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INFRASTRUCTURE FAILURES

New Zealand, like all developed nations, is highly reliant on its infrastructure: energy (electricity, gas, petroleum), information and communications technology (ICT), transport, and water. New Zealand's linear shape, rugged topography, and low population density result in long and often isolated infrastructure networks that are vulnerable to natural hazards. Infrastructure networks may also be disrupted by other external factors such as terrorism, or internal causes such as a lack of maintenance or planning.

Local infrastructure failure is not uncommon and can generally be dealt with by lifeline utilities (infrastructure providers). However, because of interdependencies, a failure of one can cascade across others. The resulting widespread and potentially long-term failure can affect the economy and may require coordinated regional involvement for welfare and logistical issues. While a single utility failure can be a significant event, the disruption from multiple utility failure is potentially very severe.

The physical nature, along with ownership, operational and regulatory frameworks of infrastructure sectors vary, as do levels of resilience and operational response capability. While there are pressures in some sectors, for example energy supply and road congestion, a 2004 infrastructure audit prepared by PricewaterhouseCoopers (PwC) as part of a government infrastructure stocktake concluded that at a national level New Zealand's infrastructure is in reasonable condition. The audit did, however, draw attention to some previously identified local and sector-level issues that may have a significant local and national impact.

Energy

Electricity

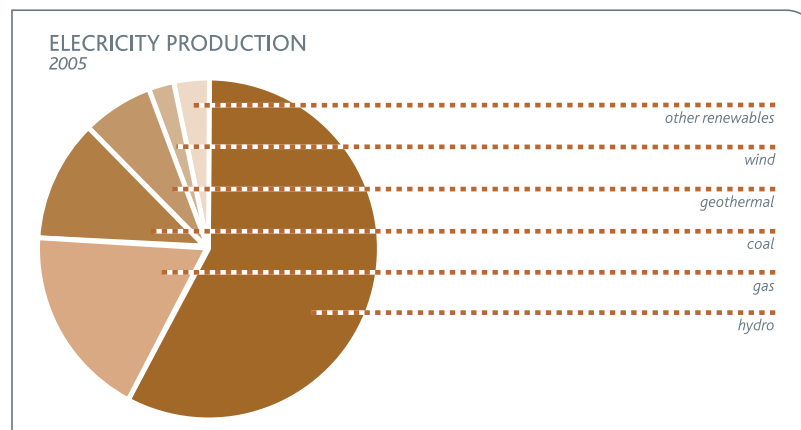
New Zealand currently uses almost 40 000 gigawatt hours (GWh) of electricity each year and this is projected to grow significantly over the next 20 years.

Before 1987 the Government controlled and operated almost all electricity generation and transmission in New Zealand through the New Zealand Electricity Department. Reforms over the last 20 years have seen the Department and other electricity market entities corporatised to a combination of state-owned enterprises and trust-owned or private companies.

Five major power companies now generate 93 per cent of New Zealand's electricity and dominate the electricity retail market. Transpower, a state-owned enterprise, operates the national transmission grid connecting power stations to local distribution lines and major industries. The grid comprises more than 12 300km of high voltage transmission lines including the Cook Strait submarine cable between the North and South Islands.

As at March 2005, 28 network distribution businesses in New Zealand supplied electricity from the national grid to customers. Network ownership ranged from community-owned trusts, shareholder cooperatives, and local authorities, to publicly listed companies.

The 2004 PwC infrastructure audit identified long-term security of electricity supply as a concern. The national transmission grid is



In the year ending March 2005, hydro-generation provided 64 per cent of New Zealand's electricity (65 per cent of this in the South Island). Ten per cent was generated by other renewable resources and the remaining 26 per cent from fossil fuels. Figures vary from year to year because of hydro-generation's dependence on rainfall. Industry was the largest user of electricity during the same period. *Ministry of Economic Development.*

coming under increasing pressure as electricity demand grows, but new regulatory arrangements need to be established, and land access issues resolved, before new investment can take place. Capacity into and north of Auckland, and between the Waitaki Valley and Christchurch, are key areas requiring upgrading.

