Let’s Talk about Earthquakes: Wellington Edition

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What is this presentation about?

- Who we are
- Why we study earthquakes
- Wellington's "It's Our Fault" project
- Lessons from Christchurch

- but first a survey….and a short movie

What is the "*It's Our Fault*" project?

- To see Wellington positioned to become a more resilient city through a comprehensive study of the likelihood of large Wellington earthquakes, the effects of these earthquakes, and their impacts on humans and the built environment
- ***Translation*: to understand the potential for earthquakes so we can strengthen Wellington**

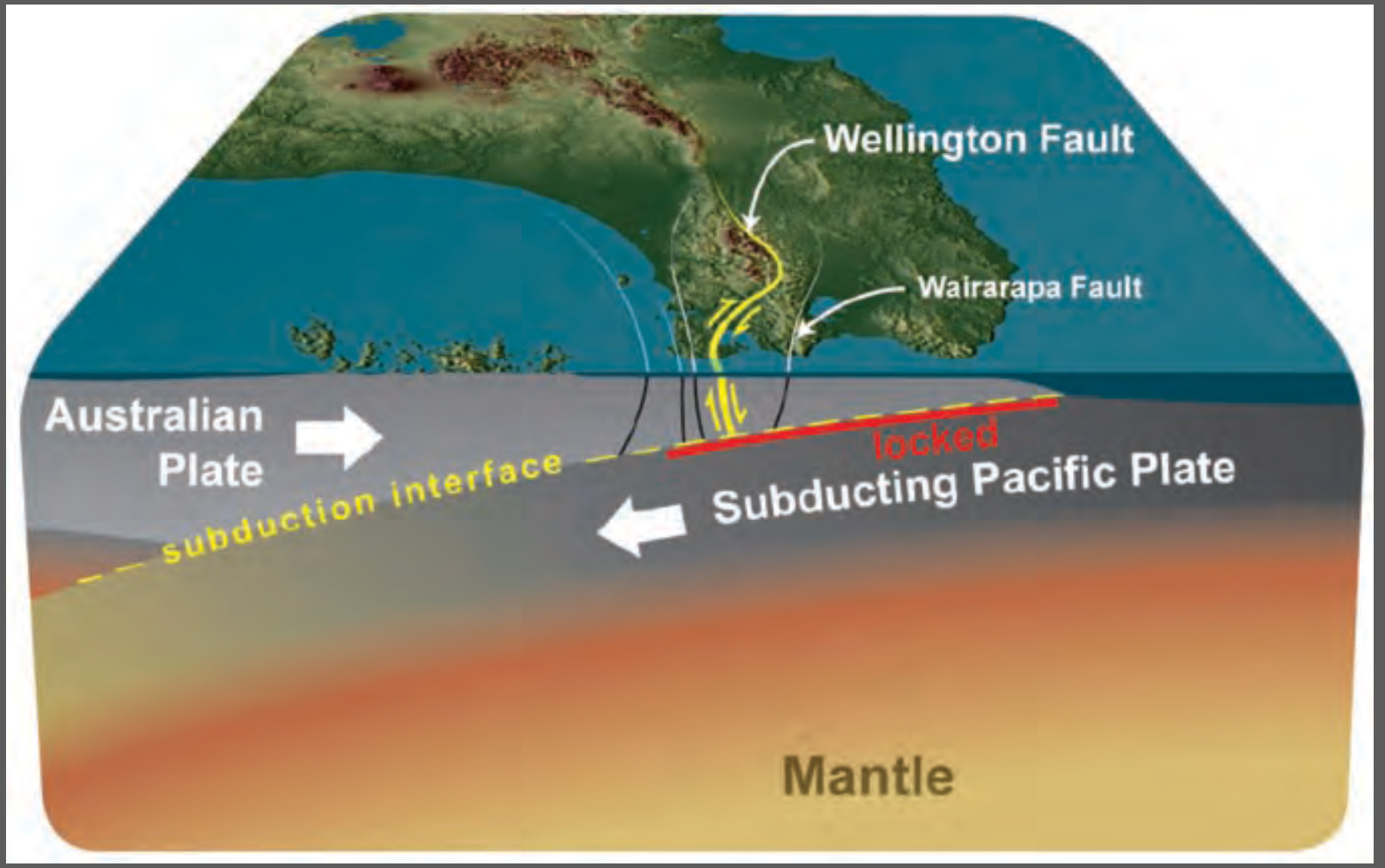
EQC EARTHQUAKE COMMISSION

NHRP

Absolutely Positively Wellington!

