



**REGIONAL LIFELINE  
VULNERABILITY ASSESSMENTS  
METHODOLOGIES AND OUTPUTS**

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# THIS PRESENTATION COVERS .....

## Brief summary of Lifeline Projects

- What is a Lifeline Project?
- Main features
- Desirable features
- Current issues

Purpose: to stimulate discussion on approaches, current developments and future issues

# PRESENTATION DOESN'T COVER ....

- Other typical Lifeline Group projects , e.g.
  - Priority routes
  - Petroleum studies/planning
  - Electricity outage management
  - Communication protocols
  - Many others

# WHAT IS A LIFELINE PROJECT?

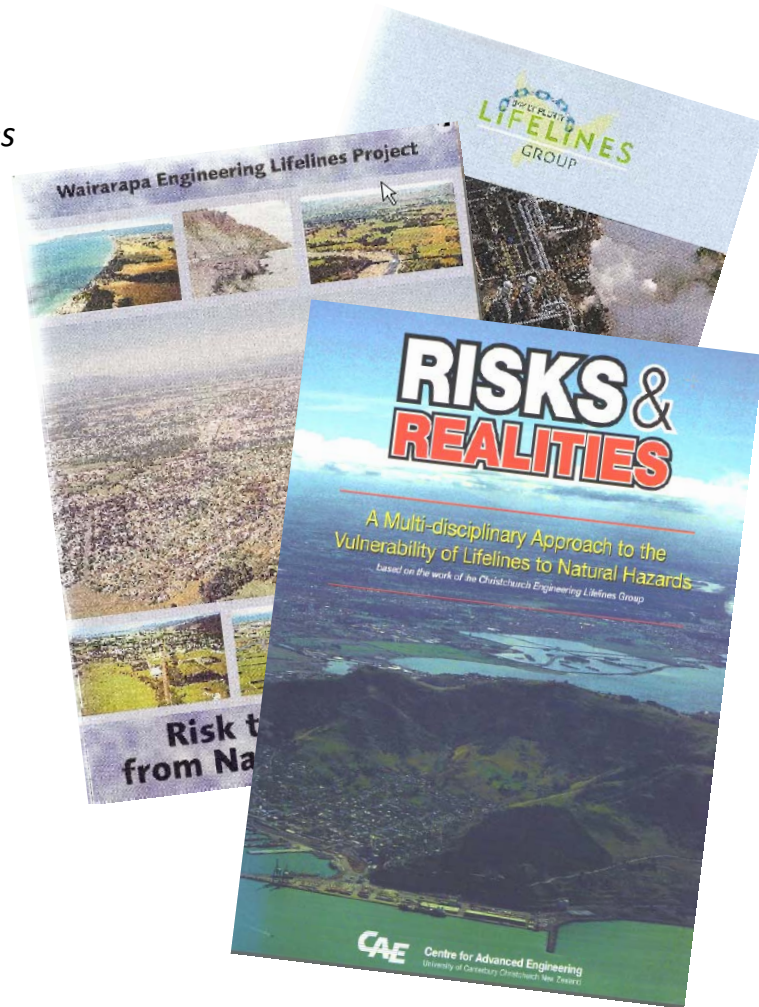
- Survey of lifeline asset vulnerability to hazards in the area
  - Output: component risk rating from which critical locations identified
  - Interdependencies: identified but usually not integrated
  - May also list possible mitigation measures
- Traditionally prepared in bound / printed form
- Intended to be updated from time to time
- Leads naturally to a Group multi-year work programme
- Can integrate with CDEM planning

# DIFFERENT APPROACHES: OVERVIEW

- First Order Assessment – Qualitative / Indicative
  - Identification of readily apparent critical areas and sites
- Lifelines “Vulnerability” Assessments
  - Qualitative / Systematic
  - Most Lifeline Projects are at this level
- Integrated Risk Modelling of Regional Networks – Quantitative
  - Evidence-based network modelling of multiple networks
  - Requires integration of interdependencies / wider economic and social impacts
  - An aspiration, but reality just around the corner

