

Before the Hearings Panel at Wellington City Council

Under Schedule 1 of the Resource Management Act 1991

In the matter of the Proposed Wellington City District Plan

**Statement of evidence of Alistair Osborne on behalf of Wellington City Council
(Flood Hazard Modelling)**

Date: 22nd May 2023

INTRODUCTION:

1 My name is Alistair Mark Osborne. I am employed as a Senior Hydraulic Modeller at Wellington Water Ltd (**Wellington Water**).

2 I have prepared this statement of evidence on behalf of the Wellington City Council (**Council**) in respect of technical related matters arising from the submissions and further submissions on Wellington City Council's Proposed District Plan (PDP); primarily in relation to flooding hazard modelling and mapping.

3 I have been providing input into the flood hazard mapping for the PDP since 2021. This input includes managing the hydrological and hydraulic modelling, peer review programme, and development of flood hazard mapping based on model output.

4 In preparation of this evidence, I have reviewed the following documents:

4.1 The PDP;

4.2 Relevant submission points as outlined in the PDP 'Summary of Submissions by Submitter' documents.

5 I am authorised to provide this evidence on behalf of Wellington Water and the Council.

QUALIFICATIONS AND EXPERIENCE

6 I hold the qualification of a Master of Science (with Honours) from Victoria University, Wellington.

7 I have 19 years' experience in hydraulic and hydrological modelling in New Zealand. I have worked for both Engineering Consultancies and Councils.

8 I am a member of the New Zealand Hydrological Society.

Code of conduct

9 I have read the Code of Conduct for Expert Witnesses set out in the Environment Court's Practice Note 2023. I have complied with the Code of Conduct in preparing my evidence and will continue to comply with it while giving oral evidence before the Council hearing panel. My qualifications as an expert are set out above. Except where I state I rely on the evidence of another person, I confirm that the issues addressed in this statement of evidence are within my area of expertise, and I have not omitted to consider material facts known to me that might alter or detract from my expressed opinions.

SCOPE OF EVIDENCE

10 My statement of evidence covers the following matters:

10.1 The framework that Wellington Water and Council have applied to manage flood risk.

10.2 Comments on submission points as follows:

- Submission PDP/025 by Rod Halliday;
- Submission PDP/112 by Oliver Sangster;
- Submission PDP/129 by Singvest Group Limited;
- Submission PDP/219 by Michael Thomas;
- Submission PDP/309 by David Karl;
- Submission PDP/380 by Southern Cross Healthcare;
- Submission PDP/348 by Kimberley Vermaey;
- Submission PDP/391 by Kainga Ora Homes and Communities;
- Submission PDP/406 by Wellington International Airport Ltd.

FLOOD HAZARD MODELLING AND MAPPING

- 11 Wellington Water generates flood hazard overlay data from hydraulic models developed based on the Wellington Water Hydraulic Modelling Specification (Wellington Water, 2017). This process includes model validation and external peer review (as set out in the specification).
- 12 The flood hazard overlays in the PDP are based on the outputs from validated hydraulic models, flood records and feedback from the community.
- 13 The modelling and mapping approach is in line with industry standards applied in major centres across New Zealand, but it has been tailored toward the Wellington environment and the needs of Wellington Water's client councils.
- 14 The modelling and flood hazard mapping approach for Wellington City is consistent with the approach used to inform flood hazard overlays in both Porirua and the Hutt valley.
- 15 The flood hazard overlays have been developed from modelled scenario of the 100-year Annual Return Interval (ARI) design storm, with an allowance for climate change out to the year 2130. The climate change allowance has been applied in the modelled scenario with a 20% increase in rainfall and a 1 metre rise in sea-level.
- 16 A total of 15 models have been developed between 2016 and 2022 to cover the Wellington City Council stormwater catchments. These models are as follows:
 - i Churton Park
 - ii Hataitai/Kilbirnie
 - iii Horokiwi
 - iv Island Bay
 - v Johnsonville/Newlands
 - vi Karori

vii	Khandallah/Rangoon
viii	Lyall Bay/Houghton Bay
ix	Miramar
x	Ngaio/Khandallah
xi	Northern CBD
xii	Owhiro Bay
xiii	Roseneath
xiv	Southern CBD
xv	Tawa

17 The flood hazard overlays for the PDP show flooding hazards in the following categories:

17.1 **Stream Corridors** – typically consists of a buffer of 5m either side of the stream centreline. Open water courses in urban areas were selected to be included in the stream corridor layer alongside contributing branches in the upper reaches of stormwater catchments. Flooding in stream corridors is the most hazardous of the three types we have identified due to it being deep and fast flowing water.

