BEFORE THE HEARING PANEL

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of Proposed Plan Change 12 to the Operative Hamilton City District Plan

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STATEMENT OF REBUTTAL EVIDENCE OF STUART JAMES EDGAR FARRANT

(STORMWATER MANAGEMENT)

Dated 14 August 2024

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INTRODUCTION

1. My full name is Stuart James Edgar Farrant.

2. I have read the respective evidence of:

   a) Philip Thomas Jaggard on behalf of Kāinga Ora – Homes and Communities (including appended technical report: Appendix A).

   b) Fraser Guy McNutt on behalf of Pragma Holdings Limited

QUALIFICATIONS AND EXPERIENCE

3. My full name is Stuart James Edgar Farrant. I am a Principal Ecological Engineer and Southern Regional Manager at Morphum Environmental Ltd; and hold a Bachelor of Engineering (Natural Resources) from University of Canterbury.

4. I have recently been engaged by Hamilton City Council (**HCC**) to review submitter evidence lodged in respect of Plan Change 12 (**PC12**) which relate to stormwater management within Hamilton, and provide a technical response on behalf of HCC.

5. I have over 17 years' experience working in multiple aspects of freshwater management and ecological engineering. I have worked for Morphum Environmental for 10 years establishing the southern sector office (Wellington) in 2014. Prior to that, I worked for 5 years as an Ecological Engineer in Melbourne, Australia.

6. I have experience working in a range of aspects relating to three waters management including design, technical review and auditing of constructed wetlands, vegetated stormwater treatment/conveyance systems, stream restoration and land application. Specifically, I have extensive experience with the design and delivery of integrated stormwater management devices to mitigate adverse water quality effects from urban development in addition to natural wetland

restoration projects.

7. I have contributed to and authored technical design guidelines for Councils/Utilities in New Zealand and Australia (including updated HCC Practice notes and Waikato Regional Infrastructure Technical Specifications) and have participated in a number of technical advisory panels including the Wellington City Mayoral Taskforce on Three Waters in 2020. I was awarded a 2018 Winston Churchill Fellowship to travel internationally for the purposes of researching leading practice with urban water management in Europe, Scandinavia, and USA.

8. I am a member of Engineering New Zealand and Co-Chair of The Sustainability Society which is a technical interest group of Engineering New Zealand.

9. While this is not an Environment Court hearing I have met the standards in that Court for giving expert evidence.

10. I have read the Code of Conduct for expert witnesses issued as part of the Environment Court Practice Note 2023 and I agree to comply with the Code of Conduct. I am satisfied that the matters addressed in this statement of evidence are within my expertise. I am not aware of any material facts that have either been omitted or might alter or detract from the opinions expressed in this statement of evidence.

PURPOSE AND SCOPE OF EVIDENCE

11. The purpose of my rebuttal evidence is to provide a response to evidence submitted on behalf of Kainga Ora and Pragma Holdings Limited. This evidence responded to various aspects of PC12 relating to stormwater management in which I have previously provided technical support to HCC on.

12. Specifically, in my evidence I will cover matters related to the PC12 requirements for stormwater retention via the use of rainwater reuse tanks and the technical basis for this approach. I note that I have not

provided comment on matters relating to infrastructure capacity in terms of mitigation of flood risks and levels of service but would note that the capacity of the current and future stormwater networks should consider the capacity to protect downstream freshwater environments and therefore respond to Te Ture Whaimana (**TTW**).

13. It is important to emphasise the importance of HCC meeting the objectives of TTW through the provision of planning rules and instruments that provide a high level of environmental protection for the Waikato Awa and its tributary streams. This must be considered within the context of increasing residential development pressures and an increasing appetite for intensification to address the current housing shortfalls. There is therefore a need to think holistically and seek improvements to how residential developments are designed and delivered to ensure that the provision of future housing is not at the expense of the environment and the wealth of tangible and intangible benefits it provides. PC12 aims to do this through embedding development practice which protects the environment through the integrated management of stormwater quality and quantity. These are supported by technical design guidelines and practice notes which will support industry to achieve the change in practice required.