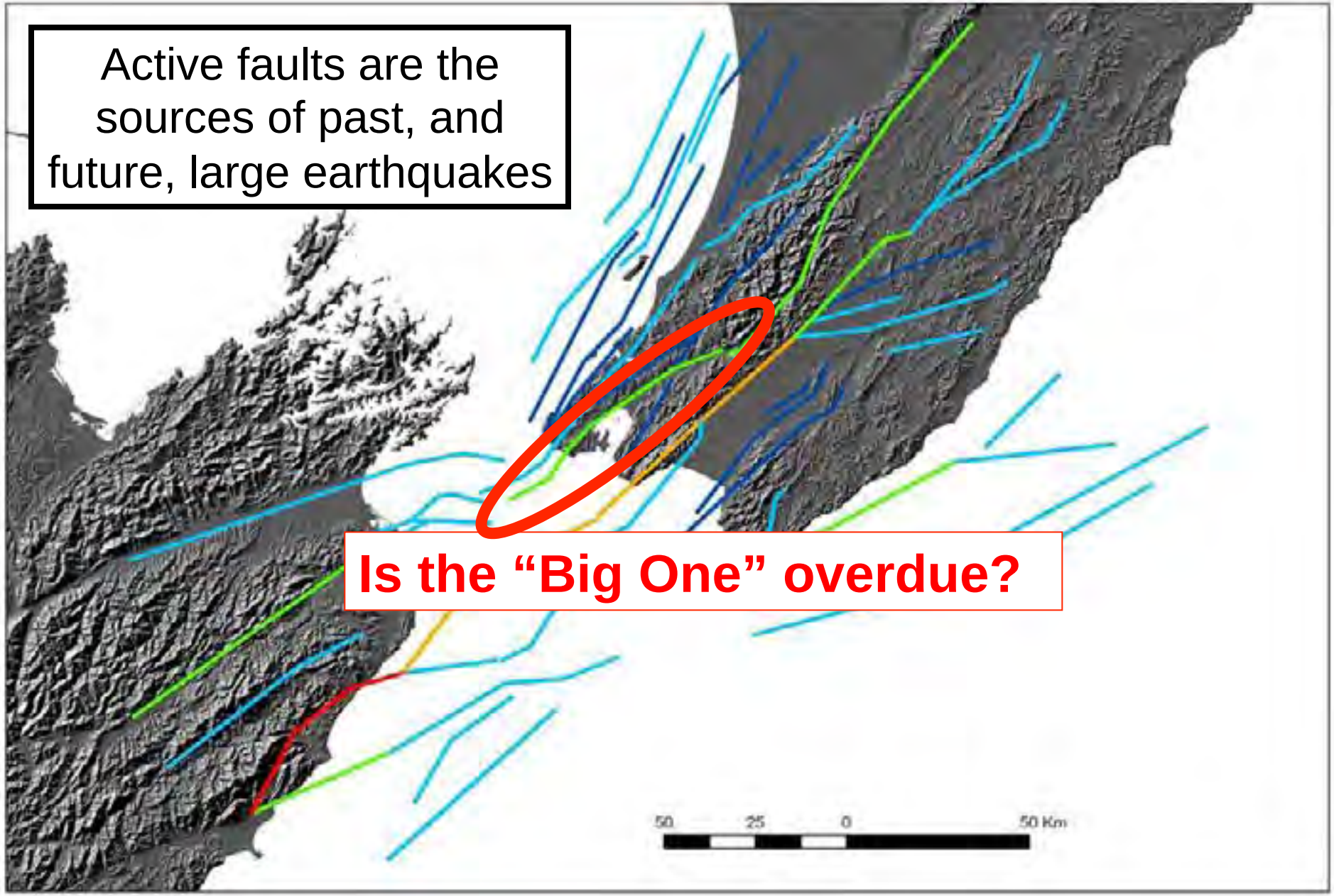
greater WELLINGTON REGIONAL COUNCIL

Wellington's Earthquake Setting



Wellington's Earthquake Setting

Simplified Active Fault Map of Region



Wellington Fault:
Digging up past big earthquakes

Long Gully Station on South Coast
- Te Kopahou trench site for It's Our Fault

Wellington Fault: Conditional Probability of Rupture

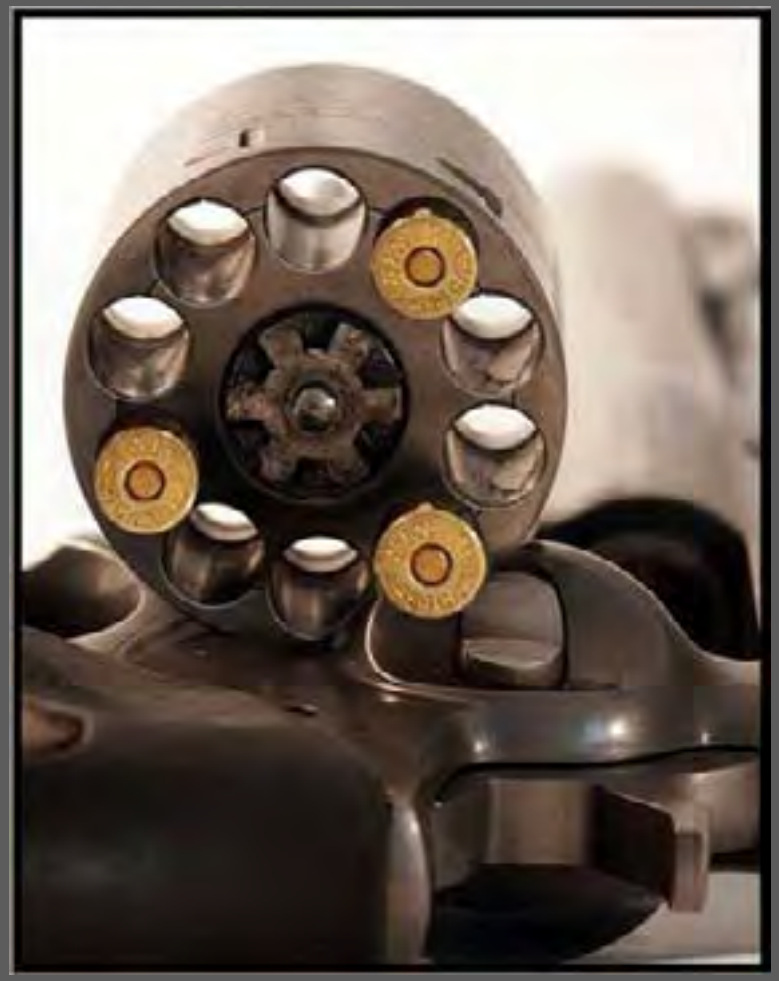
Likelihood of a really big earthquake on the Wellington Fault
(accounting for)

- Elapsed time since most recent rupture
  - Slightly younger than previously thought (*~ 300 years ago*)
- Timing of older ruptures
  - Slightly less frequent than previously thought (*~ every 800-1000 years*)
- Single event displacement size
  - Slightly larger than previously thought *(~ 5 m per rupture*)
- Slip rate
  - Slightly slower than previously thought (*~6 mm/year*)
- Rupture statistics of the Wellington-Wairarapa fault pair in a synthetic earthquake catalogue derived from a physics-based numerical model
  - Rupture of nearby Wairarapa Fault “unloads” Wellington Fault
- Various recurrence-time models

Exponential, Lognormal, Weibull, inverse Gaussian

Results: Likelihood of rupture of *Wellington Fault* within next 100 years

Pre-It's Our Fault: ~ 30%



New: ~ 10%

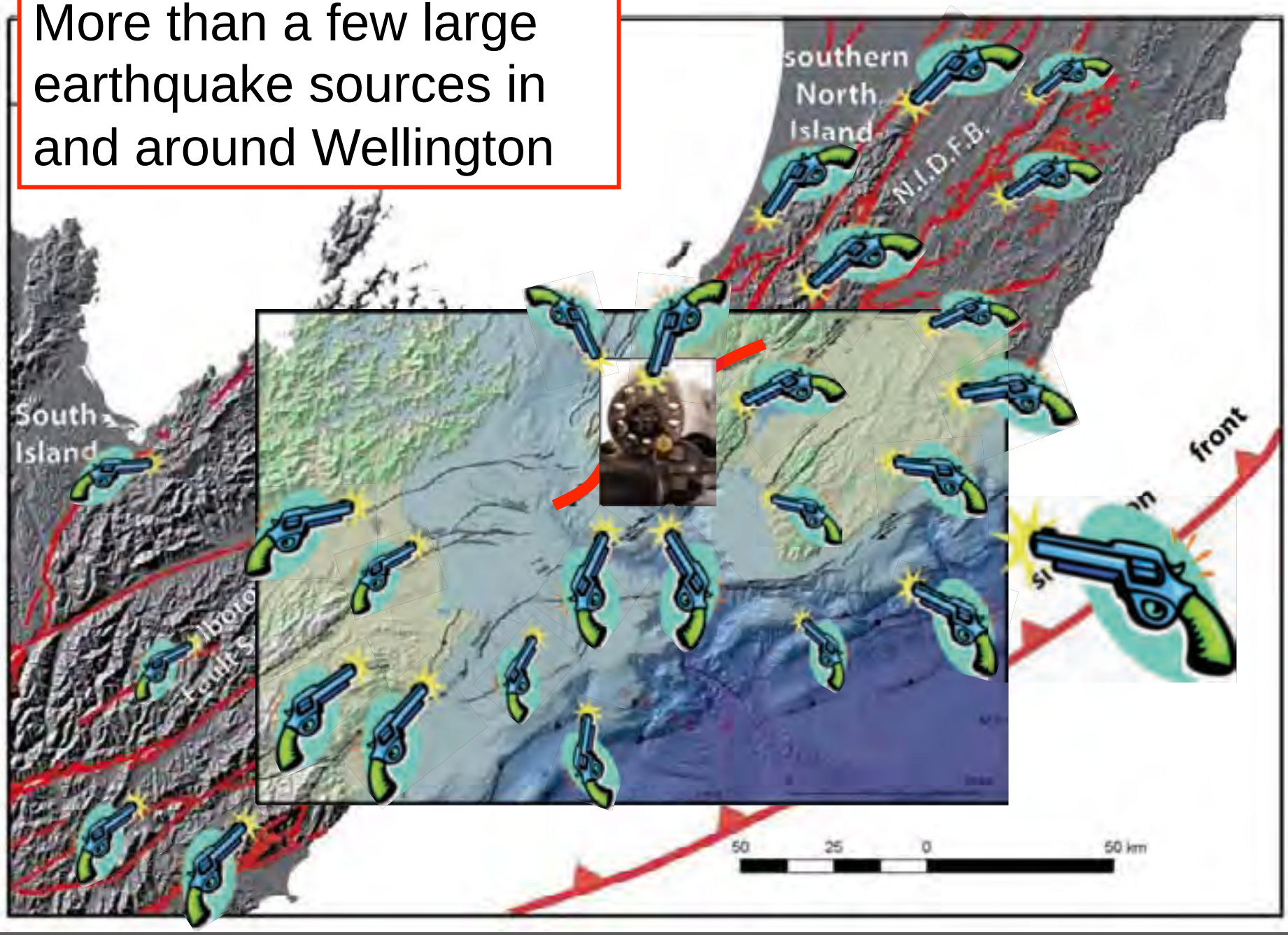
It's Our Fault – key Likelihood conclusion

- Significant reduction in the likelihood of a really big earthquake on the Wellington Fault over the next hundred years.

