

What to Audit and Rectify: UHCC PC42 - Mangaroa and Pinehaven Flood Extents

To: Hearing Commissioner (Hearing: 27th to 29th September 2017)

From: Save Our Hills (Upper Hutt) Incorporated (SOH)

At the hearing, the Commissioner quoted expert evidence by Michael Law, para. 38-39 –

“I concluded in my 2015 audit that the hydraulic modelling behind the GWRC flood maps was fit for purpose for producing flood extent and hazard maps ...

The modelling represented industry standard practice and a further audit would not change this or alter the flood extent and depths for the ... scenarios modelled ...

... and so the flood modelling is fit for defining the flood hazard extents proposed...”

With that in mind, I’ll go back to my original question: Is it the modelling that you want to be reviewed, or is it the way the flood extent maps from the modelling have been undertaken and are shown in the District Plan that you want reviewed? What Mr Law is saying is that if there was an independent – sorry – if there was a further audit it is highly unlikely that it would change the extent of the flood hazard maps, highly unlikely. What I’m reading into that document is that the only way that would change is if there was a complete new modelling exercise undertaken Now that’s quite different from an audit. That’s a completely new modelling exercise using completely different information, or some different information. Now I didn’t think that that’s what you’re asking for. You’re asking for an audit of the way in which the results of the modelling have been undertaken and how they’re shown on the plans?

First we wish to note that, from very recent discussions with Bob McLellan (6/10/17 & 9/10/17), we understand that Upper Hutt Town & Country Association agree with and support in principle the following five points by Save Our Hills (Upper Hutt) Incorporated:

1. that PC42 be withdrawn or put on hold while Council genuinely engage with the community to understand and satisfactorily address key community concerns;
2. that there appears to be a disconnect between the flood modelling and the flood hazard maps, and a disconnect and lack of validation of the flood maps against what is actually happening on the ground, a lack of groundtruthing;
3. that there are certain aspects of PC42 which we want critically reviewed by an independent expert(s), including:
 - a. topography (where GWRC modelling differs markedly at individual site level from facts on the ground);
 - b. assumptions about climate change;
 - c. assumptions about blockages;
 - d. assumptions about ground roughness coefficients;
 - e. the [mis]use of freeboard;
 - f. how ‘depth <0.1m’ is removed from the flood maps;

4. that the independent auditor to see to the provision of “*true flood hazard maps*” that follow the NSW Government accepted method of categorising flood hazard as Low, Medium or High based on the product of flood depth x flow velocity at any location, without treating freeboard as hazard so that the mapped flood extents are of modelled flood water, and without mapping areas of insignificant risk where water depth <0.1m; and that this method of mapping be used consistently for both the Mangaroo River and Pinehaven Stream catchments;
5. that the independent auditor see to that we are provided with accurate and reliable hydraulic neutrality provisions for both Mangaroo River and Pinehaven Stream catchments, including flood hazard maps that accurately represent the baseline ‘current situation’ data graphically in map form, all based on 2005 hydrology for Mangaroo River, and 2008/9 hydrology for Pinehaven Stream, and that this accurate baseline data be published in the District Plan.

As we are not flood engineers, we reserve the right to amend and confirm the items we request to be independently reviewed after obtaining hydraulic engineering, planning and legal advice. We elaborate on these five items as follows:

1. Mr Law may be correct in stating that “*a further audit would not ... alter the flood extent and depths for the ... scenarios modelled ...*”. However, that is what SOH is challenging, ‘*the scenarios modelled*’. We think the scenarios modelled are spurious, due to apparent inconsistent assumptions about climate change, unreasonable assumptions about blockages, and the misuse of the concept of freeboard, and that these spurious scenarios are responsible for the disconnect between the flood maps and observations of flooding on the ground by the local community;
2. We think that the scenarios modelled for both Mangaroo and Pinehaven catchments are incorrect, and, if rectified, we think it is HIGHLY LIKELY that the hydraulic modelling would produce significantly reduced flood extents and therefore significantly different flood hazard maps. SOH expects that the difference for both Mangaroo and Pinehaven catchments would be of the order demonstrated by the difference between GWRC’s 100-year flood hazard map for 27 Elmslie Road and the 100-year flood hazard map for the same property by flood expert R J Hall;
3. Aspects of the modelled scenarios which SOH wants independently audited include:
 - a. Topography – at the individual site level there are examples of GWRC’s modelling of the Pinehaven Stream channel being out by approximately 8m horizontally and about 0.3m to 0.5m vertically where there are trees obscuring the channel from LIDAR and the model is relying on interpolated data between quite distant ground surveys; when property owners supply GWRC/UHCC with surveyed property data highlighting the discrepancies (which must surely affect the accuracy of the flood modelling), and challenge the modelled topography, their complaints are being disregarded;

