8. OTHER HAZARDS

8.1 Summary

The purpose of this section is to address technical failure of one or more lifeline utilities due to causes or hazards not previously covered in other sections of the AELP-2.

The effects of larger, more frequent hazard types such as earthquake, volcanic eruption, tsunami and severe storm are widespread and covered in existing sections of the AELP-2. Many organisations across multiple lifeline utility sectors are affected and large portions of the population are affected and possibly even displaced meaning the priorities for restoration are usually location specific.

Computer Virus

Almost all networks are monitored and able to be controlled by independent SCADA telemetry. This opens up the possibility of terrorism through a computer virus although all lifelines organisations have some mitigation measures in place and each organisation's SCADA system is separate.

Pandemic

The largest impact on infrastructure from pandemic is the availability of lifeline utility staff to carry out core operations and the increased requirement for remote working through the telecommunications network.

Hazardous Substances

The impact of hazardous substance incidents is usually more localised and unlikely to have a large impact on lifeline utilities. The worst case scenarios involve hazardous substance spills at key transport nodes such as the airport, port or at one of the pinch points in the road network.

Wildfire

Impacts due to wildfire are also likely to be localised unless the electricity transmission lines are affected (which would have a knock on impact on other utilities).

Solar flares

Solar flares or geomagnetic storms cause increased ground currents that can travel through electricity distribution networks causing circuit breakers to trip resulting in large scale black outs and permanent damage to transformers. Telecommunications systems including long and short wave radio can be disrupted by the increased ionisation. GPS services can be disabled by solar radiation which can affect aviation.

8.2 Hazard Overview

There are other hazards that are less frequent and generally have a more localised impact that have not been considered so far that are included in this section under technical failure, as follows:

Infrastructure Failure

When outages are cause by infrastructure failure within one organisation or sector, life is still required to continue in a business as usual fashion for the public and other organisations. While many sectors experience smaller disruptions more frequently, they are often in localised areas and of a short duration (less than 24 hours). This section is focussed more on large scale, longer term outages that have widespread impacts.

Auckland has been impacted by the effects of large scale technical failure in the past, particularly power outages, and the AELG has prepared the Auckland Power Outage Plan to address potential issues. Likewise there is a strategy in place for the management of a gas crisis. Fuel contingency Plans have also been developed for any major disruption to the Auckland region and there is a National Fuel Contingency Plan.

Solar Flares/Geomagnetic Storms

Geomagnetic storms pose one of the largest threats to infrastructure without an emergency affecting the general public. There is no single cause and effect for how extreme solar events impact Earth's systems. However, power supply, telecommunications and global satellite navigation are especially vulnerable.

Geomagnetic storms are caused by coronal mass injections and solar flares. These storms result in massive ground currents, increased ionisation of the ionosphere and solar radiation being trapped in belts around the Earth.

Wildfire

Large scale wildfires are less common in New Zealand than in other parts of the world and although Auckland is not listed as the one of the most susceptible areas that does not rule out the possibility of one occurring. Transport has been the most affected lifeline by wildfires in New Zealand in the past (the closure of State Highway 1 during the 2000 Marlborough Fire).

Pandemic

There has been large impacts worldwide due to a number of pandemics historically (usually caused by a new strain of an influenza virus) and it is accepted that there will be another pandemic in the future. The impact on lifeline utilities will be the loss of human capability causing high absentee rates in the workforce. Lifeline utility staff often have specialised training and experience. The Ministry of Health is the lead agency and extensive planning and preparation has occurred nationally to prepare for a pandemic.

Hazardous Substance Incidents

The New Zealand Hazardscape defines a hazardous substance incident as:

> *"an unplanned or uncontrolled release of hazardous substances such as fuels, flammable substances, explosives, toxic chemicals, pesticides, radioactive material, or microorganisms, including contaminated waste products."*

The New Zealand Fire Service are called to lead and manage many hazardous substance incidents every year but a large scale hazardous substance leak that requires mass evacuation and CDEM involvement are very rare.

The largest impact would be a hazardous substance leak while during movement or delivery through the transport network (roads, ports and airports).

Terrorism

The largest threat to lifeline utilities through terrorism is the intentional interference or disruption to infrastructure, whether as an act of violence towards location specific hardware (substations, pipes etc) or through intellectual attacks on software (viruses etc). This is categorised as terrorism due to the impact it would have on society's ability to function.

8.3 Telecommunications

Telecommunications within the Auckland region are largely resilient through diversity as there are multiple organisations delivering similar services.

The loss of one organisations SCADA network or internal computer system through infrastructure failure or terrorism would not necessarily cause widespread loss of service to all consumers.

Wildfire and hazardous substances incidents could have a localised impact on telecommunications but it is unlikely to be widespread. However, disruptions caused by geomagnetic storms could have widespread effects across all telecommunications networks due to the interruption of long and short wave radio, satellite transmission and GPS systems.

