Upper Hutt City Council – IPI Hearing

S65 – Stephen Pattinson – Expert Evidence (Rev 8)

I am a Registered Architect with over 30 years professional practice experience in New Zealand. Through my occupation as an architect I am reasonably familiar with the RMA including the Resource Management (Enabling Housing Supply and Other Matters) Amendment Act 2021, with the UHCC District Plan (including the NPS structure and format), with the NPS-UD 2020, the MDRS, with Plan Change processes and with the Government's general IPI requirements for Council's.

I have a Master of Architecture Degree in medium density housing, which involved field research at over 200 medium density housing development sites in Auckland, Wellington, Christchurch, Melbourne, London and California. In my occupation as an architect I have worked on a number of medium density housing projects.

I live at 27 Elmslie Road, Pinehaven, Upper Hutt, which has been my family's home for 29 years now, so I am very familiar with Pinehaven and Silverstream and the surrounding area.

I have been very closely involved over the last 10 years or so with the flood modelling and flood mapping of Pinehaven Stream by GWRC and UHCC and their consultants. I am very familiar with the PC42 process and outcomes, and the Pinehaven Streamworks consultation, hearing and outcomes.

Regarding my submission on the UHCC IPI (S65), it has been suggested that parts of my submission are 'beyond scope' or contrary to the Government's requirements for the Council's IPI, and should therefore be rejected.

A primary theme of my submission is the importance of accurate and reliable baseline flood modelling. This is essential for ensuring that people and property are not shown falsely to be in a flood zone; for guiding the selection of land for housing developments so as to avoid or mitigate flood hazard; and also for the purpose of achieving hydraulic neutrality for the proper management of stormwater runoff from housing developments to protect life, property and the environment.

All of this depends on getting the base model right, as accurate and reliable as possible.

This is especially important with increasing housing intensification, more medium density housing, more retirement villages, more impervious urban area, more pressure to build on slope hazard sites.

We have recently witnessed in the 27 January flooding in Auckland and in Cyclone Gabrielle in Coromandel and Hawkes Bay the disastrous consequences of getting it wrong – houses swept away, fatal land slips, and in the case of Hawkes Bay flood damage exacerbated by slashings and logs from poorly managed plantation forestry harvesting.

Pinehaven has all these potential ingredients for a future disaster …. of human making. I say of human making because of grossly inaccurate baseline flood modelling for the Pinehaven Stream catchment, because of Council's plans to intensively develop its so-called Southern Growth Area (the high earthquake zone and slip prone Pinehaven hills), and because of plantation forestry on the hills surrounding Pinehaven being harvested right now, from which the residents of Pinehaven have no protection. There is nothing in the UHCC District Plan, nor in the GWRC Pinehaven Floodplain Management Plan, nor in the Government's NES for Plantation Forestry that protects Pinehaven from unmanaged slashings and debris from pine plantation harvesting on the hills around us.

I therefore ask the Hearing Panel to carefully consider the following expert evidence and ensure that the Pinehaven flood modelling is urgently corrected so as to provide a reliable baseline for hydraulic neutrality and thereby prevent a future disaster in Pinehaven of human making:

1a. GWRC 100yr flood map 27 Elmslie Rd - smoothed

1b. COMPARISON GWRC & R J Hall 100yr flood map for 27 Elmslie Road

1c. GWRC_100yr flood depths_27 Elmslie Rd

2. Robert J Hall – CV and evidence for 27 Elmslie Road

3a. GWRC locations of Chainages 640 & 650 at 27 Elmslie Rd

3b. CDA_Drwg TS01 RevC_Survey Plan with 200mm Contours

3c. CDA_Drwg TS04 RevC_GWRC Chainage 650 & 640 locations

4a. GWRC locations of channel surveys at 21 & 35 Elmslie Rd

4b. Comparison Section MM with GWRC Interpolated Section at Chainage 650

4c. Comparison Section YY with GWRC Interpolated Section at Chainage 640

5a. Case Study #1_27 Elmslie Road

5b. Case Study #1_27 Elmslie Road - Calculated 100yr flow

5c. Case Study #1_27 Elmslie Road - GWRC mapped 100yr flow

5d. Case-Studies #2, 3 & 4_Calculated vs mapped 100yr flow

6a. SKM 2010_Future Case Scenario

6b. Petition for Pinehaven Stream Flood Mapping Audit 2015

6c. M Law reply to Kristin Stokes MWH cc M Harkness & M Hooker_RE- Pinehaven Stream hydrology - Existing and Future Development