- b. Inconsistent climate change assumptions – Pinehaven flood modelling is based on a medium forecast of 16% increase in rainfall, whereas Mangaroa flood modelling appears to be based on a higher forecast of 20% increase in rainfall; if this is so, why aren't the assumptions consistent across both catchments?
- c. Unrealistic assumptions about blockages –
 - i. in the Pinehaven flood modelling, it has been assumed ALL culverts up to 1.2m diameter are 100% blocked, meaning this will happen every time there is a 1-in-100 year event; we know this is incorrect because of evidence that in the 1976 100-year flood event the culverts at Chichester Drive and Wyndham Road were not 100% blocked (and this was before they were upgraded in the 1980's); a realistic assumption about blockages would likely result in less flood extent;
 - ii. We want an independent review of the post-1976 upgrade of the Pinehaven/Silverstream public stormwater drainage network, and a full assessment of its existing capacity, to identify the extent to which the network already has a 1-in-25 year storm capacity; improvements to the network in the 1980s included a new 2.1m overflow bypass in Whitemans Road (which increased the capacity of that portion of the network from a 1-in-25 year to a 1-in-50 year storm capacity), the Pinehaven Road overflow bypass, new aprons and grillage to tributary intakes, and Hulls Creek detention dam; blockages in GWRC's modelled scenario negate upgrade work (post-1976 flood) and thereby unreasonably increase, rather than reduce, flood extents;
- d. Assumptions about ground roughness coefficients: in the Pinehaven catchment the model grid is coarse (5m x 5m) and the model assumes an unobstructed floodplain (no houses or fences); in reality there are many buildings and fences along the stream channel that must influence the behaviour of overflow, but these factors do not appear to be taken into account in the flood modelling;
- e. The [mis]use of freeboard – this is SOH's key issue of concern:
 - i. GWRC is treating freeboard as floodwater in the flood modelling and flood hazard extents for the Mangaroa and Pinehaven catchments, shaded blue and indistinguishable from actual modelled floodwater; this is not industry standard practice, and SOH rejects attempts that appear to present freeboard applied in this way as if it is industry standard practice (e.g. M. Law, par. 50-53);
 - ii. It might be appropriate in some catchments to treat freeboard as floodwater and therefore as hazard, however we think it is highly INAPPROPRIATE to apply freeboard in this way to the Mangaroa and Pinehaven flood modelling and flood hazard maps because of a

known significant feature in the upper catchments - Council's intended 'Southern Growth Area' (the Guildford land) as advised in Council's Land Use Strategy 2016-2043 (adopted September 2016);

- iii. treating freeboard as floodwater, indistinguishable in the hydraulic modelling and flood mapping from actual flood water, artificially inflates flood extents to the outer extent of the freeboard;
- iv. there is the potential in GWRC's flood modelling and flood hazard extent maps and in UHCC's PC42 Flood Hazard Maps, inflated as they are by the presentation of freeboard as floodwater, for extra stormwater run-off from future development on the Guildford land in the upper catchments of both Mangaroa River and Pinehaven Stream to be accommodated within the freeboard zone which has been modelled and mapped by GWRC and UHCC as floodwater;
- v. this possibility potentially alleviates future development on the Guildford land of full and proper stormwater attenuation works;
- vi. it also removes existing residents' ability for any recourse for relief from future increases in flooding caused by unmitigated run-off from future development because, being contained largely within the modelled and mapped freeboard extents, it will be claimed by the developer's consultants and by Council that the extra run-off is not making the current flooding situation any worse;
- vii. we have an email from UHCC's former Director of Infrastructure, Mr Lachlan Wallach, indicating that the flood hazard extent maps will be used by Council exactly in this way: *"...the owners of the Guildford land were investigating development of the land and stormwater was raised as an issue. ... we (UHCC) would be looking for stormwater neutrality ie not worsen the current situation. ... The 100-year flood map ... represents the current situation."* (email from L. Wallach to S. Pattinson dated 6.6.14).
- viii. SOH has consistently challenged the misrepresentation of "the current situation" in GWRC's 100-year flood maps;
- ix. In particular, SOH has challenged SKM's reported assertion that the impact on flooding from future development on the Guildford land will be only 'minor' (GWRC's Pinehaven Stream Flood Hazard Assessment_May 2010 Revision E_Vol 1, Fig.19, p30 – see below);

6.3. Future Development in the Catchment

In this investigation the future development in the catchment was also analysed in the 100 year storm with the predicted impacts of climate change and the 10 year storm without climate change. For details on how the future case hydrology was developed refer to section 3.2.

The modelled flood extents associated with the 100 year storm including climate change for the current existing hydrology are compared with the flooding extents from the future case hydrology in Figure 19.



The model results show that there is the potential for future development to increase flooding in the catchment as connected impervious areas can have a much faster runoff response, with less catchment losses than vegetated catchments. However this comparison of the 100 year rainfall event also shows that the change in extents are minor and may be possible to be mitigated. The steep topography of the catchment appears to constrain the overflows in the upper catchment and thus the minor differences observed are in the lower catchment in the vicinity of Whiteman's Road. The comparison of the modelled inundation depths between current existing and future case hydrology for the 100 year storm results in less than 100mm increase in inundation depths across the catchment.