14. The evidence provided by Mr Jaggard on behalf of Kainga Ora includes an appended technical report and seeks to challenge the PC12 retention requirements through analysis and comments on the role that rainwater reuse plays in the overall stormwater systems. Having reviewed the evidence of Mr Jaggard it appears that the importance of management of the volume of stormwater to broadly mimic the natural water balance has been misunderstood and comparisons between the proposed rainwater reuse tanks and detention tanks do not appropriately reflect the fundamental difference between retention (as proposed by PC12) and detention (typically used for flood mitigation).

15. It is well understood that there is limited existing management of urban

stormwater across the city to mitigate the adverse impacts on the Waikato River and tributaries from landcover and land use which generate or accumulate contaminants which is conveyed in stormwater flows.

16. In recent years there has been an increased focus on the provision of 'best practice' stormwater management to mitigate potential adverse impacts of stormwater from new 'greenfield' development areas. This has been supported through proactive Integrated Catchment Management Planning (**ICMPs**), revisions to design guidance (including RITS and other practice notes) and investment in citywide condition audits and education to improve lifecycle performance of treatment devices.

17. Greenfield development across Hamilton typically includes a mix of on-lot stormwater devices (including rainwater reuse tanks, soakage, and raingardens) and larger centralised public devices (including constructed wetlands and raingardens).

18. Investigations across the city have identified the lack of available space suitable for the retrofit of 'best practice' stormwater treatment devices in existing urban areas with a requirement to purchase private land to accommodate retrofit stormwater management devices prior to discharge to the environment.

19. HCC therefore seeks to promote cost effective stormwater management options to manage adverse effects, achieve environmental outcomes and compliance. This will enable future development (both greenfield and brownfield) to contribute proportionally to a progressive improvement in freshwater outcomes and TTW.

20. The mitigation of site generated stormwater must consider both the hydrology and quality of stormwater to protect freshwater receiving environments. This needs to reflect the complex physical, biological, and

chemical processes which support functioning ecosystems and the vulnerability of stream structure and indigenous biodiversity to urban development impacts.

21. The purpose of this rebuttal statement of evidence, which is provided on behalf of HCC, is to respond to matters raised in the evidence relating to green policies, specifically, water conservation measures, urban tree canopy and deep soils.

REBUTTAL POINTS

Mr Philip Thomas Jaggard - Kāinga Ora

22. Mr Jaggard states in Section 3.1 that '*A key outcome of the National Policy Statement on* Urban *Development is to minimise barriers that constrain the ability to deliver housing development across public housing, affordable housing, affordable rental, and market housing'.* Whilst this is true it must also be considered alongside other legislated requirements including TTW and the National Policy Statement – Freshwater Management. Future urban development must be designed and delivered to support multiple objectives including robust environmental protection.

23. I agree with the points raised by Mr Jaggard on the benefits of redevelopment (Section 4) but would add that redevelopment also provides the opportunity to manage hydrology from urban areas in a manner which appropriately mitigates potential adverse impacts on freshwater ecosystems.

24. In Section 7, Mr Jaggard questions the role of rainwater reuse tanks connected to non-potable reuse and in Section 7.3 questions why 'detention tanks' are not suitable for managing effects. It is fundamental to understand that the intention of stormwater retention is to reduce the post development volume of stormwater which is well understood

to be a key contributor to adverse freshwater outcomes. Whilst other measures which achieve similar retention outcomes (such as green roofs or centralised stormwater harvesting) could be considered it is my opinion that rainwater reuse tanks are more cost effective and easy to maintain than these.

25. The commissioned work described in Section 7.5 appears to have missed the key objective of providing retention rather than detention making the comparison between a basic detention tank and a rainwater reuse tank redundant. Any comparative analysis should evaluate the proposed rainwater reuse tanks against an alternative measure that provides an equivalent outcome in terms of stormwater volume reduction.

26. Comments raised by Mr Jaggard in Section 7.6 appear to misrepresent the key objective of the provisions in PC12 which is to mitigate increased stormwater volumes to protect and enhance freshwater values in accordance with TTW. In particular points i, ii, iv in Section 7.6 are considered to speak to completely different matters which are not relevant when considering the use of rainwater reuse to achieve specific water retention outcomes.

