

HUTT CITY PROPOSED DISTRICT PLAN  
HEARING STREAM 5 – NATURAL  
HAZARDS

SUPPLEMENTARY  
COMMENTS OF  
DIETER ENGEL –  
PDP/475 - ON  
PROPOSED FLOOD  
REMODELLING  
PARAMETERS

10A Bloomfield Terrace, Lower Hutt

2 October 2026

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## HUTT CITY PROPOSED DISTRICT PLAN

### HEARING STREAM 5 – NATURAL HAZARDS

#### SUPPLEMENTARY COMMENTS OF DIETER ENGEL – PDP/475

#### ON PROPOSED FLOOD REMODELLING PARAMETERS

2 October 2026

**Submitter:** Dieter Engel – PDP/475

**Property:** 10A Bloomfield Terrace, Lower Hutt

**Prepared by** Dieter Engel with assistance from Stephen Pattinson, Flooding Us NZ Ltd

#### 1. Introduction

1. These supplementary comments are provided in response to Minutes 14, 16 and 17 of the Hearing Panel and the memorandum dated 23 September 2026, *Proposed Remodelling Parameters for Flood Hazard Overlays*.
2. Minute 17 provides submitters having relevant submissions concerning the flood hazard overlays, effects of climate change, or related provisions with an opportunity to comment on the proposed remodelling parameters by 3.00 pm on 2 October 2026.
3. Dieter Engel's submission PDP/475 raised concerns about the transparency of rainfall assumptions and flood mapping. It also raised the effects of increased development and impervious surfaces on stormwater runoff and downstream properties.
4. Mr Engel's own comments on the proposed remodelling are attached as Appendix A. Those comments are in his own voice and should be read together with these supplementary comments, which have been prepared by Mr Engel with assistance from Stephen Pattinson of Flooding Us NZ Ltd.
5. We support reconsideration of the 35% climate-change rainfall uplift. However, simply changing the rainfall uplift from 35% to 20% does not address the more fundamental question of whether the underlying hydrological and hydraulic models reliably represent actual flood behaviour.
6. In our view, **the remodelling should include explicit requirements for validation against observed flood events and community ground-truthing before the resulting flood hazard overlays are relied upon in the Proposed District Plan.**

#### 2. The proposed remodelling changes only limited parameters

7. The 23 September 2026 memorandum proposes that the six Tiaki Wai models — Black Creek, Eastern Lower Hutt, East Harbour, Petone, Stokes Valley and Western Hills — be rerun by replacing:
  - 1.59 m sea-level rise with 1.0 m; and
  - 35% rainfall increase with 20%.

8. The memorandum specifically proposes that other components remain unchanged, including the LiDAR and building coverage, hydraulic network, velocity/depth classification criteria and smoothing processes.
9. We do not oppose correcting an excessive climate-change assumption. Our concern is that **a change in climate-change uplift is not the same thing as validating the underlying model.**
10. If a model materially overstates or understates existing runoff, flood depths or flood extent, changing the climate-change uplift does not necessarily correct that underlying bias.
11. The Panel therefore needs to distinguish between:
  - a. rerunning an existing model with revised climate-change inputs; and**
  - b. demonstrating that the underlying model itself reliably reproduces observed flood behaviour.**

### **3. Validation and ground-truthing should be part of the remodelling parameters**

12. HCC's section 42A evidence states that the hydraulic models have been validated and peer reviewed and that the PDP flood hazard overlays are based on model outputs, flood records and community feedback.
13. We accept that validation work has been undertaken. Our concern is with its **extent, quality, transparency and continuing relevance**, particularly where statutory flood overlays will affect property owners and where the same modelling may later inform development and stormwater assessments.
14. Validation should not simply mean that a modeller has concluded that a model "validates well". The Panel and affected communities should be able to see the evidence underlying that conclusion.
15. For each relevant historical flood event, the validation record should, so far as information is reasonably available, identify:
  - the rainfall that actually occurred;
  - recorded stream levels and flows where available;
  - observed flood depths and extents;
  - photographs, videos and flood marks;
  - reports from residents and property owners;
  - known blockages or infrastructure failures;
  - the modelled extent and depth for that event; and
  - the differences between the modelled and observed event.
16. This is particularly important now because significant storm events have occurred after several of the models were originally developed.