■ **Figure 19 Current Existing vs. Future Case Comparison of Predicted Flooding Extents in the Q₁₀₀ with Climate Change.**

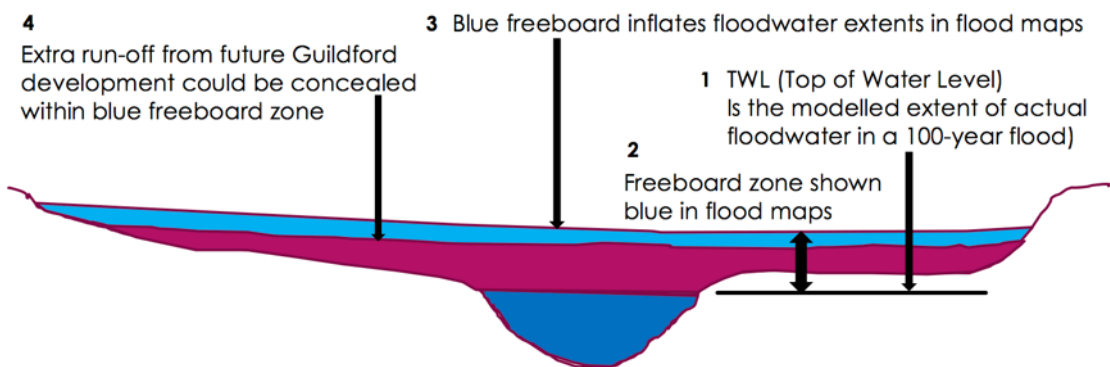
GWRC's Pinehaven Stream Flood Hazard Assessment_May 2010 Revision E_Vol 1, Fig.19, p30

- x. The 2015 audit affirms SOH's concerns: *"SOH's concerns are upheld that the effects of future development on flood extent are not modelled correctly"* p17. The audit describes this as a "major issue" which, if not rectified, means *"future development runs of SKM's flood model are potentially compromised"* (2015 Audit, pp5,9);

Unsatisfactorily, the 2015 audit suggests... extra run-off from future development can go in the blue freeboard zone without materially affecting the flood maps

"the effects of future development on flood extent are not modelled correctly. However... because there is freeboard incorporated into the results, the flood maps are unlikely to be materially affected by this apparent anomaly."

Michael Law, Auditor, Beca Report, 13 July 2015, p17



Is this why HVFMS (GWRC, HCC and UHCC) and their experts and consultants have insisted all along that freeboard must be modelled as floodwater, to accommodate future run-off from the Guildford development?

SOH Slide 5.7 (See SOH presentation #5 - Pinehaven Stream Flood Mapping Audit 2015)

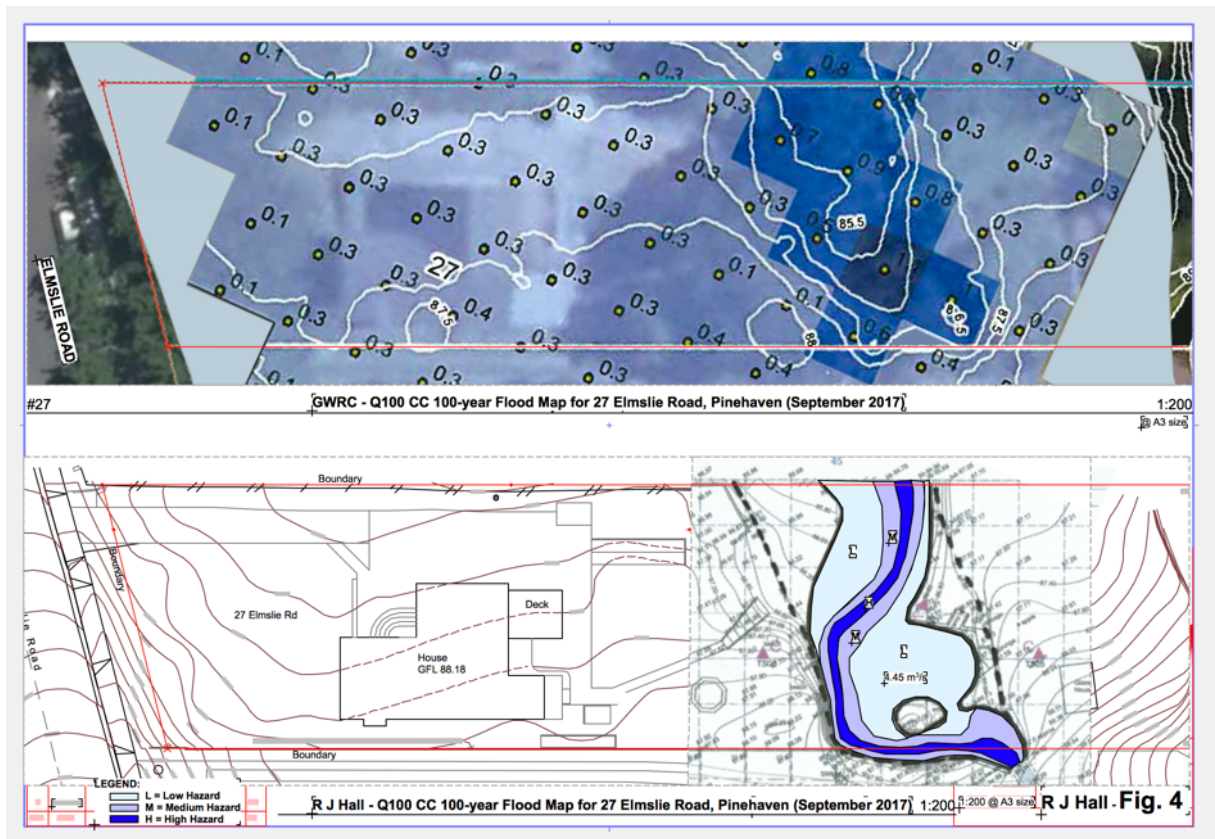
- xi. The 2015 Audit (p17) notes that the additional run-off from future development on the Guildford land can be accommodated within the freeboard that has been modelled and mapped as water: "*However, because the peak flow has been increased [acknowledging the extra run-off from future development on the Guildford land], and because there is freeboard incorporated into the results [acknowledging GWRC's treatment of freeboard in the modelling and mapping as floodwater], the flood maps are unlikely to be materially affected by this apparent anomaly [the extents of the current flood maps can accommodate significant extra run-off from future development on the Guildford land without materially affecting the flood maps!].*
- xii. This circular argument (that there isn't any material problem with the flood maps because additional peak flow from future development on the Guildford land can combine with freeboard-presented-as-floodwater to resolve any apparent anomalies) assumes [incorrectly] that it is acceptable to fill freeboard with additional peak flow from future development, flow that did not exist in the "current situation" before the arrival of new development on the Guildford land!
- xiii. This is strongly challenged by SOH (see SOH slide 5.7 above) because the additional peak flow (extra run-off from future Guildford land