Transpower has plans to upgrade the national grid's capacity. Vulnerabilities do exist; for example, just one substation supplies most of Auckland city. This vulnerability was highlighted in the power cut of 12 June 2006, which blacked out central Auckland for 5 hours.

While New Zealand's existing electricity generation plant is generally reliable, there is uncertainty around fuel availability for future

generation and supply during dry periods. Uncertainty about regulation – for example, the Government's response to climate change – may also affect new generation investment. In December 2006, the Government released a Draft Energy Strategy and associated documents aimed at establishing clear policies for electricity generation and other energy sources.

Along with internal risk factors, electricity infrastructure is vulnerable to natural hazards. Earthquakes, volcanic eruptions, lahars, tsunamis, wind, lightning strikes, and snow could all cause widespread damage to electricity infrastructure, particularly transmission and distribution lines. An influenza pandemic could also affect electricity supply if illness causes staff shortages.



Power poles brought down by the weight of snow during the June 2006 Canterbury snowstorm. The snowstorm left thousands of people in South Canterbury without power for up to 4 weeks. *Electricity Ashburton.*

The consequences of a widespread or long-term electricity outage include:

- ❑ welfare issues, particularly heating, sanitation, and medical facilities for vulnerable groups such as the elderly and sick
- water and wastewater pump system failures and subsequent sewage releases
- disruption to communications, air-traffic control and fuel supply (as many fuel pumps rely on electricity)
- economic losses from businesses unable to operate without ATM and EFTPOS transactions
- loss of refrigerated food
- farm animal welfare issues
- reduced security and lighting
- school closures.

These consequences can be reduced where local emergency generation is available.



1998 AUCKLAND POWER CRISIS

New Zealand's worst recent infrastructure failure occurred in January and February 1998, when electricity supply to the Auckland central business district (CBD) was disrupted for almost 2 months.

Four cables supplied almost all of the Auckland CBD's electricity. One cable failed on 20 January, followed by another on 9 February. The two remaining overloaded cables failed on 19 and 20 February, leaving most of the CBD without power.

Generators were brought in to the CBD to power essential services, such as Auckland Hospital, but most shops and businesses could not operate. Around 6000 inner-city apartment residents had to find alternative accommodation. Sixty thousand of the 74 000 people who usually worked in the CBD had to work from home or in relocated offices elsewhere in Auckland or further away.

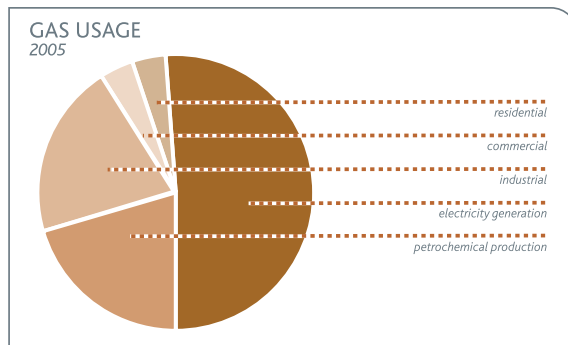
It was 5 weeks before an emergency cable was completed and electricity restored to the CBD. The long-term economic impact was estimated at 0.1–0.3 per cent of GDP, and many small businesses never recovered from the event.



Auckland, early morning, during the 1998 power crisis. The crisis left the city without power for five weeks. *PhotoNewZealand.*

Gas

New Zealand's natural gas comes primarily from seven gas fields in the Taranaki region, with 74 per cent coming from the two largest fields, Maui and Kapuni.



Electricity generation uses most of New Zealand's extracted gas. The remainder is used to produce petrochemicals or is reticulated for industrial, commercial and residential use. *Ministry of Economic Development.*

Gas is supplied throughout the North Island by two transmission companies through 3400km of high-pressure transmission pipelines, and five distribution companies through 2800km of distribution networks. There are two small South Island LPG reticulation networks in Christchurch and Queenstown. The gas industry is currently moving from a situation of a few large companies managing a few large gas fields to a larger number of companies managing a larger number of fields of varying sizes.