17.2 **Overland Flowpaths** – these convey stormwater when the pipe or stream network capacity is exceeded or blocked. The flowpaths were identified and mapped using the modelled results backed up with flood records considering depth and velocity to identify hydraulically significant paths. This type of flooding is generally less hazardous than in stream corridors as the water is shallower and slower.

17.3 **Inundation/Ponding** - these are the low velocity flood extents which have ponding deeper than 50mm. This is the least hazardous of the three types of flooding, however it is important to manage its effects on damage to property.

COMMENTS ON SUBMISSIONS

SUBMISSION 025 by Rod Halliday – 28 Westchester Drive

- 18 Rod Halliday considers that the flood ponding and overland flowpath zone at 28 Westchester Drive is inaccurate. His view is that the presence of the Stebbings Dam upstream and concrete retaining wall structures holding up the road will prevent this hazard.
- 19 The modelled flooding predicted to impact 28 Westchester Drive is a result of runoff from the property during the extreme design storm (100-year ARI with allowance for climate changes) rather than overflow from the Porirua Stream. This means it is unaffected by the Stebbings Dam and retaining walls. The modelled stormwater network and topography include a 300mm culvert beneath the access road on the property. Figure 1 shows the modelled culvert in green and indicates the depression where the runoff accumulates before overtopping and flowing across Westchester Drive to the Porirua Stream. The flow direction arrows marked in red, Figure 1. As a result, I do not believe any adjustments should be made to the flood hazard mapping.

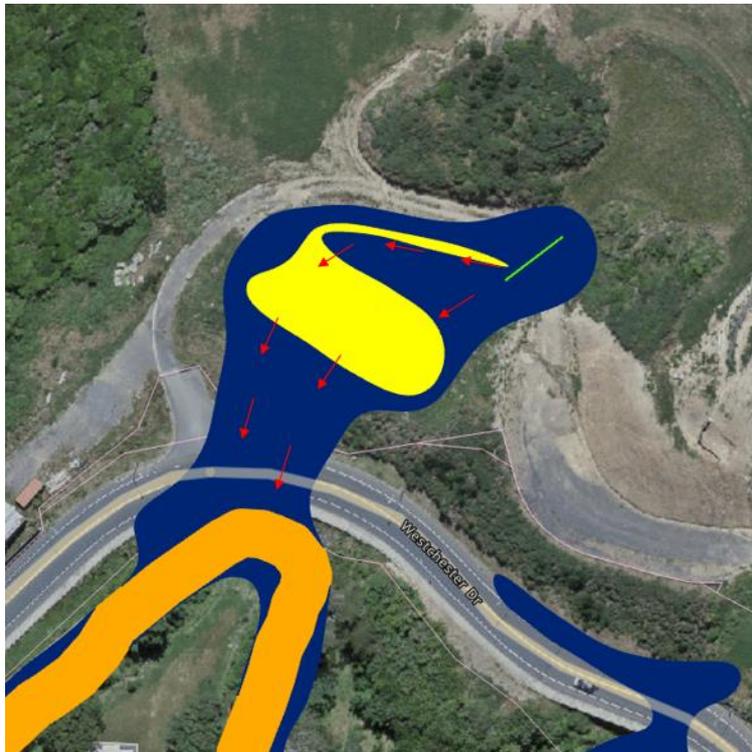


Figure 1: Current District Plan mapping with modelled flow direction arrows

SUBMISSION 112 by Oliver Sangster – 22B Glenside Road

- 20 Oliver Sangster has noted that the property of 22B Glenside Road was filled as part of a recent subdivision for the site and the flood levels do not reflect the new ground levels. The submitter has asked for confirmation whether the flood models consider the new ground level on the site.
- 21 Due to the small nature of the site development and earthworks, the new ground levels have not been captured in the flood model and is not accounted for in the model output. As a result it is recommended that mapping is manually changed, as per Figure 2 and Figure 3, to reflect this.