Network and Service Impacts

Network Assets at Risk of Technical Failure	Expected Service Impacts
▪ SCADA telemetry used to maintain remote visibility of the network. Malicious attack (e.g. computer virus) could potentially shut down a network although each organisation runs an independent SCADA system. Resilience built in through diversity, multiple organisations delivering similar services. ▪ Southern Cross cable for internet connectivity. Two connection points in New Zealand and multiple routes across the Pacific. ▪ Billing software, particularly for prepaid cellular networks. ▪ Internal computer networks ▪ Geomagnetic storm could cause disruption of radio signals, particularly AM and long wave broadcasting. ▪ Potential for localised impact to above ground infrastructure due to wild fire. ▪ Increased loading of telecommunications networks in a pandemic due to increased absences from work and more remote working.	▪ Without SCADA there would be loss of surveillance of the infrastructure however that would only cause problems when another fault happens to the network. The loss of SCADA to one organisation could impact their customers however it is unlikely loss of SCADA would occur to multiple organisations at once. Sites would need to be manned to repair faults. SCADA is an internal network and not connected to the internet to reduce the risk of virus. ▪ Use of satellite internet is available in the event of loss of the Southern Cross cable but at a limited capacity. ▪ There is the ability to ensure connectivity to the network even if the billing software is affected. ▪ Internal networks are at risk of virus but the network would continue to operate. It will only affect the ability of staff to work. ▪ Loss of radio or television broadcasting due to geomagnetic storm. This could potentially impact emergency radio networks, especially now that they are digital.

Table 8-1: Telecommunication Network: Vulnerability to Technical Failure

8.4 Water/Waste Services

Technical failure of water, wastewater and stormwater infrastructure is possible but the impacts would not necessarily cause a loss of service. There are multiple water supply points and the trunk mains are largely underground giving them greater resilience to man-made risks. The impacts from damage to wastewater infrastructure are usually environmental and not a loss of service to customers. Failure of stormwater pump stations would only have an impact during periods of high rainfall where it would cause flooding. Wildfire could pose a risk to water supply as the supply dams are located in remote, bush surrounded areas but there is redundancy across the network.

Solid waste runs are pre-programmed and there are multiple disposal sites. There would be no impact on the ability for the service to be delivered due to technical failure.

Network and Service Impacts

Network Assets at Risk of Technical Failure	Expected Service Impacts
▪ SCADA telemetry used to maintain remote visibility and control of the network. Malicious attack (e.g. computer virus) could potentially shut down the network. ▪ Loss of water supply infrastructure (treatment plants, trunk mains and pump stations) could impact supply pressure but there is redundancy built in to the network to prevent a complete loss of supply. ▪ Technical failure of the Wastewater treatment plants, mains or pump stations would cause environmental impact but not necessarily a loss of supply to customers. Blockages will be caused by long term water restrictions or reduced supply which can impact customer supply. ▪ Solid waste disposal site or collection point.	▪ Disruption of response and situation assessment. While most of the infrastructure will continue to operate without SCADA visibility, some critical points have a fail-safe to shut off. ▪ Loss of supply from Ardmore (supplies 60%) would impact fire fighting pressure within 8 hours. Localised impacts due to the pressure required to get water to heights for high rise apartments etc. ▪ Environmental impact of wastewater overflows. ▪ Multiple solid waste disposal sites and collection points across the region providing redundancy so no impact on service. Several months worth of storage for recyclables is available.

Table 8-2: Water/Waste Networks: Vulnerability to Technical Failure

8.5 Energy

Electricity is one of the most critical lifelines and possibly the most at risk of a large disruption due to technical failure. There is one entity that controls the power supply and distribution within New Zealand, the System Operator although there are security measures in place to prevent a malicious attack. In terms of hardware, the Whakamaru Substation is critical for the supply of electricity to the upper North Island.

Failure of the gas mains (Vector and Maui pipelines) from Taranaki to Auckland poses a risk to supply as has been seen in the past. There is a system in place to cope with outages although the effects on consumers and the economy of Auckland are still widely felt.

Fuel is critical on a day to day basis and even more so in an emergency. Fuel for Auckland comes from the Marsden Refinery through the RAP. Any damage along this route would cause fuel shortages for Auckland and parts of Waikato. Automotive fuels can be trucked in from the truck loading facility at Marsden or Mt Maunganui bulk storage terminals and is limited to available trucks and drivers. Aviation fuel to Auckland International Airport Limited (AIAL) would not be practical through trucking and International flights would need to tanker fuel from other locations.

Damage to the receiving Wiri Oil Services Limited (WOSL) terminal could result in no fuel being pumped via the RAP or WAP and would result in similar disruption to that of either an extended Refinery or RAP outage as well as prevent aviation fuel being pumped directly to the AIAL.