6d. Beca Audit July 2015_MWH explained but Beca didn't disclose

7a. 2018.8.10_Graeme Horrell_Letter to SOH re 1976 flood in Pinehaven_FINAL

7b. Stormwater infrastructure improvements after 1976 flood

7c. Eyewitness accounts of 20 December 1976 flood extents in Pinehaven and Silverstream

7d. How have the Pinehaven Flood Maps been so grossly inflated?

8a. AK Ross Evidence 27 July 2020 re Infiltration Tests

8b. AK Roos - Appendix 1 Infiltration Results

8c. AK Ross - Appendix 2 - Single Tube Infiltration Tests - 27 Elmslie Rd

8d. Sponge or Rock?

9a. Graeme Horrell_Revised Letter re 23 July 2009 flood_Updated 27-11-2020

9b. Graeme Horrell, CV

10a. Pinehaven Sub Catch B hydrology 05.11.2019_FINAL & SIGNED

10b. RJ Hall & Assoc_ADDENDUM A_At-A-Site Evaluation of Appropriate CN Numbers_2019-9-27

10c. SOH (S. Pattinson) - Pinehaven Stream_Time of Concentration

11a. GMacky - Review1911114-2

11b. CV_GHMacky191115

12a. SOH - Pinehaven Storm on 08 December 2019_published 18 Dec 2019; 7 Aug 2020; 25 Nov 2020; 16 April 2023 p5,36,40,41 amended

12b. RJ Hall & Assoc_Letter to Save Our Hills 29 June 2020

12c. Bob Hall evidence on behalf of Save Our Hills - Report Pinehaven flood 8 Dec 2019 Updated 3 August 2020

12d. Bob Hall Report Pinehaven flood 8 Dec 2019_issued 27 July 2020, no change 3 Aug 2020_Figs. 1 2 & 3

12e. Graeme Horrell_Review of Pinehaven Stream flood 8 December 2019 at Chatsworth road gauge site and its implications for flood frequency estimates in the catchment by Robert Hall

13. 2019-12-11_S Pattinson & A Ross_Whaitua Meeting 11-12-19_FINAL clean

14a. 2020-12-02_Bob Hall Memo-Summary of Pinehaven Hydrology, Hydraulic Neutrality and Stream Channel Upgrade_FINAL

14b. 2020-12-02_Bob Hall_Figure 2 Flood Frequency Curves

15. Pinehaven Stream Catchment - RJ Hall Fig.2 - Flood Frequency Curves (simplified)

UHCC S42A Evidence Report, p276 - The S42A Planning Consultant states in his report:

1121. Submission S65.2 - Stephen Pattinson requests that the flood zones in the Pinehaven Stream Catchment Overlay are reassessed using accurate input parameters that are truly representative of the catchment in order to provide flood zones that are genuine qualifying matters. The Pinehaven Stream Catchment Overlay is identified in the District Plan hazard maps, and includes the catchment itself in addition to a stream corridor hazard, overland flow hazard, and ponding hazard. ***The relevant natural hazard provisions are proposed to be specifically identified as an existing qualifying matter area.*** *The submission does not include any technical information that indicates the Council's flood hazard mapping is inaccurate in this area, and I do not have any reason to suspect this to be the case. I therefore recommend submission S65.2 - Stephen Pattinson be rejected.*

I therefore set out the technical information for the inaccurate Pinehaven Stream flood modelling in the following table:

Technical Evidence for the inaccurate and unreliable Pinehaven Stream flood modelling and flood hazard mapping by GWRC and UHCC:				
No.	**Item / Evidence**	**Brief Description**		
1a 1b 1c	GWRC 100yr flood map 27 Elmslie Rd - smoothed COMPARISON GWRC & R J Hall 100yr flood map for 27 Elmslie Road GWRC_100yr flood depths_27 Elmslie Rd	1b. The map by R J Hall shows 100yr flood extent confined to the stream channel; 1a. GWRC 100yr flood map shows about a 70m wide flood extent across the property from the street boundary to the foot of the hills. 1c. Most of GWRC's "flood" is actually not flow but 300mm freeboard inappropriately added to a few millimeters of stormwater.		
2	Robert J Hall – CV and evidence for 27 Elmslie Road	Includes Robert (Bob) Hall's CV. Hall para. 23, *"I conclude … the flow conditions are in fact wrong and cannot be relied upon."* Hall para. 27, subtracting 300mm freeboard there is only 11 – 13mm of flow depth on the front lawn. *"By no stretch of the imagination could we describe these conditions as hazardous".* Summary, Hall para. 33(d), *"…the deficiencies evident in both the UHCC and GWRC flood hazard maps are likely to be present elsewhere in the catchment and not limited simply to the Pattinson property and accordingly this indicates to me that a critical review … needs to be undertaken …"*		
3a 3b 3c	GWRC locations of Chainages 640 & 650 at 27 Elmslie Rd CDA_Drwg TS01 RevC_Survey Plan with 200mm Contours CDA_Drwg TS04 RevC_GWRC Chainage 650 & 640 locations	3a – GWRC's map of stream on 27 Elmslie Rd and location of 2 cross-sections by GWRC; 3b – Topographical Survey Plan of 27 Elmslie Road by Co-Design Architects Ltd (CDA) 3c – CDA Survey Plan overlaid on GWRC map showing 7.5m horizontal error in GWRC's location of stream bed		

4a 4b 4c	GWRC locations of channel surveys at 21 & 35 Elmslie Rd. Comparison CDA Section with GWRC Interpolated Section at Chainage 650 Comparison Section YY with GWRC Interpolated Section at Chainage 640	4a – GWRC's cross-sections at 27 Elmslie Rd (bold yellow lines) are interpolated from channel sections surveyed at 21 & 35 Elmslie 4b– green line is CDA surveyed cross-section; the red line is GWRC interpolated section – generally 0.5m vertical error in stream bed. 4c – green line is CDA surveyed cross-section; the grey line is GWRC interpolated section, 1.8m vertical error and 5m horizontal error in location of stream channel invert when compared with actual channel invert, GWRC show channel invert on BBQ concrete paving		
5a 5b 5c 5d	Case Study #1_27 Elmslie Road Case Study #1_27 Elmslie Road - Calculated 100yr flow Case Study #1_27 Elmslie Road - GWRC mapped 100yr flow Case-Studies #2, 3 & 4_Calculated vs mapped 100yr flow	Topography plus calculated and mapped 100yr flow must be accurate, but it isn't. 27 Elmslie Rd, the calculated 100yr flow (by GWRC, and confirmed by R J Hall) is 4.8m3/s and is easily contained in the stream channel But at 27 Elmslie Rd, GWRC's mapped 100yr flow turns out to be about 15m3/s, i.e. about 3 times as much as what it should be. Three other Case Studies, Dunns St (bottom of catchment), Pinehaven Reserve (middle of catchment), and 142 Pinehaven Road (top of catchment) all likewise show at least 3 times more flow in the flood maps than the 100yr flow calculated by GWRC for each location.		
6a 6b	SKM 2010_Future Case Scenario Petition for Pinehaven Stream Flood Mapping Audit 2015	SKM test the impact of unmitigated runoff from possible 1,665 new houses on hills and find no increase in flooding in Pinehaven. Public challenge future case scenario finding. 260 residents sign petition for independent, transparent audit of Pinehaven flood maps; Public request Depth x Velocity flood maps.		

