AUCKLAND ENGINEERING LIFELINES PROJECT

Stage 2

Assessing Auckland's infrastructure vulnerability to natural and man-made hazards and developing measures to reduce our region's vulnerability.

Auckland Engineering Lifelines Group Report

Version 1.1: February 2014

PREFACE

Acknowledgements

The level of effort and time provided by the contributing lifeline utility staff cannot be understated and is gratefully acknowledged by the Auckland Engineering Lifelines Group.

The following AELG participants enabled this project to be completed:

Air New Zealand
Auckland Airport
Auckland Council
Auckland Transport
Chorus
Counties Power
Kordia
New Zealand Transport Agency
Ports of Auckland
Refining New Zealand
Telecom
Transpower
Vector
Vodafone
Watercare
Wiri Oil Services Limited

A number of key stakeholder organisations also contributed to workshops and provided information on critical community sites, including:

Progressives
ASB
BP
Foodstuffs
Auckland DHB
NZ Fire Service
NZ Police
St John Ambulance
Counties-Manukau DHB
Waitemata DHB
BNZ
ANZ

Disclaimer

This report is general in its application and subjective in its recommendations. While every effort has been made to ensure the accuracy of the report, no liability whatsoever can be accepted for any error or misprint.

The hazard information in this report has been prepared for the purposes of the Auckland Engineering Lifelines Project. Its use for any other purpose may be limited. The hazard maps have been prepared at a regional scale and do not replace any requirement for detailed site-specific geological, geotechnical or other investigation. Readers of the report are advised to consult with the Auckland Council Civil Defence Emergency Management Hazards team as to the suitability of information in this report for other applications.

Infrastructure information in this report is current at the time of application but ongoing changes will occur. Information in this report should therefore not be taken to indicate the current state of hazard vulnerability or preparedness of the lifeline utilities described.

The vulnerabilities in this report were identified by the utilities themselves and the Auckland Engineering Lifelines Group is not responsible for the disclosures made or withheld. The decision as to which vulnerabilities to identify and disclose was the responsibility of each individual utility.

Document History

Version	Issue Date	Notes
1.0	September 10 2012	First Issue
1.1	February 2014	Re-structure to consolidate recommendations into new Section 9. Update Volcanic Ash Posters. Update Summary section with Severe Weather information. Update website references. Updated telecommunication and energy sector overlay maps.

CONTENTS

SUMMARY

This Auckland Engineering Lifelines Project, Stage 2 (AELP-2) aims to identify the critical infrastructure in the Auckland region, understand the impact of hazards on this infrastructure and identify actions that can be taken to reduce critical infrastructure vulnerability.

Section 2 defines 'nationally' (Criticality 1), 'regionally' (Criticality 2) and 'locally' (Criticality 3) critical infrastructure and community assets. The definition takes into account the importance of the site for its own network (ie, the extent of outage if it failed) and to other critical customers that depend on its supply (for example, the electricity feeders supplying major hospitals or water treatment plants). Using these definitions, Criticality 1 and 2 infrastructure has been mapped for the purpose of the vulnerability assessment presented in Part B.

All lifeline utility sectors have identified at least one Criticality 1 asset that, if inoperable, would cause loss of that service to a significant part of the region. An example from each sector includes:

- The fuel pipeline from Marsden Refinery to Wiri Oil Depot which supplies 95% of Auckland's fuel.
- The Otahuhu substation and transmission lines supplying most of the electricity to western/northern areas and Northland. While major network upgrades are underway to reduce this vulnerability, a transmission bottleneck remains between Penrose and Otahuhu.
- The larger gas supply pipeline that brings carries most of the gas from Taranaki to Auckland (and onto Northland).
- State Highway 1, Auckland Airport and Ports of Auckland (CBD), and the southern rail line and key stations such as Britomart.
- The main telecommunication exchanges and cellular line 'strong nodes' (which make the connection between the caller and the called).
- Mangere and Rosedale Wastewater Treatment Plants, servicing all of metropolitan Auckland.
- The trunk water supply mains from the Hunua Ranges and Ardmore Water Treatment Plan into Auckland, carrying 2/3 of Auckland's water supply.

Section 2 also looks at the interdependencies between the lifeline utility networks and the dependence on those networks for other critical community services. Figure 1 summarises those dependencies. A quick look down the first column shows why electricity security of supply is so critical to Auckland.

Dependence on	Electricity	Gas	Fuel	Telecomms	Transport	Water / Waste
Lifeline Utility Sector Reliance						
Electricity						
Gas						
Fuel						
Telecommunications						
Road Transport						
Other Transport						
Water						
Wastewater						
Stormwater						
Community Sector Reliance						
Health						
Police						
Fire						
Banking						
Fast Moving Consumer Goods						

Legend	Critical requirement to maintain service continuity during business-as usual.	Some impact on ability to function. Utility becomes more critical in an emergency.	Not required for network operation, though may require for staff needs.

Figure 1: Lifeline Utility and Critical Community Sector Dependencies.

Section 3 provides an overview of the Auckland hazards that are being assessed for AELP-2[1].

Volcanic Hazard:

Metropolitan Auckland is built directly on the Auckland Volcanic Field (AVF). The AVF covers an area of 360km^2 and comprises a minimum of 50 scattered volcanic centres in the form of maars, tuff rings, scoria cones and associated lava fields.

The risk of an AVF basaltic eruption has been assessed at around 1,000 years, however a significant amount of research is currently underway as part of DEVORA (DEtermining VOlanic Risk in Auckland). This report will be updated to incorporate research learnings when they are available.

