

How effective has the Wairau River erodible embankment been in removing sediment from the Lower Wairau River?

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ABSTRACT

The district of Marlborough has had more than its share of river management projects over the past 150 years, each one uniquely affecting the geomorphology and flood hazard of the Wairau Plains. A major early project was to block the Opawa distributary channel at Conders Bend. The Opawa distributary channel took a third and more of Wairau River floodwaters and was a major increasing threat to Blenheim. The blocking of the Opawa required the Wairau and Lower Wairau rivers to carry greater flood flows more often. Consequently the Lower Wairau River was breaking out of its stopbanks approximately every seven years. The idea of diverting flood waters at Tuamarina by providing a direct diversion to the sea through the beach ridges was conceptualised back around the 1920s however, limits on resources and machinery meant the mission of excavating this diversion didn't become feasible until the 1960s. In 1964 a 10 m wide pilot channel was cut from the sea to Tuamarina with an initial capacity of 700 m³/s. It was expected that floods would eventually scour this 'Wairau Diversion' to its design channel width of 150 m. This did take many more years than initially thought but after approximately 50 years with a little mechanical assistance the Wairau Diversion reached an adequate capacity. Using the power of the river to erode the channel out to its design width and depth was a brilliant idea that saved many thousands of dollars in construction costs and it is somewhat ironic that it is that very same concept that is now being used to deal with the aggradation problem that the Wairau Diversion has caused.

The introduction of the Wairau Diversion did provide some flood relief to the lower reaches of the river but unfortunately as the Diversion channel was eroding and enlarging the Lower Wairau River was aggrading and reducing in capacity due to its inability to pass its sediment load with reduced flood flows. It is estimated that approximately 2,000,000 m³ of sediment was deposited on the bed of the Lower Wairau River in the time between the Diversion's introduction in 1964 and 2010, raising the Lower Wairau's bed upwards of 1.5m in some locations.

A numerical morphological model (MIKE-11 ST) was used to assess a number of options which led to the decision and resource consent to construct an erodible (fuse plug) bank at the head of the Wairau Diversion to divert more frequent scouring-flows (+ 400 m³/s) down the Lower Wairau River. Full control gates were ruled out on the grounds of expense. The initial construction of the erodible bank followed in late 2009 with the bank's level at the fuse location set to overtop and begin washing out at a combined Wairau flow of 1,400 m³/s which avoids berm flooding in the Lower Wairau. In the three years since the erodible bank was first constructed the Wairau River has sustained 14 events with recorded flows at Tuamarina above 1,000 m³/s and three of events in excess of 2,500 m³/s. These freshes and floods have resulted in washout and rebuild of the erodible bank eight times with a combined rebuild expenditure of \$80,000.

Marlborough District Council's Rivers & Drainage Department maintains a regular monitoring program for the bed of the Lower Wairau River, which consists of recurrently surveying a series of standard cross sections and estimating the mean bed level (MBL) at each section as well as an overall MBL change over time. A survey was carried out just prior to the installation of the erodible bank and another survey was carried out earlier this year. The results from this latest survey show for the first time since construction of the Wairau Diversion the Lower Wairau River is enlarging. It is estimated that the entire bed of the Lower Wairau has eroded down by an overall average of 60 mm since the introduction of the erodible bank which equates to a total volume of 260,000 m³. At a cost of \$0.30/m³ this represents excellent value compared to mechanical dredging which would likely be in excess of \$10/m³.

This confirms that the idea of using the river to enlarge the channel is again working for the Wairau River system and that in time nature's "excavator" will provide a channel capacity that will continue to meet design requirements.

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