6c 6d	M Law reply to Kristin Stokes MWH cc M Harkness & M Hooker_RE-Pinehaven Stream hydrology - Existing and Future Development Beca Audit July 2015_MWH explained but Beca didn't disclose	Unbeknown to the public (because it wasn't reported in the Beca flood mapping audit), MWH explained to the Auditor why it was that the future case modelling surprisingly showed no increase in flooding in Pinehaven. It was because inputs in the 'before 1,665 new houses' model were the same as inputs in the 'after 1,665 new houses' model, hence no extra flooding showed up in Pinehaven from 1,665 new houses on the hills. Clearly this modelling is fatally flawed, because adding 1,665 houses dramatically changes the hills from highly absorbent forest to large areas of impervious roofs, roads, footpaths and driveways. The model inputs for the 'before' and 'after' situations should not be the same but should be very different. The future case modelling should have shown an enormous increase of flooding in Pinehaven. The Auditor did not disclose this but instead repeatedly (and falsely) stated in the Audit that MWH were not able to explain the lack of expected increase in flooding in SKM's modelling of 1,665 new houses on the hills. Instead of reporting the flood modelling as fatally flawed and rectifying it, the Audit misleads the public into thinking the flood model and flood maps are fit for purpose.		
7a	2018.8.10_Graeme Horrell_Letter to SOH re 1976 flood in Pinehaven - FINAL	The 20 December 1976 flood in Pinehaven and Silverstream peaked at about 30m3/s and was a 500 – 3,000yr flood event, not a 100yr flood as GWRC claims. Flood extents in 1976 were far greater than a 100yr flood.		

7b 7c 7d	Stormwater infrastructure improvements after 1976 flood Eyewitness accounts of 20 December 1976 flood extents in Pinehaven and Silverstream. How have the Pinehaven Flood Maps been so grossly inflated?	Major investment was made by Council in the 1980's and early 1990's to improve stormwater management in Pinehaven and Silverstream, including a very large new drainpipe down Whitemans Road to Hulls Creek, and a retention dam in Heretaunga. Instead of Council's flood modelling showing any improvement from this investment, their supposed 100yr flood extent maps go way beyond 500-3,000yr flood extents observed by many eye-witnesses of the 1976 flood. GWRC's 100yr flood extents have been grossly inflated by effectively removing all the 1980s/90s improvements and modelling the forested and highly absorbent Pinehaven catchment as highly impervious. In other words, unmanaged runoff from future intensive housing on the hills has already been built into the current flood maps.		
8a 8b 8c 8d	A K Ross – Evidence 27 July 200 re Infiltration Tests AK Ross - Appendix 1 Infiltration Results AK Ross - Appendix 2 - Single Tube Infiltration Tests - 27 Elmslie Rd Sponge or Rock?	Infiltration tests on the Pinehaven hills by A K Ross find very high infiltration rates from 500 – 900 mm/hr. In contrast to this, GWRC inputs in the current Pinehaven flood model are 5mm initial loss and 2mm/hr ongoing loss, in other words, as if the catchment is impervious, like a supermarket carpark. The modelling is totally wrong because existing catchment is like a sponge, not a rock.		
9a 9b	Graeme Horrell_Revised Letter re 23 July 2009 flood_Updated 27-11-2020 Graeme Horrell_CV	GWRC flood hydrology (by MWH) for Pinehaven Stream is based on a single storm 23 July 2009. MWH report that *"A high flow event in the Pinehaven Stream on 23 July 2009 is the largest event*		

