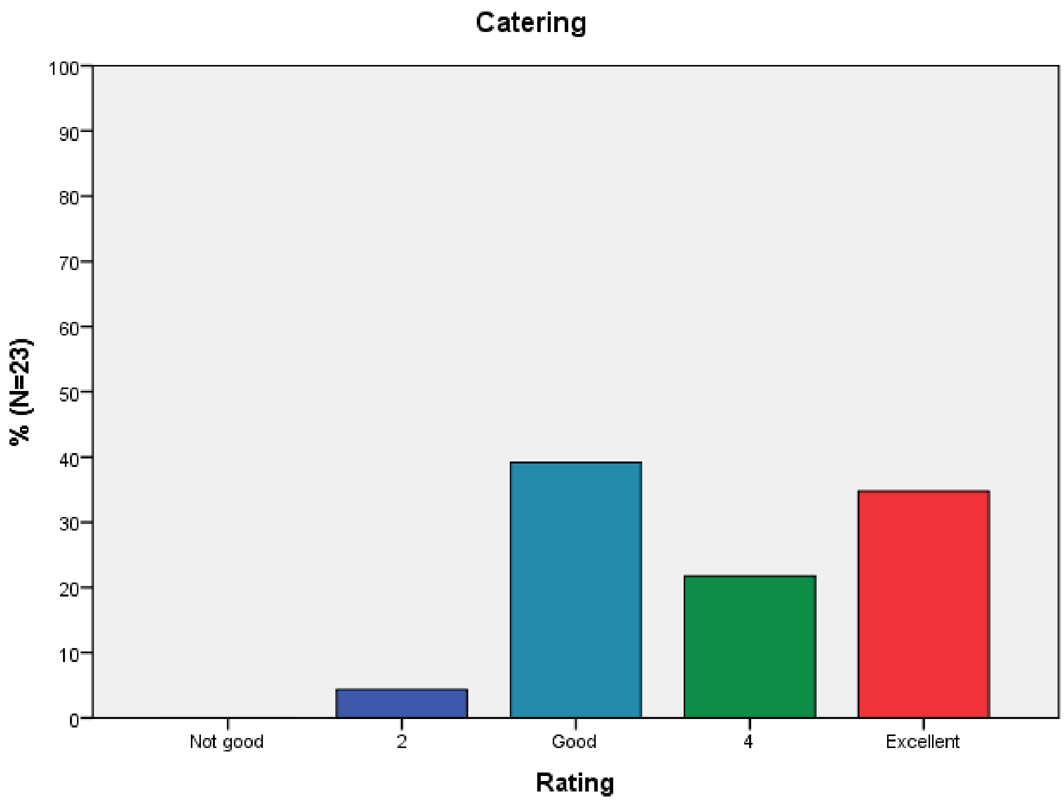
Q6. How good were the workshop logistics? Translation (*Please tick the score that you think is most appropriate*)

	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	2	8.7
4	9	39.1
Excellent	12	52.2
Total	23	100.0



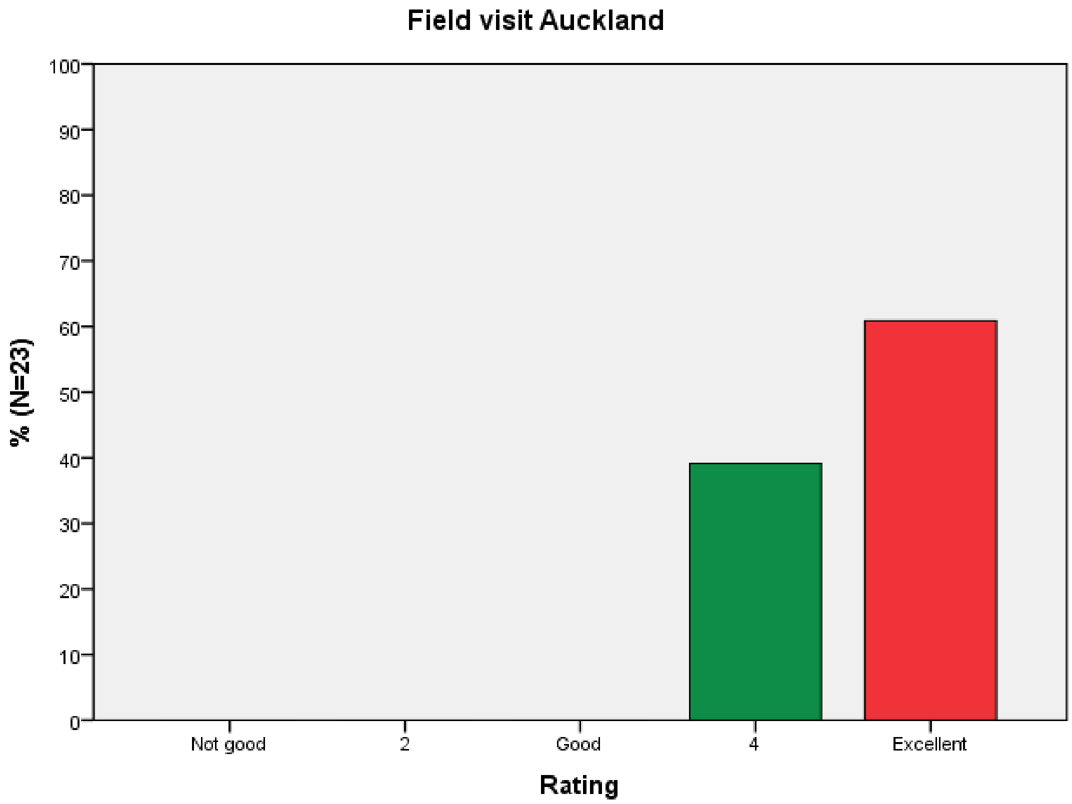
Q6. How good were the workshop logistics? Catering (*Please tick the score that you think is most appropriate*)

	Count	Table N %
Not good	0	0.0
2	1	4.3
Good	9	39.1
4	5	21.7
Excellent	8	34.8
Total	23	100.0



