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| Version | Date | Last edited By |
| V7 | 17 Feb 16 | Greg Preston |

# Towards New Zealand Guidelines for Pipe Renewals

## Objectives

To provide guidance and tools to enable New Zealand Water organisations to implement advanced asset management processes to develop inspection, maintenance and renewal strategies for pipework in potable water, wastewater and storm water systems.

Using these processes organisations across New Zealand will be able to produce long-term strategies that optimise cost, risk and level of service using a consistent framework. They will be able to show the implications of adopting alternative strategies and select the strategy that best suits the needs of their community. The accuracy of forecasts will be improved by lessons learnt being shared and specific research being undertaken.

The focus will initially be on pipework assets as they make up the largest proportion of water systems, but over time the scope will be extended to other assets.

### Key Approaches

* Aim for common framework and analysis methods, but allow organisations to interpret them to suit the differing needs of their communities.
* Do not reinvent the wheel. Use oversea guidance where applicable to New Zealand.

## Context

In 2014, the total replacement value of the 3 waters assets in New Zealand was estimated to be about NZ$45.2 billion. The wastewater network had the highest replacement value at around NZ$17.8 billion, followed by drinking water assets at NZ$16.2 billion and storm water at NZ$11.2 billion.[[1]](#footnote-1) It is estimated that many of these assets will need to be replaced within the next 30 years which potentially puts the annual renewals bill in the order of NZ$1.5 billion per year. As these assets are upgraded or replaced, many difficult decisions will need to be made in respect to the trade-offs between Levels of Service, capital costs, operating costs and management of risk. In addition to this, the ownership and governance structures of the 3 waters are varied across the country as are the business practices and procurement systems. If even a small percentage of the possible renewals cost can be saved by a better understanding of the renewals process, this would amount to many millions of dollars that may be invested more productively elsewhere.

Local Government New Zealand’s “3 Waters Project”, highlighted that Councils are investing significant resources in trying to address this challenge – each operating in independent silos and not taking advantage of a shared approach.

MBIE & LINZ are implementing a project to explore the implementation of shared data standards (Metadata Standards) for water infrastructure and built assets (buildings). This is linked to a separate roading initiative. The intension of these projects is that “with shared infrastructure data standards used by all infrastructure providers; infrastructure condition and performance would be comparable and could be benchmarked, data analysis could be automated and best practice established, and entities can more easily engage in joint procurement initiatives or shared services arrangements.” To gain the benefit of these projects, work needs to be undertaken to develop tools and guidance to show how this data can be developed into information that can be used for renewals planning.

Whilst there are a number of guidance documents available such as the International Infrastructure Management Manual these outline generic management approaches. There is a need for guidance and tools specifically developed for water assets that move the discussion from general process to implementation.

A significant amount of data is available from SCIRT on the Christchurch water systems. This is currently being analysed to gain learnings on how to improve the seismic resilience of water systems, but it can also provide valuable learnings on renewal requirements under business as usual.

## Uncovering the need

On 2 Feb 2016, the Quake Centre convened a workshop to explore the needs of the sector in respect to pipe renewals standards and guidance. The 24 participants from a broad spread of the sector showed a high degree of agreement as to the need. The framework that was drafted at this workshop is laid out in Appendix A: Framework for Pipe Renewals Guidance. There was general understanding that much of this material already exists in some form but a coordinated effort is required to collate, update and share this information. There were also significant gaps that were uncovered, some of which will require long-term research.

Post the workshop, Philip McFarlane of Opus put some thought into the framework outlined in Appendix A. He has developed a list of actions which is laid out in below.

### Scope

The workshop did not identify a divide between the needs of the urban and rural sectors. However, to maintain an achievable outcome in the first instance, it is suggested that the initial scope of guidance and standards is limited to 3 water pipe networks within the urban environment.