17. Recent events provide an opportunity to test the models against contemporary catchment conditions before revised statutory flood overlays are finalised.
18. We therefore request that **the best available recent observed flood events be incorporated into the validation process before the remodelling is completed**, including the February and April 2026 events where relevant to particular catchments.
19. Earlier significant events should also be used where sufficiently reliable rainfall, flood-level, photographic or community evidence exists.
20. The purpose is not to require every historical storm to be modelled. It is to use the best available real-world evidence to answer the essential question:

**Does the model reproduce what actually happens on the ground?**

#### **4. Stokes Valley demonstrates why this matters**

21. The Stokes Valley model provides a useful example.
22. The March 2023 draft Stantec *Stokes Valley Model Build Report* states that the model was validated using the 15 November 2016 and 8 December 2019 events.
23. However, the report also says:
  - there are **no recorded flow or level data for the Stokes Valley Stream**;
  - no actual flood levels were obtained during the validation exercise;
  - comparisons were principally made with photographs and approximate observed depths;
  - no allowance was made for antecedent conditions;
  - the functionality of structures such as bridges and screens was not assessed; and
  - complaint data was not included.
24. Stantec itself describes the purpose of the validation as obtaining a **“high-level understanding”** of model performance.
25. The report also acknowledges locations where modelled flooding was greater than observed flooding.
26. None of this means that the Stokes Valley model is necessarily wrong. It does mean, however, that the description **“validated model” should not be interpreted as equivalent to comprehensive quantitative calibration against measured flood levels and stream flows.**
27. The February and April 2026 events now provide additional real-world evidence that was unavailable when the Stokes Valley model was completed.
28. We consider that this evidence should be actively sought and compared with the model before revised Stokes Valley flood overlays are confirmed.

## 5. Community ground-truthing

29. The section 42A evidence records that Tiaki Wai/Wellington Water and HCC held eleven public engagement sessions in 2021 and says that community feedback generally supported the modelled flood extents. Section 42A report - Natural Ha...
30. Community knowledge is potentially very valuable validation evidence. However, the usefulness of that evidence depends on the underlying record being available and sufficiently specific.
31. Greater Wellington's current **Flood Hazard Modelling Standard, May 2025**, provides a useful contemporary benchmark. It specifically recognises community observations, photographs, flood marks, depth information and recollections as inputs to calibration and validation. It also provides for engagement during the calibration/validation stage so communities can compare modelled historical events with what they actually experienced.
32. We therefore request that the remodelling process identify and make available the relevant ground-truth evidence used for each model, including:
  - community photographs and videos;
  - mapped observations of flood extent;
  - recorded or reliably estimated depths;
  - dates and locations of observations;
  - information about blockages or unusual circumstances; and
  - an explanation of how that evidence was used, rejected or reconciled with model results.
33. A statement that community feedback "generally supported" the maps does not by itself allow the Panel or affected property owners to assess how closely the model reproduced actual flooding.
34. There should be a transparent **observed-versus-modelled comparison**.

## 6. Ten-year flood modelling should be made readily available

35. The Stokes Valley Model Build Report confirms that both 10-year and 100-year design events were modelled.
36. The 10-year simulation predicted moderate flooding across Stokes Valley, including extensive overland flow in the eastern branch of the valley.
37. Ten-year flood modelling can provide an especially useful ground-truthing tool because events of approximately that scale occur much more frequently than a 1% AEP or 100-year event.
38. The PDP may properly use a 1% AEP event for land-use planning, but that does not diminish the usefulness of lower-return-period modelling as a check on model performance.

39. If a model predicts material flooding during a relatively frequent event, but repeated comparable real events do not produce flooding in those locations, that discrepancy should be investigated before extrapolating the same model to a 100-year event.
40. We therefore request that **10-year flood depth and extent outputs be published alongside the 100-year outputs**, particularly where those outputs already exist.
41. This would allow residents, engineers and the Panel to compare modelled frequent-event flooding with observed experience.