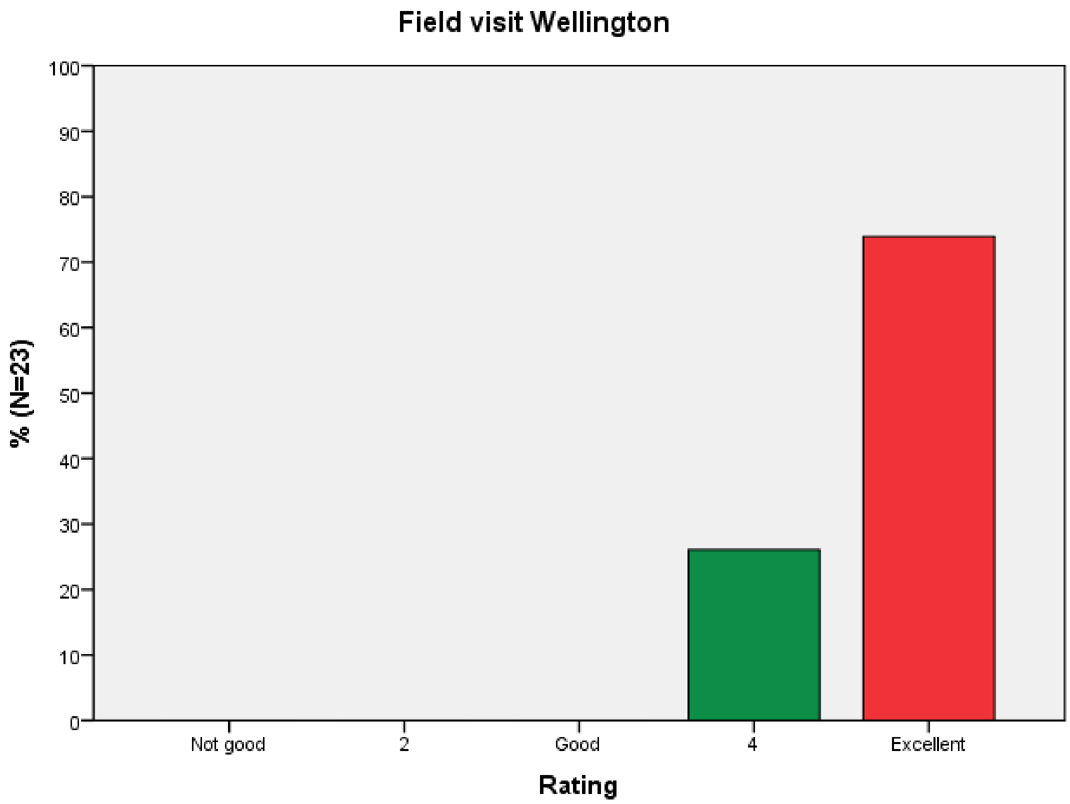
Q7a. How useful was the field visit? Auckland

	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	0	0.0
4	9	39.1
Excellent	14	60.9
Total	23	100.0



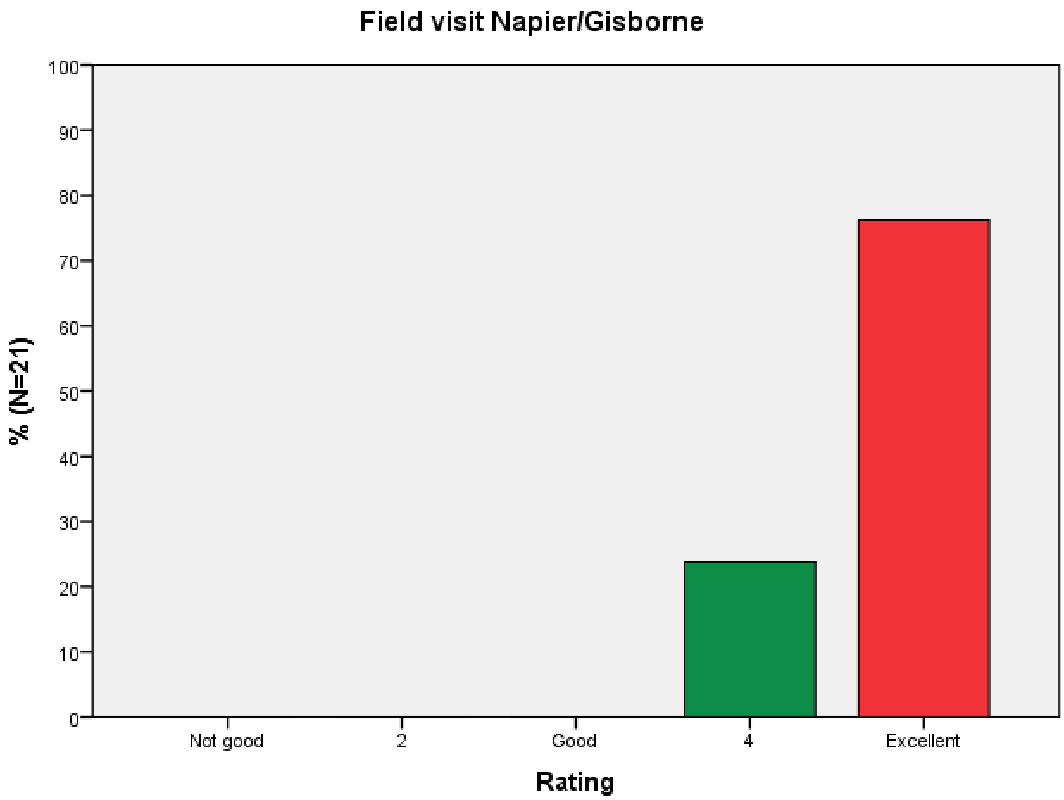
Q7b. How useful was the field visit? Wellington

	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	0	0.0
4	6	26.1
Excellent	17	73.9
Total	23	100.0



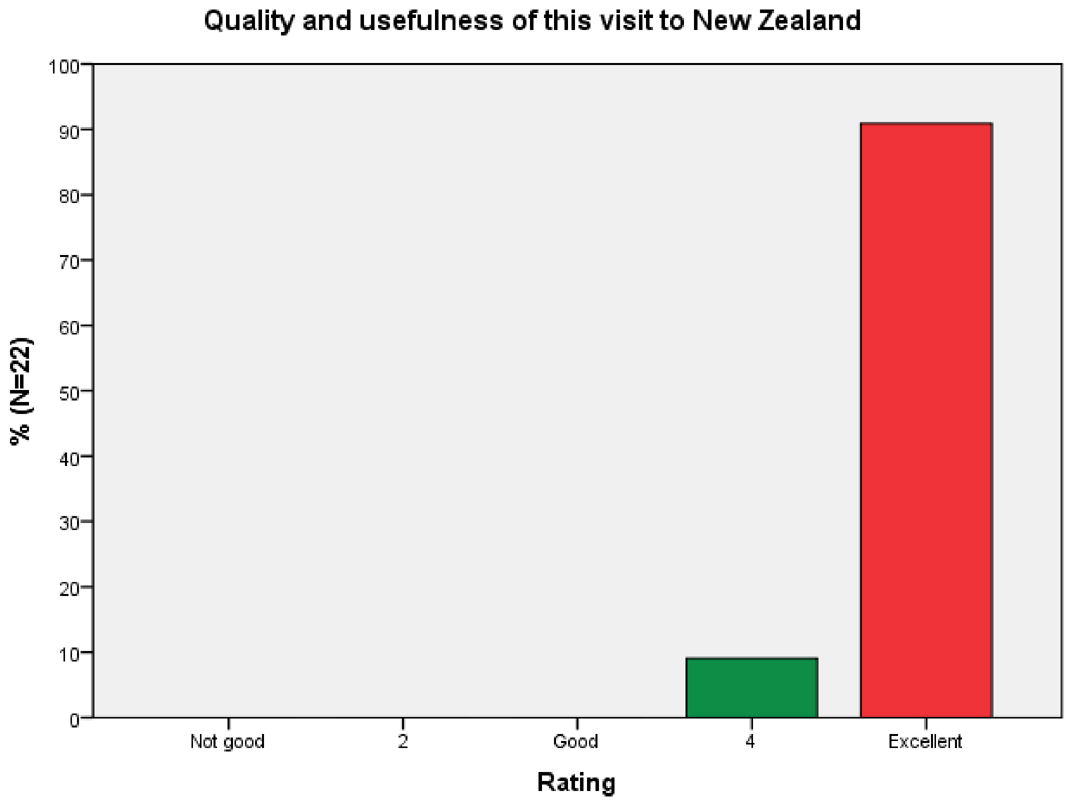
Q7c. How useful was the field visit? Napier/Gisborne?

