IN THE MATTER of the Resource Management Act 1991 (**RMA**)

AND

IN THE MATTER of **Private Plan Change 28** to the Nelson Resource Management Plan

JOINT WITNESS STATEMENT (JWS) IN RELATION TO:

Flooding (3)

25 May 2022

Expert Conferencing Held on: 29 April, 6 May and 25 May 2022

Venue: Online and by Email

Independent Facilitator: Marlene Oliver

Admin Support: Jessica Marchbanks

1 Attendance:

1.1 The list of participants is included in the schedule at the end of this Statement.

2 Basis of Attendance and Environment Court Practice Note 2014

2.1 All participants agree to the following:

(a) The Environment Court Practice Note 2014 provides relevant guidance and protocols for the expert conferencing session;
(b) They will comply with the relevant provisions of the Environment Court Practice Note 2014;
(c) They will make themselves available to appear before the Hearing Panel;
(d) This statement is to be filed with the Hearing Panel and posted on the Council's website.

3 Matters considered at Conferencing – Agenda and Outcomes

Note from the Facilitator: At earlier expert conferencing sessions where Flooding was discussed, there were a number of matters that were not recorded in a Joint Witness Statement (JWS). For completeness this JWS has been prepared to record those matters as follows:

3.1 Areas of Agreement

Dali Suljic, Damian Velluppillai and Kate Purton agree:

50mm minimum threshold for assessing post-development flood depth differences – all flooding experts agree that this is appropriate for the purpose of this assessment.

3.2 Additional Information – Tonkin & Taylor Report

In the course of the expert conferencing sessions, a report was prepared by Tonkin and Taylor titled: "Additional flood hazard information – PC28" dated 5 May 2022.

The report was originally issued without prejudice and for the purpose of assisting expert conferencing on flooding. The authors of the report subsequently withdrew these limitations on its use so that experts could discuss it with other experts who were not part of the expert conferencing sessions. In order to make this report now available to the Hearing Panel Members and for wider public distribution, a copy is attached to this JWS.

3.3 Areas Not Agreed

Several areas of disagreement have been raised through the expert conferencing sessions, some of which are related to the additional Tonkin and Taylor report dated 5 May 2022. These areas remain unresolved at this time and will be discussed further in the subsequent expert conferencing sessions and/or addressed in evidence or reports to the hearing.

4 PARTICIPANTS TO JOINT WITNESS STATEMENT

4.1 The participants to this Joint Witness Statement, as listed below, confirm that:

(a) They agree that the outcome(s) of the expert conferencing are as recorded in this statement; and
(b) They agree to the introduction of the attached information – Refer to para 3.2 above; and
(c) They have read Appendix 3 of the Environment Court's Practice Note 2014 and agree to comply with it; and
(d) The matters addressed in this statement are within their area of expertise; and
(e) As this 25 May 2022 session was held by email , in the interests of efficiency, it was agreed that each expert would confirm their position to the Facilitator by email and this is recorded in the schedule below.

Confirmed by email: 25 May 2022

EXPERT'S NAME	PARTY	EXPERT'S CONFIRMATION REFER PARA 4.1
Damian Velluppillai	Applicant	Yes
Kate Purton	S42A NCC	Yes
Dali Suljic	Save the Maitai	Yes

Tonkin+Taylor

Job No: 1012397.9002
5 May 2022

CCKL Maitai Dev Co LP
PO Box 2284
Stoke 7041

Attention: Mt T Munnerly

Dear Tony

Additional flood hazard information - PC28

Tonkin & Taylor Ltd (T+T) has undertaken additional flood hazard modelling to provide further information on the effects of the proposed Maitahi / Kaka Subdivision development on Maitai River flooding.

The first version of this report was dated 26 April 2022 and prepared to inform the first Expert Conference on flooding held on 29 April 2022. During the conference, experts representing Nelson City Council (NCC) and Save the Maitai (STM) requested additional information, as recorded in the Interim Joint Witness Statement (IJWS). This updated report includes this additional information.

1 Revised earthworks footprint

The Nelson City Council's (NCC's) Maitai River flood model[1] was previously used to model the effects of proposed filling within the floodplain. We note that the 2130 future time horizon has been used for this assessment, which complies with NCC's Inundation Practice Note, which stipulates an "at or beyond 2120" design criteria for inland subdivision.