## **7. Modelled floodwater should be distinguishable from freeboard**

42. We also have concerns about the treatment of freeboard.
43. In our view, the public should be able to see clearly what the hydraulic model predicts as the **1% AEP flood itself**, without having to determine what part of the displayed extent or depth results from an additional freeboard allowance.
44. Freeboard is an allowance for uncertainty and residual risk. It is not rainfall and it is not additional floodwater predicted to occur during the design storm.
45. Greater Wellington's current **Flood Hazard Modelling Standard, May 2025** makes this distinction expressly.
46. It states that "modelling freeboard" is not used as part of its current Flood Hazard Modelling Standard process. Modelled flood levels and extents are established using the base model, climate-change allowance and modelled uncertainty scenarios. Freeboard is then applied separately when Greater Wellington provides advice about recommended minimum building floor levels. [Greater Wellington](#)
47. We consider this distinction logical and transparent.
48. The HCC/Tiaki Wai methodology presently before the Panel appears to treat freeboard differently.
49. This matters because a member of the public looking at a mapped flood extent should be able to distinguish:

**the floodwater predicted by the design-event model**

from

**an additional planning or safety allowance applied because of uncertainty.**

50. Those two things should not be visually indistinguishable.

## **8. The Stokes Valley freeboard simulation illustrates the problem**

51. The Stokes Valley Model Build Report describes a particularly unusual freeboard methodology.
52. Stantec states that agreed freeboard values were added to the maximum flood depths from the 100-year design event.

53. Those resulting water depths were converted into 2D initial-condition polygons.
54. The report then states that **all subcatchments, all 1D pipes and all 1D river reaches were deleted**, after which a simulation containing only the 2D initial water condition was run for five minutes so that the resulting water could spread across the catchment.
55. Stantec says that this was undertaken to establish a baseline flood extent for assigning minimum building floor levels. HCC\_Stokes\_SW\_ID00004\_Model\_Bui...
56. Whatever the engineering rationale for that historical methodology, we do not consider the resulting extent should be presented to a property owner as though it is simply the modelled extent of the 100-year flood.
57. The modelled design-event flood and the additional freeboard exercise should be **separately identifiable**.
58. This distinction is especially relevant because Greater Wellington's current 2025 Flood Hazard Modelling Standard now separates modelled flood levels from freeboard used for building-floor-level advice. [Greater Wellington](#)

### 5.2.2 Freeboard Simulation Setup

The freeboard simulation was developed as described in "Dynamic Freeboard Analysis – Tawa", Jacobs Memorandum, 04 October 2017. The agreed freeboard values were added to maximum flood depths (m) for the 100yr ARI 12hr nested profile with +20% allowance for climate change. These were processed in GIS and imported back into the network as IC Zone – hydraulics (2D) polygons. All 1D network elements were deleted including all sub-catchments, 1D pipes, and 1D river reaches. The IC Zone – hydraulics (2D) polygons were then used to create an Initial Conditions 2D database object. A simulation including only the Initial Conditions (2D) file was run for five minutes. This allowed the maximum water levels to spread naturally across the catchment in order to establish baseline flood extent to be used for assigning minimum building floor levels for Stokes Valley.

**Figure 1 – Extract from Stantec, *Stokes Valley Model Build Report*, section 5.2.2, showing the freeboard simulation methodology: freeboard added to maximum 100-year flood depths, deletion of the 1D network and subcatchments, and five-minute 2D redistribution.**