development) makes the true current situation WORSE (the top of actual water level) but doing so stealthily within the blue-coloured freeboard extents;

- xiv. Mr Law [soundly] advises GWRC that “true flood hazard maps” would not display freeboard as hazard: *“Using a single shading for the whole hazard extent does not give a full understanding of the hazard in each location ... Flood hazard maps often show the flood hazard calculated as a product of the flood depth and water velocity. ... such a map would not show any hazard in the buffer zone [the freeboard zone] between the modelled flood extent [actual flood water] and the extent including freeboard”* (2015 Audit, p13);
- xv. Mr Law recommended *“GWRC ... provide true flood hazard maps, based on the combination of water depth and flow velocity at any location”* (2015 Audit, p23);
- xvi. The current flood maps are not “true flood hazard maps” because they portray ‘freeboard’ as floodwater and as a hazard;
- xvii. Furthermore, as R J Hall points out, *“GWRC apply 300mm of freeboard ... on any surface water that the GWRC model predicts flowing on the berm regardless of the depth of that berm flow nor whether or not it might actually be there at all in an AEP 1/100 year event. Freeboard applied in this way creates a very confusing and misleading impression of the nature of the flooding present if at all and fails to clarify the scale of the hazard in any meaningful way. In reality, it has the effect of concealing the actual flood conditions that may be present at a site and fails to quantify the true nature of the flood hazards that may be present”* (R J Hall evidence, par. 32);
- xviii. The way GWRC uses freeboard can create a significant hazard out of an insignificant puddle, by adding 300mm freeboard over a few millimetres of surface water (as noted by RJ Hall above), thereby creating a vacancy within the mapped flood extent which significant run-off from future development can then occupy unchallenged, and in doing so create a real flood risk;
- xix. This is a misuse of freeboard. Freeboard is a necessary regulatory safety margin required by law to be added, for good reasons (see SOH slide 1.24), to the Top of Water Level (TWL) to determine a minimum Recommended Building Level (RBL);
- xx. SOH considers that the shading of freeboard as floodwater is probably the reason for the error in the reported result of SKM’s future case scenario (see ix above);