Figure 2: Current District Plan mapping



Figure 3: Proposed District Plan mapping

SUBMISSION 129 by Singvest Group Limited – 154 Victoria Street

- 22 The submitter has commented that they do not believe the site is in a flood zone.
- 23 The property of 154 Victoria St, Te Aro does not appear to directly impacted by the flood hazard mapping (Figure 4), however it is immediately adjacent to flooding generated by the Wellington Water peer reviewed model for the Wellington CBD. As a result, I do not believe any adjustments should be made to the flood hazard mapping because the site does not intersect the flood hazard zone and is therefore not affected by the rules associated with them.



Figure 4: Current District Plan mapping

SUBMISSION 219 by Michael Thomas – 18 Campbell Terrace

24 Michael Thomas considers that 18 Campbell Terrace is considerably higher than 16a Campbell Terrace and any flood waters would flow through this area rather than across 18 Campbell Terrace. The submitter also notes that 18 Campbell Terrace has a retaining wall along its boundary which will prevent flooding.

25 The modelled flooding predicted to impact the rear of 18 Campbell Terrace arrives from the south (20 to 24 Campbell Terrace) as shown in Figure 5. This means the height difference between 18 Campbell Terrace and the adjacent property, 16a Campbell Terrace, is unlikely to prevent the predicted flooding. As a result, I do not believe any adjustments should be made to the flood hazard map.

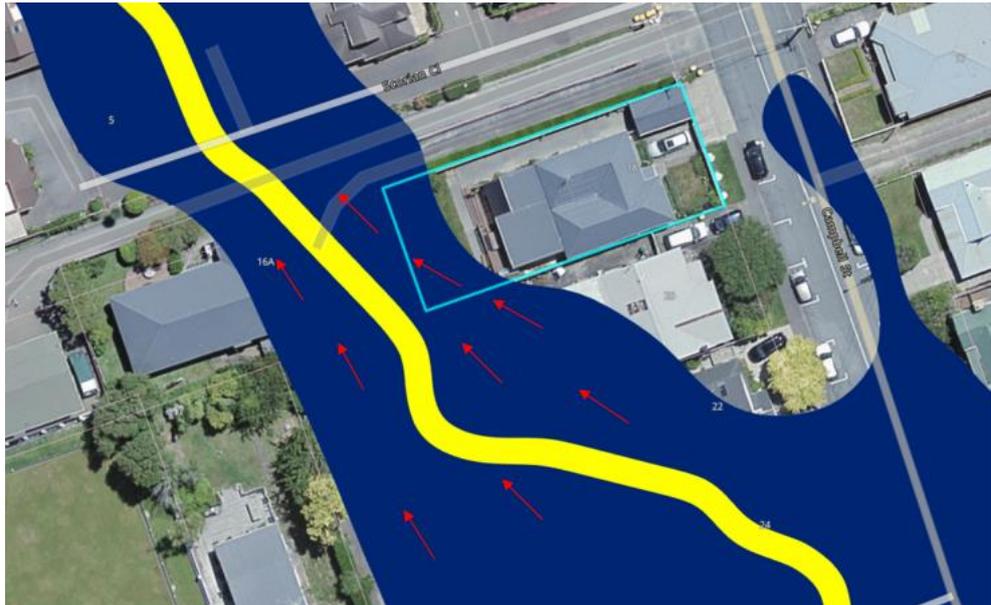


Figure 5: Current District Plan mapping with modelled flow direction arrows

SUBMISSION 309 by David Karl- 29a Trent Street

- 26 David Karl has noted that the property at 29a Trent Street was filled by 1m when the new dwelling at this location was built. David would like confirmation whether the flood models take into account the current ground level at the site.
- 27 A comparison of the modelled topography, Figure 6, (based on LiDAR collected in 2013) and new topography, Figure 7, generated from LiDAR collected in 2019/2020 shows the model does not include in the raised building platform at 29a Trent St. This will impact the flood extent in this area. As result, it is recommended that flood hazard map is changed, as per Figure 8 and Figure 9, to reflect this.