## 9. Flood depth mapping and flood-hazard classification should be transparent

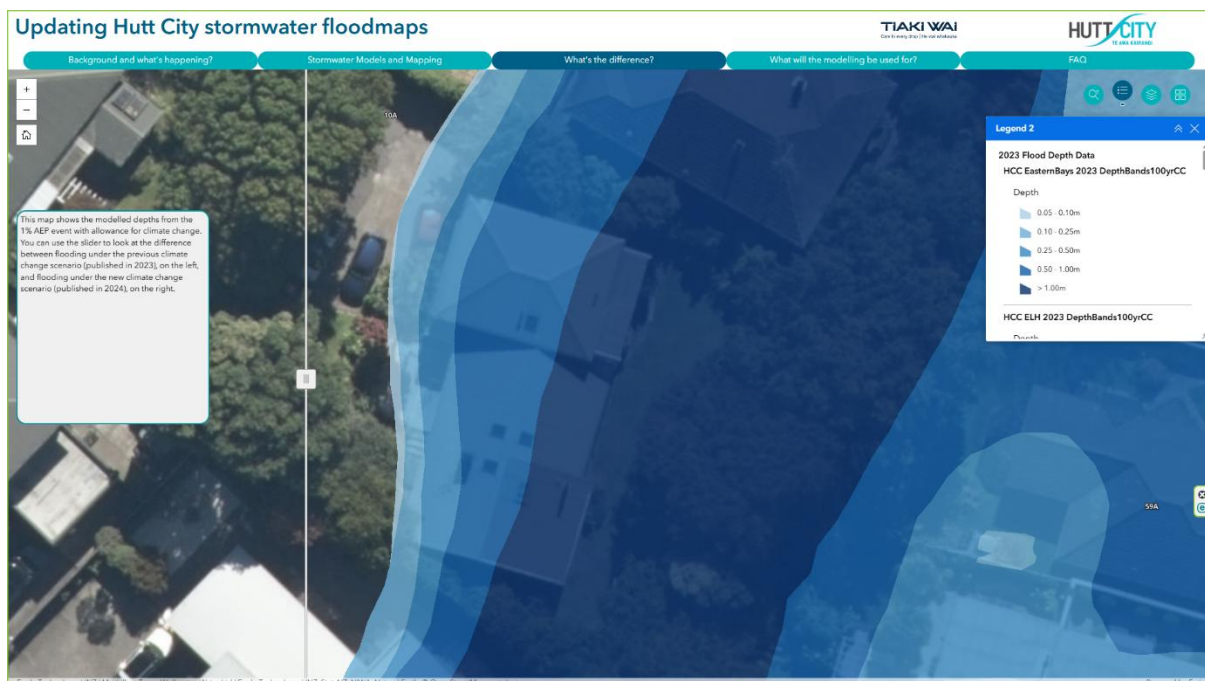
59. There is also a practical communication issue for property owners.
60. At 10A Bloomfield Terrace, Mr Engel and Mr Pattinson found it difficult to distinguish visually between the darker blue flood-depth bands on the online map.
61. It was necessary to interrogate the map digitally to establish that the darkest area affecting part of the property represented a modelled depth band of approximately **0.5–1.0 m** rather than the next depth category.
62. A flood-depth map is not, by itself, a complete expression of flood hazard. Flood hazard classification also depends on velocity and the relationship between depth and velocity.
63. The section 42A material confirms that the PDP classification process uses modelled depth, velocity and depth-velocity product. Section 42A report - Natural Ha...

64. The criteria subsequently described in the s42A material identify High, Medium and Low categories by reference to depth and velocity thresholds. Section 42A report - Natural Ha...

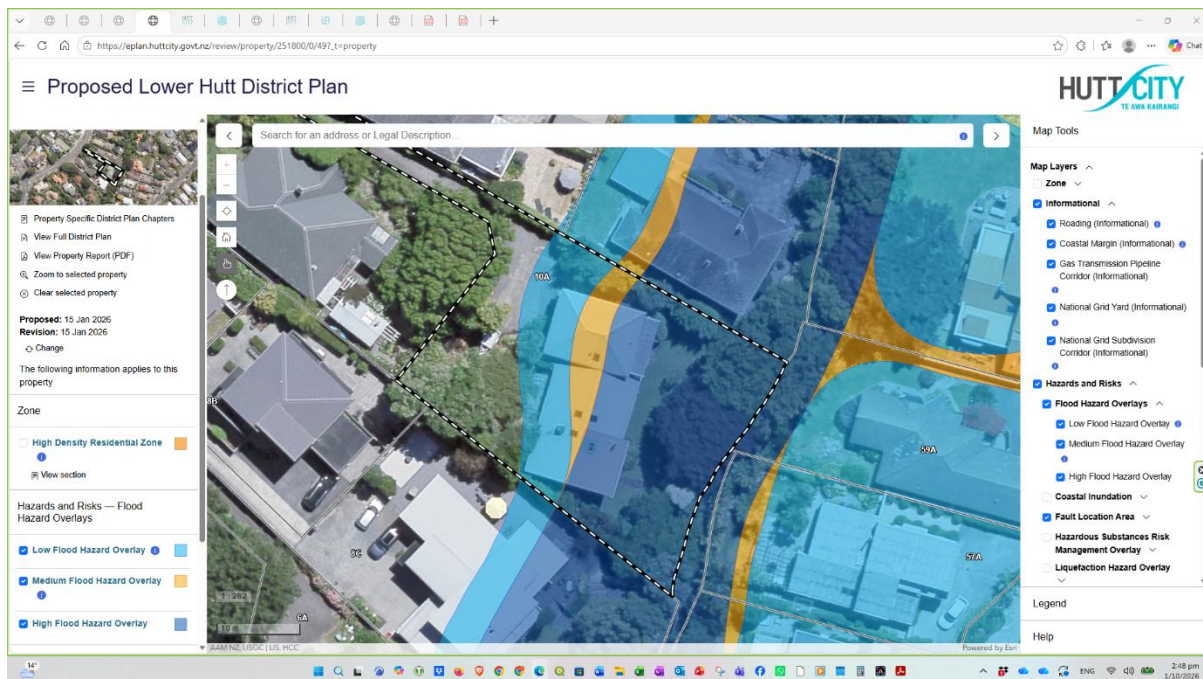
65. However, a property owner looking only at the planning map and Definitions chapter cannot readily determine whether a particular classification arises from depth, velocity, depth-velocity product, stream-corridor identification, post-processing, or an additional freeboard process.