## Tools and Guidance to be developed

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| **Theme** | **Condition** |
| **Scope** | Undertake the appropriate level of Condition Assessment |
| **Actions** | 1. *Develop guidance document that defines which assets should be inspected and how often based on likelihood and consequence of failure and predicted deterioration. Whereas the IIMM and other documents outline the generic process, this document will provide specific guidance on inspection requirements and frequencies. The document will provide guidance on assessing assumed condition where appropriate for assets with a low consequence of failure.* |
| **Scope** | *Use of Appropriate Condition Assessment Techniques* |
| **Actions** | 1. *Update Pipe Inspection Manual – amend grading approach so that gradings assigned better reflect the need for renewal. Update fault photographs and general update.* 2. *Provide guidance on condition assessment of pressure pipes. Outline pros, cons, comparisons and calibration of new non-destructive technologies (review oversea guidance and use where appropriate).* 3. *Update asbestos cement pipe manual – already underway (WaterNZ/Opus)* |

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| **Theme** | **Pipe Vulnerability and Likelihood of Failure (BAU)** |
| **Scope** | Understand how pipes deteriorate and how this affects level of service, risk and renewal predictions. |
| **Actions** | 1. *Develop guidance document on expected failure modes for various pipe types (Opus pipe cohorts document might be able to be used as a starter)* 2. *Define standard useful lives for various pipe types (there is a large amount of variation in the standard useful lives currently in use, some of the published material is likely to be too conservative)* 3. *Implement a pipe failure database to record repairs and renewals. In the future this can be analysed to refine useful life predictions and expected repair rates and LOS (the UKWIR Database might be suitable)* |

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| **Theme** | **Levels of Service** |
| **Scope** | Common measures of level of service |
| **Actions** | 1. *Develop common measures for levels of service. Note target LOS may vary from organisation to organisation but measures should be standardised (Use WaterNZ benchmarking and DIA mandatory measures as a starting point)* |

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| **Theme** | **Risk & Resilience** |
| **Scope** | Use a common framework for assessing pipe criticality |
| **Actions** | 1. *Develop a common framework for assessing pipe criticality* i.e. *Applying AS/NZS ISO 31000:2009 in the context of 3 Waters at suitable scale* |
| **Scope** | Assess vulnerability to natural disasters and improve resilience |
| **Actions** | 1. *Develop guidelines for assessing vulnerability and improving resilience of buried utilities to seismic events (already underway MBIE/Opus).* 2. *Develop guidelines for assessing vulnerability and improving resilience of pipelines to other natural disasters.* |

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| **Theme** | **Capacity and Growth** |
| **Scope** | Coordinate deterioration related renewal with works to improve capacity and delay with growth |
| **Scope** | 1. *Develop guidelines that help organisation address the following when undertaking renewal planning*  * *Current pipe utilisation* * *Spatial planning* * *Interdependencies and coordination with other utilities* * *Environmental standards* * *Understanding the ownership implications of laterals and inherited systems* * *Impacts of negative growth* |

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| **Theme** | **Life-Cycle Costs** |
| **Scope** | Develop Whole of Life Costing Models |
| **Actions** | 1. *Establish common data base of costs for asset creation, repair, rehabilitation and renewal (provide a common basis of costing but allow for regional differences)* 2. *Generate expected cost curves by linking cost information with deterioration and other useful life predictions to develop cost curves (Development of repair and maintenance versus time and asset deterioration curves)* |

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| **Theme** | **Building Standards and Constructability** |
| **Scope** | Develop standardisation of specifications |
| **Actions** | 1. *Develop standard specifications for use across New Zealand* 2. *Develop standard specifications for Trenchless technologies* 3. *Develop process that enable innovative methods and materials to be assessed and trialled before they are introduced for widespread use (this is not intended to slow down the adoption of new technologies rather ensuring they are introduced in a manner where learnings can be shared.* |

## Structures for delivering national guidance in the 3 Waters sector

With such a clearly identified need and the very large positive financial benefits that are likely to accrue, it would be sensible to create a structure that can support the development of the guidance. There are important ongoing discussions regarding the structure and governance of the 3 Waters sector. Much of this thinking is laid out in the positioning paper published by LGNZ *Improving New Zealand’s water, wastewater and stormwater sector.[[2]](#footnote-2)* The structure for producing and delivering national guidance needs to integrate seamlessly with the eventual governance structure of the sector but it also needs to reflect the needs the end-users of the guidance and current structures and intellectual property constraints. Some perspectives from the Quake Centre on the production of the guidance materials are laid out as follows.

In respect to guidance material, key issues can be separated into the following aspects.

1. Governance
2. Leadership
3. Ownership
   1. Funding
   2. Writing
   3. Dissemination
   4. Training
   5. Updating and long-term research need

There are a number of key organisations in the sector that could come together to provide the aspects required.