	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	0	0.0
4	5	23.8
Excellent	16	76.2
Total	21	100.0



Q8. Overall how would you rate the quality and usefulness of this visit to New Zealand? *(Please tick or circle the score that you think is most appropriate)*

	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	0	0.0
4	2	9.1
Excellent	20	90.9
Total	22	100.0



Q9. Do you have any comments that would help us improve future comparative study programmes?

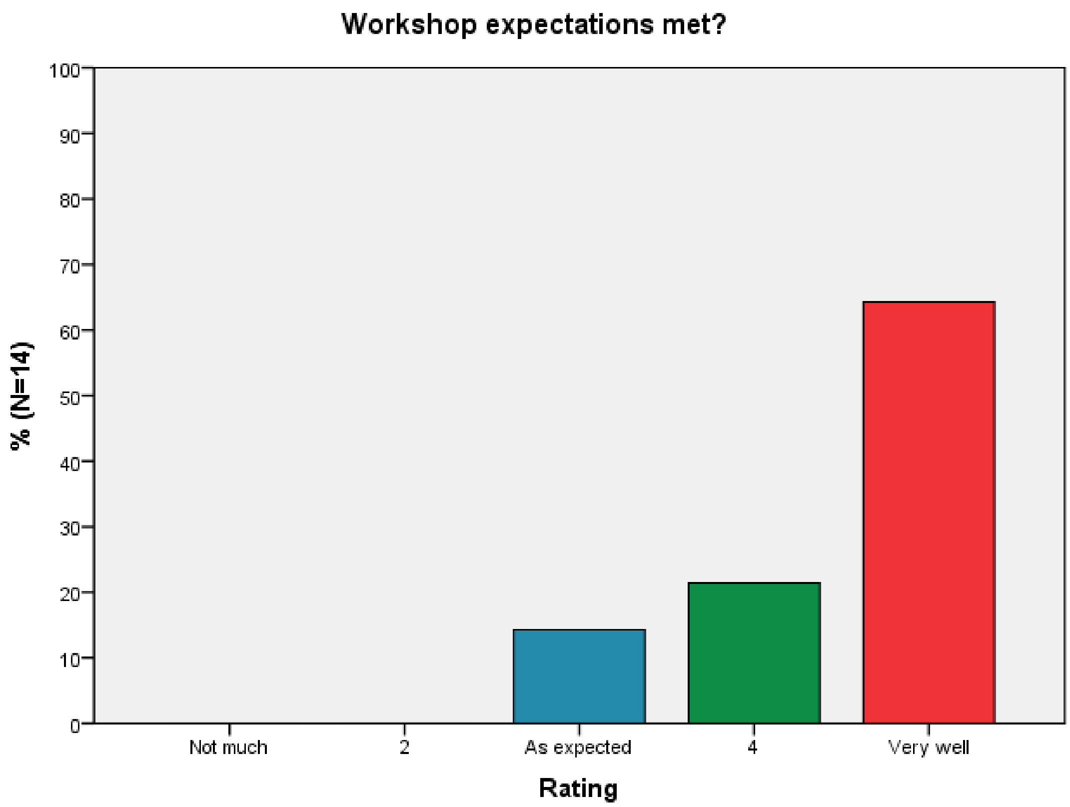
- 1. 40% indoors and 60% outdoors. 2. Activities in the classroom: 50% exposure, 50% discussion. 3. In the discussion session, each participant is given the opportunity to express their opinions.
- 1. Able to see how the practice of DRR activities (technical and social). 2. Get a lot of opportunity to learn more about the community engagement.
- 1. All the food should be labelled 'Halal'. 2. In fieldtrip activities, all participants can communicate with people who have experienced disasters. So that it can give you an idea how far ahead the disaster also destroyed the entire infrastructure. 3. In the fieldtrip, participants were given time to ask in order to absorb all the issues in the field.

- 1. Improved diet. Meal costs we suggest be given to each participant in order to buy the preferred food. 2. Should raincoats and umbrellas be provided by the committee. 3. Transfer of luggage between cities in order to be accommodated by the committee.
- 1. Involve regional head and chief secretary to ensure that policies and decisions can be implemented. 2. Regional secretary is the chief BPBD's authority that can coordinate the entire SKPD.
- 1. Involve the stakeholders. 2. Invite community or somebody who once lived in disaster prone areas. 3. The need for policies or recommendations considering the characteristics of Indonesia.
- 1. It may provide an opportunity to take a nap for about an hour. 2. Sunday were given a half holiday.
- 1. Please be prepared to eat rice at lunch time. 2. Need to engage with the executive as policy makers. 3. For the future, this program should be continuous.
- 1. Related to the conditions in our place, Agam regency, in the future need to learn about how to handle the ejected volcanic dust. 2. There should also be accompanied by a simulation for each type of disaster.
- 1. The food wherever possible in accordance with the tongue of Indonesia. 2. The next comparative study is expected to involve the Regional Head. 3. Visit the example implementation of the DRR activities physically.
- 1. The topics of Local/Community engagement need to be extended. How Maori cultural values were adopted and assimilated with the western culture and hand in hand to build a resilient community is an interesting topic. 2. The planning, budgeting, and political process in terms of governance role division (SW + 1H) among (central, provincial and districts) is assured to bring a new paradigm to Indonesian officials. NZ has a different system with Indonesia, however, the principles of governance is the same. The similarities and differences needs to be deepened to get the foundation of policy making process to give the audience a better understanding about input - process - output - evaluation related to DRR.
- 1. Workshop materials will be distributed to participants at least one week before leaving in terms of soft file. 2. Needing support from other references to enrich problem mastering such as regulations and national policy. 3. The disaster risk decreasing forum is needed to establish that consist of comparative study participants.
- Build understanding of local government more concerned with disaster management in total involving the synergy of the three parties (government, public and business)
- More time for discussion.
- Need to consider the local weather when it's changing rapidly.
- Participants are divided into groups corresponding to the background, for example, engineering group and socio-cultural group.