The assessment process was iterative, and information provided during the RMA Section 92 process was based on v3 of the earthworks footprint (refer solid green line in Figure 1.1 below).

Modelling results indicated a small increase in flood levels on adjacent property (specifically 5 Ralphine Way). To investigate possible reduced effects of the proposed development we modelled a v4 earthworks footprint (refer dashed green line below) seeking to reduce any increased flood levels on neighbouring properties.

In both cases, the flood modelling assumes fill-only (i.e. no cut for offset flood storage) and a vertical fill wall at the boundary. In reality, the fill boundary would be graded down to natural ground, i.e. slightly less fill volume in the flood plain than modelled.

[1] For model build details refer http://www.nelson.govt.nz/environment/nelson-plan/natural-hazards/flooding/

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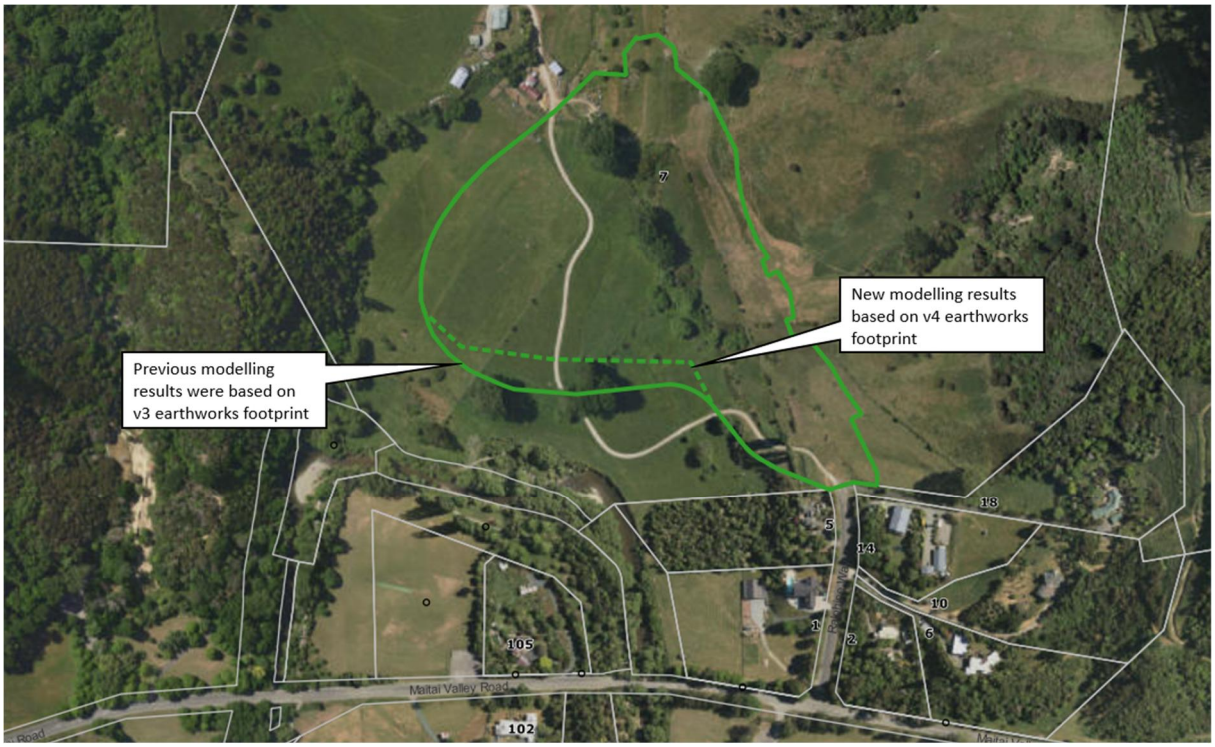


Figure 1.1: Earthworks scenario v4 shows a reduced footprint when compared with v3.

Previous modelling results indicated that the 12hr event is critical in terms of Maitai River flows and flood levels in this reach. The 2130 RCP8.5 1% AEP 12hr event was modelled for both the v3 and v4 Earthworks scenarios, and results (flood depths / levels and flow velocities) compared to the baseline (pre-development) scenario.

1.1 Effects on flood depths / levels

Refer Figure 1.2 and Figure 1.3 below, with flood depth differences shown in 0.05 m increments, and with differences below ±0.05 m considered within the tolerance limits of the model and neglected for purposes of effects assessment.