# SELECTED PROJECTS

- 1991: *Lifelines in Earthquakes: Wellington Case Study*
  - Plus: *Additional work on Critical Sites*
- 1997: *Risks and Realities: Christchurch*
- 1999: *Auckland Engineering Lifelines Project (AELP1)*
  - Plus: *Assessment of Infrastructure Hotspots in the Auckland Region (2007)*
- 2001: *Facing the Risk (Hawke's Bay)*
- 2003: *Risk to Lifelines from Natural Hazards (Wairarapa)*
- 2005: *Risks and Responsibilities (Manawatu-Whanganui)*
- 2011 – 2012: *Bay of Plenty / Southland*



# KEY FEATURES

## ***Wellington***

- The original CAE Lifelines study – 1991
- Task Group approach
- Urban area only
- Earthquake only
- Interdependencies
- Second study - critical areas 1993

## ***Christchurch***

- CAE's *Risks & Realities*
- Christchurch only
- All hazards, interdeps
- Mitigation
- Task Group approach
- International views

## ***Auckland***

- AELP 1 - 1999
- Five-year project
- Four hazards incl volcanic
- Hotspots (Opus, 2007)
- AELP 2 – further hazards, interdeps

## ***Wairarapa***

- Approach based on Wgtn and Chch
- AS/NZS 4360
- Detailed risk analysis matrices

## ***Hawke's Bay***

- Based on Chch and Wairarapa
- AS/NZS 4360
- International review / best practice

## ***Manawatu-Whanganui***

- Semi-quantitative risk ranking formula
- Interdependencies
- No of affected customers factored in

## ***Bay of Plenty (&Southland)***

- Risk-based
- Utilities did the work
- Interdependencies
- Phase 2 to come
- Southland based on BoP's approach

# EVOLUTION PATH

- Early stages:
  - Cities originally, then broadened to regions
  - Detailed reviews of component vulnerability
  - Lifeline Group formation
- Followed by
  - Increasing interest in interdependencies, economic and social impacts
  - Increasing use of formal risk management (AS/NZS 4360)
  - Impact of CDEM Act 2002
  - Increasing use of GIS
  - Interest in quantification
- Current issues
  - Increased focus on mitigation possibilities
  - Decreasing resource availability / intensity



# DESIRABLE FEATURES

- 2009 NZLC report recommended
  - Comprehensive coverage of hazards
  - Sufficient detail to ensure that vulnerabilities are exposed
  - Recognition that individual assets /sites and points of asset co-location may be nationally significant
  - Use of GIS
  - Based on AS/NZS 4360:2004
  - Recognition of interdependencies
  - Recognition of economic and social consequences of failure
  - Cost-effectiveness
- Plus some other desiderata
  - Focus should be on region (not urban)
  - Recognition of cross-regional issues / contributing to understanding national vulnerabilities
  - Compatibility with CDEM Plans
  - Inclusion of mitigation
  - Quantification

# DEFINITIONS MATTER

- Risk
- Likelihood
- Consequence
- Hazard
- Vulnerability
- Hotspot (aka “critical area”)
- Critical site
- Pinchpoint
- Interdependency

# DEFINITIONS - SUGGESTED

<b>Risk</b>	Likelihood and consequence of a hazard, considered together
<b>Likelihood</b>	The chance that the event will occur in the future (probability)
<b>Consequence</b>	The things expected to happen if the event occurs (generally “bad” things)
<b>Hazard</b>	Something that, if it occurs, will endanger public safety
<b>Vulnerability</b>	The susceptibility of an asset to damage
<b>Hotspot (aka “critical area”)</b>	A small area where infrastructure of consequence is co-located
<b>Critical site</b>	A particular site (e.g. a building) needed for service continuity
<b>Pinchpoint</b>	Equivalent to “single point of failure”
<b>Interdependency</b>	Dependence arising from a supply chain requirement (e.g. cell-sites need electricity)

# AELG SIGNIFICANCE LEVELS

## Nationally Significant

- Failure would cause loss of utility supply to most of region or loss of supply to another nationally significant site that depends on its service.
- Eg: Auckland Airport, Otahuhu substation, Ardmore/Huia Water Tmt Plant, SH1 / SH16 / SH20