2016 NZ Post workshop questionnaire Extension Segment tables and graphs

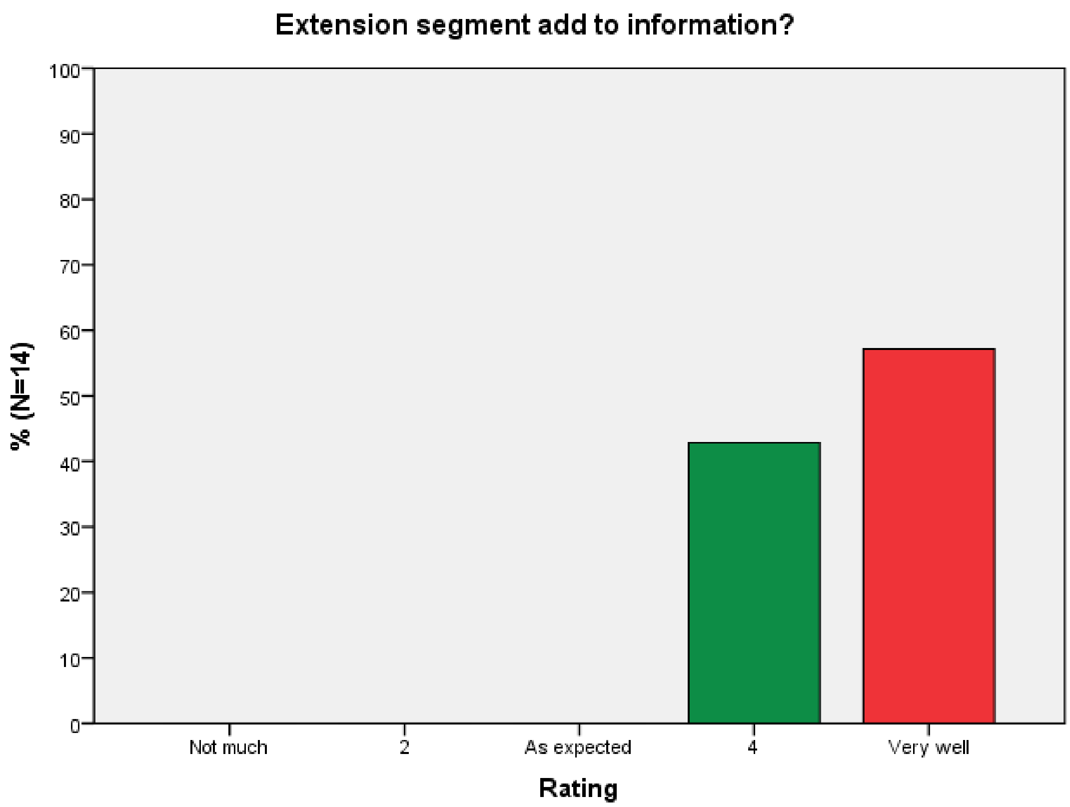
Q1. How well did the *Extension* workshop meet your expectations in the knowledge or information areas/topics that you thought were important? (*Please circle the score that you think is most appropriate*)

	Count	Table N %
Not much	0	0.0
2	0	0.0
As expected	2	14.3
4	3	21.4
Very well	9	64.3
Total	14	100.0



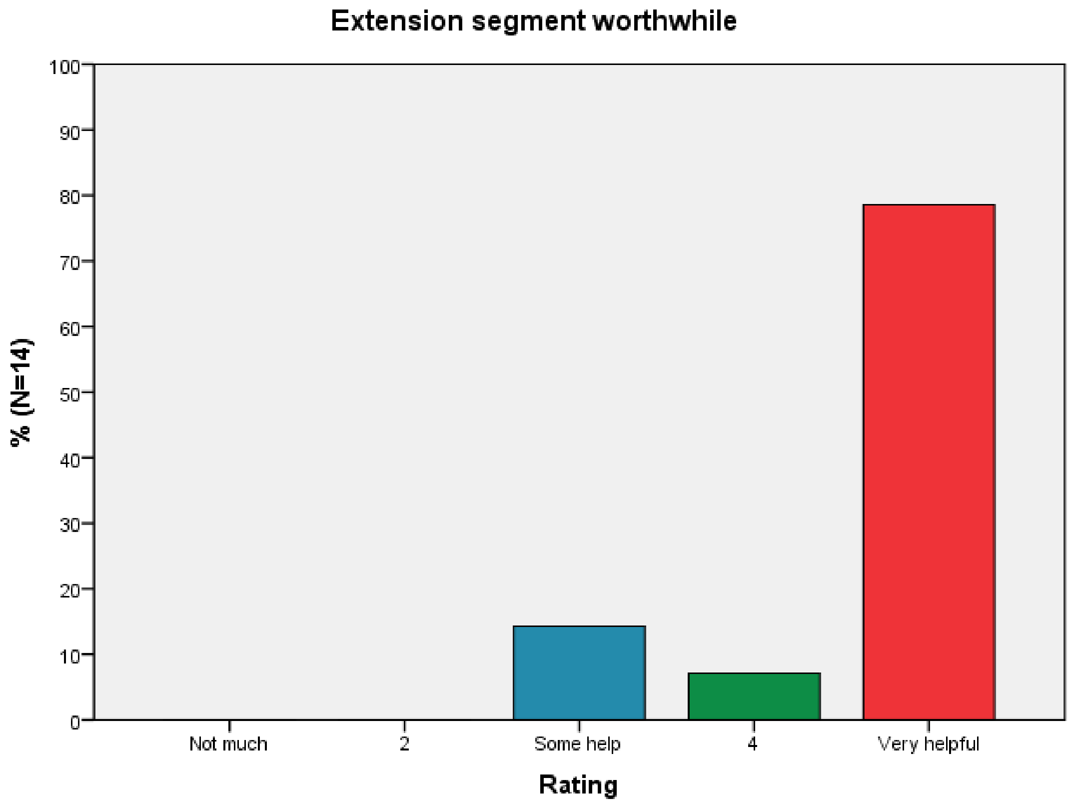
Q2a Did the *Extension* segment add to the information you learned from the *Local Government* segment?
(*Please circle the score that you think is most appropriate*)

	Count	Table N %
Not much	0	0.0
2	0	0.0
As expected	0	0.0
4	6	42.9
Very well	8	57.1
Total	14	100.0



Q2b. Has the *Extension* segment been a worthwhile addition to the overall Comparative Study Visit? (*Please circle the score that you think is most appropriate*)

	Count	Table N %
No	0	0.0
2	0	0.0
Neutral	2	14.3
4	1	7.1
Yes	11	78.6
Total	14	100.0

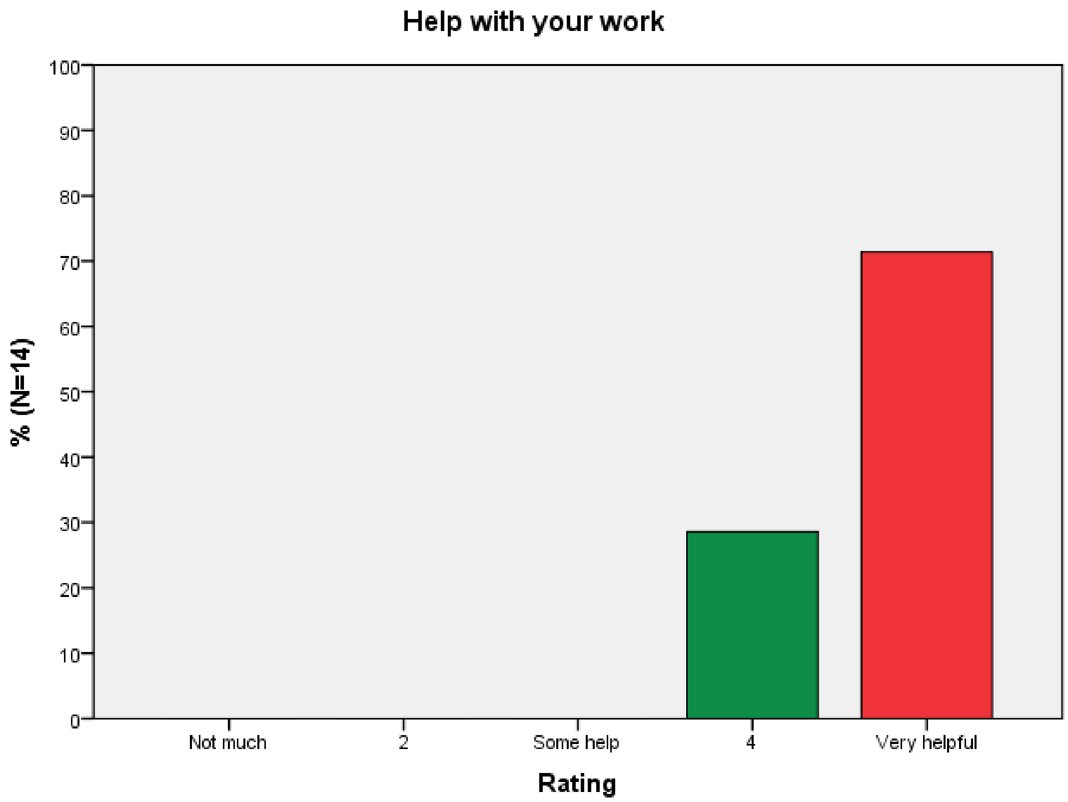


Q3a. What were the major learnings you gained from the *Extension* segment?