Figure 1: Ruaumoko Volcanic Scenario, Day 35

For the purposes of the vulnerability assessment carried out in Part B, the scenario developed for Exercise Ruaumoko (national exercise, 2008) has been adopted; an eruption in the Manukau Harbour (refer Figure 2).

In addition to the risk posed by a local eruption in the Auckland Volcanic Field (AVF), Auckland is at risk from ash fall from eruptions at several large and frequently active andesitic and rhyolitic volcanoes in the central North Island, as well as from any reawakening of volcanic activity in Northland.

Tsunami Hazard

Tsunami are typically generated as a result of displacement of ocean water due to landslides, earthquakes, volcanic eruptions and bolide impacts. Tsunami in Auckland can be categorised as:

- Distant source; > 3 hours travel time to NZ from sources such as South America and to a lesser extent Cascadia (North America) and the Aleutian islands.
- Regional source; 1-3 hours travel time to NZ from sources such as the Solomon Islands New Hebrides and the Tonga-Kermadec trench.
- Local Source < 60 minutes travel time to the nearest NZ coast. Activity on the southern end of the Tonga-Kermadec trench can cause tsunami to reach the Northland coast within 1 hour. Other sources can include submarine landslides or a slump in the continental shelf north of Northland.

For the purposes of the vulnerability assessment carried out in Part B, AELG have analysed both a maximum distant source and maximum regional source event.

Earthquake Hazard

Auckland is one of New Zealand's least seismically active regions, however the hazard should not be discounted as the effects of a damaging earthquake would be significant due to the city's concentrated population.

For AELP-2, a uniform hazard scenario has been assessed where ground shaking occurs uniformly across the region, with shaking equating to an earthquake with a return period of around 2,500 years. The scenario results in Peak Ground Accelerations (PGA) of 0.17g to 0.27g (depending on soil type) for the central Auckland area.

[1] *AELP-2 is being completed in a staged manner and only the first three hazards – volcano, tsunami and earthquake – are included in this report version.*

Severe Storm

Weather events are the most frequent natural hazard to affect the Auckland Region and they vary greatly in magnitude and duration. They can be widespread affecting the whole region or more localised with site specific impacts. Accordingly, they are also the most planned for and practiced.

The main effects of a severe storm event in the Auckland region arise from high winds, heavy rainfall and flooding, slope failure and storm surge.

For AELP-2, a 1:100 year return period event has been assessed, which is likely to have significant effects on infrastructure, particularly transport and power supply which are two of the critical lifelines for other service providers.

1. INTRODUCTION

1.1 The Auckland Engineering Lifelines Group

The Auckland Engineering Lifelines Project (AELP) was initiated by the Auckland Regional Council in 1996 and involved some 40 lifeline utility and stakeholder organisations. The project focused on four natural hazards (earthquake, volcano, cyclone, and tsunami) and the impact on lifeline utility assets. The purpose was defined as:

> ***To identify measures and co-ordinate efforts to reduce the vulnerability of Auckland's lifelines to hazard events and to improve service reinstatement after a disaster.***

The Auckland Engineering Lifelines Group (AELG) was subsequently established in 2000 to continue the work of the AELP. The AELG mission is:

> ***Enhancing the connectivity of lifeline utility organisations across agency and sector boundaries in order to improve infrastructure resilience".***

⇒ *More information on AELG can be found in the business plan and charter at www.aelg.org.nz.*

1.2 What has been achieved since AELP-1

Since AELP-1 was completed in 1999, a large body of work has been completed by AELG, for example:

- Several AELG projects have researched the potential impact of volcanic ash on Auckland's infrastructure, in association with the Volcanic Impacts Study Group (VISG).
- A regional list of critical utility sites and critical utility customer sites has been developed.
- There have been some hazard studies undertaken by other organisations (flooding, tsunami, earthquake) to improve knowledge of potential hazards in the region.

  ⇒ *A full list of AELG projects can be found at http://aelg.org.nz/document-library/*

The aim of the Auckland Engineering Lifelines Project, Stage 2 (AELP-2) is to draw on this improved knowledge to update and improve confidence in AELP-1 findings. The project scope is also being extended to include consideration of infrastructure failure impact on communities when assessing risk priorities.

1.3 Project Benefits

As a result of AELP-2, lifeline utilities will:

- Have the latest hazard information available (in GIS files where available). This includes information for the existing hazards analysed in AELP-1 (volcanic, earthquake, cyclone and tsunami hazards) as well as other priority hazards identified in the scoping phase.
- Have maps of critical lifelines and community sites (to enable them to take into account supply to these sites in prioritising response and recovery).
- Use the latest hazard data to understand the direct probable impact of hazards on their assets and services.
- Understand the impact of hazards on other utilities that they rely on, and the knock-on impact to their services (interdependency impacts), as well as the broader economic and community impact of the infrastructure failure arising from each hazard.
- Have knowledge of potential mitigation measures to reduce infrastructure vulnerability to hazards.

1.4 Project Scope

It was initially intended to use software tools to support the hazard impact assessment on Auckland's infrastructure. However, following an initial scoping phase[2], the available software options were not considered to be able to provide the outcomes that AELG sought. The intention is that AELP-2 will consolidate the knowledge gained over the last decade and extend that through hazard impact workshops using updated hazard and utility information. Software modelling options will be reviewed again in the future.

[2] The scoping report (AELG-20) can be downloaded at http://aelg.org.nz/document-library/critical-infrastructure-reports/