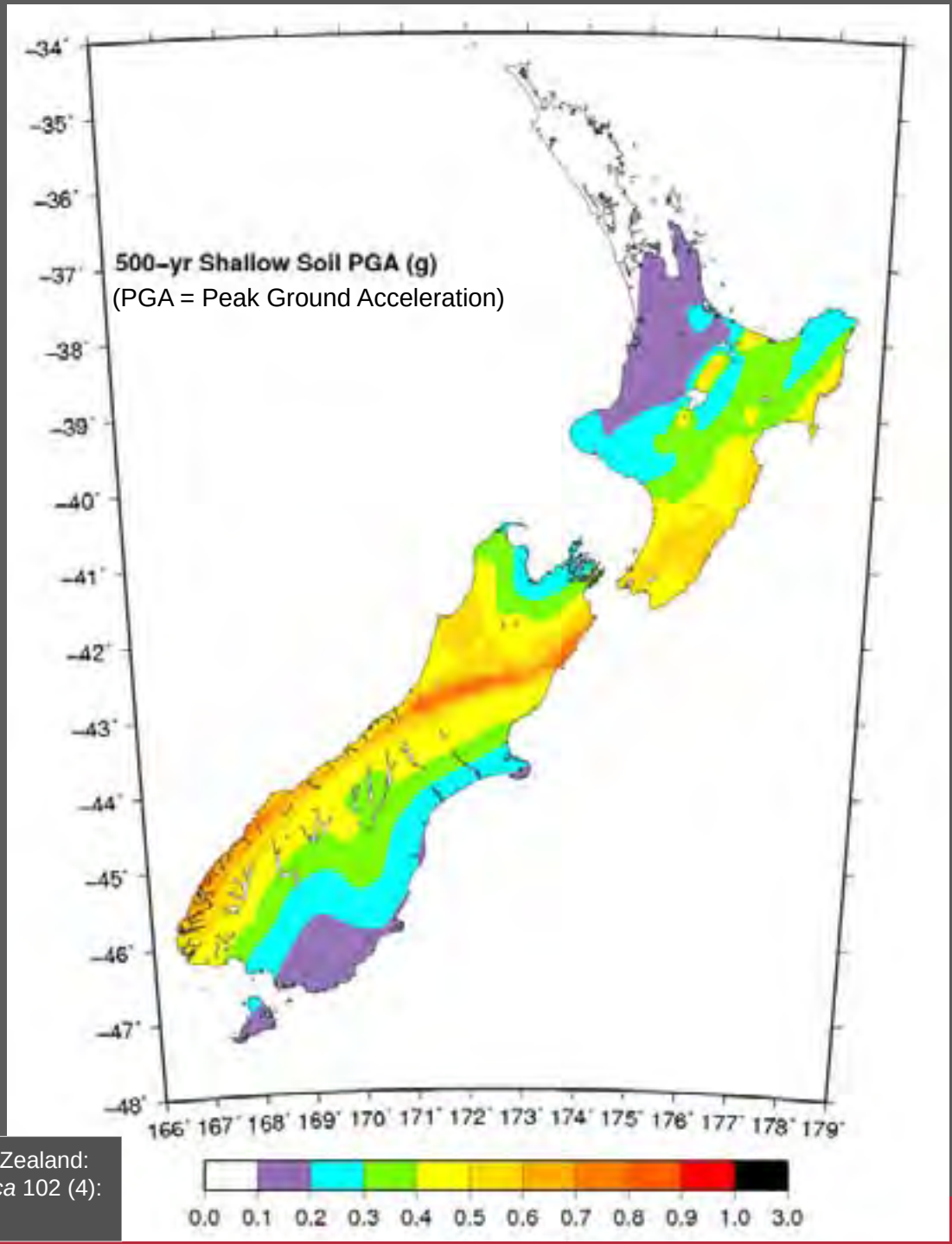
This is Good News!!!

- **However, no room for complacency**. There are other earthquake sources in, and around, the region that can produce significant damage and loss.

More than a few large earthquake sources in and around Wellington



Time averaged ground shaking hazard



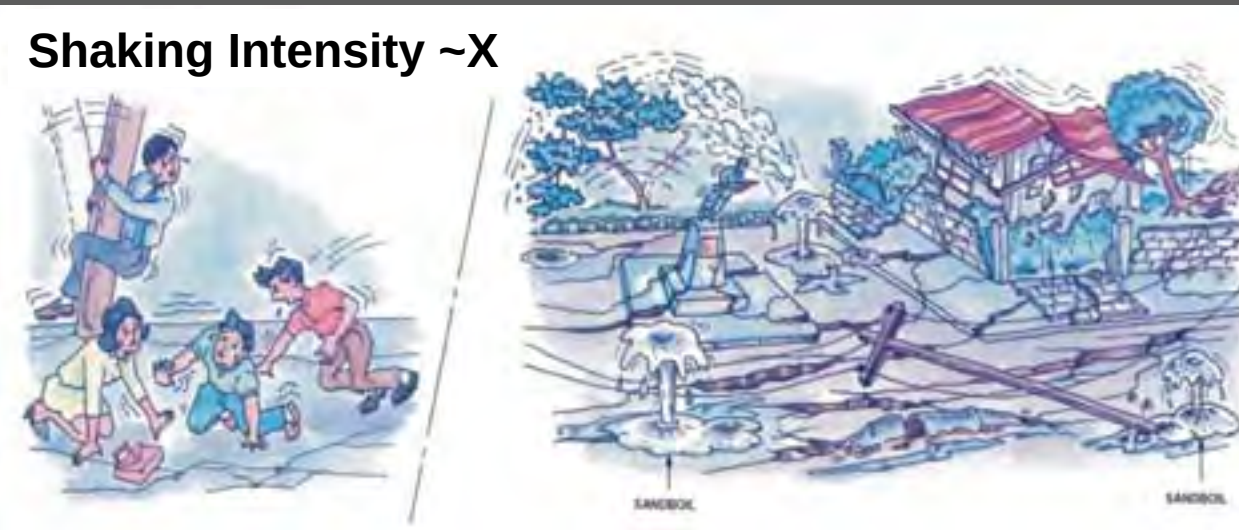
From: Stirling et al., 2012, National seismic hazard model for New Zealand: 2010 update. *Bulletin of the Seismological Society of America* 102 (4): 1514-1542.

