Before Independent Hearings Commissioners
At Wellington

Under	the Resource Management Act 1991 (the Act)
In the matter of	Applications for resource consents, and a Notice of Requirement for a Designation by Wellington Water Limited on behalf of Upper Hutt City Council, for the construction, operation and maintenance of the structural flood mitigation works identified as the Pinehaven Stream Improvements Project

Supplementary statement of evidence of Peter Frederick Kinley for Wellington Water Limited

Dated 3 August 2020

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Supplementary statement of evidence of Peter Kinley

1 Qualifications and experience

1.1 My full name is Peter Frederick Kinley.

1.2 My qualifications and experience are set out in my Statement of evidence dated 20 July 2020.

1.3 I confirm the statement in my evidence in chief that I have read the Code of Conduct for Expert Witnesses and have complied with the Code in the preparation of this evidence.

2 Scope of evidence

2.1 This supplementary statement of evidence addresses evidence lodged for the submitters Save Our Hills and Alex Ross.

2.2 I have read the following documents received on 28 July 2020:

a Statement of evidence of Robert James Hall dated 27 July 2020;

b Draft report on the Pinehaven Stream flood 8 December 2019 dated 27July 2020 by Robert Hall;

c 'Application1' which relates to the statement of evidence of Robert Hall, dated 27 July 2020;

d Statement of evidence of Alexander Keith Ross, dated 27 July 2020;

e Graeme Horrell's CV and review of Robert Hall's report on the Pinehaven Stream flood 8 December 2019, dated 27 July 2020;

f A letter from Graeme Horrell to Stephen Pattinson, revised on 24 July 2020;

g A memorandum from Alasdair Kean to Stephen Pattinson, dated 3 July 2020; and

h CDA drawings in relation 8 December 2019 flood event, dated 27 July 2020.

2.3 My supplementary evidence responds to the evidence and documents above, and, in doing so, addresses the following matters:

a 23 July 2009 flood event;

b 8 December 2019 flood event; and

c General model concerns.

3 23 July 2009 flood event

3.1 Mr Hall suggests the peak flow for the flood event of 23 July 2009 flood event is provisionally set at 12.7 to 13.0m^3/s with an average annual recurrence interval of 35 years to 40 years (2.5% < AEP < 2.8%).[1]

3.2 I note that this value differs to the value for peak flow rate for the event of 23 July 2009 provided in the MWH report that I have relied upon to assess the effects of the project on flooding. The MWH report states the peak flow for the event of 23 July 2009 is estimated to be 8.8m^3/s and Table 6-3 of the report can be used to show that the Average Recurrence Interval for the peak flow is less than 5 years.

3.3 Mr Horrell considers the estimated flood peak of 8.8m^3/s is an under estimation.[2] Mr Horrell considers the 23 July 2009 flood peak is 12m^3/s.[3]

3.4 The method used by Mr Horrell to estimate the flows relies on a number of assumptions and simplifications that are not used in the modelling that supports the Flood Hazard Assessment for this Project. The modelling undertaken by MWH is more detailed than Mr Horrell's work because it divides the catchment into multiple sub-catchments and it routes the flow through the stream network, which provides a better representation of the complex processes that occur in an urban stormwater network. Mr Horrell has not provided sufficient information for me to confirm the validity of his calculations.

3.5 I consider that the most direct cause of nuisance and damage from flooding is water levels and flood depths, rather than flows. While there is a well established relationship between water depth and flow rate, the emphasis of the modelling work I am responsible for is on correctly estimating the flood depth and flood extent. As explained in my Evidence in Chief, the method for assessing the effectiveness of the project used the same set of inflows for the 4% AEP flood event and the 1% AEP flood event on the "without works" and "with works" stream configurations in the hydraulic model.[4] If another set of flows had been used they would still show that the works were effective at reducing flood depths and flood extents. However, it was not necessary to use any other set of flows

[1] Attachment to Hall EIC, Application1(2020-7-27)0003, page 2.
[2] Graeme Horrell Revised Letter 2009 flood, para 5.
[3] Graeme Horrell Revised Letter 2009 flood, para 5.
[4] Kinley EIC, para 9.2.

because the information available was from a model that had been calibrated, validated to independent peak flow assessment methods and validated to flood extents from the 1976 flood event. Mr Horrell's work is not calibrated or validated.

4 8 December 2019 flood event

4.1 Mr Hall's evidence considers the two hour rainfall depth of the 8 December 2019 flood event is 53mm with an estimated two hour duration recurrence interval of 30 years.[5] Mr Keane considers that the rainfall was a 1 in 28 year event while the flood event was between a 1 in 25 year flood and a 1 in 30 year flood level at a gauge located near the Silverstream Reformed Church.[6]

4.2 I agree that the rainfall that caused the flood event of 8 December 2019 had an Average Recurrence Interval of approximately 1 in 30-years for the 2-hour duration.

4.3 Mr Ross considers the Pinehaven Stream channel 'coped' with the December 2019 flood event.[7] Mr Ross also considers the runoff modelled did not reflect the reality of the 8 December 2019 flood event.[8]

4.4 I have seen photographs of the event of 8 December 2019 that show the floodwaters were not contained within the main stream channel and caused flooding of properties adjacent to the stream in several locations. I noted that debris lines were evident in the photographs, and this shows the peak had passed by the time the photographs were taken. This shows that the peak flooding had a greater depth and extent than shown in the photographs. I have been advised that at least one resident suffered property damage during the event.

4.5 The flooding shown in the photographs and the report of property damage are not consistent with Mr Ross' claim that the channel 'coped'; I consider the channel did not cope with the 8 December 2019 event and that this event shows that the proposed works are necessary.