66. We request that the revised modelling outputs clearly distinguish and make available:

- modelled depth;
- modelled velocity;
- depth-velocity product;
- flood extent;
- hazard classification; and
- any separate freeboard or residual-risk allowance.



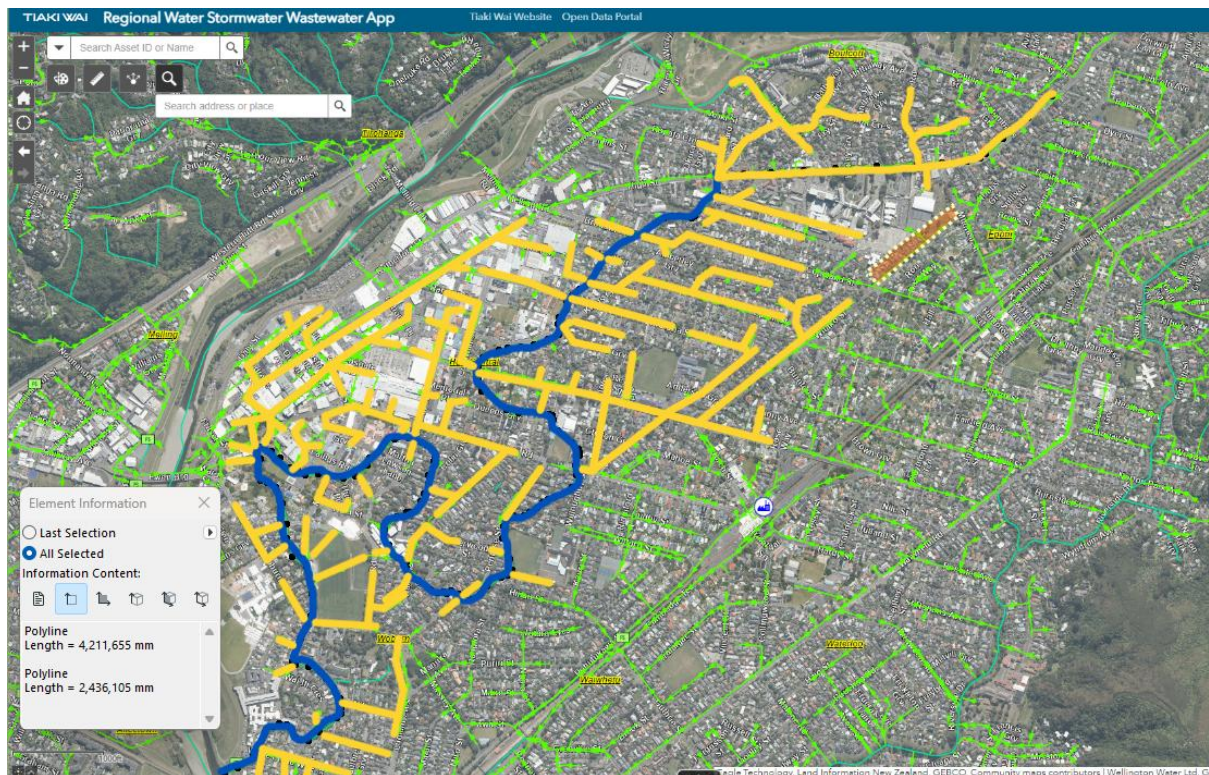
**Figure 2 – Tiaki Wai flood-depth mapping for 10A Bloomfield Terrace showing the depth bands and the 0.5–1.0 m depth category affecting part of the property.**



**Figure 3 – HCC Proposed District Plan flood-hazard overlay at 10A Bloomfield Terrace, for comparison with the underlying flood-depth mapping.**