### Governance

From a governance perspective, a tiered approach may be required to ensure all relevant parties are included but without creating a structure that is too cumbersome to be effective. The governance group need to ensure the overall direction of the guidance meets the national need and that the approach is effective and sustainable. Initial suggestions of the governance membership include:

#### Tier 1: National representation (Industry and Government)

* IPWEA
* Water New Zealand
* LGNZ
* Civil Contractors NZ
* The National Infrastructure Unit
* MBIE
* The Quake Centre
* National Lifelines

#### Tier 2: Primary stakeholders

* Asset owners and managers such as:
  + CCC
  + Auckland Council
  + Watercare
  + Wellington Water
  + Veolia, etc.
* Consultants:
  + Opus
  + Beca
  + MWH, etc.
* Manufacturers and contractors:
  + Hynds
  + Fletcher/Humes
  + Fulton Hogan
  + City Care
  + Etc.
* Concrete Pipe Association of Australasia
* Irrigation Association of NZ

### Programme development leadership team

This represents those people who will directly contribute to the leadership and development of the guidance and who have a financial stake in the programme of work. Some possible contributors are:

* MBIE
* Water NZ
* Quake Centre
* IPWEA
* Watercare
* CCC
* Fletcher
* Fulton Hogan
* Hynds
* Etc.

The leadership need to decide on priorities, formats, writing and reviewing teams and programme and project management.

### Ownership

Ownership of the guidance material is a very important topic. The owner is responsible for quality assurance, updating, deciding who has the rights to use the material and at what cost. The Quake Centre has a preferred ownership model under which all materials are developed for the public good regardless of the sources of funding. Ownership of the material belongs to whoever developed it but it is shared under a creative commons licence allowing any person to use the material as long as it is unaltered and the owner is attributed. Underpinning this ownership model is a partnership arrangement whereby organisations pool their resources to deliver the outcomes required.

### Funding

Funding the development of the guidance material is linked strongly to the model chosen for dissemination. One model is that the cost of material development is completely covered by the cost of material dissemination, i.e., selling the material to fund its development. The model preferred by the Quake Centre is one whereby a combination of partnership funding, central government, other funds and in-kind support are used for the production of the material. Material is available online for free whereby it can be updated easily and cheaply. Other dissemination and training costs are charged to the end user to cover the cost of those activities with a small profit accrued sufficient to cover the costs of updating. This creates long-term sustainability.

### Hosting, dissemination and training

As previously stated, a preferred method of dissemination is via the web. The advantage of this is the lower cost of publication and updating. With material that will be used widely across the country and by many different organisations it is useful to have a single source of truth that can easily be accessed and kept up to date.

Running seminars around the country can be a good way of raising the awareness of the guidance. This can be augmented by webinars and other online support to assist users in gaining the maximum benefit from the guidance. In addition, training is required to ensure that guidance material is used correctly and behavioural change is embedded in the sector. This training could be online or face-to-face and could be delivered via such organisation as NAMS or, indeed, fed back into undergraduate and postgraduate programmes as appropriate.

## Next steps

It is proposed to call a meeting of the aforementioned Tier 1 and 2 organisations to begin the process of creating a leadership and governance structure as well as a road map for developing the tools and guidance documents laid out in Appendix B. This would involve:

* Preparing a more detailed business case
* Developing briefs for each tool and guidance
* Assessing the appropriateness of documents and other material currently available
* Developing priorities and timeline for implementation
* Estimating budgets and determining available funding streams.

The Quake Centre is offering its services as the programme manager. We would seek support from practitioners, engineering consultants and academics where appropriate. It is expected that the implemented roadmap could be finalised by mid-2016 and the first tools and guidance documents be completed by the end 2016.

## Appendix A: Framework for Pipe Renewals Guidance

The following was the output of a workshop hosted by the Quake Centre at the University of Canterbury on Tuesday 2 February 2016 to explore the need for and scope of a guidance document relating to the renewal of New Zealand’s 3 water buried infrastructure. The workshop identified 10 themes. These themes created a framework for the creation of guidance material which contextualised the asset management and renewals guidance and decision tools set out in the International Infrastructure Management Manual 2015 Edition for use within the New Zealand 3 Waters Industry.