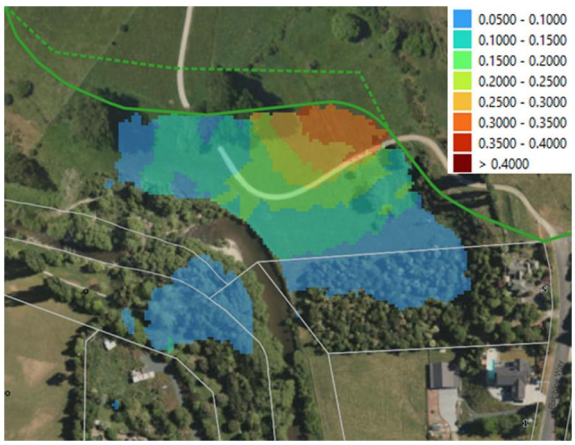


Figure 1.2: Extent of local increase in flood depths as a result of proposed filling (Earthworks scenario v3, 2130 RCP8.5 1% AEP 12hr event)

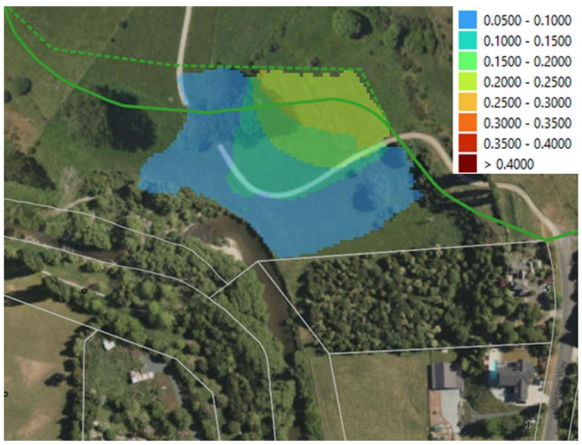


Figure 1.3: Extent of local increase in flood depths as a result of proposed filling (Earthworks scenario v4, 2130 RCP8.5 1% AEP 12hr event)

Figure 1.3 shows that for the revised Earthworks scenario v4 (dashed green line), modelled off-site effects are reduced to less than model tolerance levels (i.e. less than 0.05 m).

1.2 Effects on flow velocities

The model has also been used to assess potential impacts on flow velocities, both in the river channel and within the floodplain.

1.2.1 In the river channel

Modelling results indicate that the proposed earthworks will increase flow velocities within the Maitai River channel approximately to the extent shown in Figure 1.4 below, during the 2130 RCP8.5 1% AEP 12hr flow event. This shows an increase of less than 0.05 m/s for a peak flow velocity of approximately 3 m/s.

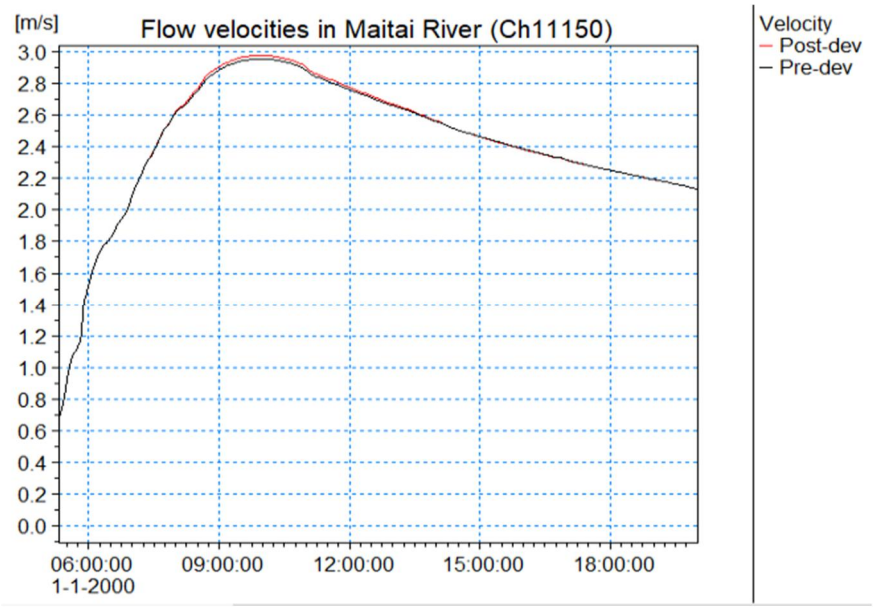


Figure 1.4: Effect of the proposed development (earthworks scenario v4) on flow velocities in the Maitai River channel.