## **10. 10A Bloomfield Terrace – why existing-condition hydrology matters**

67. Mr Engel's property at 10A Bloomfield Terrace provides a practical example of why the representation of the existing urban catchment matters.
68. The property lies within the Opahu Stream/stormwater drainage catchment in Hutt Central.
69. Based on tracing of the public stormwater mapping, approximately **4.2 km of open and piped Opahu channel lies upstream of 10A Bloomfield Terrace**, with approximately another **2.4 km downstream** before discharge to the Hutt River.
70. A dense network of stormwater pipes and surface drainage routes feeds into this system from the surrounding urban area.
71. Accordingly, flood behaviour at 10A Bloomfield Terrace reflects the cumulative response of a highly modified urban catchment containing extensive impervious surfaces and a complex drainage network.

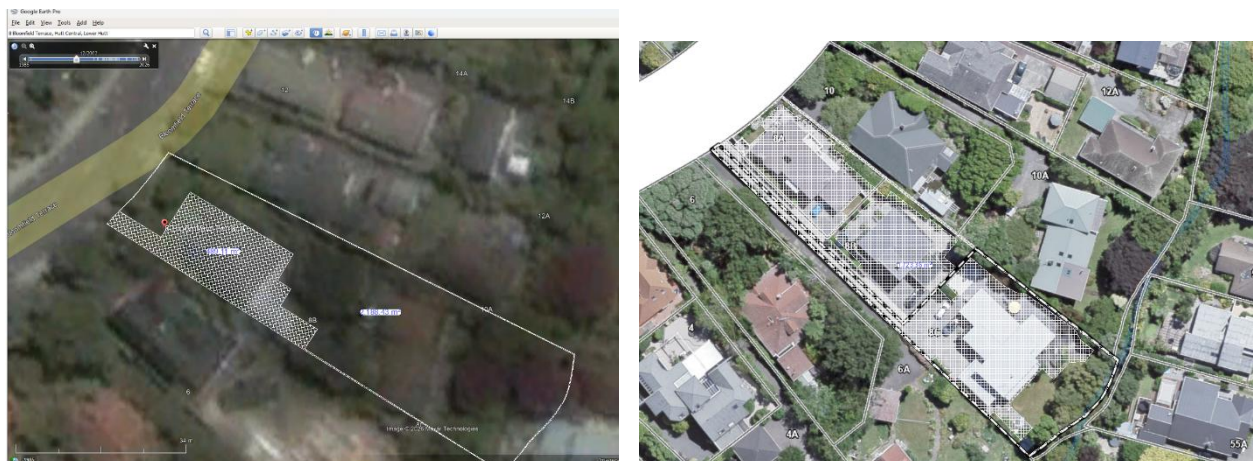


**Figure 4 – Approximate Opahu Stream/open-channel and piped drainage network: approximately 4.2 km upstream of 10A Bloomfield Terrace and approximately 2.4 km downstream to the Hutt River. Stormwater lateral drains feed into the trunk network throughout Hutt Central.**

## **11. Historic intensification immediately adjoining 10A Bloomfield Terrace**

72. The adjoining property provides a small-scale illustration of the cumulative change occurring within the wider urban catchment.
73. The original Lot 12 DP 1548 had a total area of **2,188 m<sup>2</sup>**.
74. Historical aerial imagery from December 2002 indicates that the original site was approximately **22% impervious**, or about **490 m<sup>2</sup>**.
75. Following subdivision and subsequent development as 8A, 8B and 8C Bloomfield Terrace, the impervious area is now estimated at approximately **1,720 m<sup>2</sup>**, or approximately **79–80%** of the original site.
76. This represents an increase of approximately **1,230 m<sup>2</sup> of impervious surface**.
77. These figures are approximate measurements from aerial imagery, but the scale of change is sufficiently large to illustrate the hydrological issue.
78. Unless increased runoff from such redevelopment is detained, infiltrated or otherwise offset, increasing impervious area can increase the volume and/or rate of stormwater leaving a site.

79. We have not yet established whether hydraulic-neutrality or equivalent stormwater attenuation requirements applied to the March 2003 subdivision or subsequent dwelling developments. The relevant subdivision consent conditions and historic District Plan/engineering requirements are being obtained.
80. This historical example is not advanced as proof that the present flood model is incorrect.
81. Rather, it illustrates why the existing-condition model needs robust validation. Present-day flooding reflects the cumulative effects of decades of subdivision, paving, building, drainage connections and alterations to the urban catchment.