- 1. Collaborative research of DRR in every stakeholders. 2. RiskScape.
- 1. Community engagement of risk disaster reduction. 2. Risk modelling.
- 1. GeoNet as data sources. 2. RiskScape for local government.
- 1. Learning how a big project like 'It's our Fault', Devora and ECLAB could manage a joint funding, collaboration of all stakeholders etc. 2. RiskScape training - next step.
- 1. Management risk of disaster
- 1. RiskScape
- 1. RiskScape tutorial. 2. Risk communication.
- 1. Sister city/ Fault city. 2. Collaboration with researchers.
- 1. Strengthening and repairing structures (Richard Sharpe). 2. University contribution to StIRRRD project. 3. Liquefaction.
- 1. The collaboration between disaster-related institutions. 2. Council role (government)
- 1. The program from different agency, 'It's Our Fault, EC Lab, Devora, Hawkes Bay, got support from government and other agencies.
- 1. The role of university in supporting local government and community in DRR projects.
- 1. Understanding risk communication - risk language. 2. Hazard and risk research to practice. 3. University involvement.

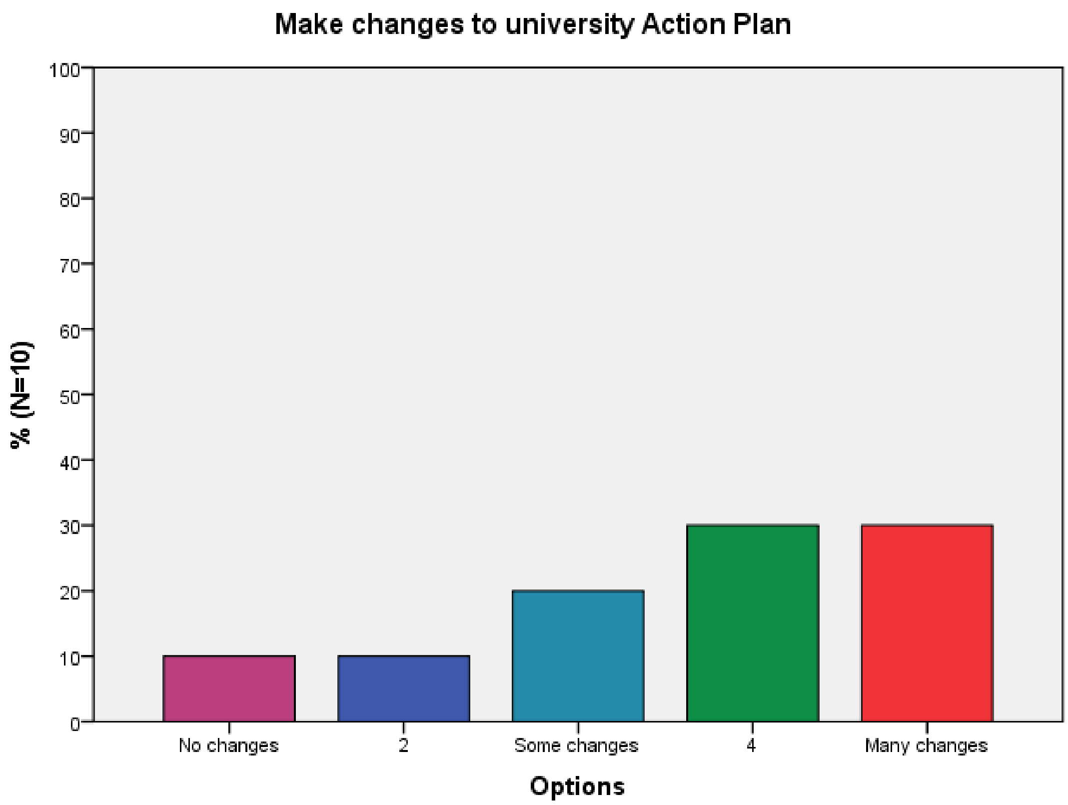
Q3b. How much will these learnings help you with your work? *(Please circle the score that you think is most appropriate)*

	Count	Table N %
Not much	0	0.0
2	0	0.0
Some help	0	0.0
4	4	28.6
Very helpful	10	71.4
Total	14	100.0



Q4a. Did you make changes to your *university* DRR Action Plan as a result of any part of the comparative study programme? *(Please circle the score that you think is most appropriate)*

	Count	Table N %
No changes	1	10.0
2	1	10.0
Some changes	2	20.0
4	3	30.0
Many changes	3	30.0
Total	10	100.0



Q4b. If changes were made, what were some of these?

- 1. Development of RiskScape for each local government. 2. GeoNet
- 1. Establishing a collaboration with national and local government institutions - with joint funding and sharing the responsibility.
- 1. Hazard map. 2. Final project undergraduate student to combine DRR programme.
- 1. Use RiskScape to help make business cases to local government (e.g. present BPBD budget)
- 1. How to encourage the capacity building.

- 1. Socialization of Disaster management
- 1. The university roles and partnership with local government.

Q5a. What topic areas did you find the most useful?

- 1. Build good communication to local government
- 1. Collaborative research. 2. RiskScape. 3. GeoNet.
- 1. Community education and engagement. 2. Partnership and consultation.
- 1. Early warning system as tool to educate community about hazard. 2. RiskScape training (although the time was too short).
- 1. GeoNet. 2. Infrastructure and earthquakes. 3. Hazard and risk research to practice.
- 1. Liquefaction. 2. Rockfall. 3. University contribution to DRR programme.
- 1. Multi-stakeholders hazard and risk research. 2. Risk modelling and RiskScape.
- 1. Risk Analysis. 2. University/research agency
- 1. Risk Maps
- 1. RiskScape. 2. GeoNet.
- 1. Social sciences. 2. RiskScape.
- 1. All
- 1. Risk language.

Q5b. What topic areas did you find the least useful?