### Framework themes

The 10 themes comprised:

* Strategy and Planning for Capacity and Growth (both positive and negative)
* Levels of Service, Risk and Resilience
* Pipe Criticality
* Pipe Vulnerability
* Pipe Inspection and Condition
* Forecasting Remaining Pipe Life
* Business Processes
* Data management
* Building Standards and Constructability
* Life-cycle Cost of Pipes

It was recognised that underlying all the themes are the Metadata standards currently under development. The standards will provide a consistent methodology for describing three waters assets and are an essential underpinning for any national guidance framework.

### Specific Guidance by Theme

Within each theme a number of specific guidance modules were identified.

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| **Theme** | Strategy and Planning for Capacity and Growth |
| **Scope** | Current pipe utilisation  Spatial planning  Interdependencies and coordination with other utilities  Environmental standards  Understanding the ownership implications of laterals and inherited systems  Impacts of negative growth |

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| **Theme** | Levels of Service, Risk and Resilience |
| **Scope** | Level of Service Definitions and applications  Application of AS/NZS ISO 31000:2009 in the context of 3 Waters at suitable scale and in the context of extreme events |

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| **Theme** | Pipe Criticality |
| **Scope** | Creation of a common framework for assessing pipe criticality |

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| **Theme** | Pipe Vulnerability and Likelihood of Failure |
| **Scope** | Understanding Hazards  Failure modes in pipes and creation of a failure database  Quality assurance  Standard useful life |

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| **Theme** | Pipe Inspection and Condition |
| **Scope** | *Pipe Inspection Manual* update and extension to pressurised pipelines  Pros, cons, comparisons and calibration of new technologies  Sampling rates and currency of pipe inspection in relation to criticality and knowledge of condition  Guidance on assumed condition  Contractor guidance on fault recording |

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| **Theme** | Forecasting Remaining Pipe Life |
| **Scope** | Development of repair and maintenance versus time and asset deterioration curves  Guidance on forecasting for generic renewals and critical pipelines |

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| **Theme** | Business Processes |
| **Scope** | Better business case in the 3 Waters context  Appropriate allocation of risks  Procurement standards for water  Whole of life cost modelling  Asset inheritance issues |

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| **Theme** | Data management |
| **Scope** | Implementation of metadata standards  Data collection, storage and analysis |

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| **Theme** | Building Standards and Constructability |
| **Scope** | Standardisation of specifications  Trenchless technologies  Introduction of innovative methods and materials. |

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| **Theme** | Life-cycle Cost of Pipes |
| **Scope** | Pipe performance – physical  Pipe financial performance  Pipe LoS performance |

Other areas identified as requiring coordination or further research are:

* Creation of a NZ Pipe database
* Research on pipe condition as a function of time from the extensive data collections of SCIRT, CCC and international data sources
* Value of data archives as a source of information for future planning

## Appendix B: Workshop participants

The following people attended the workshop on 2 February 2016:

* Philip McFarlane , Opus
* Dukessa Blackburn-Huettner, Auckland Council
* Arnold Louw, Fletcher Infrastructure
* Cherie Leckner, Fulton Hogan
* Haydn Read, Wellington City Council
* Peter Whitehouse, Water New Zealand
* Tom Osborn, Dunedin City Council
* Braden Austen, Palmerston North City Council
* Bruce Apperly, CERA
* Geof Stewart, Watercare
* Matthew Hughes, University of Canterbury
* Melanie Liu, University of Canterbury
* Mark Christison, Beca
* David Heiler, Beca
* Dave Bain, SCIRT
* Richard Wesley, SCIRT
* Americo Dos Santos, Hynds Ltd
* Rob Blakemore, Wellington Water
* Paul Utting, Project Max Ltd
* Assad Shamseldin, University of Auckland
* Robert Finch, Quake Centre
* Kalley Simpson, Waimakariri District Council
* Roger Fairclough, Treasury

Facilitator Greg Preston, Quake Centre

1. 1 From the Department of Internal Affairs analysis of 2014 Local Authority Annual reports [↑](#footnote-ref-1)
2. Improving New Zealand’s water, wastewater and stormwater sector, Local Government New Zealand, September 2015 retrieved from: <http://www.lgnz.co.nz/assets/Uploads/29617-three-Waters-Position-Paper.pdf> [↑](#footnote-ref-2)