Return time of ***shaking*** in Wellington
(Modified Mercalli Intensity shaking)

Shaking Intensity	Return Period (years)
VII	30
VIII	120
IX	400
X	1350

Shaking Intensity ~VII

Shaking Intensity ~X



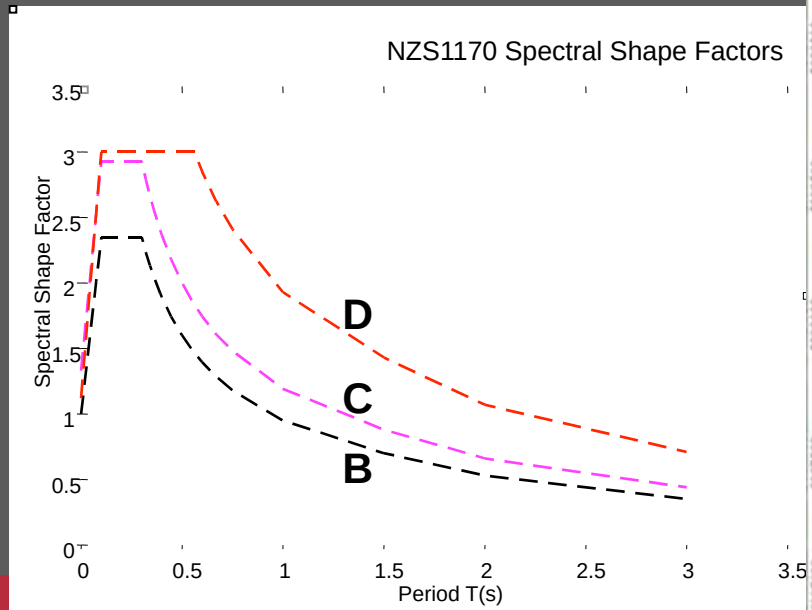
What would happen in a big earthquake in Wellington? Let's look at Christchurch:

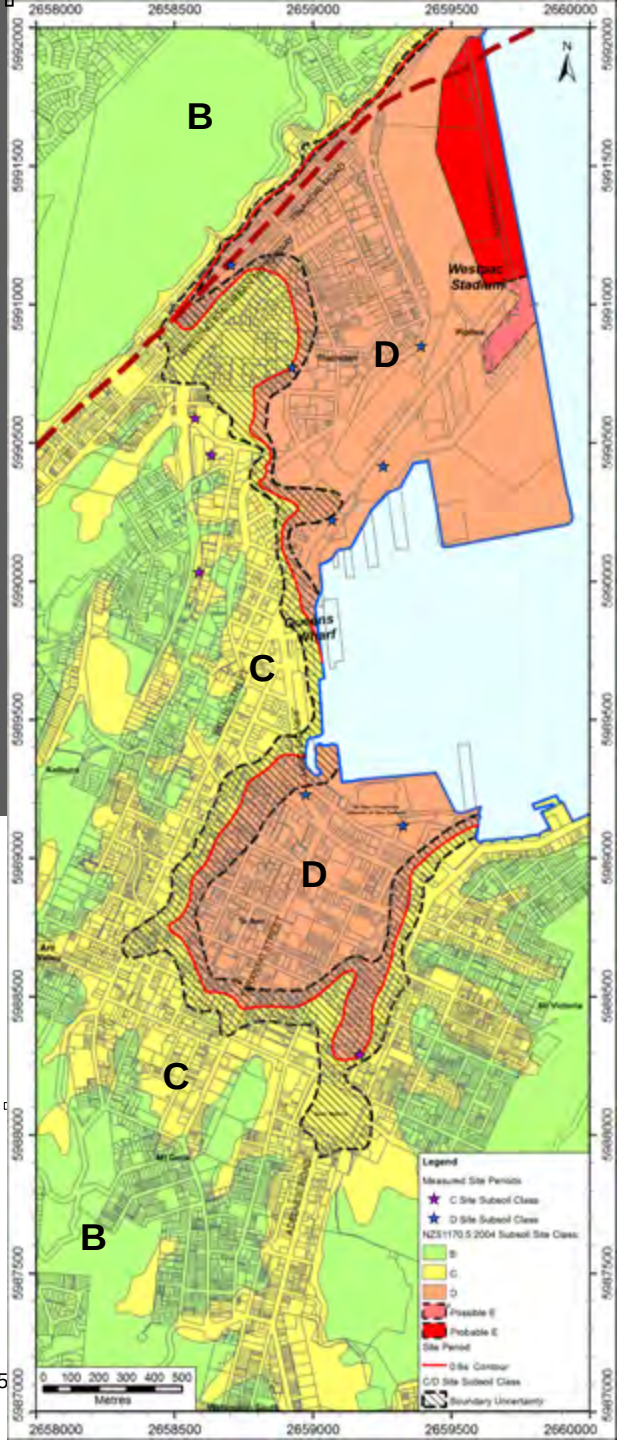
- Ground Shaking
- Liquefaction (including lateral spreading)
- Slope Failure
- Surface Fault Rupture (including tectonic tilting)
- Tsunami

Areas affected by permanent ground deformation, as well as strong ground shaking, suffer greater levels of damage and loss