**Figure 5 – Former Lot 12 DP 1548, 8 Bloomfield Terrace. Left: December 2002 historical aerial imagery, estimated impervious area approximately 490 m<sup>2</sup> or 22%. Right: present development at 8A, 8B and 8C Bloomfield Terrace, estimated impervious area approximately 1,720 m<sup>2</sup> or 79–80%.**

## **12. Relevance to hydraulic neutrality and Hearing Stream 7**

82. We recognise that the detailed provisions governing subdivision, stormwater management and hydraulic neutrality are matters for other hearing topics, particularly Hearing Stream 7.
83. Mr Engel’s submission point **475.4** specifically seeks consideration of the stormwater “load factor” of subdivisions and new buildings on both stormwater infrastructure and downstream properties.
84. Mr Engel intends to address that matter in Hearing Stream 7.
85. We mention it here only because there is an important technical connection.
86. **Hydraulic neutrality depends upon comparison between an existing-condition baseline and a post-development condition.**
87. If the existing-condition hydrology or hydraulic model is materially inaccurate, the comparison used to demonstrate hydraulic neutrality may also be unreliable.

88. Consequently, ensuring that the existing flood models are properly validated and ground-truthed is not only important for accurate statutory flood-hazard overlays. It also establishes a sound baseline for later assessments of whether development increases downstream runoff and flood risk.

89. These Stream 5 comments therefore provide technical context for, but do not seek to determine, the matters Mr Engel intends to address in Hearing Stream 7.

### **13. Requested amendments to the remodelling process**

90. We respectfully request that the Panel require the flood remodelling process to include the following additional parameters and outputs:

#### **a. Validation against observed flood events**

Each model should be checked against the best available significant observed events, including recent events where relevant.

#### **b. Transparent observed-versus-modelled comparisons**

The validation should identify available observed flood extents, depths, photographs, flood marks, rainfall and stream-flow information and compare these with the modelled result.

#### **c. Community ground-truthing**

Affected communities should be given a meaningful opportunity to provide photographs, videos, flood marks, observations and historical knowledge for validation purposes.

#### **d. Publication of 10-year model outputs**

Existing 10-year flood depth and extent outputs should be readily available alongside the 100-year modelling so that more frequent observed flood behaviour can be used as a reality check.

#### **e. Separate identification of the design-event flood and freeboard**

The 1% AEP modelled flood level, depth and extent should be identifiable without freeboard. Any additional freeboard or planning safety allowance should be separately identified and explained.

#### **f. Publication of the underlying hazard information**

Modelled depth, velocity, depth-velocity product, flood extent and resulting hazard classification should be transparently available.

#### **g. Documentation of model changes following validation**

Where observed events or community evidence reveal material discrepancies, the resulting model adjustments — or the reasons for making no adjustment — should be documented.

#### **h. Review against current modelling practice**

The remodelling methodology, particularly the treatment of freeboard, should be reviewed against Greater Wellington's current May 2025 Flood Hazard Modelling Standard before the revised overlays are adopted.

## 14. Conclusion

91. We support the Panel's decision to reconsider the flood modelling and the climate-change assumptions applied to it.
92. However, changing the rainfall uplift from 35% to 20% is only one part of the issue.
93. A rerun of an existing model does not itself establish that the model is correct.
94. Before revised flood hazard overlays are incorporated into the District Plan, there should be transparent evidence that the models reasonably reproduce observed flood behaviour.
95. The public should also be able to distinguish the **modelled flood itself** from additional allowances such as freeboard.
96. This is important because these maps affect people's homes, development opportunities, insurance concerns, minimum floor levels and perceptions of risk.
97. It is also important because reliable existing-condition modelling provides the foundation for assessing whether future development is genuinely hydraulically neutral and does not transfer additional stormwater risk to downstream communities.
98. We therefore ask the Panel to expand the remodelling parameters beyond simply changing the climate-change uplift and to require **validation, ground-truthing, transparent publication of model outputs, and clear separation of modelled flooding from planning safety allowances before the revised maps are finalised.**