Most of the gas transmission network in New Zealand was constructed in the late 1960s, and both transmission and distribution networks are currently able to meet demand. However, natural gas is a non-

renewable resource. Supply will be determined by the rate of use and by the discovery and exploitation of new gas fields.

Gas supply is vulnerable to hazards, in particular earthquakes, floods, landslides, and tsunamis. Gas supply may also be affected by staff shortages during an influenza pandemic. A volcanic eruption affecting Taranaki, the source of all New Zealand's gas, could disrupt gas supply throughout the country.

Possible effects of gas infrastructure failure include:

- reduced capacity for industry and businesses (for example, food processors) to operate
- disruption to heating, cooking, and hot water for homes and essential facilities such as hospitals
- reduced gas-fuelled electricity generation.

Petroleum

New Zealand, like other developed countries, is highly dependent on oil products, particularly petroleum.

New Zealand's only oil refinery is operated by the New Zealand Refining Company at Marsden Point near Whangarei. Built in the mid-1960s, Marsden Point refines fuel for the country's four major fuel distribution companies and supplies around 80 per cent of New Zealand's jet fuel, 72 per cent of its diesel, and 63 per cent of its petrol. The remainder is imported directly, mostly into Lyttelton, Wellington, and Tauranga. About half Marsden Point's produce is transported by pipeline to the Wiri storage facility in South Auckland, and the remainder is either shipped to other New Zealand ports for road distribution or trucked directly from the refinery around Northland and North Auckland.

A natural hazard or hazardous-substance event at Marsden Point refinery could result in a loss of production capacity which would be felt nationwide. Damage to a number of New Zealand's ports or a large area of the road network, most likely from an earthquake, flood, or tsunami, could disrupt fuel supplies. Oil is a non-renewable resource and petroleum prices in New Zealand will continue to be dependent on global oil availability and international events.

Disruption to petroleum supplies would reduce the ability of many businesses and households to function normally, reduce emergency services' capability, and disrupt supply lines of other goods and services.

Information and communication technology

New Zealand has a high uptake of information and communication technology (ICT). ICT networks in New Zealand are generally privately owned by a few large companies.

ICT infrastructure tends to be more flexible than other infrastructure sectors and investment can generally occur in small increments. The ability to re-route traffic, along with the diverse capacity of main trunk lines, helps reduce the impact of failure or congestion along a particular route. The PricewaterhouseCoopers infrastructure audit did not identify any immediate ICT concerns with respect to security of supply.

ICT failures can occur through electricity outages, software problems (including viruses and hackers), or electromagnetic pulses. Hardware failure is often responsible for ICT failure. This includes the accidental severing of cables and damage from natural hazard events such as earthquakes, volcanic eruptions, floods, landslides, tsunamis, wind, or snow.

Service outages due to hardware failure, including those caused by natural hazard events, are often much shorter than failures in other sectors. For example, most ICT links were restored within 2 days after the 2006 Canterbury snowstorm, compared to up to 4 weeks for the restoration of electricity supply to some users. The New Zealand rural community is highly dependent on ICT, particularly landlines. Restoration of ICT services is a major priority for rural communities following adverse events.

Where ICT is most vulnerable is in the potential for overloading during and after an emergency. An influenza pandemic could also place stress on the ICT sector through both staff absences and an increase in ICT traffic as people work and interact from home using the internet.

While the undergrounding of the ICT infrastructure has lowered its risk to physical damage, modern ICT systems, particularly the extension of broadband, means ICT is increasingly reliant on mains power supply and is therefore more vulnerable to extended mains power failure. Facilitating access to Asymmetric Digital Subscriber Line (ADSL) broadband has increased the dependence of networks on continuous power supplies as electronic equipment is moved progressively closer to end-users. Radio ICT links are also reliant on mains power and are widely used in remote regions where difficult terrain makes cable ICT links uneconomic. Cabinets and radio sites both rely on mains power to operate and contain batteries that provide short term (up to 24 hours) back-up power.

