Report No.	20-129
Decision Required	

MATARAWA STREAM FLOODWATER DIVERSION

1. PURPOSE

1.1. This item summarises matters relating to the Matarawa diversion structure, specifically whether any scope exists to fully divert flood flows around Whanganui East.

2. EXECUTIVE SUMMARY

2.1. The Matarawa Scheme provides benefit in the form of flood control for the valley floor of the Matarawa Stream, including parts of Whanganui East. The main components are five floodwater detention dams in the upper catchment and a diversion structure in the lower catchment.

2.2. Staff have been assessing the state of the diversion structure and the scope for complete rather than substantive diversion of floodwater from the upper Matarawa Stream catchment. That technical work concludes that a complete rebuild of the structure is warranted given the critical nature of the structure, its age and condition and the limitations associated with the current configuration.

3. RECOMMENDATION

That the Committee recommends that Council:

a. receives the information contained in Report No. 20-129 and Annexes.

b. endorses the replacement of the Matarawa Stream diversion structure for consideration as part of Council's 2021 Long-term Plan (LTP) update.

4. FINANCIAL IMPACT

4.1. This item recommends the replacement of the existing structure, estimated to be in the order of $300,000. That expenditure is intended to be included in the updated LTP as a capital expenditure line item for the Matarawa Scheme funded by way of a loan against that Scheme. The debt servicing costs associated with that loan are intended to be met solely by the Whanganui urban part of the scheme targeted rate classification as the benefit is confined to the city.

5. CLIMATE CHANGE IMPACTS

5.1. The recommendations contained in this item are consistent with the underlying approach to climate change; a greater level of operational resilience in the face of likely changes in flood frequency for the Matarawa Stream.

6. TE AWA TUPUA

6.1. The Matarawa Stream is a part of the Whanganui catchment and as such the values associated with Te Awa Tupua, Tupua Te Kawa, apply. No engagement has yet taken place with the Te Awa Tupua governance entity **Ngā Tāngata Tiaki (NTT)** around this particular project and whether it fits with the values of Tupua Te Kawa; the focus to date

has been determining whether modifying the structure has merit from a flood control perspective.

7. BACKGROUND

7.1. The need to divert floodwater in the Matarawa Stream around Whanganui was identified relatively early in the city's development. A diversion structure and associated diversion channel to the Mateongaonga Stream was built in the 1950's by the then Whanganui City and County Councils. Originally intended as a high flow bypass, successive floods have progressively enlarged the diversion channel to the Mateongaonga Stream enabling it to carry larger flows over time.

7.2. The Matarawa Scheme was established by the Rangitikei – Whanganui Catchment Board in the early 1980's, with the focus on the construction of the five detention dams in the upper Matarawa Stream catchment. The Catchment Board also assumed ownership of the diversion structure with the establishment of the Scheme, and in the late 1980's the structure was modified to its current form.

7.3. The Matarawa Scheme has had numerous 'tests' since its inception with perhaps the greatest test the June 2015 flood event. The current estimate (bearing in mind that the flood frequency relationship for the Matarawa Stream continues to evolve as the rainfall and stream flow dataset accumulates over time) puts detention dam capacity at around a 50 year return period storm, compared with the original design estimate of 25 years.

7.4. However floodwater storage is sensitive to storm duration – a lower peak rainfall intensity but longer storm duration will also fill the dams and once the dams are at capacity they cease to have any attenuation. That was particularly the case with the June 2015 event, placing considerable pressure on the diversion structure and leading to (in combination with intense / prolonged lower catchment rainfall and a flooded Whanganui River) flooding of valley floors including parts of Whanganui East.

7.5. The diversion structure as currently configured includes two culverts that allow Stream low flow to pass through the city. The flow in those culverts is not regulated – although a large percentage of flood flow is diverted some discharge to the lower reach of the Stream continues, with the discharge increasing as flood levels through the diversion increase.

7.6. The February 2004 flood saw flood flow bypass the diversion structure; repairs following that event included earthworks adjacent to the structure to limit how much flow can bypass the structure in the future. Staff also blocked off one culvert leaving only one culvert to convey low flow to the lower reach of the Stream.

7.7. Horizons response to the June 2015 flood event, as it applies to the Matarawa, was two-fold; clear vegetation from the urban reach of the Stream to allow freer movement of flood flow and assess whether upper catchment flood flow could be fully diverted around the city. That has also included adding the city to the targeted rate classification to ensure benefit, in broad terms, is still apportioned correctly with the funding model.

8. DISCUSSION

The flood event of June 2015

8.1. A considerable number of Whanganui East properties were affected in the June 2015 event. Extremely heavy rainfall fell in the catchment, resulting in flooding in the lower stream reaches with an assessed return period well in excess of 100 years.