### Dieter Engel

Submitter PDP/475  
10A Bloomfield Terrace  
Lower Hutt

### With assistance from:

Stephen Pattinson  
Flooding Us NZ Ltd

**2 October 2026**

## References

1. Hutt City Proposed District Plan Hearing Panel, **Minute 14 – Hearing Stream 5: Requests for Modelling**, 24 August 2026.
2. Hutt City Proposed District Plan Hearing Panel, **Minute 16 – Hearing Stream 5: Requests for Modelling – Revised Dates for Directions**, 9 September 2026.
3. Hutt City Proposed District Plan Hearing Panel, **Minute 17 – Hearing Stream 5: Requests for Modelling**, 24 September 2026.
4. Stephen Davis, Alistair Osborne and Nicola Arnesen, **Proposed Remodelling Parameters for Flood Hazard Overlays**, 23 September 2026. The memorandum

proposes rerunning the six Tiaki Wai models with 20% rather than 35% rainfall uplift while retaining the existing hydraulic network, classification criteria and smoothing process. 2026-9-23\_Hearing-5-Flood-Remod...

5. Hutt City Council, **Section 42A Officer's Report – Hearing Stream 5: Natural Hazards**, 21 July 2026, including Appendix B1.
6. Stantec, **Stokes Valley Model Build Report**, March 2023, particularly sections 2.3.2, 4, 5.2 and 7.1.
7. Greater Wellington Regional Council, **Flood Hazard Modelling Standard**, May 2025. The current standard expressly separates modelled flood levels from freeboard used for building-floor-level advice. [Greater Wellington](#)
8. Dieter Engel, **Submission PDP/475 on Proposed Lower Hutt District Plan 2025**.

## APPENDIX A

### PERSONAL COMMENTS OF DIETER ENGEL ON THE FLOOD REMODELLING

Given the existing capacity of permeable ground and the stormwater collection system, any change in the relationship between the two can increase or decrease flood levels.

Impervious surfaces such as roofs, patios, driveways and paving accelerate the movement of rainfall into the stormwater system and downstream. In Lower Hutt there are both open streams and piped stormwater networks to convey this water. Both have finite capacity, beyond which serious flooding problems can occur.

In my view, new development should comply with the principle of **hydraulic neutrality without discretion**. The effects of development should be assessed against that principle.

There should be a clearly defined process for assessing the **before-development and after-development peak stormwater flows and volumes** from a property. Those values should remain with the property record so that the cumulative effects of later development can be assessed.

Later additions such as garages, sheds, patios and paving should come under the same regime. Potential future additions should also be considered when the initial development or subdivision is assessed. Otherwise, numerous relatively small additions can cumulatively increase the burden on the stormwater system and downstream properties.

Where hydraulic-neutrality requirements are breached, there should be effective monitoring and enforcement.

It also needs to be recognised that remodelling natural flood hazards will not, by itself, resolve flooding if the cumulative effects of **man-made changes to catchments** are not properly managed.

A single development may not immediately require additional public expenditure on stormwater infrastructure, but it can still add runoff and have effects downstream. That is why cumulative effects matter.

The Three Waters Independent Hearing Panel Recommended Amendments dated 8 February 2024 illustrate this issue. THW-P4 included consideration of whether:

*“The additional demand generated will not necessitate additional unplanned public investment in, or expansion of, the three waters infrastructure network or compromise its ability to service other activities permitted within the zone.”*

However, avoiding an immediate requirement for additional public infrastructure investment is not necessarily the same thing as avoiding additional downstream stormwater effects.

The 2024 Three Waters provision THW-O3 stated:

*“There is no increase in offsite stormwater peak flows and volumes from current levels as a result of subdivision, use and development in urban areas.”*

That is the outcome I consider important.

The Opahu Stream in Lower Hutt collects stormwater through a mixture of open channels, piped sections and a large network of stormwater pipes across a substantially urbanised catchment.

In my view, flood levels within central Lower Hutt should therefore not be regarded solely as the result of a “natural hazard”. They may also reflect the cumulative consequences of urban development, increased impervious surfaces, stormwater connections and historic decisions about the amount of runoff permitted to enter the drainage system.

That is why I consider **hydraulic neutrality and reliable flood modelling to be inseparable issues**.

If we are to manage future flood risk properly, we need to know that:

- the existing flood model accurately represents present conditions;
- the baseline against which new development is assessed is reliable; and
- new subdivision and development does not increase stormwater flows or transfer additional flood risk to downstream properties.

**Dieter Engel**

Submitter PDP/475

10A Bloomfield Terrace

Lower Hutt

2 October 2026