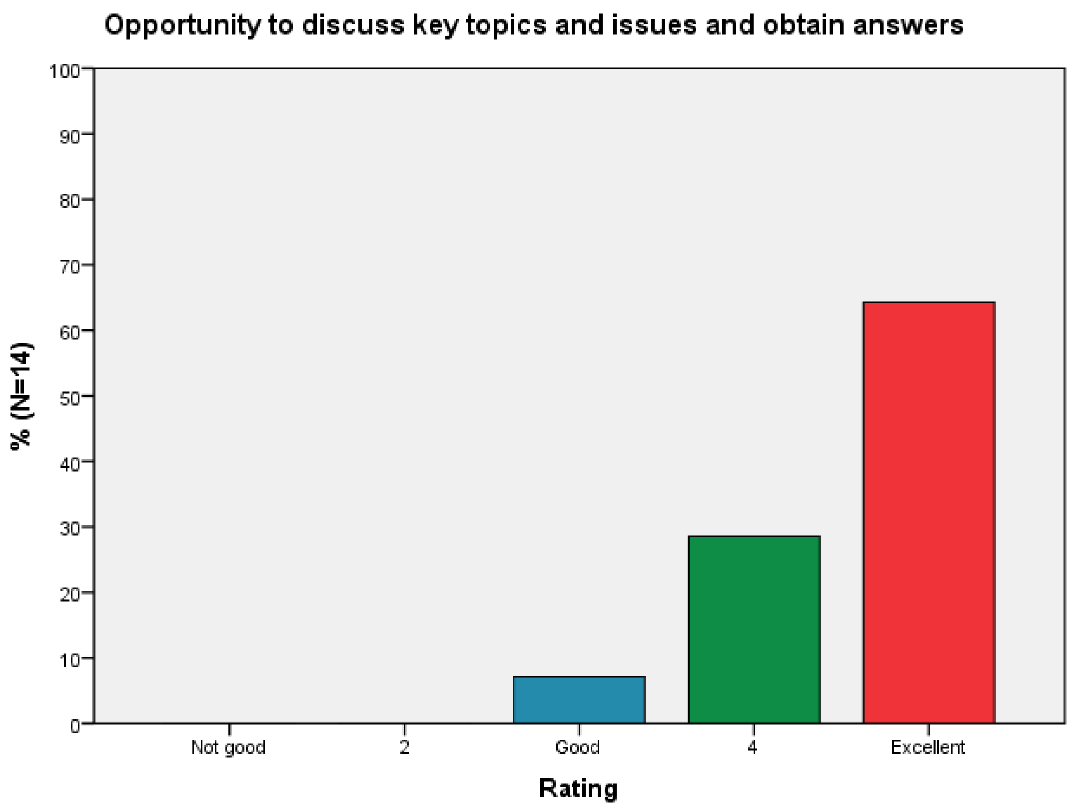
- None
- None
- Risk management

Q5c. What topic areas would you have liked more of?

- 1. Multi-stakeholders hazard and risk research. 2. How it works? What is the mechanism? How to initiate? What are the obstacles?
- 1. RiskScape training. 2. Community engagement and communication.
- Cultural differences and how to involve it in DRR.
- Cultural differences and impact on approaches for DR (e.g. include transmigration info)
- Educating people all levels including government staff.
- Risk management
- RiskScape
- Try to retrieve some data from GeoNet.

Q6. How good was the opportunity to discuss key topics and issues and obtain answers to your questions? (*Please circle the score that you think is most appropriate*)

	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	1	17.1
4	4	28.6
Excellent	9	64.3
Total	14	100.0



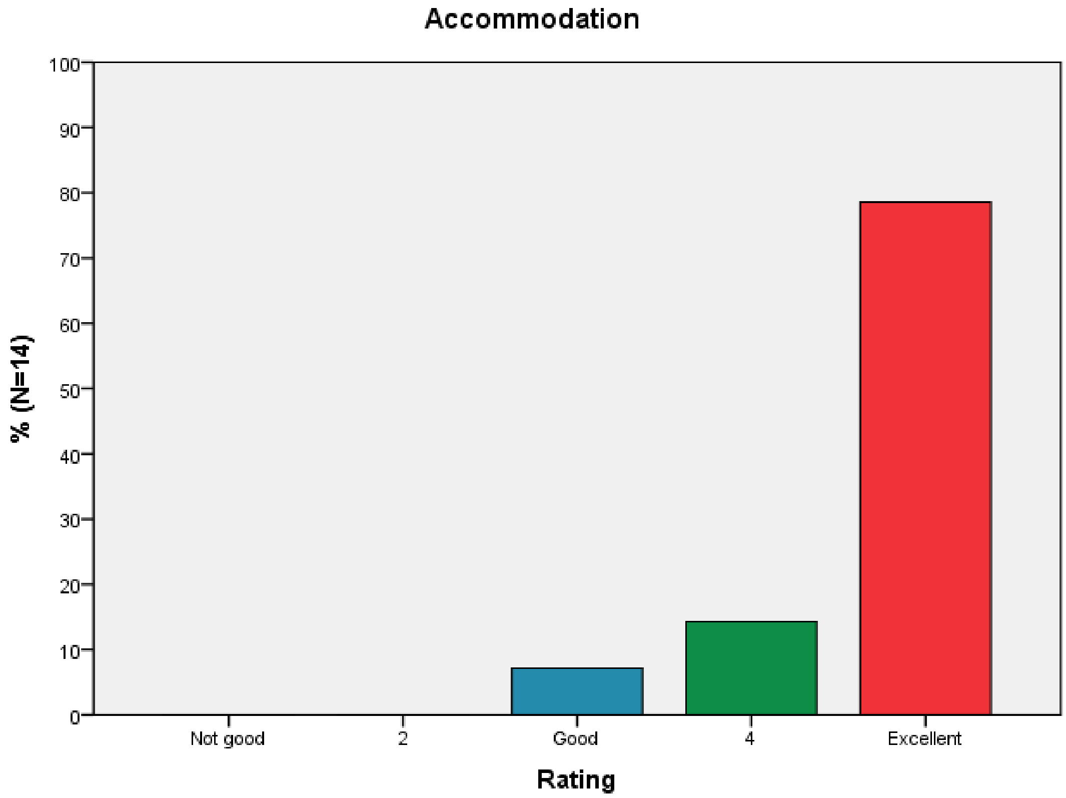
Q7. How good were the workshop logistics? *(Please tick the score that you think is most appropriate)*

		Count	Table N %
Accommodation	Not good	0	0.0
	2	0	0.0
	Good	1	7.1
	4	2	14.3
	Excellent	11	78.6
Presentation room	Not good	0	0.0
	2	0	0.0
	Good	0	0.0
	4	2	14.3
	Excellent	12	85.7
Course materials	Not good	0	0.0
	2	0	0.0
	Good	0	0.0
	4	2	14.3
	Excellent	12	85.7
Translation	Not good	0	0.0
	2	0	0.0
	Good	0	0.0
	4	4	30.8
	Excellent	9	69.2
Catering	Not good	0	0.0
	2	0	0.0
	Good	0	0.0
	4	4	28.6
	Excellent	10	71.4

Q7. How good were the workshop logistics? Accommodation (*Please tick the score that you think is most appropriate*)