- xxi. SKM's future case scenario assumed 1,665 future dwellings on just part of the Guildford land, and reported that the effect of this high level of development on flooding would be 'minor';
- xxii. SKM displayed this erroneous conclusion in a map overlay which showed very little additional peak flow from future development beyond the extent of SKM's 1-in-100 year base flood map which claims to represent 'the current situation' (SKM's Pinehaven Stream Flood Hazard Assessment_May 2010 Rev E_Vol 1, Fig.19, p30 – see SOH slide 5.3);
- xxiii. SOH thinks the error [the "major issue" with regard to future development identified in the 2015 Audit – see (x) above] is that SKM's base map is inflated by the-freeboard-presented-as-floodwater device;
- xxiv. This "major issue" viz. that *"the effects of future development on flood extent not being modelled correctly"* (2015 Audit p17) has still not been transparently investigated and rectified;
- xxv. Mr Law's evidence doesn't explain what the error is, but claims this error has subsequently been corrected (para. 40);
- xxvi. Unfortunately, Mr law's evidence provides no detail to substantiate the claim that the error has been corrected.
- xxvii. A Jacobs Report (dated 23 June 2016) of the re-worked future case scenario likewise provides no detail (apparently Mr Law has reviewed this report). This report merely states that the scenario was re-run using 'a lower level of development'. It provides no information about the building typologies assumed, or the number of new dwellings assumed in this lower level of development, or where they are located on the Guildford land, or in what density;
- xxviii. Mr Law's claim that the "major issue" has been corrected lacks transparency and therefore lacks credibility;
- xxix. SOH considers that the error still exists, evidenced by the fact that there has been no change to GWRC's modelled flood extents; they still include the-freeboard-presented-as-floodwater device, used to artificially inflate the modelled and mapped flood hazard extents for both the Mangaroa and Pinehaven catchments. This "major issue" must be investigated in an independent critical review, and the modelled flood extents and hazard maps rectified to provide the community with *"true flood hazard maps, based on the combination of water depth and flow velocity at any location"* (2015 Audit, p23).
- xxx. Meanwhile, GWRC and UHCC misuse of freeboard as floodwater creates a misleading impression of actual flood water extent, and is

the main reason for the difference between GWRC’s inflated 100-year flood hazard map for 27 Elmslie Road and R J Hall’s correct 100-year flood hazard map of actual flood water for the same property (see SOH slide 3.23);



SOH Slide 3.23 (See SOH presentation #3 – Flood Maps Must be Accurate – 27 Elmslie Road)

xxx. R J Hall concludes “My assessment of the situation on the Pattinson’s property [27 Elmslie Road] and 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 of what is presently being made available with respect to the nature and the extent of the flood hazards in the Pinehaven and Mangaroo catchments needs to be undertaken to ensure that what is eventually produced serves the purpose of presenting flood hazard information in an informative and accurate way that can readily be understood by the community.” R J Hall evidence, para. 33(d)

xxxii. SOH requests that the independent critical review recommended by R J Hall be carried out, and expects that it is HIGHLY LIKELY that the review WILL result in significant changes to the flood modelling and mapped hazard extents, as exemplified in xxx (SOH Slide 3.23) above.

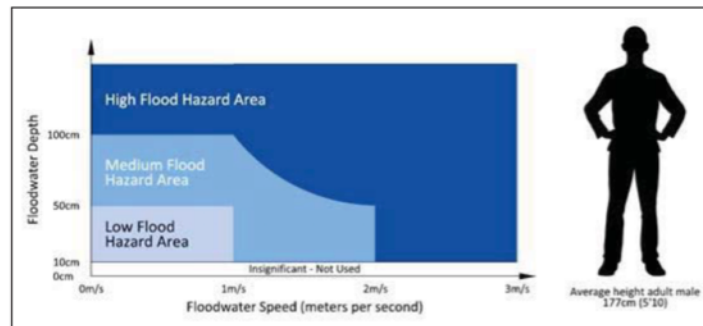
4. Provision of “true flood hazard maps”: this is what members of SOH have been consistently requesting from Council for at least the last five years, “ ... *provide true flood hazard maps, based on the combination of water depth and flow velocity at any location* (2015 Audit, p23);
- a. According to Mr Law, “*This is useful from a hazard assessment perspective to understand potential danger to people, and can be readily calculated from the outputs of 2D hydraulic models. ... such a map would not show any hazard in the buffer [freeboard] zone ...*” (2015 Audit, pp 23, 13);
 - b. GWRC and UHCC consultants’ have made 7 or 8 attempts to produce “true flood hazard maps” for Pinehaven Stream [see SOH’s Executive Summary, items 3(a) to 3(h)], and still haven’t got it right, therefore SOH does not want any more flood hazard extent maps from these consultants and experts;
 - c. Advice from R J Hall is that there is no reason why flood modelling and hazard mapping for both the Mangaroo and Pinehaven catchments cannot be done following the widely accepted NSW government method of using Depth x Velocity to identify and map areas of Low, Medium and High Flood Hazard;
 - d. At the Hearing, the Commissioner put the question to the Planners “*as to whether there is any merit in distinguishing the three types of risk – Low, Medium and High - in the way that the Hamilton City case has done that*” (PC42 Hearing, Day 2, Thursday 28/9/17, session after lunch). SOH suggests that it is not for the Planners to decide for the community how the community would prefer to see flood hazards categorised and displayed on the flood hazard maps. The Planners seem to prefer vague categorisation by ‘elements’, as shown and poorly defined in PC42, a method that employs the freeboard-presented-as-floodwater device to present hazard in a misleading, ambiguous way that is open to wide misinterpretation by the community;
 - e. What SOH wants is simple: “*...true flood hazard maps, based on the combination of water depth and flow velocity at any location ... to understand potential danger to people, and ... readily calculated from the outputs of 2D hydraulic models ... not show[ing] any hazard in the buffer [freeboard] zone*” (See SOH slide 5.9);
 - f. SOH prefers the simple term ‘Freeboard’ to describe the buffer zone, rather than the term ‘Flood Sensitive Area’ suggested on p23 of the Audit, because the term ‘Flood Sensitive Area’ has already been misused by GWRC in one of its many editions of the Pinehaven Stream flood maps [see SOH’s Executive Summary, item 3(d); & SOH slides 1.16 – 1.19 ‘Yellow Means What?’];
 - g. Note that the diagram in SOH Slide 5.9 (which is from the 2015 Audit, p23) indicates that flood water depth less than 10cm is of insignificant risk and therefore not mapped;

