

QUEENSTOWN LAKES

DISTRICT COUNCIL

THREE WATERS

CRITICALITY FRAMEWORK

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Review Period: 1 Year

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The specification is split into two parts. Part 1 outlines why QLDC has a Criticality Framework and how it is intended to work. Part 2 contains the Criticality Scoring methodology.

# Background and Discussion

## Introduction

Section 10 of the Local Government Act 2002[[1]](#footnote-1) requires local authorities to meet the current and future needs of communities through the provision of efficient and effective local infrastructure in a way that is most cost-effective for households and businesses. This is a requirement on local authorities to ensure affordable and sustainable water supply and drainage services within their set service areas (scheme boundaries).

In order to work in an efficient and effective manner, it was determined that criticality should be used to prioritise/plan the capital and operational spend e.g:

* Asset renewals
* Preventive maintenance and asset condition inspections
* Required levels of resilience and headroom

The application of the above will be documented in separate documents that refer back to this criticality framework.

The New Zealand metadata standard defines criticality as “the significance of the removal of any individual component or asset to the ability of a network or facility to deliver the service it was designed to perform”. From a system point of view this definition is suitable, but from a QLDC perspective it has been determined that the wider effects of failure should be encapsulated in the framework. Essentially this framework has been developed to quantify the consequence of failure for any asset (or group of assets in the case of a facility) in the network.

## Determining Criticality

This framework has been based on the 2015 QLDC Corporate Risk Management Framework (CRMF), and has been developed over time along with QLDC’s engineers and Three Waters Contractors (Veolia). This final version is a simplified version of criticality compared to early draft versions that added an additional dimension that accounted for failure event types. The inclusion of event types was probably overcomplicated for a first generation assessment and proved difficult to apply with current data and systems. The current principle of assessing the consequence (as defined by the CRMF) of each asset, or facility, as a complete and catastrophic failure is recommended to be the most practicable option at this time.

There are two dimensions to the criticality assessment before a final score calculation:

* Pipe size has been used as a proxy for the number of connections/population served.
* Scores have been increased based on the proximity of an asset to high amenity locations such as water bodies, public parks, or homes.

The final criticality for the asset is then calculated using the consequence equation from the CRMF.

Generally pipe criticality has been assessed with the associated point assets and facilities being attributed the maximum score of the contributing pipe assets. For example, if a manhole is located at the junction of three pipes with criticality scores of 1, 2, and 3 respectively, then the manhole will be assigned a criticality of 3.

## Review Period

Review and update is likely to occur after the earliest of the following:

* Adoption and embedding of an updated QLDC Risk Management Framework
* Three Years

# Criticality Scoring

## Pipe size as proxy for connections/population explanation

As stated previously, pipe size was adopted as a proxy for the number of connections or population served by the asset. Ranges of pipe sizes were assigned initial PESTLE consequence scores between 1 (Moderate) and 5 (Extreme). The following tables show the current standard scores for each network. These scores are a subjective estimate of the consequence purely from a population perspective. They are subject to change as the framework is tested and updated. The example of a 200 mm wastewater pipe (highlighted in orange) will be carried through the rest of this framework.

Table 1. Water supply consequence score

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Min Diameter (mm) | Max Diameter (mm) | P | E | S | T | L | E |
| 0 | 160 | 1 | 1 | 1 | 1 | 1 | 1 |
| 161 | 225 | 1 | 1 | 2 | 2 | 1 | 1 |
| 226 | 300 | 2 | 1 | 2 | 2 | 1 | 1 |
| 301 | 375 | 2 | 2 | 3 | 3 | 2 | 2 |
| 376 | 2000 | 3 | 3 | 3 | 4 | 2 | 2 |

Table 2. Wastewater consequence score

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Min Diameter (mm) | Max Diameter (mm) | P | E | S | T | L | E |
| 0 | 100 | 1 | 1 | 1 | 1 | 1 | 1 |
| 101 | 150 | 1 | 1 | 2 | 2 | 1 | 1 |
| 151 | 200 | 2 | 1 | 2 | 2 | 1 | 1 |
| 201 | 350 | 2 | 2 | 3 | 3 | 2 | 2 |
| 351 | 1000 | 3 | 3 | 3 | 4 | 2 | 2 |