## Regionally Significant

- Failure would cause loss of supply to more than 20,000 customers or reduction in service across the region or loss of supply to a regionally significant site
- Eg: Main cellsite hubs and telephone exchanges, Army Bay/Orewa Wastewater Tmt Plant

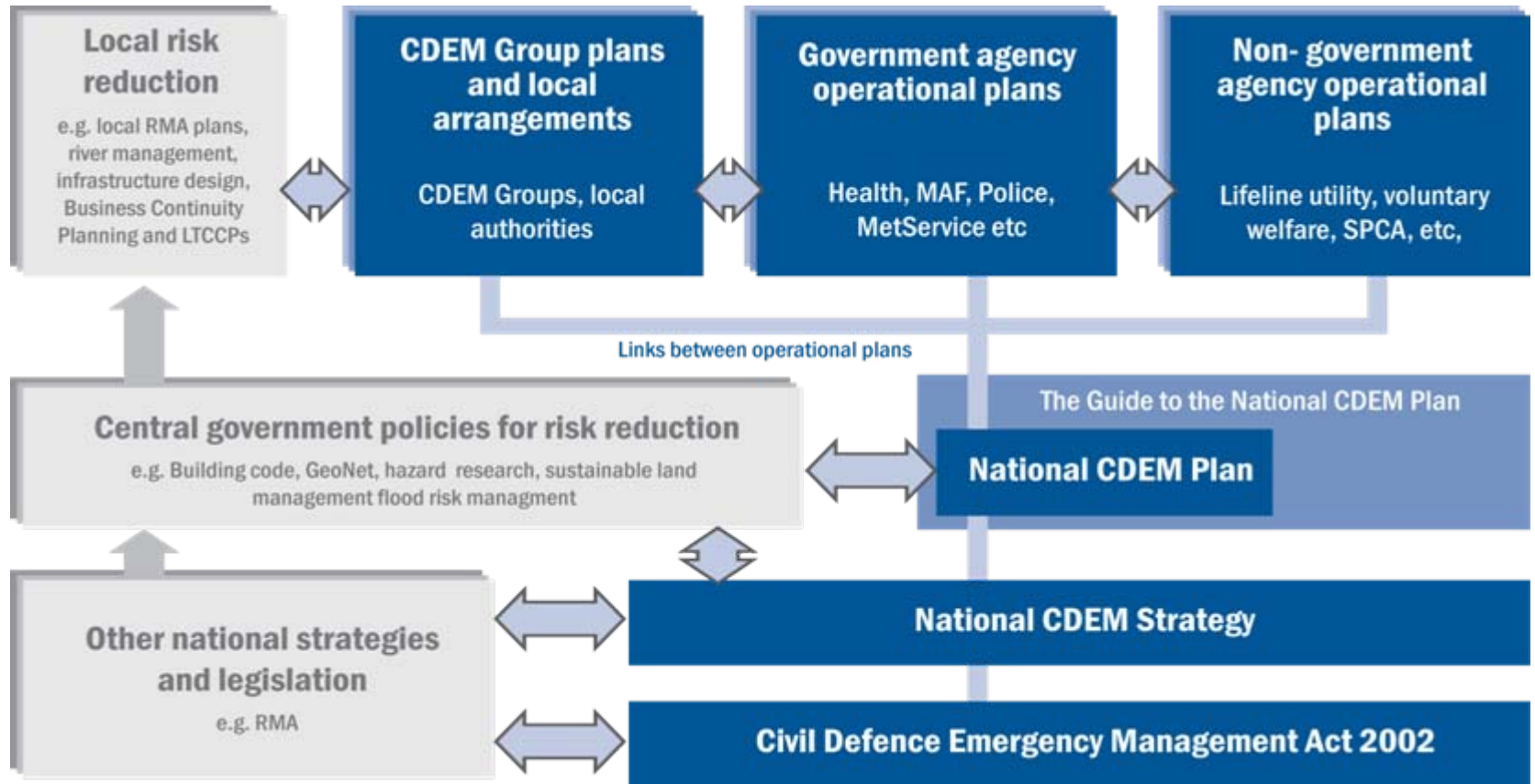
## Locally Significant

- Failure would cause loss of supply to more than 5,000 customers or reduction in service across part the region or loss of supply to a locally significant customer.
- Eg: Smaller water supplies (eg: Wellsford) & Wastewater tmt plants (Orewa).