1.2.2 In the floodplain

Figure 1.5 and Figure 1.6 below show the peak velocities across the Maitai River floodplain in the project reach, pre and post-development respectively.

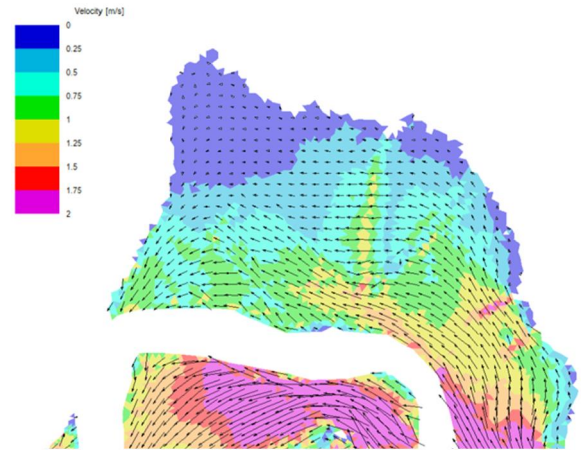


Figure 1.5: Existing (pre-development) modelled peak velocities – 2130 RCP8.5 1% AEP 12hr

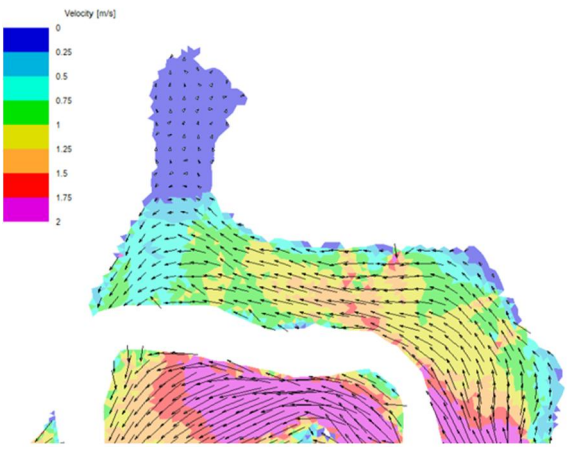


Figure 1.6: Post-development (Earthworks scenario v4) modelled peak velocities – 2130 RCP8.5 1% AEP 12hr

Figure 1.7 below presents the differences in flow velocities within the floodplain as a result of the proposed earthworks. Increased flow velocity can increase scour potential within the floodplain, and this should be considered in more detail during detailed design.