27. Similarly, Section 7.7 relates the need to continue to provide a full mains supply to properties despite them including rainwater tanks. As stated in paragraph 25 above, the requirement for the use of rainwater tanks is primarily to mitigate adverse freshwater outcomes and does not negate the need for a fully compliant mains system to provide for potable water uses not serviced by rainwater and to provide backup supply for non-potable uses (toilet and laundry) when the rainwater tank is empty.

28. Section 7.8 references conclusions summarised in the report commissioned by Kainga Ora that is appended to Mr Jaggard's evidence. Specific comment on the report is provided below but it is noted

concerns with resilience to power outages and failures are shared with the current mains supply which is also reliant on a stable electricity supply and the points around disinfection are not considered applicable given that rainwater is only to be used for toilet flushing and cold water laundry specifically to reflect the potential risks from other uses which could cause human ingestion (such as showers). It is also noted that in many international jurisdictions, rainwater is reused for hot water demands (including showers, baths, and hot water taps) with only heat treatment via the residential cylinder.

29. Mr Jaggard's conclusion in Section 7.9 appears to base the 'limited' benefits of rainwater reuse on a narrow scope of consideration which does not appropriately reflect the primary purpose of the rainwater reuse to manage the frequent flow hydrology from future development through retention (volume reduction in order to mitigate adverse impacts on receiving waterways and align with the intent of TTW. The statement that detention tanks are 'more than adequate' appears to misunderstand the fundamental difference between detention and retention and the potential for detention tanks being used for small frequent rainfall events resulting in extended periods of elevated stormwater discharge which can contribute to worsened freshwater outcomes.

30. Mr Jaggard's comments in Sections 7.10 and 7.11 infers that there are no water quality benefits from providing treatment of roof surfaces. Whilst it is noted that roofs generate less of some contaminants than other land uses (such as heavy metals derived from vehicles), recent research by University of Canterbury Department of Civil Engineering supports other research internationally that roof surfaces remain a source of contaminants from materials (including wear on painted roofs). The Auckland CLM[1], was based on research at the time, and assumes a zinc concentration in stormwater runoff from metal roofs of

[1] *Development of the Contaminant Load Model* Auckland Regional Council Technical Report No.2010/004 June 2010

0.04 g/m3for Colorsteel© and 0.20 g/m3 for well painted galvanised steel. A University of Canterbury[2] study found that the concentration of zinc in a new Colorsteel© roof over 9 events ranged from 0.2 to 1.0 g/m3. As the coating degrades over time then the concentration increases, and it is not uncommon to see highly weathered 'coated' roofs which have not been repainted to prevent zinc leaching. While I accept that coated roofing materials are likely to have lower zinc leaching than non-coated materials, I do not agree that it has no effect. Further well documented concerns with other physical changes in terms of water temperature, dissolved oxygen and pH provide motivation to ensure that future development appropriately mitigates the potential adverse impacts on freshwater systems.

31. The assertion by Mr Jaggard that detention tanks are a 'more than adequate solution to manage and control stormwater' are not supported.

32. Mr Jaggard questions the technical basis for the required 10 mm retention depth in Sections 7.15 to 7.18 and states that in his opinion the technical reports do not provide sufficient analysis or assessment to support the 10mm retention depth.

33. It is agreed that due to the complexity with data collection and monitoring for very small frequent rainfall events, and the lack of calibrated flow data for these events, there is some residual uncertainty with a definitive value, but it is considered that the 10mm provides a reliable metric that aligns best with existing data on natural hydrological processes.

34. Scion Research are currently undertaking a MBEI funded research program 'Forest Flows' which is undertaking detailed monitoring of all

[2] O'Sullivan AD, Cochrane TA, Charters F (2017). *Stormwater Contaminant Load Monitoring (2016) and Modelling of the Heathcote Catchment and Six Representative Subcatchments.* University of Canterbury. Christchurch City Council.

components of the natural water cycle in 10 selected plantation and native forest blocks. This research is intended to respond to the current lack of data and build on the historical research which looked at hydrology from a range of landcovers. Whilst not yet finalised, the provisional results are indicating between 30-35% of all rainfall is 'lost' through evapotranspiration with a further 30% contributing to shallow and deep infiltration. These numbers are consistent with our conclusions drawn from the available literature and observations in the field.