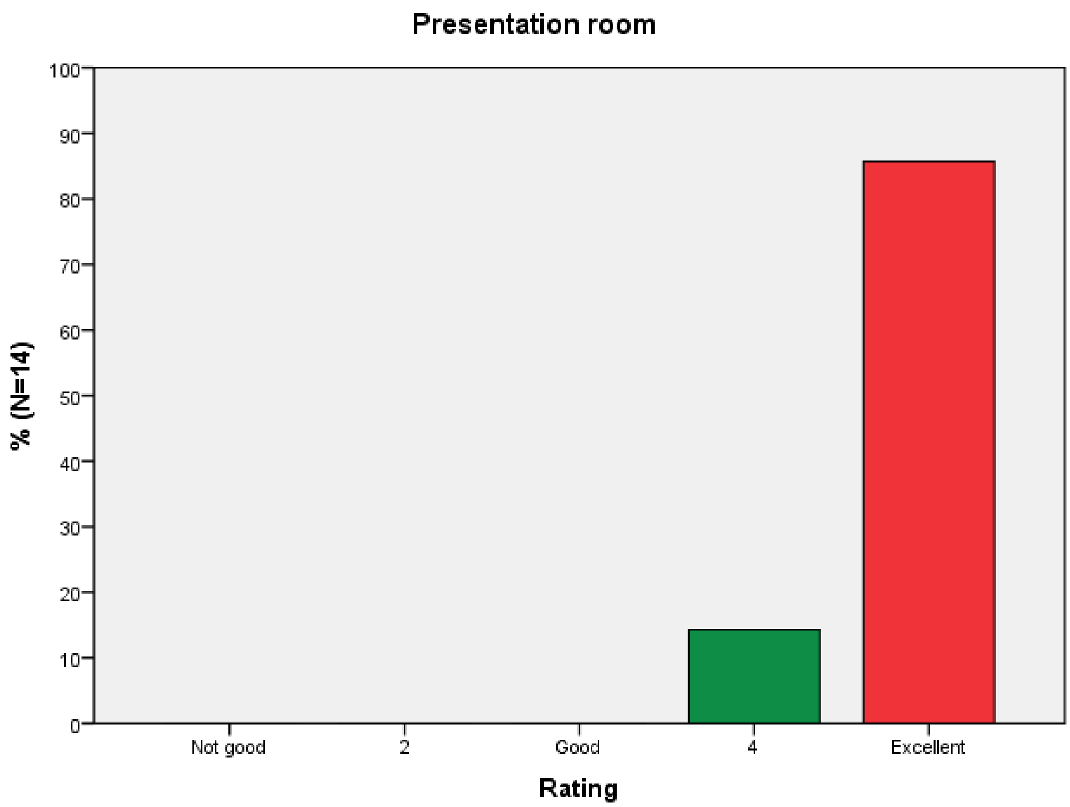
	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	1	7.1
4	2	14.3
Excellent	11	78.6

Total	14	100.0



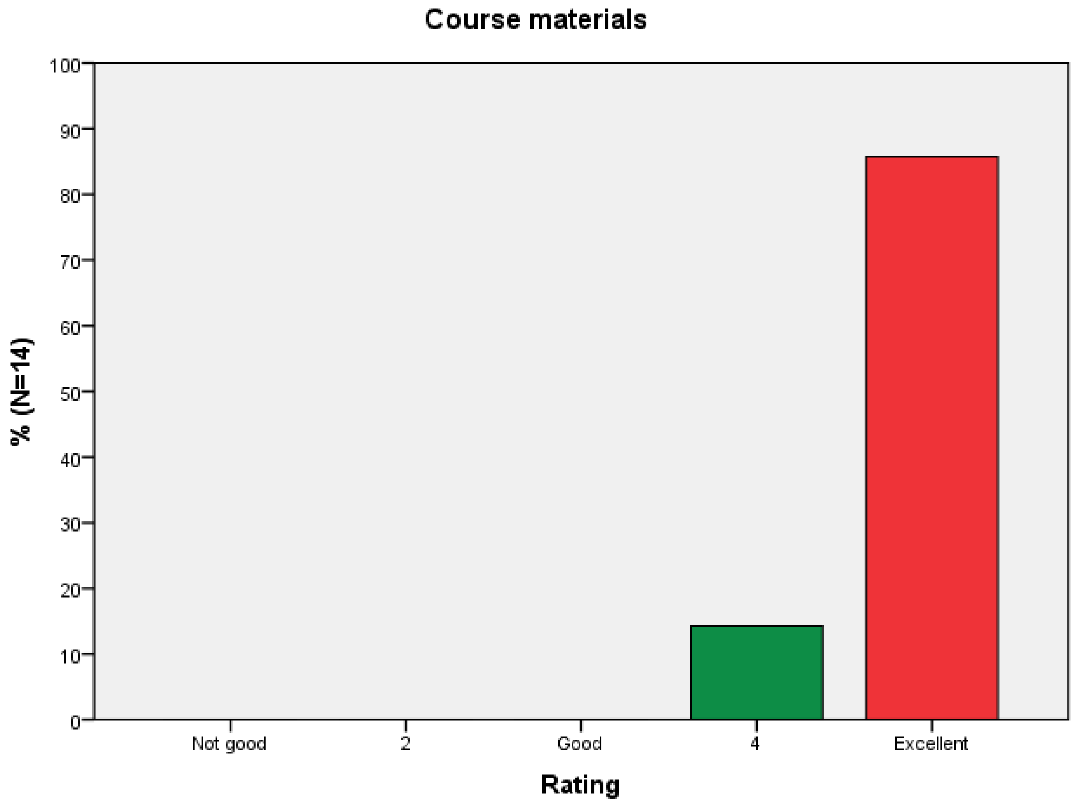
Q7. How good were the workshop logistics? Presentation room (*Please tick the score that you think is most appropriate*)

	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	0	0.0
4	2	14.3
Excellent	12	85.7
Total	14	100.0



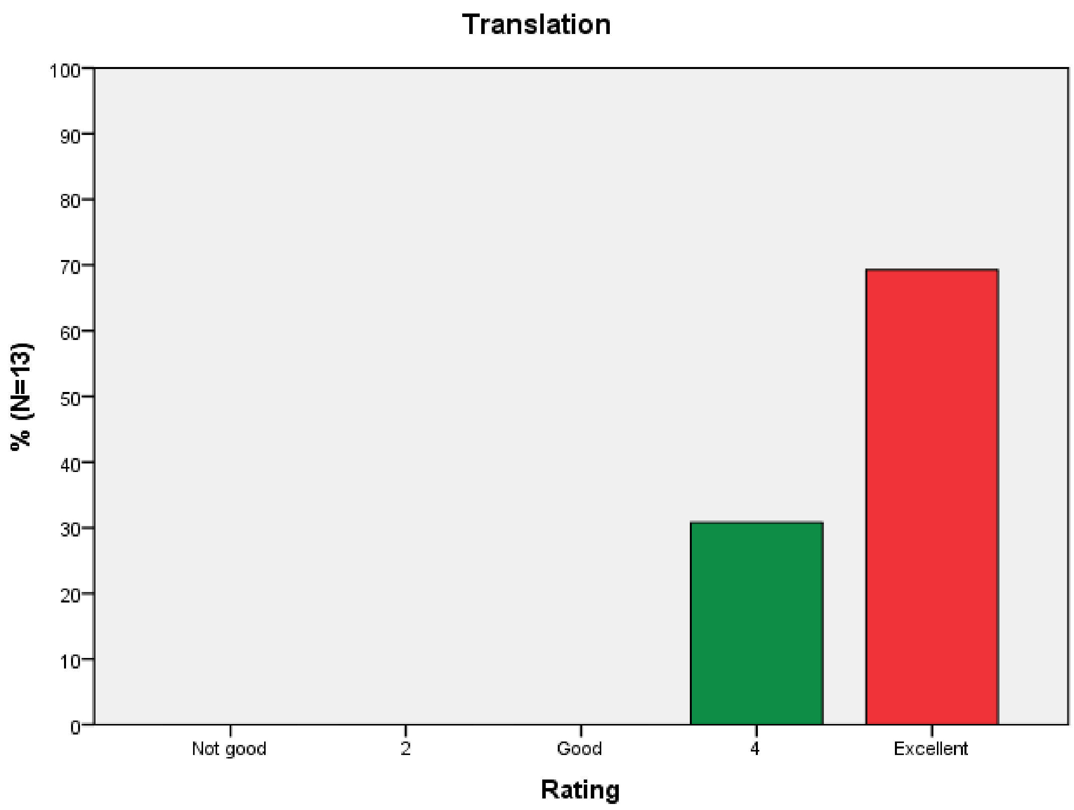
Q7. How good were the workshop logistics? Course materials (*Please tick the score that you think is most appropriate*)