# CURRENT ISSUES

- CDEM expectations
  - Integration with CDEM Group Plans
- Balancing Lifeline Projects against lessons from experience
  - Do Christchurch earthquakes offer better ways to frame the resilience agenda?
- Modelling
  - Recent MBIE-funded research
- Extending to cross-regional and national exposures
  - National Infrastructure Unit interest

# CDEM EXPECTATIONS



*Linkage between national, regional and local operational plans and arrangements and risk reduction policies and programmes.*

**Guide to the National CDEM Plan**

# 2<sup>ND</sup> & 3<sup>RD</sup> GENERATION CDEM GROUP PLANS

- CDEM Groups now completing 2<sup>nd</sup> round of Plans
- DGL 09/09: Chapter 5 “Risk Profile”
  - Summary of the natural, social, built and economic environments
  - Hazard descriptions
  - Qualitative risk assessment (risk template provided)
  - Evaluation of current and potential actions: “SMG” (Seriousness, Manageability, Growth)
- Lifeline Groups can contribute to CDEM planning by adopting compatible approaches

# NZ IS LEARNING FROM THE EARTHQUAKES

- Lifeline Group activities
  - Canterbury presentations / workshops
- CERA: Lessons Learnt project
- Research: MSI investment round, TCLEE interest
- Government / National Infrastructure Unit
  - National Infrastructure Plan
  - *Building Infrastructure*
- Reviews: LUC and overall CDEM response
- New Zealand Lifelines Committee
  - TCLEE visits and report
  - Value of Mitigation report
  - National Lifelines Forum



# NEW MODELLING PROJECT

- *Economics of Resilient Infrastructure*: 2.8 m for 4-year project
  - Project team: GNS Science, Resilient Organisations, Market Economics, Tony Fenwick
- Model features:
  - Quantifying consequences of infrastructure failure
    - Hazards and infrastructure-only events
    - Temporal and spatial
    - GDP, employment, income
  - Assessing mitigation, business response and post-disaster recovery strategies
- Deliverables:
  - Simulations for
    - Auckland and Christchurch
    - Six infrastructure-only events
  - Model able to be used:
    - To value infrastructure resilience improvements
    - To aid local spatial and CDEM planning around NZ

# LIFELINE PROJECTS: BRINGING THE ELEMENTS TOGETHER

A pragmatic approach:

- 1 Infrastructure: Identify main locations
  - Nodes and links
  - Co-Locations (aka Hotspots / Critical Areas)
  - Critical infrastructure sites (aka Pinchpoints)
- 2 Hazards: Understand the hazards, including mapping against the infrastructure locations
- 3 Risk Analysis: Prepare this for the key locations
  - Draw on AELG’s Significance Levels
  - Judgemental adjustment for “sensitive users” including infrastructure interdependencies
- 4 Mitigation:
  - Evidence: Learnings from other events etc
  - SMG evaluation: Seriousness, Manageability, Growth
  - Hotspots / Critical Areas: MoU may be required

# WHAT'S NEW IN THIS APPROACH?

- Brings in all key infrastructure locations
  - E.g. Hotspots and pinchpoints are integrated
- Is consistent with approach to CDEM planning
- Deletes detailed component by component approach
- Draws in Learnings and other mechanisms (e.g. MoU) in developing mitigation plan
- Can meet most of the “Desirable Features” mentioned earlier
  - Supplementation for national vulnerabilities required
- Appears achievable even with limited resources
  - Is scaleable

# CONCLUSION

- Lifeline Group projects are at different stages
  - Many done some years ago
  - A few not undertaken / commenced
  - Auckland renewing
- Difficulty resourcing detailed projects
  - Learnings from experience offer an opportunity
- Interest in national vulnerabilities
  - Is there a way to move from Lifeline Group plans to a national perspective?