The consequences of a large-scale ICT failure include:

- security issues
- economic losses to business
- disruption to banking and implications for international trade
- disruption to air and sea transport
- risk to public safety from disruption to the medical sector, emergency services, water and electricity supply, and traffic.

ICT failure is unlikely to be of national significance unless it seriously disrupts large areas of a major city such as Auckland, Wellington, or Christchurch.

Transport

Roads

There are 11 000km of state highway in New Zealand, managed by Transit New Zealand, and 82 000km of local road managed by territorial authorities. Overall, the state highway network is of a good, consistent standard, but the standard of the local road network is variable.

The road network is particularly vulnerable to earthquake shaking and liquefaction, landslides, lahars, and tsunamis. Floods and earthquakes often damage bridges and the services attached to them. Work has been carried out in recent years to strengthen major links such as the Thorndon overbridge in Wellington and the Newmarket viaduct in Auckland.

Disruption to the road network could isolate communities and cause economic losses from disrupted freight services.

Rail

New Zealand's rail network carries more than 14 million tonnes of freight a year, mainly coal, forestry and dairy products, and containers, and this amount is increasing. There are now only four remaining passenger services, linking Christchurch with Picton and Greymouth, Palmerston North with Wellington, Wellington with Auckland, and two metropolitan commuter systems in Auckland and Wellington.

Although there has been a general lack of investment in rail infrastructure over recent years, the main risks to failure of the rail

network are from earthquake, landslide, tsunami, lahars, and flood damage. The primary impact of rail infrastructure disruption would be on freight distribution. However, a major event in Wellington or Auckland metropolitan areas would have a significant impact on commuters.

Ports

New Zealand has 13 commercial ports throughout the country. Sea ports carry 80 per cent by value and 99 per cent by weight of New Zealand's exports. Twenty-six billion dollars worth of cargo was exported from New Zealand sea ports, and almost \$28 billion worth of cargo was imported into them in the year to June 2005.

Ports are particularly vulnerable to earthquakes and tsunamis. If the event is very large and affects a number of ports, or affects one of the larger ports – Auckland, Wellington, Tauranga, Lyttelton or Port Chalmers – it is likely to have a significant national economic effect.

Airports

Major international airports are located at Auckland and Christchurch with five minor international airports at Dunedin, Hamilton, Queenstown, Palmerston North, and Wellington. There are 20 local airports. Airports are critical for New Zealand's economy in terms of both trade and tourism, particularly Auckland International Airport. In the year ending June 2005, 70 per cent of international visitors, 80 per cent of air exports and 92 per cent of air imports by value went through Auckland International Airport.

Airports are vulnerable to earthquake damage and to disruption during volcanic eruptions and extreme weather. It is unlikely that an event would seriously affect more than one major airport and there is generally enough airport capacity within New Zealand to cope



The Saddle Road bridge over the Pohangina Bridge in the Manawatu after the February 2004 storm. The bridge carried the main gas transmission line between the Manawatu and Hawke's Bay and its loss affected food processing industries in Hawke's Bay. *Westmoreland School.*

with this. An exception would be a volcanic eruption in Auckland which would likely close Auckland International Airport for weeks to months, or ash from a large central North Island eruption affecting several airports.

Given the importance of Auckland International Airport for international visitors and trade, closure for a length of time would have significant impacts on tourism and export industries. An influenza pandemic would also have major impacts on airports, particularly international airports, as international visitor numbers reduce, and from staff absences.

Air travel in New Zealand can be significantly affected by poor localised weather conditions at any one of the five main airports (Auckland, Wellington, Christchurch, Dunedin and Nelson), causing widespread disruption of flights across the country. It is unusual for poor weather conditions to continue for longer than 24 hours.