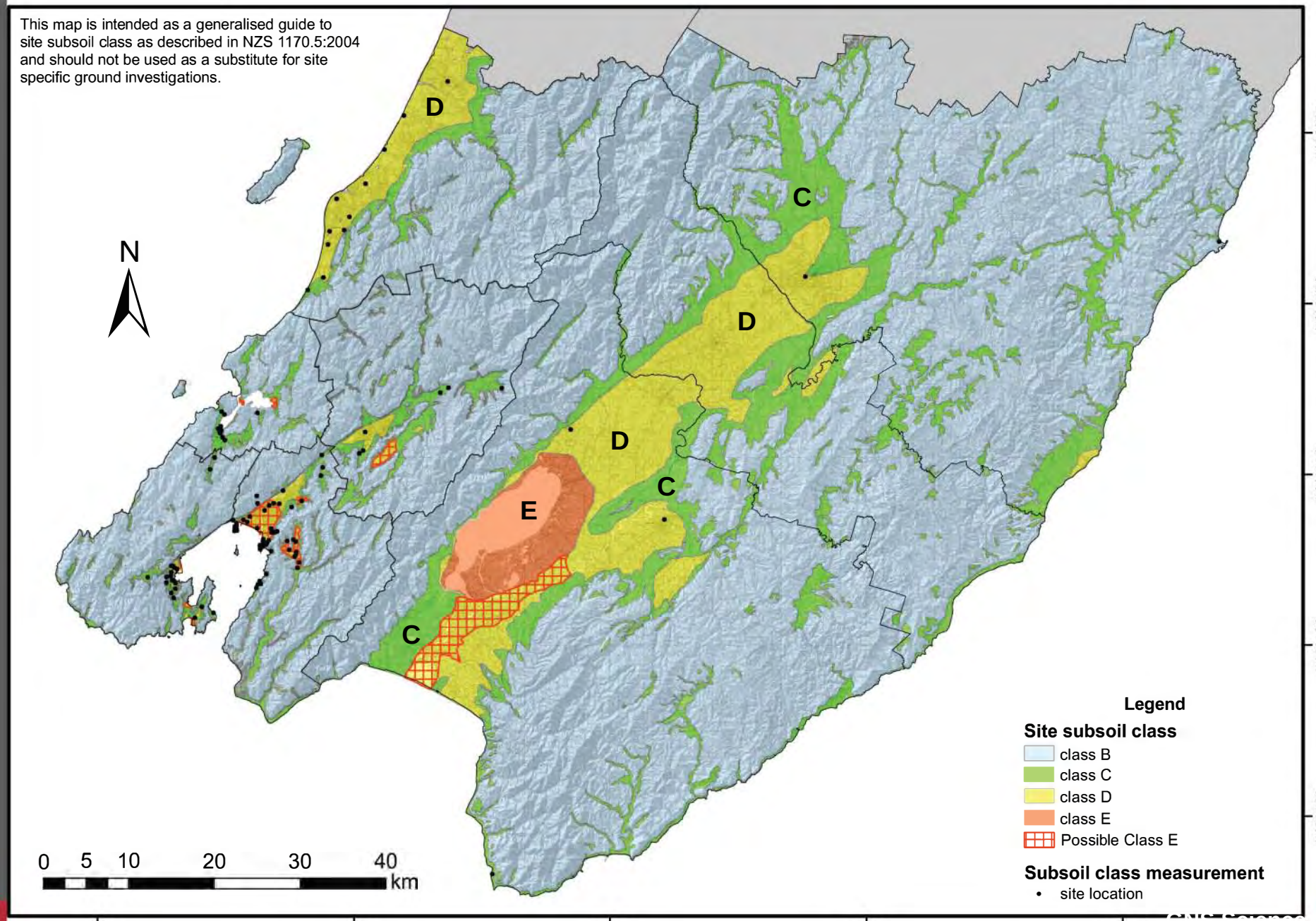
Ground Shaking

Not all ground is created equal & how we deal with it





Wellington Region site subsoil classes

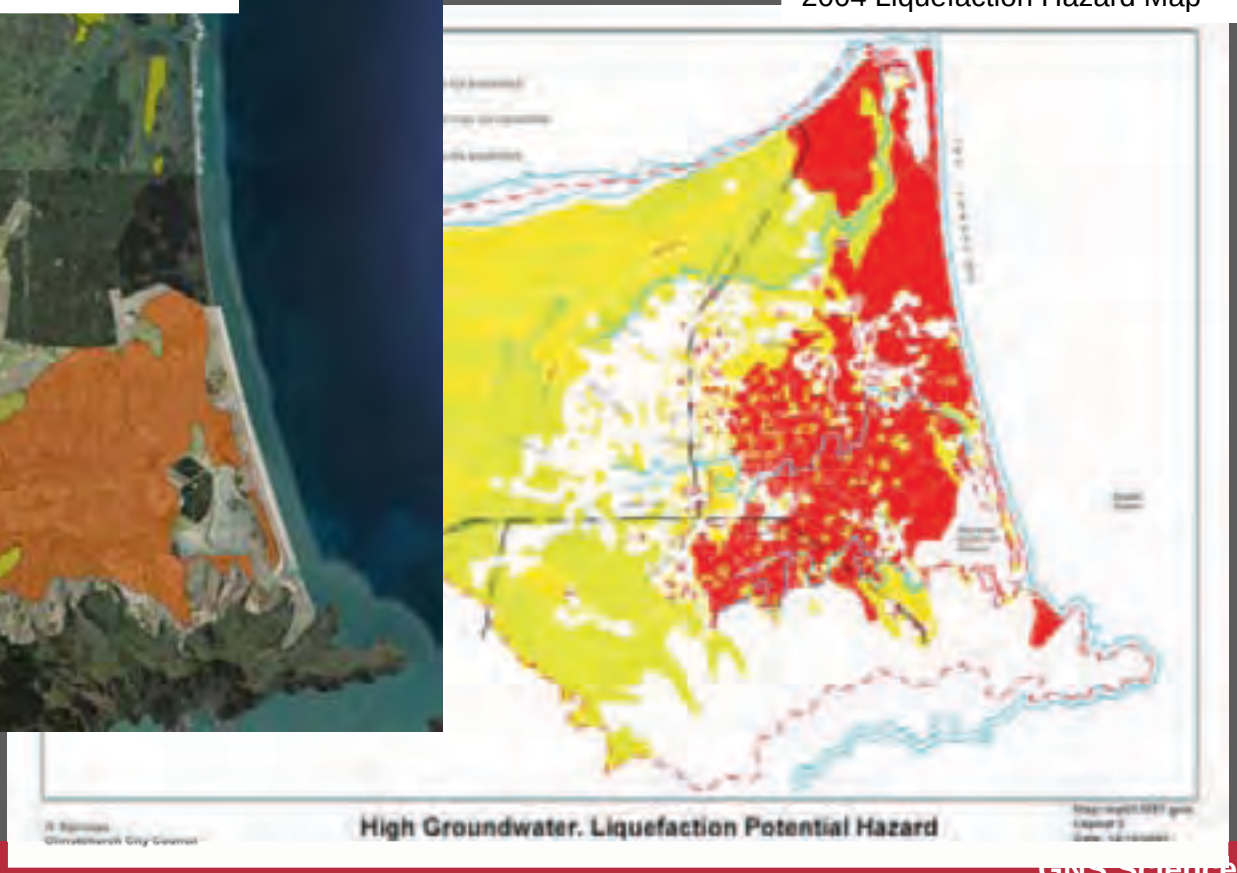


Liquefaction (in CHCH)

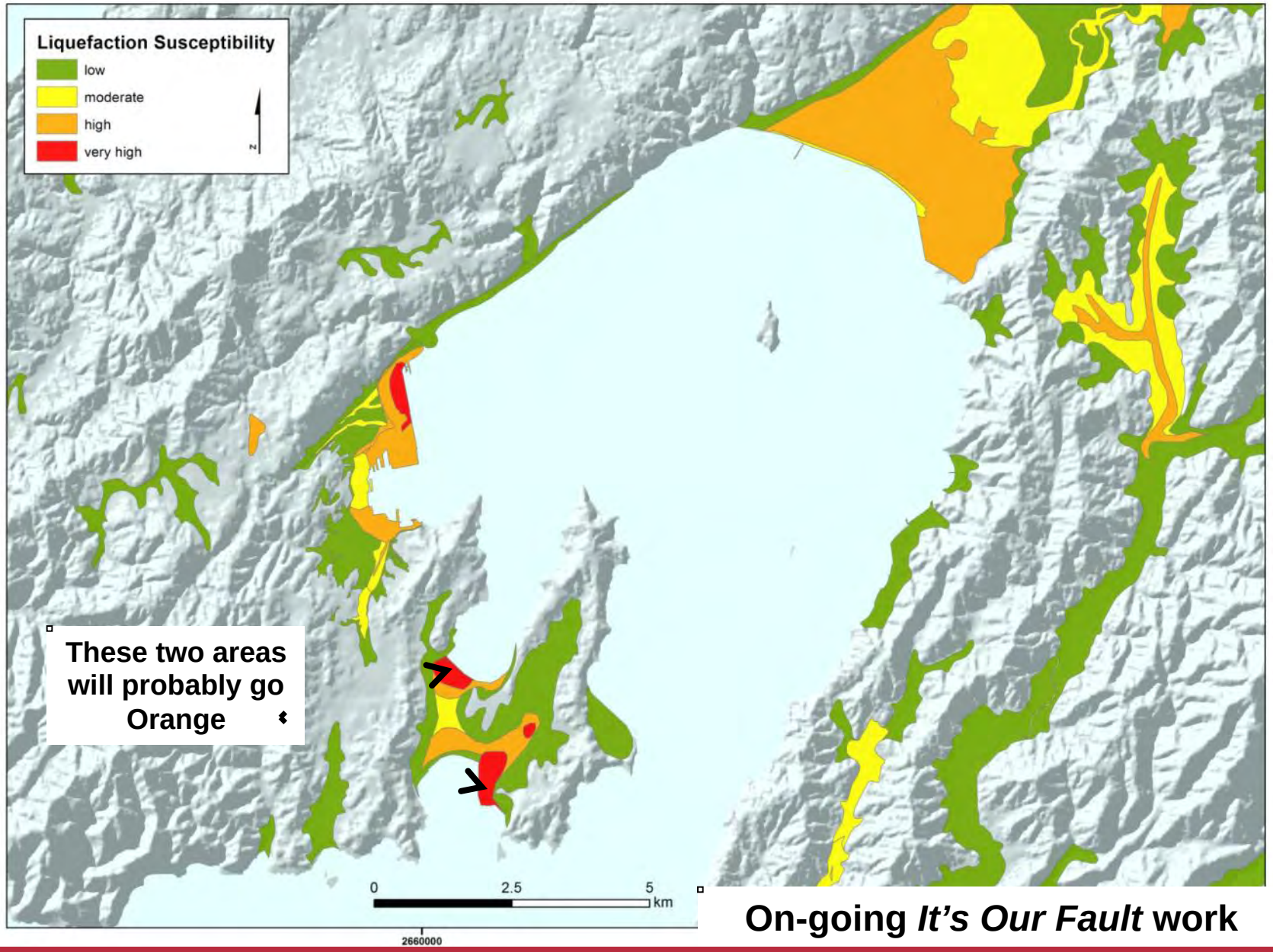
Actual vs. Previously Mapped Hazard

Extent of liquefaction from 22 Feb 2011.
Preliminary indicative land damage map.
Orange = major liquefaction.
Yellow = minor / trace / isolated small liquefaction areas