8.2. Even though the resultant peak flows in the diversion channel were an estimated 16% greater than the design flow for the channel, it is understood that, unlike in the 2004 event, the control structure or its immediate surrounds were not overtopped or bypassed to any great degree. This was partly due to the fact that a bypass mechanism was available across the road, just to the east of the road bridge. (see aerial photo in S7.5)

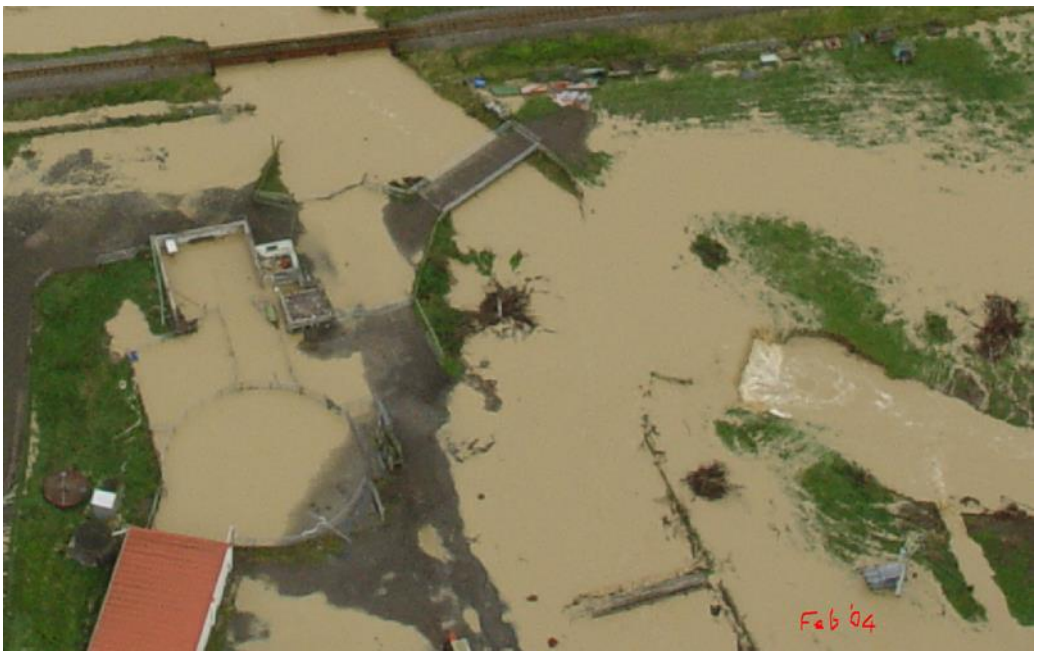

Photo credit Bill Harding

8.3. By and large the diversion structure performed its primary function. It must be noted that there is an additional ~180ha or so of catchment draining directly to the Matarawa below the control structure; the flood runoff from this portion of the catchment is not attenuated in any way.

The current control structure

8.4. This most recent assessment of the structure has focussed on further modifications to reduce the flood flow in the Matarawa Stream downstream of the diversion. This analysis looks at a maximum flood water level of RL 14.10 or thereabouts. This is the highest ponded water level possible, as at around this level ponded floodwaters start crossing over No. 3 Line which effectively acts as a much wider control weir, as shown above during the 2004 event. The escaping water then skirts through and around the western corner of Gordon's Bush, to re-join the diversion channel.

8.5. This would have happened in 2015, when rainfall was even greater. Furthermore the 2008 remedial and enhancement works around the diversion structure raised the maximum ponding level attainable. At this level around 6 cumecs is squeezing through the solitary pipe, with the balance of flow going out either along the diversion, or via the road overflow point.