[5] Hall EIC, para 4.
[6] Memorandum from Alasdair Keane to Stephen Pattinson, dated 3 July 2020, page 3.
[7] Ross EIC, para 4.5.
[8] Ross EIC, para 4.6.

5 General model concerns

5.1 Mr Hall concludes that the flood frequency curves on which the Project is based over estimate flood peaks and runoff volumes by a 'significant degree' and should not be used to inform the current designs.[9]

5.2 Mr Hall's conclusion does not directly address the issues that the project seeks to address, which are peak flood level and flood extent. The hydraulic model reflects an outcome of the Flood Management Plan, which recommended managing stormwater by improving the ability of the network to convey floods, as opposed to managing stormwater by storing floodwater. Mr Hall's reference to "runoff volumes" is misleading, because runoff volumes are not relevant to urban stormwater systems that manage stormwater through conveyance of floodwater.

5.3 I disagree with Mr Hall's conclusion and note that it is inconsistent with the findings of the independent peer reviewer, who found that the modelling was fit for purpose.

5.4 Mr Hall discussed the GWRC rating curve dated 15 August 2008 provided to Stephen Pattinson and concluded that "little confidence can be placed on the reliability of this particular rating curve".[10]

5.5 Mr Hall compares the flood frequency curves against specified criteria to establish if they reflect reality. Mr Hall concludes that the GWRC and MWH flood frequency curves do not satisfy the criteria while concluding that the flood frequency curves developed as part of his study do satisfy the criteria.[11]

5.6 I have been unable to confirm the validity of Mr Hall's flood frequency curves due to time constraints and a shortage of supporting data from Mr Hall; only his conclusions are presented. I have noted previously that the project is intended to address the issue of flood depths and extents, rather than flows, and that the modelling would show the project has benefits if alternative flow inputs were applied to the hydraulic model. On this basis I consider the emphasis that Mr Hall places on flow and the lack of discussion of other aspects of flooding such as depth and extent, in conjunction with the assumptions and simplifications inherent in his analysis, means his findings and conclusions are incorrect.

[9] Hall EIC, para 4.
[10] Draft report on the Pinehaven Stream flood 8 December 2019 dated 27July 2020 by Robert Hall, para 2.
[11] Draft report on the Pinehaven Stream flood 8 December 2019 dated 27July 2020 by Robert Hall, para 3.

5.7 Mr Ross considers that if the infiltration factor used in the GWRC calculations is too low then more runoff will be predicted.[12]

5.8 I consider that the calibration of the MWH hydrological model demonstrates that the runoff rates I have applied to the hydraulic model are appropriate and fit for purpose. I note that Mr Ross' statement is of a general principle rather than a direct challenge of the values applied to the parameters in the MWH model, and I agree that the general principle is correct.

5.9 Mr Ross considers the MWH/ GWRC model is 12 years out of date and considers that WWL has been reluctant to use the 8 December 2019 flood event to calibrate/ validate the model.[13] Mr Ross also considers that the flood modelling used for the Project have not been adequately calibrated or validated.[14]

5.10 I am confident that the hydrological model has been adequately calibrated and validated, and I disagree with Mr Ross' assertion that it is neither of these. I am also confident that the hydraulic model supplied for use on the Project has been validated to the 1976 event.

5.11 I have reviewed the model outputs and compared them to the available data for the 8 December 2019 flood event. I found that after taking into account the effects of climate change, the modelled flood extents are a good match for the observed flood extents. This comparison is a form of validation, and it shows that the model remains valid.

5.12 I do not agree that the model is out of date. The hydrological model was current when it was completed in November 2009, and the changes to the hydrological condition of the catchment as they pertain to the project have changed in a way that is no more than minor, so the hydrological model is not out of date. The hydraulic model has been updated, primarily with new LiDAR data and improved stream channel survey as described in my Evidence in Chief,[15] most recently in 2019, and the changes to the stormwater system in the catchment, if there have been any, are no more than minor, so the hydraulic model is not out of date.

5.13 Mr Ross considers WWL is "muddying the waters" by using climate change and water depths as low as 2mm as a "strategy to obfuscate the issue".[16]

[12] Ross EIC, para 3.5.
[13] Ross EIC, paras 4.2-4.3.
[14] Ross, EIC, paras 7.1, 10.5.
[15] Kinley EIC, para 6.2.
[16] Ross EIC, para 4.4.

5.14 It is standard practice to take into account the effects of climate change on major infrastructure investments with long lifespans.

5.15 The Flood Hazard Assessment has reported flood depths and levels that are rounded to the nearest 0.01m, or 10mm, and has considered flood depths of less than 0.05m, or 50mm, to be "nuisance flooding", which relates to the ability of a person to walk safely through flooding that is below the threshold depth. Communication around flood depths have been in accordance with good practice and I have not seen any evidence that the applicant has a strategy to obfuscate matters relating to flood depth.

5.16 Mr Ross considers that if the Project is constructed, the Stream will be able to cope with large floods in excess of either a 1 in 50 year flood or a 1 in 100 year flood.[17]

5.17 The modelling shows that the upgrades to the main stream channel will significantly improve the ability of the channel to contain flows in the 4% AEP flood event and the 1% AEP flood event, and thereby reduce the adverse affects on the adjacent properties. It is not clear what Mr Ross means by 'cope with', though I am inclined to agree that for many parts of the upgraded channel the design means flooding will be contained in large floods.

5.18 Mr Ross considers that GWRC's peak flood calculations, volumes, and extent of flooding are over exaggerated as they under-estimate infiltration losses and over-estimate runoff.[18]

5.19 The hydrological model developed by MWH is calibrated, and this shows that the runoff rates are fit for purpose for this project.

Peter Frederick Kinley

3 August 2020

[17] Ross EIC, para 4.7.
[18] Ross EIC, para 6.3.