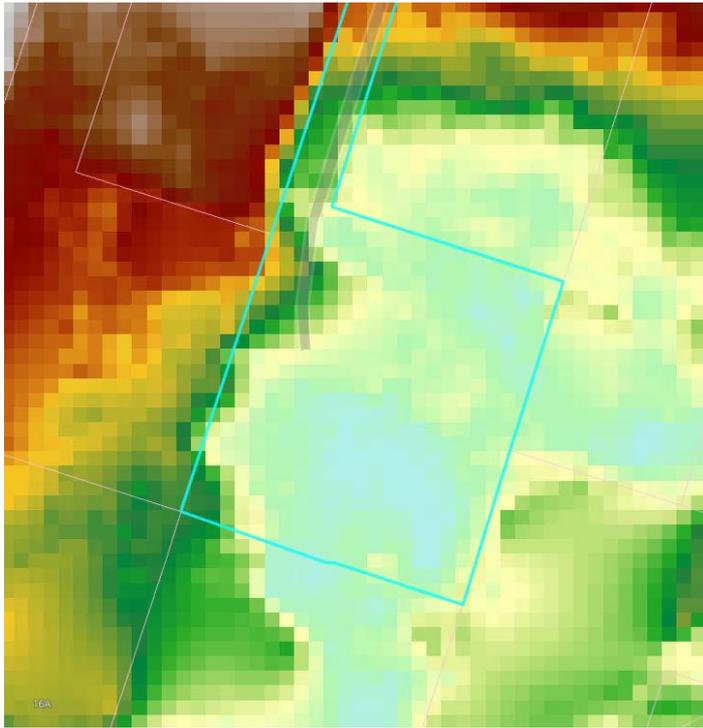


Figure 6: Modelled Topography (based on 2013 LiDAR)

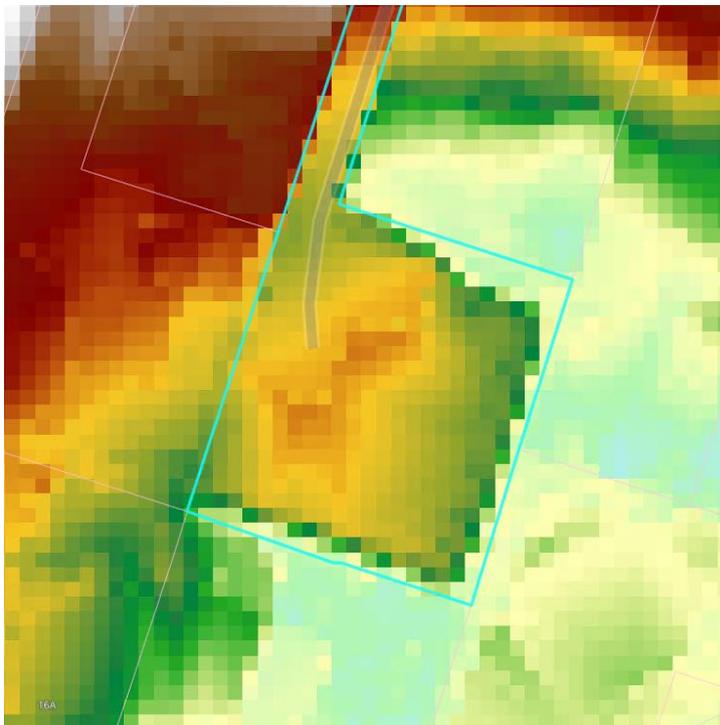


Figure 7: New topography (based on 2019/20 LiDAR)



Figure 8: Current Flood Hazard mapping



Figure 9: Proposed District Plan mapping

SUBMISSION 380 by Southern Cross Healthcare – 82 to 90 Hanson Street

- 28 Southern Cross Healthcare considers the modelled water will flow around the buildings as opposed to through the building. The submitter would like the flood hazard overlays to be removed from these sites or refined to reflect the position of the buildings on the site. This would include changes to the inundation and overland flow paths.
- 29 The mapped overland flow path shown running through Southern Cross Healthcare site at 82 to 90 Hanson St does not flow through the building but rather beneath a raised walkway and through an open loading and storage area. The photos provided below show the space available for water to flow through the site. Figure 10 indicates the photo locations. As a result, I do not believe any adjustments should be made to the flood hazard mapping.