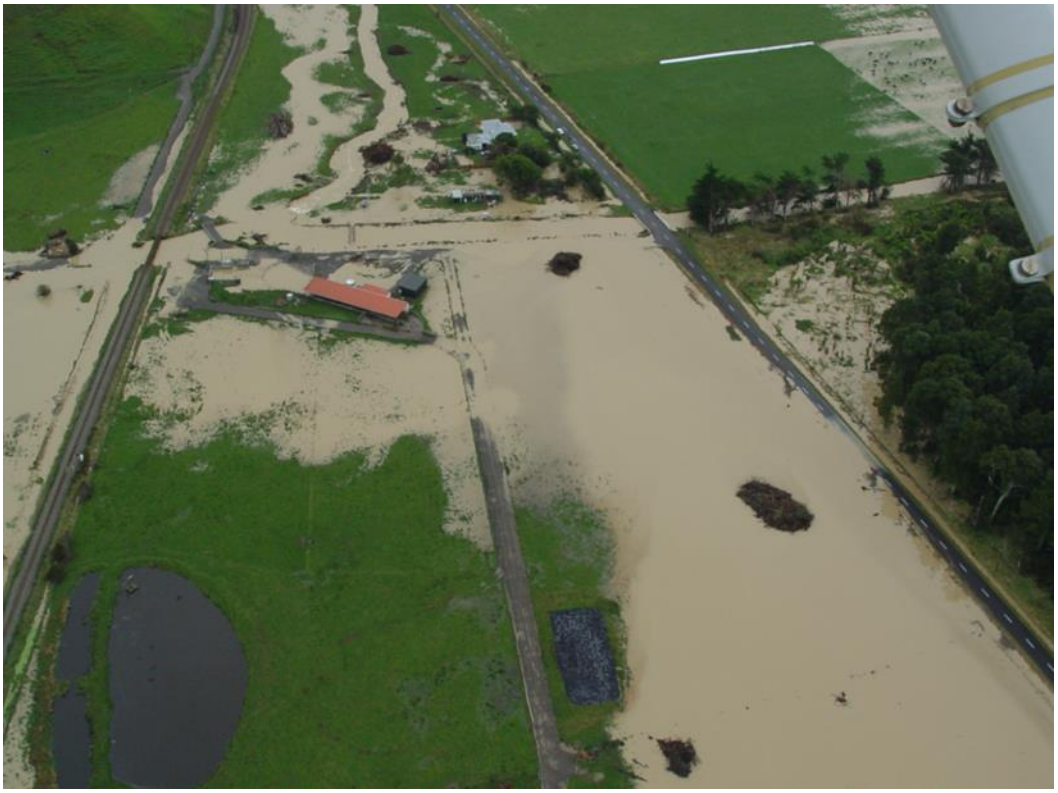

Photo credit Bill Harding

Discussion and Findings

8.6. Flow behaviour at the diversion is complex, and this analysis relies on some simplifications. Nevertheless, it clearly shows that flow through the pipe varies with the water level at the diversion, and that the peak flow able to squeeze through the solitary pipe is still too high. Ideally what would be more useful is some form of adjustable inlet gate, the opening of which decreases as water level increases, thereby achieving a properly clipped flow.

8.7. A set throttle for the existing solitary pipe would have quite serious adverse impacts. It would divert an even larger fraction of what constitutes the now present day catchment's dominant discharge away from its natural watercourse through the city. Due to the diversion structure's existing operational mechanism this flow has already been markedly cut, with too much flow going via the diversion in normal flows.

8.8. With zero or negligible flow for much of the time, the watercourse through Whanganui East has suffered, not so much from too much flood flow, but from not enough sustained smaller 'flushing' flows. Growth of all sorts has become problematic as weeds and the like are allowed to establish a better foothold in the substrate. In a heavy rain event even the runoff coming from just the 200ha catchment below the diversion will cause problems if a viable resilient watercourse is not kept available, or its conveyance capabilities continue to deteriorate.

8.9. The watercourse must remain healthfully open, and the best way to do this is to allow as much of the centuries-proven dominant discharge runoff to flow along its natural course, thereby giving back to the watercourse a degree of resilience to the higher flood flows it will still episodically experience. What are needed are changes to the control structure to facilitate improved environmental flows whilst still limiting undesirable flood flows.

8.10. This can be best achieved by replacing the existing twin circular pipe setup with a single 2m W x 1m H box culvert, governed by a flow control gate. Whilst this need be capable of only partially throttling the new box culvert, pragmatically it should be capable of full closure. A smaller version of the Makino floodgate is envisaged.

8.11. In addition the existing weir needs raising by 400mm or so. Without this measure it is impossible to force the requisite beneficial dominant flow down along its original natural watercourse; flows will still preferentially head the diversion way.

8.12. It is considered that these modifications should be able to be carried out without any recourse to a new or modified consent application. The key tenet here is that, to a great extent, whatever is allowed to flow or not flow through the culvert is essentially immaterial in a large event. Large flood flows will always still cross over the crown of No 3 Line Road regardless.

8.13. It is also worth noting that whilst these large events can contribute to the extensive higher bank scouring along the diversion channel and further downstream, as evidenced after an event, the erosion in the Mateongaonga Stream owes its origins chiefly to the changes in the geomorphological forces shaping it, brought about by the establishment of the dominant discharge in the diversion channel.

8.14. Thus the conclusions drawn from the assessment are that the existing diversion structure should be demolished and replaced with a single 2m wide by 1m high box culvert, set at the same invert. A vertical flow control gate would be installed at the same time with an automated operating regime. The scope of work would include the refurbishment and enhancement of the existing concrete weir, including raising it by 400mm.

9. COMMENT

9.1. The control structure can be modified to help better meet two of the goals of enlightened river management practice: the mitigation of extreme event adverse flows; and the enhancement of environmentally beneficial flows. In the case here of the Matarawa Stream, these two goals need are not mutually exclusive, they can be met together.

10. SIGNIFICANCE

10.1. This is not a significant decision according to the Council's Policy on Significance and Engagement.

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GROUP MANAGER RIVER MANAGEMENT

ANNEXES

A Matarawa Scheme Map

B Diversion Structure