Water

Territorial authorities manage most of New Zealand's water supply, stormwater, and wastewater infrastructure as geographically self-contained networks. Most of the country's medium to large urban areas have reliable and high-quality water supplies, although supplies for communities of less than 5000 people tend to vary in quality.

Most New Zealanders (83 per cent) receive water from around 700 public water-supply systems run by local government. These water networks are generally integrated – most territorial authorities, except those in the Auckland and Wellington metropolitan areas, collect, treat and distribute water, and collect, treat, and dispose of wastewater. Four per cent of the population are connected to around 1500 small privately owned or cooperative supplies. The remaining 13 per cent of the population have their own water supply, mostly from rainwater collection or bores, and dispose of wastewater through septic tank systems.

The water infrastructure sector is governed by several pieces of legislation and standards and is accountable to several different organisations. There has been substantial investment in water and wastewater treatment plants over the last 10 years. However, the 2004 PwC infrastructure audit noted concern over the security of water supply in drought-prone areas, such as Nelson, Tasman, Kapiti, and Tauranga; and over water supply and wastewater treatment capacity in small communities with large tourist-driven seasonal population fluctuations, such as Kaikoura.

Water infrastructure is critical for communities and is highly vulnerable to earthquakes, volcanic eruptions (particularly ash, in the case of surface water supplies), floods, tsunamis, droughts, and electricity failure. An influenza pandemic may disrupt water supplies due to staff shortages and disruption to supplies of treatment chemicals,

electricity and telecommunications. Hazardous substance releases, pollution incidents, and terrorism can result in contaminated water supplies.

The potential consequences of damage to water and wastewater networks include:

- environmental damage and public health risk from sanitation issues or untreated sewage releases
- ☐ reduced fire fighting capability
- economic losses for industries reliant on reticulated water supplies
- school closures.

Dam failure

There are currently around 400 large dams in New Zealand – that is, those that are more than three metres high and with a capacity greater than 20 000m³. These dams are predominantly used for irrigation, stock water, flood control, hydroelectric generation and water supply. Of these 400 dams, 96 are classed as having a medium potential impact if they fail, and 58 as having a high potential impact, under the New Zealand Society of Large Dams Dam Safety Guidelines.

Most dam failures worldwide have occurred within a few years of construction as a result of inadequate foundation or construction materials, or because of internal erosion. Dams have also failed when they have been overtopped because of inadequate spillway capacity. Dams may also fail by overtopping in natural events such as earthquakes, which cause the dam to settle, or landslides into reservoirs, which generate waves.

The potential consequences of dam failure include:

- downstream flooding of land and communities with associated casualties, damage, and economic losses
- erosion and deposition of sediment
- reduced capacity of the dam's function, for example electricity generation or water supply.

The failure of a high potential impact dam may require a coordinated response through regional or national CDEM involvement, particularly if it affects a large community, or the water supply for a large urban area or hydroelectric generation.

Managing infrastructure vulnerability

Many different organisations are responsible for managing New Zealand's infrastructure.

Electricity assets are owned mostly by government agencies; gas, petrol and ICT are largely privately owned; transport infrastructure is in private, central and local government ownership; and water is controlled by local government. All infrastructure sectors are governed by a range of regulatory and funding organisations. They have well-developed arrangements for asset maintenance and new investment.

The need for continued investment across all infrastructure sectors is recognised but there is uncertainty over required margins for security of supply. However, resilience depends not only on security of supply but also on managing demand. The more reliant New Zealand is on infrastructure, the more vulnerable it is to infrastructure failure.

Managing demand means promoting efficient use of existing assets, but there are differences between sectors in the scope for and adoption of demand-management approaches.

Risk reduction

ENGINEERING AND PLANNING

Engineering lifeline groups play a significant role in raising the awareness of infrastructure vulnerability, and promoting and advocating engineering, planning and other initiatives to reduce risk.

