

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

**AND**

**IN THE MATTER:** Proposed Plan Change 2: Pukehangi  
Heights to the Rotorua District Plan under  
Part 5, Sub-Part 5 – Streamlined Planning  
Process and Schedule 1 Part 5 of the  
RMA

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**SUMMARY STATEMENT OF EVIDENCE OF PETER MORLEY WESTON BEHALF OF BAY  
OF PLENTY REGIONAL COUNCIL – HYDROLOGICAL BASIS FOR ANALYSIS**  
21 September 2020

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1. My full name is Peter Morley West. My experience and qualifications are laid out in my primary brief of evidence.
2. My evidence relates to the hydrological modelling of the plan change proposal in the context of the wider Utuhina Stream catchment. My evidence is in four parts:
  - a) The establishment of the calibrated hydrological model of the wider Utuhina Stream catchment;
  - b) The selection and recommendation of appropriate rainstorm scenarios to be used for assessing effects of the proposed development;
  - c) Development of a method to assess the stormwater effects in the context of currently permitted future urban land development in the catchment;
  - d) Performance-checking of the potential on-site storm water detention ponds identified by RLC;

### **Utuhina Stream Catchment Hydrological Model**

3. **A calibrated hydrological model was established that provides an underlying connective framework to detailed hydraulic modelling components in the Utuhina Stream catchment. This model was used in the PC2 modelling of environmental effects.**
4. My model calibration made use of raingauges and radar-observed rainfall to better understand the hydrological situation. Due to the lack of any raingauges in the catchment, a good relationship between rainfall and stream flow is not attainable (as pointed out by Mr Mark Pennington). However radar-rainfall observations provide a much clearer picture.
5. Good model calibrations were achieved from five large recent flood events. When run with the 72 hour nested-storm design rainfall, the model produces peak stream flows similar to those determined from statistical analysis of historic flood flows.
6. One item of key importance in this part of my evidence: (paragraph 17 in main brief) **Figure 1** shows the model discharge results at the location of the Utuhina stream recorder at Depot Street for the 1%AEP current climate and 1%AEP 3.68 degrees climate scenario. The figure illustrates the potential increase in flood flow that can be

expected over the next 100 years. This is an increase of from about 55 m<sup>3</sup>/s to up to 95 m<sup>3</sup>/s.

### **Rainstorm Scenarios**

7. **The rainstorm scenarios used in the PC2 modelling were agreed to be appropriate. However it is important to ensure that future mitigation design adopts a similar suitably rigorous approach. Details of future methodology should be controlled within the plan change provisions.**
8. The hypothetical Mitigation Scenario 15 has been thoroughly investigated and agreed by the stormwater experts to appropriately assess the effects of the development described in the PC2 structure plan.
9. However, from a hydrologist's view, the provisions proposed by RLC do not ensure that the mitigation measures eventually implemented will perform equivalently to Scenario 15.
10. This part of my evidence attempts to make the point that the efficacy of the mitigation measures, and the validity of the associated AEE are sensitively dependent on what modelling inputs are applied. The PC2's own history of analysis illustrates this point: when the original analysis was updated to test appropriately-conservative design scenarios the required size of the ponds increased from 6 hectares to 14 hectares.
11. My evidence has information of observed natural local storm events, along with a précis of hydrological characteristics of the catchment that support the application of both longer storms up to 72 hours and of nested storms - the practice of nesting short-duration storm intensities within a longer storm.
12. The BOPRC has developed a suggested drafting of provisions that allows for the flexibility required for responsive land development, while ensuring certainty-of-method for stakeholders. These draft provisions are detailed in the evidence of Mr Nathan Te Pairi. A key aspect of these provisions is the prescriptive specification of the modelling methods and the key parameters that were agreed by the stormwater experts for the plan change assessment. The provisions accommodate the potential to alter any part of the methods if necessary in future - subject to approval.

### **Future Environment Scenario**

13. The methodology used by BOPRC to assess the effects of the plan change in the context of permitted future urban development outside of the PC2 area is described in this part of my evidence.
14. Of significance in this part is that although the lower stream reaches are already at high risk of flooding, the currently permitted level of development in the urban catchment will likely cause flooding to increase.

**Detention Pond dynamic performance check**

15. Following investigation, I can endorse the dynamic mechanism for the hypothetical detention pond mitigation-measure solution Scenario 15.
16. I carried out checks on the dynamic performance of a selection of detention ponds specified for representative mitigation (Mitigation Scenario 15) in the WSP Stormwater Report. Inspection of an earlier version (Mitigation Scenario 14) for the stormwater expert witness caucusing had found inappropriately long drain-down-times of up to 7 days which would have killed vegetation in the ponds and left the system vulnerable to any further rainstorms within this period.