	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	0	0.0
4	2	14.3
Excellent	12	85.7
Total	14	100.0



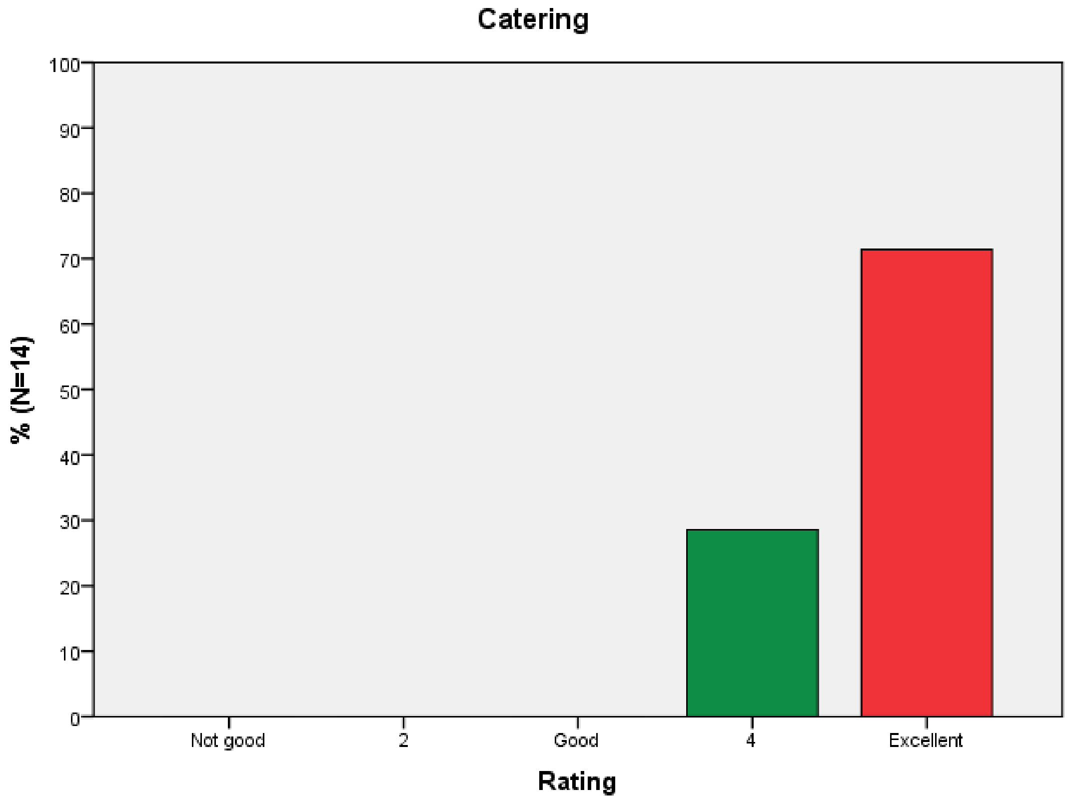
Q7. How good were the workshop logistics? Translation (*Please tick the score that you think is most appropriate*)

	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	0	0.0
4	4	30.8
Excellent	9	69.2
Total	13	100.0



Q7. How good were the workshop logistics? Catering (*Please tick the score that you think is most appropriate*)

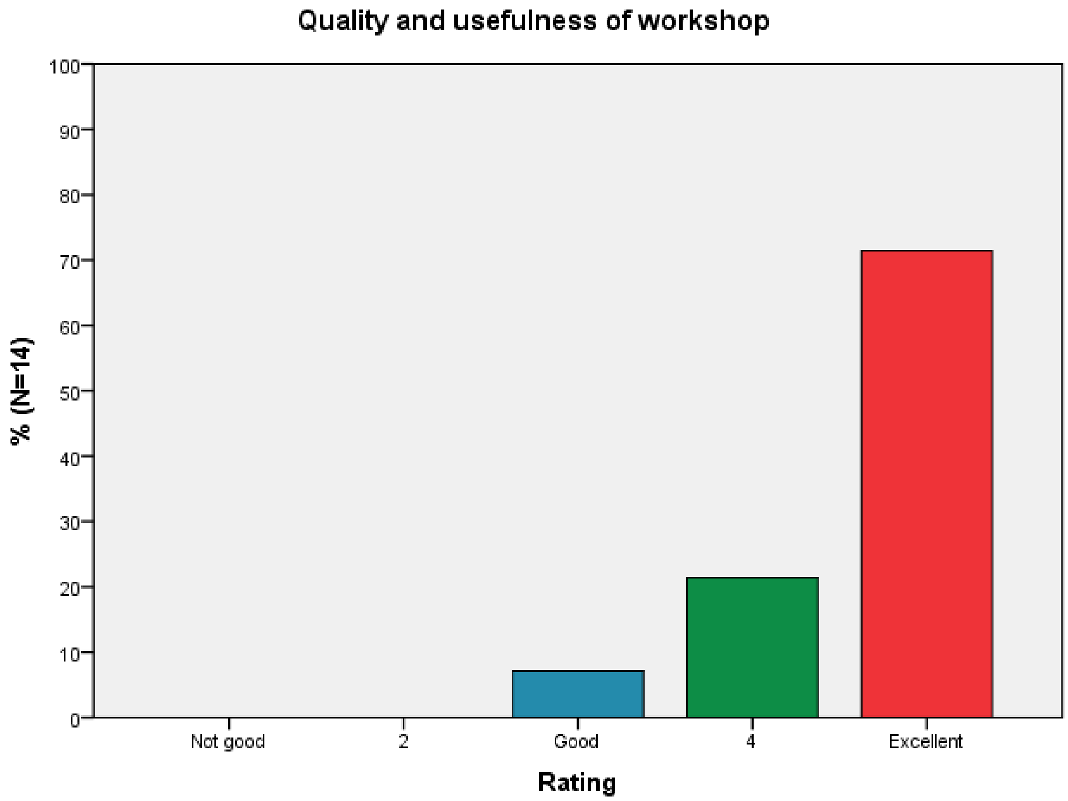
	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	0	0.0
4	4	28.6
Excellent	10	71.4
Total	14	100.0



Catering
% (N=14)
100
90
80
70
60
50
40
30
20
10
0
Not good
2
Good
4
Excellent
Rating

Q8. Overall how would you rate the quality and usefulness of this workshop? *(Please tick or circle the score that you think is most appropriate)*

	Count	Table N %
Not good	0	0.0
2	0	0.0
Good	1	7.1
4	3	21.4
Excellent	10	71.4
Total	14	100.0



Q9. Do you have any comments that would help us improve future comparative study programmes?

- 1. Some material for local government (policies). 2. Should be given to local government groups so they learn.
- Consideration of time schedule.
- Few RiskScape practice.
- Maybe more time for discussion (less packed programme).
- More time for exploring the laboratory.
- Much better for future.
- Will there be another one, please?