REGULATION AND MONITORING

The policy frameworks within which infrastructure sectors operate are set out in sector-specific legislation including the Electricity Act 1992, the Gas Act 1992, the Telecommunications Act 2001, the Local Government Act 2002, and the Land Transport Management Act 2003. These Acts contain provisions relating to establishing markets, regulation of monopolies, new investment and safety. In addition, the RMA sets out a framework to consider community and environmental impacts of infrastructure development, and the Commerce Act 1986 contains provisions that promote competition and control prices where necessary.

Policy advice on infrastructure is provided to the Government by a range of Ministries. These include the Ministry of Economic Development (for energy and ICT) and the Ministry of Transport (for transport). Policy advice on water issues is provided by Ministry for the Environment, the Ministry of Health, the Ministry of Agriculture and Forestry, and the Department of Internal Affairs. The Treasury also has a role in infrastructure policy advice, especially where central government provides funding.

Many of the sector-specific Acts set up governance institutions or other arrangements to ensure that policy objectives are met.



1997 OPUHA DAM COLLAPSE

The partially completed Opuha Dam in the Opihi catchment in South Canterbury collapsed on 6 February 1997, releasing 13 million m³ of water down the Opuha River.

Intermittent heavy rain over the preceding few days had exceeded the capacity of the culvert through the dam and the available storage within the reservoir. A cut was made at the dam abutment but water was able to erode a larger channel into the earth dam, and eventually the dam collapsed.

A state of emergency was declared early on 6 February, and 200 residents were evacuated from four settlements. No human lives were lost but 1000 head of stock died and farms adjacent to the river sustained hundreds of thousands of dollars' worth of damage.

Half a million dollars' worth of damage was done to flood protection works in the Opuha and Opihi river catchments, and State Highway 79 was washed away at Skipton Bridge.

This collapse, along with floods in 2004, highlighted the need for dam safety provisions and reinforced the need for emergency management plans to be developed for medium and high potential impact dams.

The Electricity Commission was set up by Government in 2003 under the Electricity Act 1992, to ensure security of supply in response to the variability of water levels in New Zealand's main hydro-generation lakes resulting from uneven year-to-year rainfall. The Gas Industry Company is the industry body under the co-regulatory governance model established for the gas sector. They are responsible for developing and implementing gas market arrangements.

Land Transport New Zealand was formed in 2004 to take responsibility for land transport funding and promote land transport safety and sustainability. New Zealand is required under the International Energy Agreement to hold 90 days' supply of petroleum for emergency use.

Infrastructure supply risks are also addressed in the CDEM Act, which requires lifeline utilities to plan so they can function during and after an emergency, even if at a reduced level, and to take part in developing CDEM plans.

DAM SAFETY

Changes in the Building Act 2004 recognise the potential for dam failure and the need for a formal system of monitoring and maintaining dams given the continuing changes to dam ownership, operation, and management.

Dam owners are required to classify their dam according to the potential impact its collapse would have (low, medium, or high) and to register that classification with their regional council. This classification is regularly reviewed, which means that changing risk factors such as new downstream development or changing hydrological conditions can be taken into account. Owners must also prepare dam safety assurance programmes, which include emergency action plans, and provide an annual compliance certificate for medium or high potential impact dams.

Regional councils process building consents for dams, administer and monitor dam safety management (including holding a dam register) and develop policy.

Readiness

The gas industry has developed its own emergency and contingency arrangements in the National Gas Outage Contingency Plan. The Gas Industry Company is currently reviewing the contingency arrangements to ensure they are appropriate to the changing nature of the gas market.

The Transport Emergency Management Coordination Group aims to coordinate responses to critical transport infrastructure failures. This will support the transport sector to make rapid damage assessments, identify critical interdependencies, and set regional transport infrastructure recovery priorities.

Most of the territorial authorities surveyed as part of the 2004 PwC infrastructure audit had water supply contingency plans but they varied in standard. These included emergency response plans, risk management, and lifeline documentation and scenario planning. MCDEM is engaging with a number of local government and other organisations to develop a water sector CDEM contingency plan. The main issues to be addressed are the supply of drinking water for vulnerable populations during an emergency, and the most rapid and effective way to restore damaged water systems.