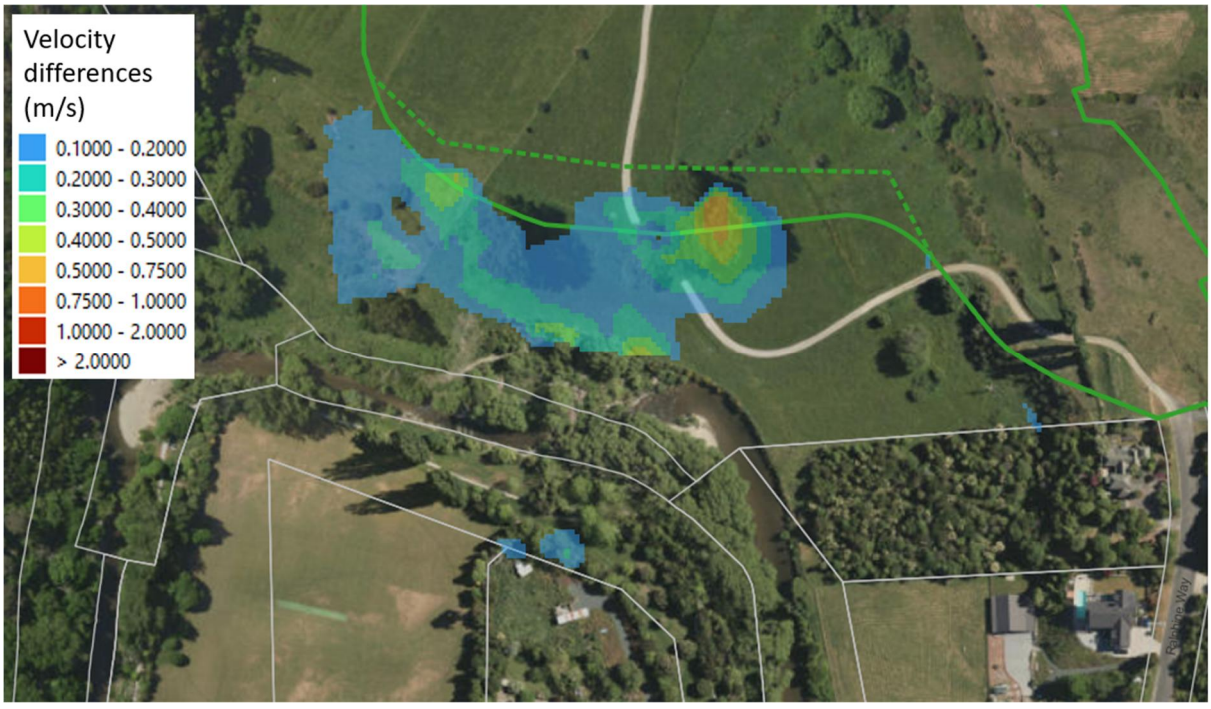


Figure 1.7: Extent of local increase in flood velocities as a result of proposed filling (Earthworks scenario v4, 2130 RCP8.5 1% AEP 12hr event)

2 Less extreme storm events

For completeness, and to enable assessment of effects across a range of storm events, the following additional 12hr storm scenarios have been modelled for the Earthworks scenario v4:

- Present day 5% AEP.
- Present day 2% AEP.

- Present day 1% AEP.
- 2070 RCP8.5 1% AEP.
- 2090 RCP8.5 1% AEP.

Modelling of these less extreme events showed that the worst case (in terms of flood depth differences) was the originally modelled 2130 RCP8.5 1% AEP event, i.e. that by ensuring no off-site effects in the most extreme event, there were also none for lesser events.

These model runs are summarised in Figure 2.1 below, where the extents of the local increase in flood depths greater than 0.05 m are presented each of the events.

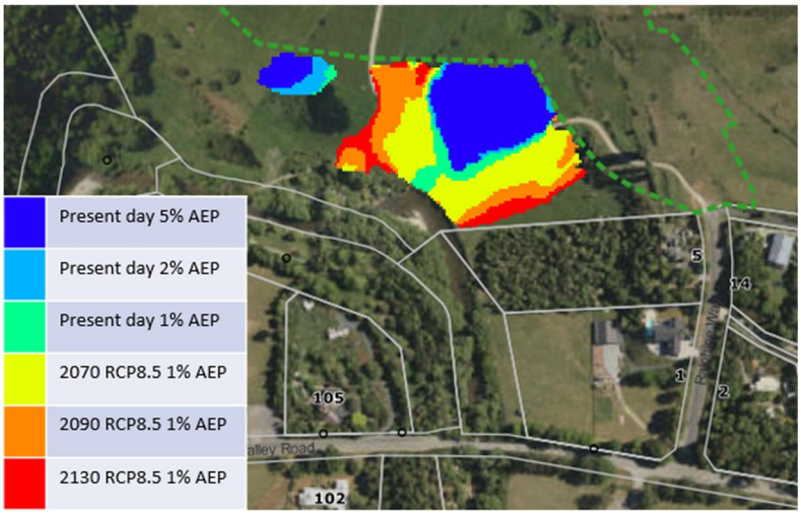


Figure 2.1: Extent of increase in flooding greater than 0.05 m shown for six design storm events (v4 Earthworks Scenario)

3 Revised Kaka Tributary runoff hydrographs

The modelling results above are based on an assumption that the post-development runoff hydrograph from the Kaka Tributary catchment into the Maitai River has the same profile as the pre-development catchment. In reality, we would expect that:

- The post-development hydrograph is likely to have a greater peak and volume due to the increased runoff from the developed catchment. However:
  - Attenuation provisions associated with any development within the catchment would be required to limit post-development flows to pre-development levels.
  - An extended detention provision would be required to mitigate the effect of increased runoff duration as a result of development on stream erosion rates.
- For a range of storm events, the increased impervious area within the catchment would result in an increase in total runoff volume. If downstream flooding is governed in any area by available storage (as opposed to peak flow capacity), then this increased runoff volume could lead to increased flooding.