		available to date to use for calibration. Rainfall totals for this event indicate it may have reached a 10-year ARI magnitude …". G Horrell reviewed the MWH hydrology report and concluded: *"It is considered the [MWH] estimated flood peak of 8.8 m3/s on 23 July 2009 is an under estimation. My estimate of the 23 July 2009 flood peak is 12 m3/s (based upon an estimate of the peak mean velocity) which is approximately a 40 year ARI. Relying on a single flood event with an incorrect flow peak coupled with the lack of any Pinehaven catchment rainfall for calibration, followed by the lack of any testing against actual data makes their analysis invalid. Any further use such as inputs into a hydraulic model will result in large errors, as shown in the differences in modelled flood extent maps with those observed by many in the community and water depth at the only water level measuring recorder site in the catchment. This will unfortunately result in unreliable design values for the Pinehaven stream works upgrade."* By seriously underestimating the size of the 2009 storm as a 10yr flood event when it is actually a 40yr event and using		

		this as the basis for the Pinehaven flood model, GWRC's flood model seriously under-predicts actual flood events. For example, the GWRC 1-in-25 year flood model used for determining the Pinehaven Streamworks has produced streamworks designed with capacity of coping with in excess of a 100-year flood.		
10a 10b 10c	RJ Hall & Assoc_Pinehaven Sub Catch B hydrology 05.11.2019_FINAL & SIGNED RJ Hall & Assoc_ADDENDUM A_At-A-Site Evaluation of Appropriate CN Numbers_2019-9-27 Save Our Hills (S. Pattinson) - Pinehaven Stream_Time of Concentration	Hall & Associates Ltd (RJH) independently investigated whether Jacobs' (2016) reworkings of the Pinehaven flood modelling corrected the future development hydrology error by SKM (2010) and found that it didn't even address the error, that the error is significant and that it still exists in the model: *"Jacobs' Memorandum (2016) does not fulfil the brief to resolve the future development hydrology, and the future development hydrology error in the Pinehaven flood modelling has not been addressed or corrected by Jacobs. … we find actual increases [due to future development] being in the order of about 500% to 700% [not 6% indicated by Beca], and conclude that the error in the Pinehaven flood modelling is significant and has not been resolved."* (p6) *"…no reliance should be placed on the efficacy of the flood mapping results that were associated with that earlier work by MWH, SKM, Beca and Jacobs."* (p32)		

11a 11b	GMacky - Review1911114-2 CV_GMackyReview191115	Review of report by R J Hall and Assoc Ltd "Pinehaven Stream: ARI 100 Hydrological Assessment Various Development Scenarios" November 2019 including ADDENDUM A: At-A-Site Evaluation of Appropriate CN Numbers 2019- 9-27 [10a & 10b reports above by Hall] G. Macky, quote: *"I concur with Mr Hall's conclusions that Jacobs' runoff volumes are consistent with a Curve Number of 96 for the undeveloped catchment, and average Curve Numbers of 97.5 and 97 for development scenarios DS1 and DS2 respectively. These Curve Numbers are higher than any recommended values for natural ground surfaces, and are close to the Curve Number specified by TP108 for sealed roads and roofs. It therefore seems likely that Jacobs … assumed an exceptionally impervious catchment."* (p3) *"Conclusions: The general hydrological method adopted in Mr Hall's report is sound, and is now long-established good practice. Mr Hall's choice of Curve Numbers for Catchment B is consistent with the infiltration tests described by Mr Ross in his report … the increase in runoff is significant, and mitigation would require detention storage at the development site. Mr Hall's modelling demonstrates the well-known hydrological consequences of urban development: less water is lost to ground, and runoff is quicker, resulting in increased peak flows."* (pp3,4)		