2004 Liquefaction Hazard Map



Wellington - Liquefaction Susceptibility



On-going *It's Our Fault* work

Earthquakes & tsunami

- In a long OR strong earthquake evacuate all zones (to above the blue line where present)
- Longer than a minute, OR hard to stand up
- Don’t wait for official warnings, there is no time for official warnings after a local earthquake generated tsunami
- A tsunami may arrive in as little as 5 minutes

What will Wellington look like after a big quake?

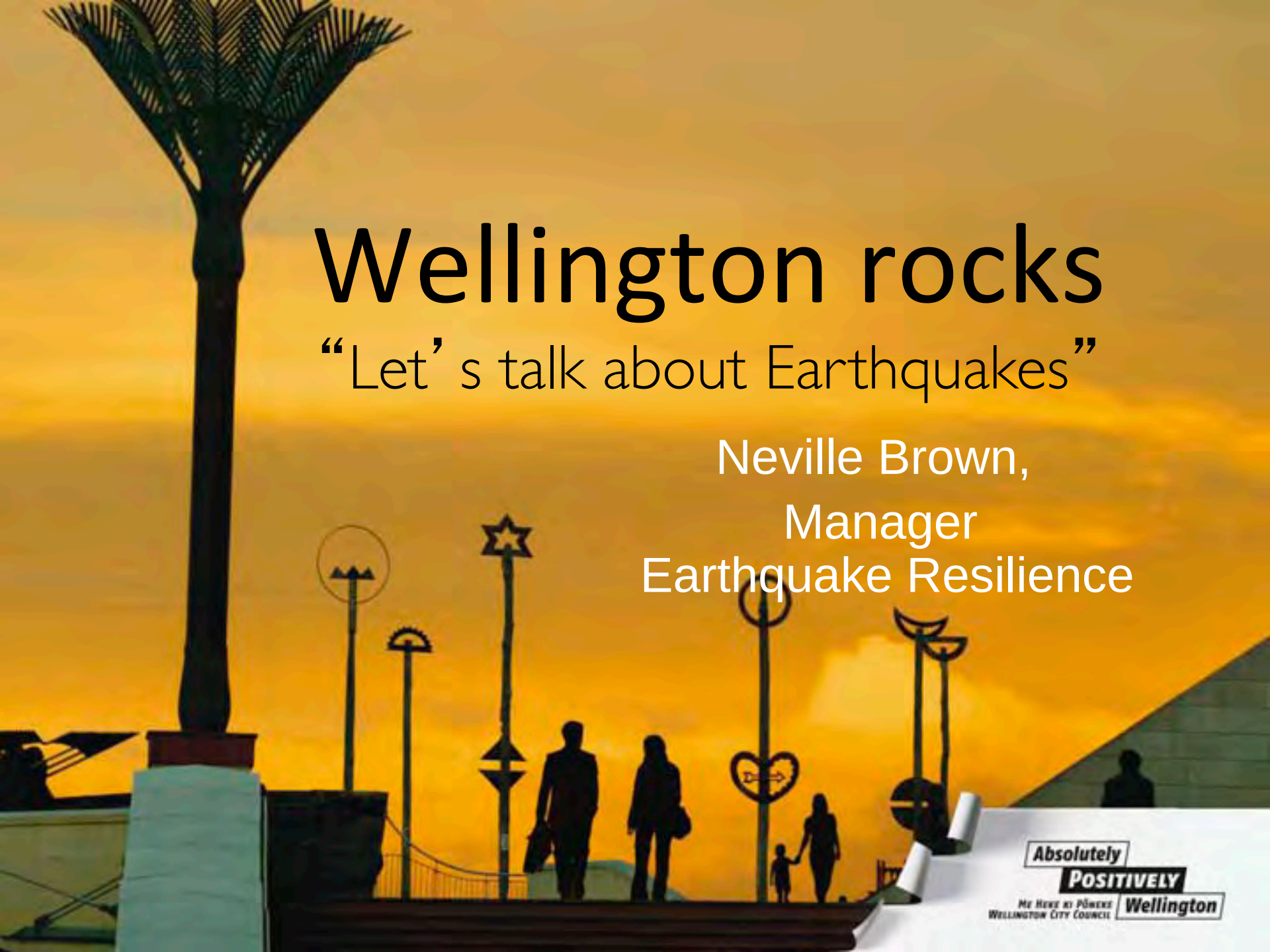
Source: TV3 Aftershock

Actually…that will depend on a number of things:

- **Location of the quake**
- **Timing (today, tomorrow, twenty years from now)**
- **The level of priority placed on increasing resilience (buildings, infrastructure, community)**
- **And…importantly…YOU!**
  - Emergency Preparedness
  - Drop, Cover, Hold
  - After a long or strong earthquake, evacuate all tsunami zones

Conclusions

- Not all ground is created equal
- Not all buildings (*and lifelines infrastructure*) are created equal
- Risk (*damage & loss*) = Hazard × Vulnerability
- To reduce Risk, need to start focusing on:
- Post-event functionality (not just life safety)
- Damage control
- Reparability
- Preparing ourselves today
- **www.gns.cri.nz/ItsOurFault**



Wellington rocks

"Let's talk about Earthquakes"

Neville Brown,
Manager
Earthquake Resilience

People are evacuated from a damaged building after an earthquake in Christchurch, New Zealand, in this February 22, 2011 image taken from video footage