- h. SOH would like the independent audit to review how ‘Depth <0.1m’ was removed by Kyle Christensen and Sharyn Westlake in GWRC’s flood maps dated 27.7.2017. At the Hearing, Kyle Christensen said it was removed from the top [of the 300mm freeboard zone], effectively leaving 200mm freeboard, while Sharyn Westlake states in her presentation at the Hearing that “*water depth <0.1m [was] removed from the lateral extent of the flooding*” (para.3.5); was it removed the way Mr Christensen said it was, or the way Ms Westlake said it was (and by “removed from the lateral extents of flooding” does Ms Westlake mean removed from actual flood water or removed from freeboard-presented-as floodwater?);

How to create clearer and more informative flood hazard maps

5.9

For example, describing the area covered by freeboard beyond the modelled flood extent as a Flood Sensitive Area may be more transparent and more appropriate than GWRC’s use of all-encompassing Flood Hazard Areas. Changing the name would allow GWRC to provide true flood hazard maps, based on the combination of water depth and flow velocity at any location. These flood hazard maps can be particularly informative in areas where flood extents are large, but there is also deep or fast flowing water in defined flow paths or depressions. Figure 6.4 shows how flood hazard is defined in Hamilton, while Figure 6.5 shows an example of a flood hazard map from the UK based on similar principles.



Beca Audit Report
2015, Page 23

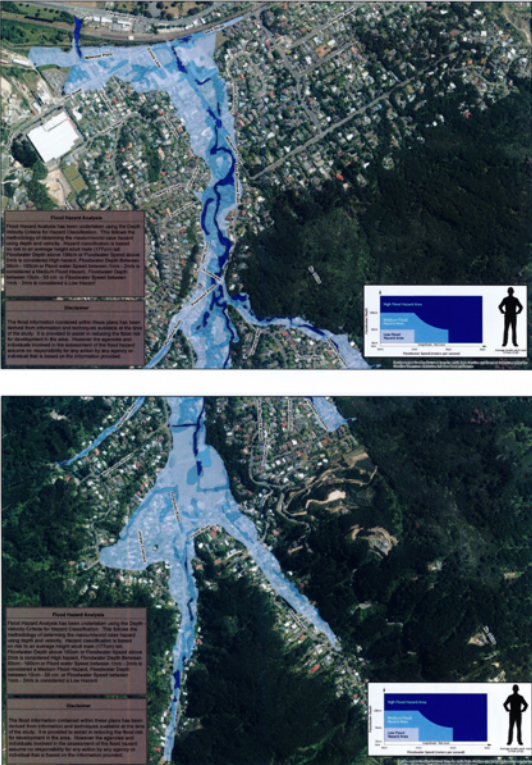
SOH Slide 5.9 (See SOH presentation #5 - Pinehaven Stream Flood Mapping Audit 2015)

- i. SOH considers that GWRC have removed “*water depth <0.1m*” incorrectly. We request that the independent auditor advise/confirm that insignificant “*water depth <0.1m*” be removed from the actual flood water extent, not the freeboard zone as done by Kyle Christensen and GWRC;
- j. SOH would like GWRC’s underlying flood hazard extent maps for PC42 investigated by the independent auditor;
- i. according to Brett Osborne the underlying GWRC map for Pinehaven Stream was GWRC’s “Pinehaven Stream: Map 0 – Flood Map” [see SOH Executive Summary, item #3(g), the ‘Marge Simpson’ map];

