

# **Kaitoke Main SH2 to SH58 Seismic Risk Assessment Executive Summary**

**Beca Carter Hollings and Ferner Ltd**

## Executive Summary

Beca Carter Hollings & Ferner Ltd (Beca) has been commissioned by the Wellington Regional Council (WRC) to review the seismic risk to the section of the Kaitoke water main between State Highway 2 and SH 58 (Old Haywards Hill Road), and a proposed alternative route. These routes are shown in Appendix B.

The Lifelines in Earthquakes, Wellington Case Study, 1991, identified a number of potentially vulnerable parts of the wholesale water supply pipeline, including the Hutt River crossing at Silverstream, the adjacent Wellington fault crossing and the segment along the Old Haywards Hill Road (OHHR).

Beca (July 2001) provided an assessment and a comparison of risks for the Hutt River and Wellington fault crossing segments of the pipeline and the proposed diversion.

This desktop study required Beca to review and extend the findings of previous reports on the OHHR segment by OPUS International Consultants Ltd. The evaluation of the seismic risk has been completed by assessing likely repair costs and times for both the existing main along the OHHR and the alternative route. The risk from earthquake for the two routes can now be compared.

We have assessed the risk in terms of present value replacement cost and the relative times to repair both options to restore water supply. The results of our assessment are summarised in Tables ES1 and ES2.

Table ES1

Present Value of Cost (rounded) Comparison

<b>Option</b>	<b>Total Annualised Damage/Repair Cost</b>	<b>Construction Cost</b>	<b>Present Value Cost (rounded)</b>
Existing Pipeline	\$180,000	-	\$3.6 million
Alternative Route	\$230	\$1,800,000	\$1.8 million

Table ES2

Estimated Time to Complete Repair Comparison

	<b>Estimated time to complete repair for MM intensity (days)</b>		
	<b>V - VI</b>	<b>VII - VIII</b>	<b>IX - X (e.g. a Wellington Fault Event)</b>
Existing Pipeline	0 to 25	25 to 45	90 to 120
Alternative Route	0	1 to 3	8 to 15

The above estimates of annualised repair cost are based on an assumption that the repairs carried out after an earthquake would result in the pipeline being of the same standard as it was before the damage (i.e., subsequent losses, in earthquakes of the same size, would result in the same level of damage).

The cost and the time required for repairs are significantly in favour of the alternative route. This is because of the much smaller risk from the landslides and the much easier access to the route. The assessed vulnerability of the existing pipeline route to small frequent earthquakes results in expected losses significantly in excess of the alternative route. The time for repairs assessment is based on some repairs being carried out concurrently for the alternative route.

We conclude that the proposed alternative route is a viable mitigation option. However, as this option does not completely eliminate the risk of failure of the main, we recommend that the WRC prepares now for the likely repairs required following a significant earthquake by:

- Preparing an emergency repair plan for repairing this segment of the wholesale water supply network
- Determining appropriate quantities and stockpiling repair materials in an easily accessible adjacent location.
- Entering into agreements with appropriately skilled contractors with appropriate equipment to undertake the repairs immediately following an earthquake.
- Entering into mutual aid agreements with other local authorities with a similarly skilled workforce for sharing skilled manpower and equipment in the event of an earthquake.
- Preparing a methodology to review and update the emergency plans on a regular basis.

We further recommend that the WRC consider undertaking the same types of preparations for emergency repairs to restore water supply service for the rest of the bulk water supply network. This is, of course, also applicable to the segment along the Old Haywards Hill Road, if WRC opts not to proceed with the construction of the alternative route.

Beca previously assessed (Beca, 2001) that the present value of annual repair costs for the Te Marua to Karori water supply main is approximately \$440,000. A simple quantitative analysis used the same probabilistic total risk approach expressed in present value terms (assuming a 5% rate of return). It is likely that this number would increase if the results of the assessment for the existing segment of the pipeline along the OHHR were included.