Terrible

Terrible . Remarkable

2 92%

480 . 37,000

Any cause: 1 in 1

Heart disease: 1 in 6
Cancer: 1 in 7
Stroke: 1 in 29

Motor vehicle: 1 in 96
Intentional self harm: 1 in 109

Air or space transport: 1 in 7,176

Earthquake: 1 in 97,807

U.S. National Safety Council

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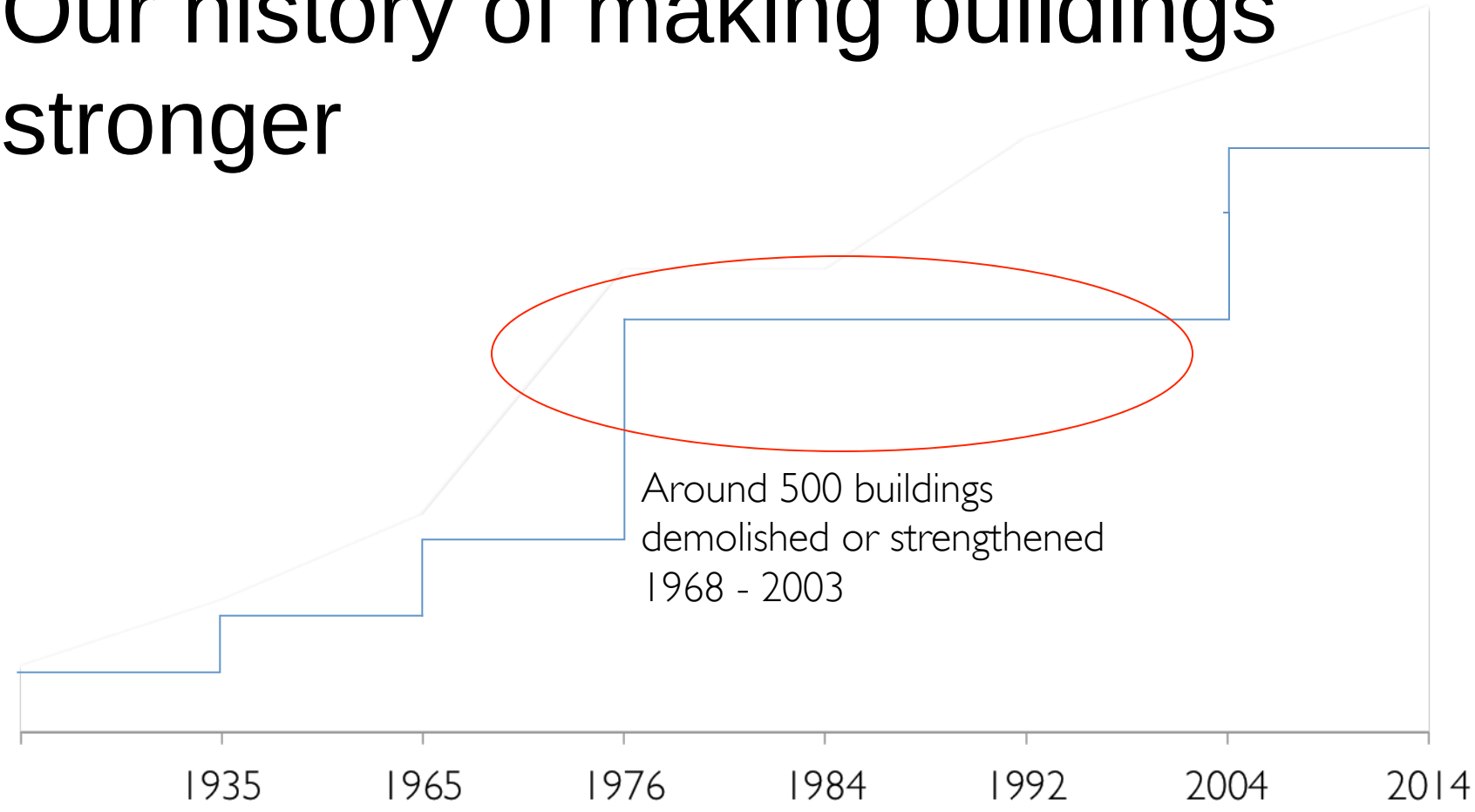
Wellington's history

Resilience is not a new concept here

- We've had 4 significant earthquakes since 1840, including an 8.2 magnitude centred at Palliser Bay
- As a city we learnt from the experience and rebuilt with more resilient material. Because of this fatalities have been low – 3 in the first 1848 earthquake, and 2 deaths in 3 later earthquakes

Our history of making buildings stronger



Demolition and strengthening of buildings

Wellington Seismic Standards

- Buildings must be built to different standards according to their seismic zone. In Wellington, since 1965 buildings have to be more resilient than buildings in other New Zealand cities.

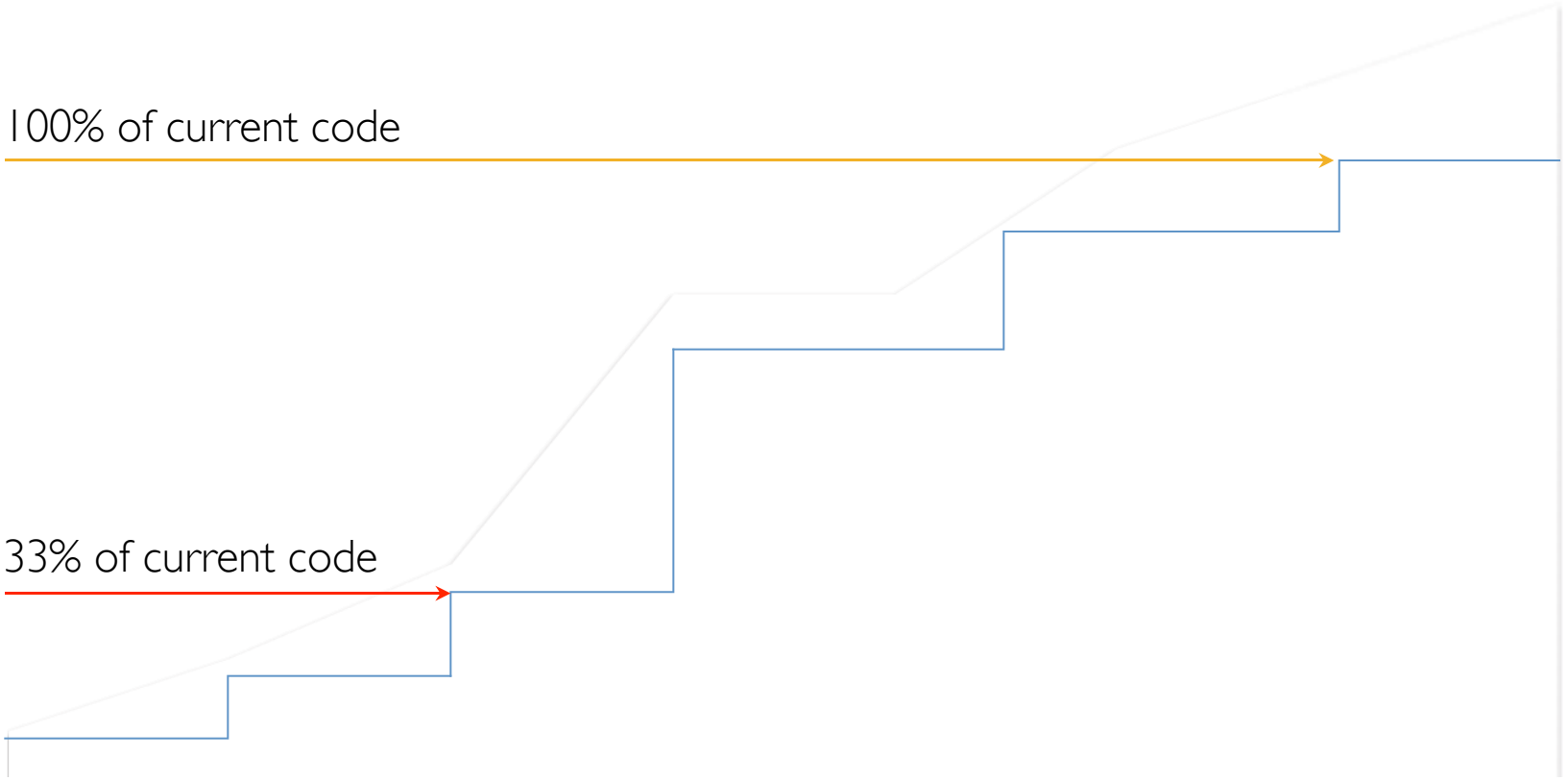
- Today, seismic loadings for new buildings in Wellington must be **one third higher** than the standard for buildings in Christchurch and **three times** the standard for buildings in Auckland.

- That doesn't necessarily mean Wellington buildings cost a lot more, but it does mean they have to be designed differently, to perform better.