Table 3. Stormwater consequence score

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Min Diameter (mm) | Max Diameter (mm) | P | E | S | T | L | E |
| 0 | 225 | 1 | 1 | 1 | 1 | 1 | 1 |
| 226 | 350 | 1 | 1 | 2 | 2 | 1 | 1 |
| 351 | 500 | 2 | 1 | 2 | 2 | 1 | 1 |
| 501 | 650 | 2 | 2 | 3 | 3 | 2 | 2 |
| 651 | 2000 | 3 | 3 | 3 | 4 | 2 | 2 |

## Additional proximity indicators and proximity score

Proximity to amenity locations is an additional component of criticality included in this framework. E.g. A wastewater pipe failure that occurs near a home or a sensitive water body has a more significant impact than one on a back road in a rural area. The categories of amenity locations included in this dimension of the scoring framework as well as the spatial query assessment performed for each network type are as follows:

Table 4. Proximity Indicators and associated spatial query included in framework for each network

|  |  |  |  |
| --- | --- | --- | --- |
| Proximity Indicator | Water Supply | Wastewater | Stormwater |
| Waterbody |  | <5 m |  |
| Single Feed | Y/N |  |  |
| Public Place | Cross (0 m) | <50 m | <5 m |
| Water Intake |  | <50 m | <20 m |
| Habitable Premises | Cross (0 m) | <10 m | <10 m |
| Key Road | Cross (0 m) | Cross (0 m) | Cross (0 m) |

For each proximity indicator if the failure of the asset in question will have an impact on a PESTLE category it is given a score of 1. The sum for each PESTLE category ranging from 0 to 5 is then assigned a standard Additional Proximity Score (APS). The APS is currently the same for all three networks. Table 5 continues the example for the failure of a 200 mm wastewater pipe that is near a waterbody and a public space and Table 6 shows the lookup values for the APS.

Table 5. Proximity Indicators scored against PESTLE categories

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PESTLE | Waterbody | Public Place | Water Intake | Habitable Premises | Key Road | Sum of category |
| P | 1 | 1 | 0 | 0 | 0 | 2 |
| E | 1 | 0 | 0 | 0 | 0 | 1 |
| S | 1 | 1 | 0 | 0 | 0 | 2 |
| T | 0 | 1 | 0 | 0 | 0 | 1 |
| L | 1 | 0 | 0 | 0 | 0 | 1 |
| E | 1 | 0 | 0 | 0 | 0 | 1 |

Table 6. PESTLE sum lookup for Additional Proximity Score.

|  |  |
| --- | --- |
| Sum of category | Additional Proximity Score |
| 0 | 0.0 |
| 1 | 1.0 |
| 2 | 1.5 |
| 3 | 1.8 |
| 4 | 2.2 |
| 5 | 2.5 |

## Final Consequence Calculation

The last step in the consequence calculation is to add the APS to the standard consequence PESTLE scores and use the CRMF equation to calculate the final criticality score as shown in Table 7.

Table 7. Final criticality score calculation

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Min Diameter (mm) | Max Diameter (mm) | P | E | S | T | L | E | Final Score |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| 151 | 200 | 2 + 1.5 | 1 + 1 | 2 + 1.5 | 2 + 1.5 | 1 + 1 | 1 + 1 | 2.7 |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |

# Definitions

## General

### Natural Disaster, Earthquake

An earthquake event where infrastructure may experience shaking at a Modified Mercalli Scale (MM) in excess of 5.

# References

1. [The Local Government Act](http://www.legislation.govt.nz/act/public/2002/0084/latest/whole.html#DLM171803), Department of Internal Affairs, 2002
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3. [QLDC Land Development and Subdivision Code of Practice](http://www.qldc.govt.nz/planning/resource-consents/land-developments-and-subdivisions/), Queenstown Lakes District Council
4. [Water Supply Bylaw](http://www.qldc.govt.nz/assets/Uploads/Council-Documents/Bylaws/QLDC-Water-Supply-Bylaw-2015.pdf), Queenstown Lakes District Council, 2015
5. [Drinking-water Standards for New Zealand](http://www.health.govt.nz/publication/drinking-water-standards-new-zealand-2005-revised-2008), Ministry of Health, 2008
6. QLDC Criticality Framework, 2017, Draft
7. [Water Distribution Modelling Guidelines](https://www.waternz.org.nz/Attachment?Action=Download&Attachment_id=198), Water New Zealand, 2009
8. [Wastewater Network Modelling Guidelines](https://www.waternz.org.nz/Attachment?Action=Download&Attachment_id=199), Water New Zealand, 2009

1. The Local Government Act 2002, [http://www.legislation.govt.nz](http://www.legislation.govt.nz/act/public/2002/0084/latest/whole.html#DLM171803) [↑](#footnote-ref-1)