Ahead of detailed design and for the purposes of preliminary effects assessment, we have developed and assessed three post-development runoff hydrograph profiles. These have been developed based on the effect that development and attenuation within a catchment typically has on runoff response.

For this assessment:

- The tributary catchment was first split in two. In the NCC model, flows from the Kaka Tributary are combined with flows from minor gullies both upstream and downstream, and applied

along a longer length of the Maitai River as the "Kaka West" catchment. The area of the modelled Kaka West catchment is 3.9 km², compared with the 2.5 km² Kaka Tributary catchment.

- The Kaka Tributary flows in the model were scaled to match the peak flows estimated in the application's Infrastructure Report. This was largely needed due to the Kaka Tributary having a shorter critical storm duration than the Maitai 12 hour duration in this reach, and the desire to err towards a conservative (higher) estimate of any potential effects, at this early stage. The Kaka Tributary's 2130 RCP8.5 1% AEP 12hr runoff was scaled up from about 10 m³/s to peak at 20 m³/s.
    - It is noted that the Kaka Tributary catchment is much smaller than the Maitai River catchment, and therefore has a much shorter critical storm duration. Therefore, we would expect the peak flows from the Kaka Tributary to occur in a shorter event than the storm that produces critical (highest) flood levels in the Maitai River floodplain.
    - By scaling up the Kaka Tributary runoff hydrograph peak and combining this with modelled peak flood levels in the Maitai River, we are making a conservative assumption with respect to likely flooding in the floodplain. This analysis can be refined during detailed design, but is considered an appropriate simplifying, conservative assumption for this stage of assessment.

This synthesised "pre-development" hydrograph was then used as a basis for three post-development hydrographs as summarised in the table below.

Table 1.1: Synthesised hydrograph parameters

Case	Assumed peak flow (m³/s)	Delay of peak to mimic effect of any proposed attenuation devices within catchment (hours)	Extension of storm duration to mimic effect of prolonged runoff and additional volume (hours)	Comment
1 (sim run 005B)	20	0	2	Would expect delayed peak, but none assumed as a conservative assumption
2 (sim run 005C)	20	1	3	Mid-range scenario
3 (sim run 005D)	20	0	12	Extreme scenario in which the catchment runoff remains at peak many hours after the storm has passed, and in which the total runoff volume exceeds the total storm volume in this catchment. Not possible, but used to indicate significance of this catchment on downstream flooding relative to the Maitai River channel capacity.

In all cases, the assessment assumed that the post-development peak flows match the pre-development flows. The resulting synthesised hydrographs clearly show the significant additional runoff volume in the synthesised events, refer Figure 3.1.

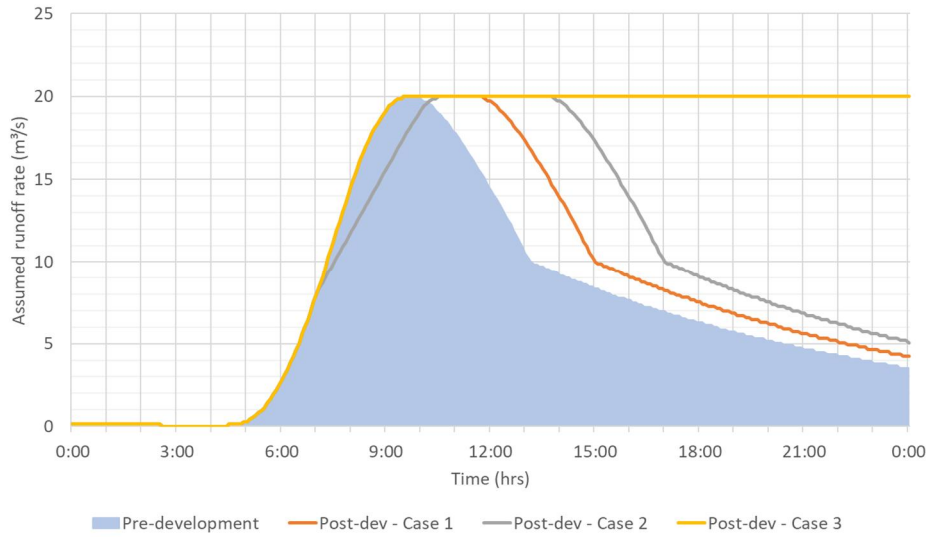


Figure 3.1: Synthesised post-development runoff hydrographs for Kaka Tributary.