12a 12b 12c 12d 12e	SOH - Pinehaven Storm on 08 December 2019_published 18 Dec 2019, 7 Aug 2020, 25 Nov 2020, 16 April 2023 p5,36,40,41 amended 12b. RJ Hall & Assoc_Letter to Save Our Hills 29 June 2020 Bob Hall evidence on behalf of Save Our Hills - Report Pinehaven flood 8 Dec 2019 Updated 3 August 2020 Bob Hall Report Pinehaven flood 8 Dec 2019_issued 27 July 2020, no change 3 Aug 2020_Figs. 1 2 & 3 Graeme Horrell_Review of Pinehaven Stream flood 8 December 2019 at Chatsworth road gauge site and its implications for flood frequency estimates in the catchment by Robert Hall	Report on flooding in Pinehaven and Silverstream on Sunday 8 December 2019. Experts advise this was a 1-in-30yr rainfall event and a 1-in-25yr flood event. This event happened during consultation by UHCC & Wellington Water Limited on the Pinehaven Streamworks. Although WWL extended the hearing while remodelling the catchment WWL refused to update GWRC's Pinehaven flood model with this data for the flood on 8 December 2019. This report and the expert analysis by RJ Hall and G Horrell contain flood data superior to any data used by GWRC, MWH, SKM, Beca or Jacobs for the Pinehaven flood model and flood maps and should have been used to rectify and update the model to produce more accurate and reliable flood hazard maps for Pinehaven. Horrell, quote: *"This [report by Robert Hall] is a thorough reality check using 6 methods to derive flood frequency curves and is something that was missing from previous flood frequency studies for Pinehaven Stream which were limited, and over-estimated flows considerably. When compared MWH mean annual flood will have an average return interval of approximately 10 years. Furthermore MWH's 10 year flood is revised to be beyond the 100 year return interval.* *Conclusions:* *The conclusions drawn from the analysis are sound, indicating clearly that previous flood*		

		frequency analysis prepared for GWRC [should] be abandoned along with the proposed stream upgrade. … It is unfortunate the flow recorder site installed in 2008 was removed, as 12 years of flow data would have been available today. Graeme Horrell 24 July 2020" If the flow recorder had not been removed then 15 years of flow data for Pinehaven Stream would have been available today (April 2023).		
13	2019-12-11_S Pattinson & A Ross_Whaitua Meeting 11-12-19_FINAL clean	On 11 December 2019, just 3 days after the storm event, Alex Ross, Robert Hall (on speaker phone) and Stephen Pattinson presented information to the Whaitua Committee about the rainfall and flooding in Pinehaven and Silverstream on 8 December. We asked this GWRC Committee: *"In conclusion we request that GWRC fix the Pinehaven baseline model and flood extent maps before we spend extra money unnecessarily on the proposed flood works and cause more habitat and property destruction through inflated baseline modelling."* This information and the request to rectify the flood modelling were disregarded.		
14a	2020-12-02_Bob Hall Memo-Summary of Pinehaven Hydrology,	Incorrect baseline (pre-development on hills) hydrology renders hydraulic neutrality provisions of UHCC Plan Change 42 and for		

14b	Hydraulic Neutrality and Stream Channel Upgrade_FINAL 2020-12-02_Bob Hall_Figure 2 revised - Flood Frequency Curves	determining stormwater management of future development on the Pinehaven hills ineffective and unreliable: *"Future hydraulic neutrality studies that must accompany any future urban development in this catchment cannot rely on GWRC and UHCC current baseline hydrology. The hydrology must first be transparently corrected by using infiltration rates that are truly representative of the catchment, and by ensuring proper account is had of the rainfall interception effects of the catchment's heavy vegetation cover."* (p6)		
15	Pinehaven Stream Catchment - RJ Hall Fig.2 - Flood Frequency Curves (simplified) (For detailed Fig. 2, see 14b above)	Curves showing stormwater runoff (flood flow) in the existing forested Pinehaven catchment for different size storms. GWRC's curve (the grey curve) ludicrously shows an 8.8m3/s flow (their estimate of the peak flow on 23 July 2009) as being off the chart (to the left) occurring about fortnightly (see detailed Fig. 2 FFC in 14b above). The actual peak flow on 23 July 2009 was about 12.5m3/s, occurring about 1-in-40yrs. The peak flow on 8 Dec 2019 was about 11.7m3/s, occurring about 1-in-25yrs. The Pinehaven Streamworks should be designed for the flooding that occurred on this day.		

Stephen Pattinson

14 April 2023