Network and Service Impacts

Network Assets at Risk of Technical Failure	Expected Service Impacts
▪ Whakamaru Substation is Transpower's main hub. All supply to the upper North Island is distributed from this point. ▪ System Operator – entity that controls the power supply and distribution in New Zealand. ▪ Geomagnetic storms could cause widespread loss of electricity supply due to circuit breakers tripping. ▪ SCADA telemetry used to maintain remote visibility of the network. Malicious attack (e.g. computer virus) could potentially shut down a network although each organisation runs an independent SCADA system. ▪ Transmission lines could be impacted by wildfire as the fire can destroy the limes themselves or affect the capacity due to heat, smoke and particulate matter. ▪ Vector and Maui high pressure pipelines and compressor stations. ▪ Marsden refinery. ▪ Refinery to Auckland Pipeline for the delivery of fuel. ▪ Wiri Oil Services Limited (WOSL) and the Wiri to Airport Pipeline (WAP) for truck loading and delivery of Jet Fuel to AIAL.	▪ Loss of System Operator or the Whakamaru Substation would cause widespread outages to the upper North Island. These outages could be long term. ▪ Loss of supply caused by geomagnetic storms would be widespread. The electricity grid takes at least 48 hours to come back online from a "black" start possibly longer. This plan is untested nationally. ▪ Loss of SCADA itself will not affect the supply although it impacts an organisations ability to respond to faults and outages. Sites would have to be manned and repair of faults could take longer. ▪ Potential loss of supply or capacity through damage to transmission lines either in or outside the Auckland Region. ▪ Damage to the gas pipelines is managed through the Critical Contingency Operator and could cause reduced supply rather than a complete loss. ▪ Damage to the refinery itself or the Refinery to Auckland Pipeline will cause severe fuel shortages to Auckland. ▪ Damage to WOSL results in no supply of Jet Fuel to Auckland Airport. Truck Loading could also be affected with this type of failure – tankering and rationing would be required resulting in traffic congestion. ▪ Roll on effect to all other Utilities requiring fuel

Table 8-3: Energy: Vulnerability to Technical Failure

8.6 Transport

The road network in Auckland is extensive and for most routes there is redundancy built in. For the larger routes and pinch points such as the Harbour Bridge, tunnels, motorways and much of the state highway the alternatives are not designed for the loading or capacity. This would lead to severe traffic congestion.

Traffic signals are coordinated and managed by a remote operating system (SCATS). Individual intersections run on isolated local demand when the signal is lost however, signals are managed for optimum traffic flow during peak conditions. Long term outage of the signal system would greatly affect the region.

Auckland Airport and the Port of Auckland have critical infrastructure for their operation (runways, terminals, wharves and cranes) and while short term outages would be inconvenient, long term outages could have significant economic impact.

The transport sector is the sector at greatest risk of a hazardous substance incident, particularly if the leak occurs in transit at the port or airport. Smaller incidents are quite common on the road network although the impact is usually short term.

Network and Service Impacts

Network Assets at Risk of Technical Failure	Expected Service Impacts
▪ SCATS, the signal coordination system that operates traffic lights across the city. ▪ Auckland Transport/Auckland Council call centre. ▪ Pinch points in the road network including the Harbour Bridge, tunnels, motorways and state highways. ▪ Infrastructure damage to bridge overpasses due to over height loads. ▪ Signal operation system on the rail network. ▪ Port – wharves, cranes and terminal operating system. ▪ Runway and terminals at Auckland Airport.	▪ SCAT runs in isolated mode when there is no signal from the operations centre. Each intersection works off its own detector loops only with no upstream or downstream coordination. This would cause traffic congestion at peak times when signals wouldn't be coordinated. There are multiple servers at multiple sites for the SCATS system to ensure operability. ▪ Loss of call centre for traffic related calls could escalate calls to 111 emergency line and affect the response to emergencies. ▪ Loss of any of the major pinch points in the road network would have considerable impact. There are diversion routes in place however they will never cope with the capacity required. Could cause severe traffic congestion. ▪ Severe traffic congestion could leave public transport passengers stranded in the CBD and elsewhere requiring short term welfare needs. ▪ Damage to overpasses could be an immediate impact on the overpass and the motorway causing severe traffic congestion due to reduced capacity diversion routes. ▪ Loss of rail network signals would affect trains. ▪ Port – loss of availability of Fergusson Wharf and/or its 5 quay cranes would require the majority of the exports/imports to go via Port of Tauranga affecting Kiwirail and State Highway network. Loss of terminal operating system or data would result in long processing delays in container receipts and deliveries. ▪ The runway and terminals are required for the airport to be open and operating.

Table 8-4: Transport: Vulnerability to Technical Failure

8.7 Future Work

All Sectors

1. Interdependency Study, focus on primary effects from the hazard and secondary effects due to loss of another lifeline.

2. Consider a virus attack as not shutting down a system but changing the supply. Run an exercise.

3. Look at the effects of failure of the banking system (i.e. Paymark EFTPOS system)

A summary for each lifeline sector and the ways they can improve their response or resilience to technical failure in Auckland is provided as follows:

Water Sector

1. Ongoing dam safety management for stormwater/Parks ponds and dams, onsite wastewater retention ponds, consider increased capacity.
2. Inclusion of Auckland Council Parks staff as many stormwater holding ponds are located and managed in reserves.

Telecommunications/Broadcasting:

1. On-going program to replace aged battery backup in the network. Back up power supply estimates are based on normal demand, power usage goes up with increased demand.
2. Set priorities of sites to be manned in the event that SCADA is lost.

Energy:

1. Ensure contact information for response is backed up if telecommunications fail. Many people only know the numbers with access to their system.
2. Potential sector exercise for a computer virus.
3. National Grid black start is untested.