3.1 Results

The modelling results show no increase in depths greater than 0.05 m anywhere within the lower floodplain for any of the three synthesised storm events, even the most extreme and unrealistic event.

In order identify a discernible difference between pre- and post-development modelling results in Case 3 (the most extreme / unrealistic scenario), the results must be analysed at a finer resolution. When doing so, the lower floodplain (in The Wood, and at scattered points between the valley and the Maitai River mouth) shows a marginal increase of around 2 mm to 5 mm in depth, as shown in Figure 3.2 below. Again, it is noted that this up to 5 mm depth impact requires more runoff volume from the Kaka Tributary catchment than it falls in rain during the event.

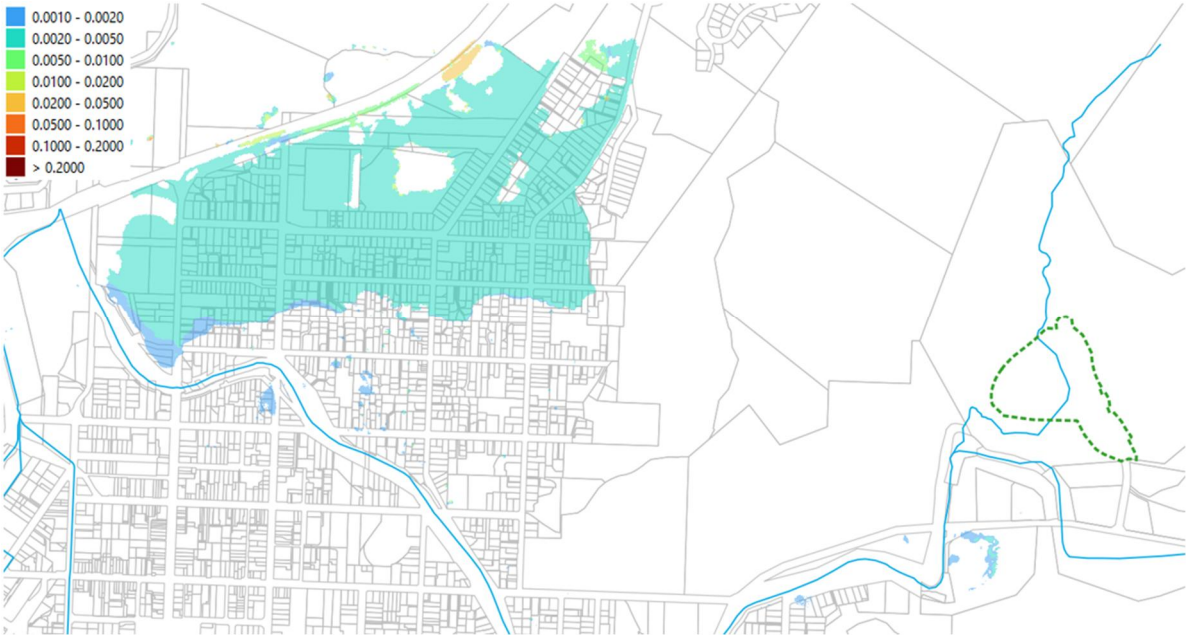


Figure 3.2: Modelled differences in flood depths due to the "unrealistic" Case 3 post-development hydrograph (i.e. based on more runoff volume than is possible). No local effects, and downstream effects due to volume issues, even in this extreme scenario, would only increase flood depths typically around 2-5 mm, well within model tolerances.

These modelling results indicated that there are no significant downstream flood storage issues that would be triggered by an increase in the total runoff volume from the Kaka Tributary catchment during extreme events.

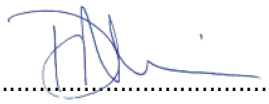
4 Applicability

This report has been prepared for the exclusive use of our client CCKL Maitai Dev Co LP, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application for resource consent and that Nelson City Council as the consenting authority will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
	*pp* 
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Damian Velluppillai	Mark Foley
SENIOR WATER RESOURCES ENGINEER	PROJECT DIRECTOR

5-May-22
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