- ii. according to Brett Osborne the underlying GWRC map for Mangaroa River was Fig. 21 in GWRC's "Mangaroa River Flood Hazard Assessment: Mangaroa Hydraulic Modelling Report, Revision F, 06 November 2015."
- iii. Neither the 'Marge Simpson' map nor Fig.21 delineate flood hazard categories or show extents of each category so it is not at all clear what the maps were that Kyle Christensen and Sharyn Westlake "amended" to arrive at the "Depth >0.1m" maps for Mangaroa River and Pinehaven Stream that were released to submitters on 4th September 2017 in the Section 42A Report;
- iv. The only GWRC flood hazard maps for Mangaroa River available to the public at the time of the PC42 consultation (8th March to 8th May 2017), was the obsolete GWRC set of "Flood and Erosion Maps – Sheets 1 – 10, dated 14.12.2010 issued for PC15 and subsequently withdrawn;
- v. The only GWRC flood hazard maps for Pinehaven Stream available to the public at the time of the PC42 consultation, besides the above mentioned simple 'Marge Simpson' map (*"which contains no information about depth or hazard category"*), was either:
 1. the obsolete 'Yellow Means What?' Revision maps [see SOH's Executive Summary, item 3(d); & SOH slides 1.16 – 1.19 'Yellow Means What?'], or
 2. the original 2010 one-colour (blue) "100-Year Flood Extent" maps (still to be found on GWRC's website) issued as a series of "Flood Hazard Information Sheets 1 – 9" which, like the Marge Simpson map contain no information about depth or hazard category.
- vi. So what were the GWRC flood hazard maps for Mangaroa and Pinehaven that Kyle Christensen and Sharyn Westlake used, and how did they "amend" them, to create the GWRC 27 July 2017 "Depth >0.1m" maps to inform and create the UHCC Flood Hazard Maps 27 July 2017 issued for PC42 four months after consultation closed?
- vii. SOH would like an independent auditor to investigate this, because it seems that were no current, publicly available GWRC flood hazard maps to "amend" to create GWRC's or UHCC's "Depth >0.1m" flood hazard maps.
- viii. Regarding GWRC's attempt at the NSW Government approach to flood hazard mapping, i.e. Depth x Velocity = Flood Hazard (Low, Medium or High) [see SOH Slide 5.10 showing illustrations from GWRC Pinehaven Floodplain Management Plan, Revision 5, 19

February, 2016, pp65-66, Appendix E – Flood hazard Maps] these flood hazard maps are incorrect for at least two reasons

1. they inflate the actual modelled water extent by incorporating blue-coloured freeboard into it (as discussed above); and
2. quite extensive areas of insignificant risk where water depth is less than 10cm are still included in the blue-coloured flood extents.



GWRC Pinehaven Floodplain Management Plan, Revision 5, 19 February 2016, pp 65-66 Appendix E, Flood Hazard Maps (D X V) = H

Depth x Velocity

5.10

"Flood hazard maps often show the flood hazard calculated as a product of the flood depth and water velocity. This is useful from a hazard assessment perspective to understand potential danger to people, and can be readily calculated from the outputs of 2D hydraulic models. ... such a map would not show any hazard in the buffer zone between the modelled flood extent and the extent including freeboard."

Beca Audit Report 2015, Page 13

Solution to flawed maps (opp.)

The flood maps opposite, although using the NSW method, are flawed (Slides 5.6 and 5.7). Assuming the outputs of the flood model are correct (check), rectify the "major issue" by:

- removing blue shading of freeboard
- removing actual water depth <10cm

Resulting flood extent will be less and represent the 'current situation' for comparing hydraulic neutrality of future developments (check).

SOH Slide 5.10 (See SOH presentation #5 - Pinehaven Stream Flood Mapping Audit 2015)

- ix. SOH requests that an independent external expert(s) oversee the task of producing "true flood hazard maps" for Mangaroa and Pinehaven, to provide clear, accurate and informative flood hazard maps, using the NSW Government method, like Hamilton City Council (see SOH Slides 3.24 & 3.25), and which the 2015 Audit recommends, and which the local community has consistently asked for.
5. Publish baseline 'current situation' data and flood hazard maps: This must be overseen by an independent external expert(s). There has been a consistent call from the community over the last five years to publish accurate and full baseline 'current situation' data, including:

- a. the hydrological model - including the delineation of sub-catchments; provision of hydrographs; peak discharges for sub-catchments, main catchment sections, and the whole catchment, all as of the date of the original hydrology studies (2005 for Mangaroa; 2008/9 for Pinehaven);
- b. the hydraulic modelling inputs and outputs, and a complete record of assumptions (including blockages, ground roughness, and allowance for climate change);
- c. accurate and informative flood hazard maps (as per Para. 4 above – “true flood hazard maps”) that do not map freeboard as a hazard but rather map actual water extents according to hazard categories using the NSW Government method of Depth x Velocity = Flood Hazard (Low, Medium or High). These maps must be accurate graphic representations of the baseline ‘current situation’ data, so that they can be used as reliable base maps against which future development modelling and mapping can be compared and demonstrated graphically and accurately in map form in a way that the community can easily understand to show that hydraulic neutrality of any future developments (particularly on the Guildford land, Council’s so-called ‘Southern Growth Area’) is being properly administered and achieved;
- d. The publishing of baseline information in the District Plan is necessary for the Pinehaven and Mangaroa catchments because, unlike PC40 (Wallaceville), there are important characteristics in the surroundings that make the enforcement of hydraulic neutrality provisions vital in the Pinehaven and Mangaroa catchments, and the provisions and process for ensuring hydraulic neutrality need to be transparent and clear. The characteristics are:
 - i. known intended large-scale future development on the Guildford land in the upper catchments of both Mangaroa River and Pinehaven Stream (Council’s ‘Southern Growth Area’ – see Council’s Land Use Strategy 2016-2043, adopted September, 2016);
 - ii. large areas of problematic mature pine trees in close proximity above built up urban areas;
 - iii. issues of forest clearance, land instability, subdivision and earthworks associated with large-scale future development on the Guildford land in the upper catchments in close proximity and directly above existing built-up urban areas;
 - iv. known problems in attempts so far by GWRC and UHCC and their consultants to model the effects of large-scale future development on flooding, problems which still have not been transparently investigated and resolved to the satisfaction of the community [see above items 3(e) ix-xiii and xxiv – xxix]
 - v. beautiful green surroundings that we value and want to preserve and enhance.