Government agencies, regulatory bodies, and industry organisations are working with lifeline utilities to develop or review contingency plans for the supply of water, wastewater, transport, energy, and telecommunications services.

The Guide to the National CDEM Plan encourages the formation of

regional and national CDEM clusters of lifeline utilities. The Guide encourages lifeline utilities to coordinate readiness activities, to develop disaster resilience summaries, hold joint exercises, and exchange emergency contact details with other lifeline utilities and CDEM agencies.

ENGINEERING LIFELINES GROUPS

Engineering lifelines groups are regionally based voluntary organisations of lifeline utilities (infrastructure providers) working together and with other agencies to identify interdependencies and vulnerabilities to emergencies.

There are currently engineering lifelines groups in most regions, which aim to reduce both the damage to infrastructure during an emergency and the time taken to restore services after a large event. This includes coordinating hazard investigations and collaborating on reduction and readiness activities.

Lifelines groups focus on hazard events which are likely to affect several infrastructure sectors at the same time. Until recently, engineering lifelines projects have dealt mainly with natural hazards, particularly earthquakes, but are now including other hazards such as influenza pandemic.

Lifelines groups do not have any statutory basis or obligations, but operate within the context that the member lifeline utilities are responsible under the CDEM Act for ensuring they can function to the fullest extent possible.

Response and recovery

Priorities for restoring infrastructure after an event are determined by individual lifeline utilities. However, the Guide to the National CDEM Plan does outline the priorities for restoring services to different groups or areas.

The Guide to the National CDEM Plan requires lifeline utility and CDEM Group coordination if:

- a lifeline utility service is disrupted in more than one territorial authority area or multiple lifeline utility services are disrupted by an event
- significant community impacts are expected because of a lifeline utility service disruption.

In other aspects, CDEM response to infrastructure failures would follow generic response and recovery procedures set out in CDEM Group plans, the National CDEM Plan and the Guide to the National CDEM Plan.

FURTHER INFORMATION

GENERAL INFRASTRUCTURE INFORMATION AND REGULATION

MINISTRY OF ECONOMIC DEVELOPMENT

www.med.govt.nz/templates/StandardSummary___11.aspx

www.med.govt.nz/templates/StandardSummary___33.aspx

www.med.govt.nz/templates/StandardSummary___36.aspx

www.med.govt.nz/templates/StandardSummary___37.aspx

MINISTRY OF TRANSPORT

www.mot.govt.nz

ELECTRICITY COMMISSION

www.electricitycommission.govt.nz

COMMERCE COMMISSION

www.comcom.govt.nz

GAS INDUSTRY COMPANY

www.gasindustry.co.nz

2004 PRICEWATERHOUSECOOPERS INFRASTRUCTURE AUDIT

MINISTRY OF ECONOMIC DEVELOPMENT

www.med.govt.nz/templates/ContentTopicSummary___5541.aspx

INTERNATIONAL CARGO STATISTICS

STATISTICS NEW ZEALAND

www.stats.govt.nz/products-and-services/info-releases/oseas-cargo-info-releases.htm

BUILDING ACT 2004 (DAM SAFETY)

MINISTRY OF BUILDING AND HOUSING

www.dbh.govt.nz/bofficials-dam-safety

OPUHA DAM COLLAPSE

LEES, P AND THOMSON, D, 2003, 'EMERGENCY MANAGEMENT, OPUHA DAM COLLAPSE, WAITANGI DAY 1997'.

IPENZ Proceedings of Technical Groups 30/2.

www.ipenz.org.nz/nzsold/2003Symposium/LargeDams2003pages84-104.pdf#search=%22opuha%20dam%20collapse%22

LIFELINE UTILITIES AND CDEM, AND ENGINEERING LIFELINES GROUPS

MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT

www.civildefence.govt.nz/memwebsite.nsf/wpg_URL/For-the-CDEM-Sector-Lifelines-Index?OpenDocument&menuexpand=forthecdemsector