An Auckland shoe

A Wellington shoe

Our Earthquake Prone Buildings Policy



Our history of making our city safer

- **1990s** strengthening of our water network begins
- **2000s** strengthening of the water networks continues along with roads.
- **2005** Wellington Region Civil Defence Emergency Management Group Plan adopted
- **2010** Wellington Earthquake National Initial Response Plan adopted

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Our future priorities

Resilient city

- City resilience a top priority for the next decade - $49 million committed to strengthening buildings and $31m to infrastructure over next decade
- Earthquake resilience team within Council
- Working in partnership with a range of other organisations on projects - example Cuba Street project with Victoria University
- Advice to government and involvement in government policy formulation

Resilient buildings

Council buildings

•Strengthening building programme in place

Citywide building assessments (Commercial and Apartment complexes)

•All buildings assessed by mid 2014

•High priority buildings strengthened by 2025, other buildings by 2035

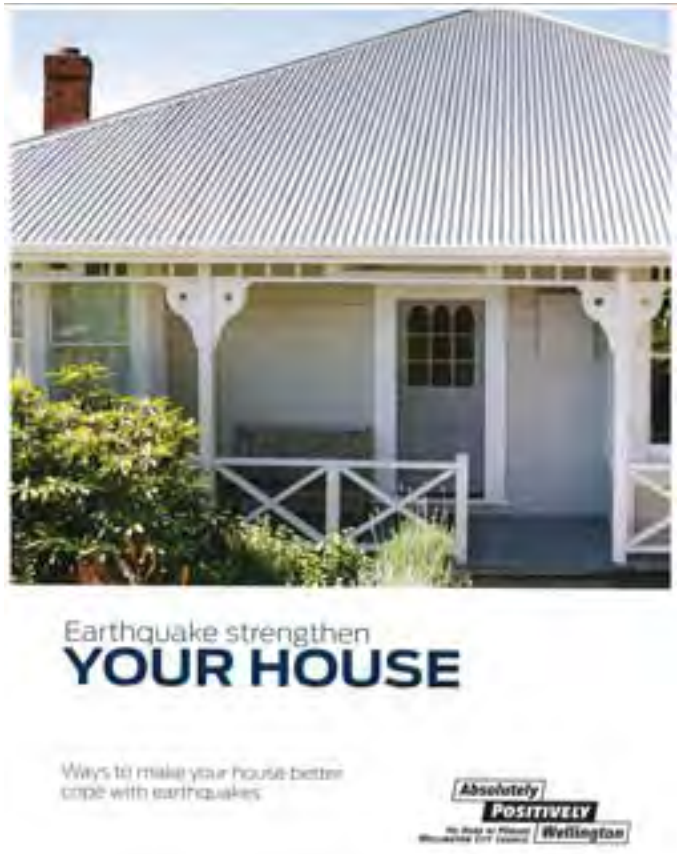
•District Plan review of high risk building features and heritage items

Resilient buildings

Assist building owners

- Financing opportunities for building owners with banks
- Tax treatment of earthquake strengthening
- Heritage grants
- Education and information for all ratepayers, and building owners
- New Insurance product.

Resilient residences



- Have developed with BRANZ a residential guide for homeowners

- Master Builders Federation & Certified Builders Association home assessment service

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Resilient infrastructure

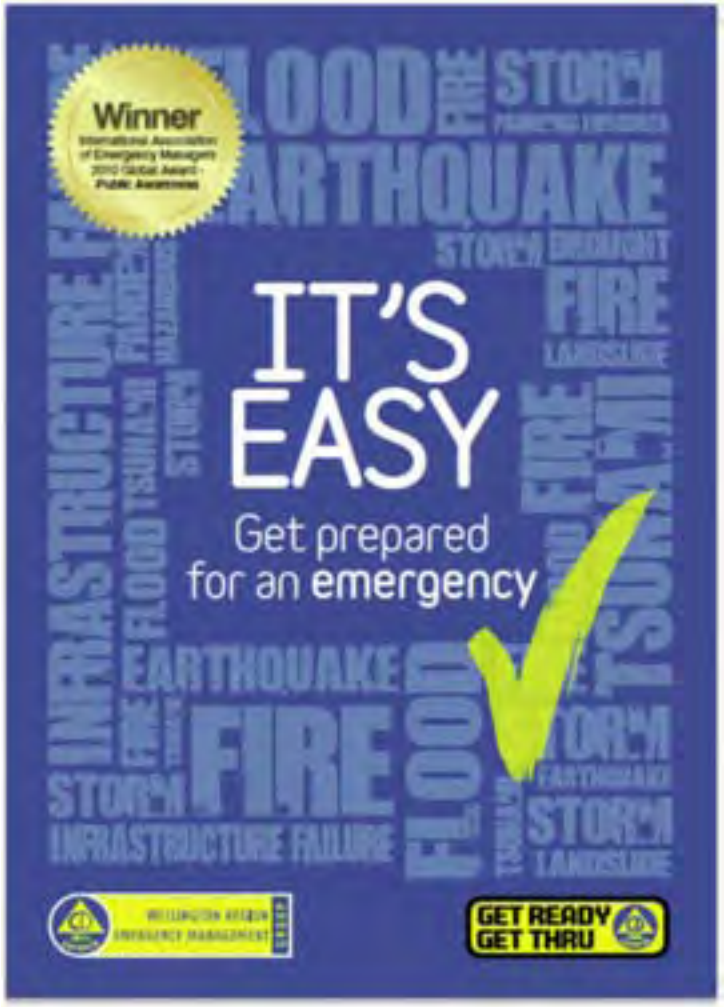
- Tunnel strengthening (Karori, Seatoun, Northland and Hataitai bus tunnel)
- Roads, retaining walls and bridge strengthening
- Regional assessment of roading network availability and alternative routes to be completed in 2012

Resilient infrastructure

- Water – strengthening reservoirs and installing shut off valves
- New central city reservoir to also provide water for hospital in case of an emergency

- Mapped route for temporary power supply and will begin installing concrete plinths so temporary power poles can be installed quickly.

Resilient people 12 easy steps to preparedness



This is a Conversation document

Household emergency plan

Survival items

Know your neighbours

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Resilient People

On the day – be prepared with a

Household Emergency Plan

- Identified meeting place
- Alternate plans to collect children
- Know how to turn off utilities
- Know evacuation routes
- Know information sources
- Know where your local CDC is
- Emergency items, list in brochure.

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Resilient people

Wellington City Council has a plan that will support the wellbeing of the people in an emergency - the city's welfare plan

However ensuring the wellbeing of people in an emergency is more than a response on the day–

It is about being prepared through

– individual preparedness

– connected local neighbourhoods

Resilient neighbourhoods

Know your neighbours

- Relationships matter and are an important resource in an emergency
- Neighbours have valuable skills sets and materials
- Meet the people who might need extra assistance
- Find ways to strengthen networks in on your street
- Consider developing a Neighbourhood Support Group

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Emergency Txt Alerts

For Vodafone & Telecom mobiles*

txt

“follow WREMOalert”

to

8987

If you receive an alert, forward it
to everyone you know!

*Not available on other networks.

Resilient neighbourhoods

Ways to get started

- See what's in the bag along with 'It's Easy'
  - 10 steps to plan a get together and stay in touch
  - Neighbourhood Support – or your own kind of group
  - Neighbourhood register – get prepared together

- Also think about…
  - Apply for a grant for a neighbourhood project*
  - See what's on at your local Community Centre

*Need a legal entity to support application

Resilient thinking

Wellington pre-schoolers get ready for Shakeout

And in all likelihood, remember,
this would come without warning,
out of a clear sky.

Bill Bryson

Thank you

www.wellington.govt.nz/earthquake

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