PART OF SOH TRANSCRIPT FROM RECORDING OF PROCEEDINGS OF HEARING
(Recorded with the prior permission of the Commissioner)

Thursday 28th, 3rd session (after lunch) Recording 0535

C-DM Commissioner David McMahon
Sue Susan Pattinson
SP Stephen Pattinson

Track Speaker Transcript

1:17:12 C-DM *What is it that you're requesting an audit of?*

1:21:41 C-DM *Let me just read you something from Mr Law's report, just for some context, and its paragraphs 37, 38 and 39. He starts off by saying:*

37. Some submissions raise a general concern about the accuracy of the flood maps. This can be due to the mapped extents not aligning with community observations of previous flood events
...

1976, for example, matters that we heard this morning from [Mr Thomas] etc.

... as well as understanding of how they are compiled, or an assumption that the underlying flood modelling is incorrect.

38. I concluded in my 2015 audit that the hydraulic modelling behind the GWRC flood maps was fit for purpose for producing flood extent and hazard maps for the current development situation for the Floodplain Management Plan.

And this is the significant paragraph, Paragraph 39 –

39. The modelling represented industry standard practice and a further audit would not change this or alter the flood extent and depths for the design flood events and scenarios modelled
...

I'll come back to that in a minute –

... and so the flood modelling is fit for defining the flood hazard extents proposed [in Plan Change 42].

With that in mind, I'll go back to my original question:

Is it the modelling that you want to be reviewed, or is it the way the flood extent maps from the modelling have been undertaken and are shown in the District Plan that you want reviewed?

What Mr Law is saying is that if there was an independent – sorry – if there was a further audit it is highly unlikely that it would change the extent of the flood hazard maps, highly unlikely. What I'm reading into that document is that the only way that would change is if there was a complete new modelling exercise undertaken that had different parameters, different variables, different inputs, that might eventually lead to a different output. Now that's quite different from an audit. That's a completely new modelling exercise using completely different information, or some different information. Now I didn't think that that's what you're asking for. You're asking for an audit of the way in which the results of the modelling have been undertaken and how they're shown on the plans.

1:24:20 SP

I think you're close to what we're trying to express, that it's not the hydrology that we're questioning. ... The maps are not trustworthy. We've been through so many versions, honestly, there are about 50 - 60 maps for Pinehaven and we don't want any more. We don't want any more [from these consultants]. We want new people on the job to do it correctly in a way that we're confident with. And we've tried to show you today what that would look like.

1:25:06 C-DM

Yes. Now I just want to thank you for acknowledging that. That's useful. And that's clarified my potential uncertainty. I'm going to focus on the maps now. There was some discussion yesterday from Mrs Robinson, and developed today, about how these maps could be better shown – High, Low, Medium, with freeboard, without freeboard, that sort of thing.

Interestingly, I note that Mr Law commented on this matter in his evidence, and had actually recommended to Greater Wellington, I think back in 2015, that that was something that could be undertaken. Paragraph 20, I think, said that he –

20. ... recommended that the presentation of flood information could distinguish between modelled extents with, and without, the application of freeboard.

I think he also mentioned about High, Medium and Low also. In any event, that wasn't taken up, and the outer extents of the flood extents based on those different elements – Ponding, Overflow Flood - were shown.

I guess if I've got a question it's here, to the Planners, as to whether there's any merit in distinguishing the three types of risk – Low, Medium and High – in the way that the Hamilton City case has done that. What I've gleaned from your presentation this far is that the rules in the Plan that are proposed don't relate per se to whether it's high or low flooding. They relate to the elements, whether it's ponding, or overflow pond, or flooding. So the rules have aligned with the elements that make up the flood extent, not to whether it's high or low per se. I don't know how much utility there is in delineating flooding. There might be other reasons for delineating, as you and Mrs Pattinson and Mrs Robinson have outlined.

- 1:27:43 SP *We think [aligning with elements] is to obscure the real situation, to be honest. Those elements are poorly defined and they're pretty meaningless.*
- 1:27:55 Sue *Can I ask too, that you've asked quite a big question, like, it's a very important question about what we want audited and reviewed. Could we reserve the right to come back to you tomorrow with a fully written answer? We'd like to talk about it with -*
- C-DM *Would that be because you don't have confidence that I've recorded it?*
- SP *No, no, no, it's not that.*
- Sue *No, we just want to be -*
- C-DM *Time to think about it?*
- Sue *Yes, we'd just like a bit of time to make sure that we've got it correct as well.*
- C-DM *There's no reason why I wouldn't agree to that. I don't want there to be any misunderstanding. It needs to be focused. I wouldn't expect, for example, that you would depart from what we've discussed today. That's a reasonable request.*
- 1:28:50 Sue *Thank you very much, that's appreciated.*

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