**DATE** 21 September 2020

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**Peter Morley West**

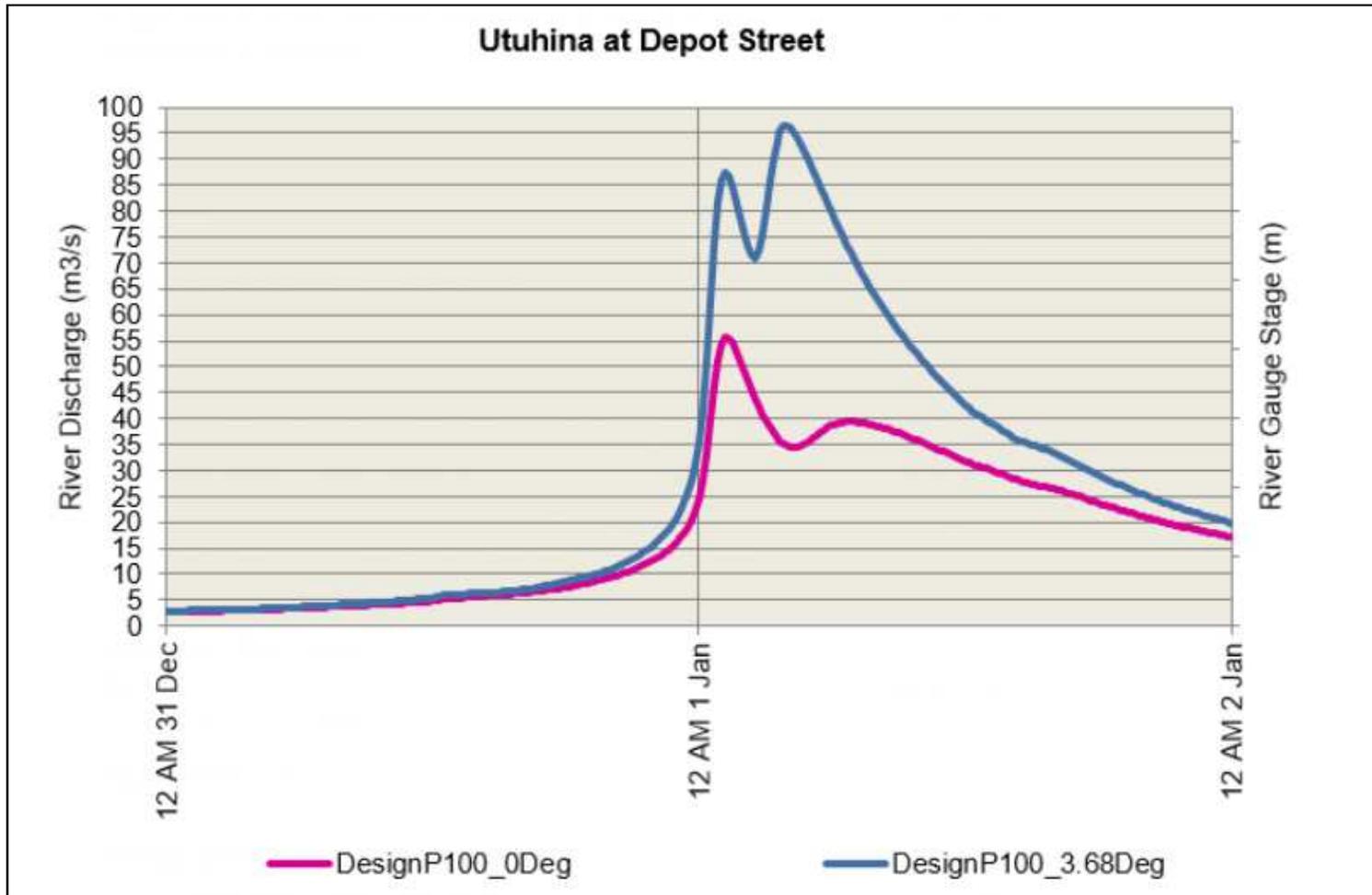


Figure 1: Hydrological model results for Utuhina Stream at the Depot Street gauge. Showing results for the 1% AEP (100 year) 72 hour nested storm centred on the PC2 plan change location, travelling on a bearing due north at 2 metres per second.