Figure 10: Photo locations and view direction at 82 to 90 Hanson Street

Photo 1



Photo 2



Photo 3



Photo 4





SUBMISSION 348 by Kimberley Vermaey – Flood Hazard Overlay

- 30 Kimberley Vermaey considers that buildings in the Flood Hazard Overlay with water depths less than 0.5m should not require resource consents, subject to minimum floor levels. The submitter notes that for buildings with floodwater depths 0.5m or greater, resource consent should be needed as proposed, with displacement effects considered.
- 31 Resource consents require the consideration on the effects of an activity. The effects of constructing a building within a flooded area (in particular, the displacement effects) are complex and are influenced by a combination of factors including the local flooding extent, water depth, water velocity, and site preparation and construction methods.
- 32 The construction of a building within the Flood Hazard Overlay with modelled water depths less than 0.5m could still lead to significant displacement effects that impact properties adjacent to the site under construction. Further, these displacement effects may compound over time if there are multiple developments within a continuous/linked flooded area.
- 33 As a result, I do not believe it would be prudent to remove the requirement of resource consents for buildings within the Flood Hazard Overlay with modelled water depths less than 0.5m.

SUBMISSION 391 by Kainga Ora

- 34 Kainga Ora seeks to have the flood hazard layers removed from the District Plan to allow for them to be more easily updated when there are changes to the modelled catchment, climate change predictions, or similar factors that inform the modelling.
- 35 Flood hazard mapping is an important flood risk management tool and Wellington Water supports its inclusion in the District Plan. It highlights potential issues to the community and helps inform decisions about development. The district plan also provides a useful mechanism to seek community feedback on any future proposed flood hazard mapping changes.

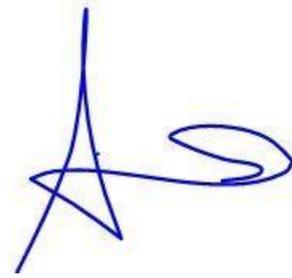
- 36 In reality, updating the flood hazard layers will occur infrequently. The modelling undertaken by Wellington Water has been completed to a rigorous standard including model validation and peer review (see paragraph 11). It is a complex process and involves significant time and expense to ensure the updated modelling meets the required standards set out in the Wellington Water Stormwater Modelling Specifications.
- 37 Wellington Water is currently developing a formal model update process for identifying when significant change has occurred within a catchment requiring an update to the flood hazard layers. Any updates would be undertaken through a plan change, which would allow for formal consultation with the public of any changes to the hazards.

SUBMISSION 406 by Wellington International Airport Ltd

- 38 Wellington International Airport Ltd (WIAL) would like the flood hazard layers removed from the airport site because they are covered by CDEM purposes. That is, under the CDEM the airport is required to remain operational following a natural hazard event, so any flooding at the site would be managed to ensure the airport was able to operate. While this is valid point, given that inundation flooding remains a potential issue at the site, it seems relevant to remain within the flood hazard map.
- 39 In addition to the above comment, WIAL notes that the mapped Inundation areas do not occur at the airport. WIAL supplied the current Stormwater Management Plan for the site and the Greater Wellington Regional Council Officers reports relating to the stormwater discharge consent for the airport site.
- 40 The current Stormwater Management Plan for the site and the Greater Wellington Regional Council Officers reports covering the stormwater discharge consent for the airport site relate exclusively to water quality and do not provide any comment on managing flood hazard.
- 41 The Stormwater Management Plan includes a map of the stormwater network that drains the airport site. This network has been included in the modelling undertaken by Wellington Water which generates the modelled flooding that has been used to develop the flood hazard layers.

42 The modelled flooding seen across the airport site originates from the stormwater network surcharging during the modelled event (see paragraph 15). The modelling indicates the stormwater network inlets, such as sumps, onsite are overwhelmed during the event causing water to pond and resulting in the mapped flooding. As a result, I do not agree with the implied assertion that because the mapped Inundation areas at the airport have not occurred this means they will not occur.

Date: 12/06/2023



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