35. Continuous simulation modelling using local Hamilton rainfall demonstrated that achieving a 10 mm retention target will closely approximate to the natural hydrology prior to development and that iteratively sizing rainwater reuse tanks to achieve the desired 30% volume reduction in tandem with soakage for lot runoff will also align with the target of 10 mm retention and therefore provide an appropriate level of alignment with TTW.

36. Mr Jaggard's comment in Section 7.19 that the original 10 mm retention depth was lowered to 5mm in the PAUP hearings process based on detailed modelling is questioned with our understanding that the retention value was reduced due to a range of non-ecological issues raised by opponents. It is noted that Auckland Council do not operate under the legislative bounds of TTW which clearly requires the health of the Waikato Awa and its tributaries to be a priority.

37. The comment in Section 7.20 around Auckland only requiring retention in a subset of Brownfields catchments due to existing imperviousness is not a precedent that Hamilton would follow given the aspirations to not just maintain the current degraded condition of the Waikato awa and tributaries but rather to seek enhancement. It is noted that whilst Auckland has been progressive in a number of areas relating to urban stormwater management it should not be considered an exemplar of 'best practice' with many instances where improved practice is justified.

38. Points raised by Mr Jaggard in Section 8 relate solely to the influence of rainwater reuse on the main stem of the Waikato Awa. It is accepted that the proposed retention will have no measurable influence on flow rates in the main stem of the Waikato Awa, but it is important to note that the health of the Waikato Awa is directly linked to the health of its tributaries which are vulnerable to the discharge of unmitigated stormwater. Therefore, any commentary on the health of the main stem must also consider the interconnected tributaries extending to their headwaters.

Appendix A: Stormwater Reuse Assessment Report

As prepared for Kāinga Ora by MPS Limited

39. Overall, the technical report appears to misrepresent the purpose of the PC12 stormwater retention requirements which are intended to provide hydrological controls to protect and enhance freshwater ecological values in line with the vision of TTW and other Regional and National policy related to freshwater systems.

40. Rather, the report focusses on the ability of the proposed rainwater reuse tanks to provide a reliable source of water at all times and therefore the ability to influence the provision of reticulated mains water supplies.

41. It is fundamental to understand that the proposed PC12 rainwater tanks have been modelled and sized based solely on the optimal configuration to provide robust hydrologic controls in a cost-effective manner and have not sought to achieve a specific reliability of supply or maximised reduction in mains water use. These objectives could in some instances be achieved but are considered unlikely to be practical given the small contributing roof areas in higher density developments (which are effectively catchment limited).

42. Discussion on the size and specification of 'first flush diverters' is unclear. These are typically installed immediately below a leaf screening device and are intended to capture residual coarse particulates to reduce the maintenance frequency in rainwater tanks. These are not intended to collect or divert fine particulate and dissolved contaminants which in the case of rainwater reuse for non-potable uses are better to divert to the wastewater network via toilet and laundry usage.

43. Most widely available first flush diverters are sold to integrate with standard New Zealand pipe sizes (90 – 100 mm) with a barrel size varying up to 300 mm diameter. These typically capture the first flush from gutters (leaf litter etc) which accumulates in the barrel with captured water able to either drain either through gravity or a tap and hose connection if the water needs to be directed away from the house. It is not standard practice to plumb these back into the stormwater network which in most instances would require a dual stormwater pipe to route flows around the rainwater tank.

44. Based on the sizing of first flush diverters provided in the report a 700mm length chamber would be required for a 100 m^2 connected roof which is considered reasonable. This volume would be collected at the onset of any rainfall event (first 0.5mm) and rainfall above this is routed to the rainwater tank. It is important to note that the term 'first flush' used in this context is different from that used in urban stormwater management where the 'first flush' is typically equated to events with approximately a 3 month return interval with a rainfall depth of 25 – 35 mm.

45. The report appears to infer that the 'first flush' in the rainwater system is the initial 0.5m of every hour's rainfall (25L/hr reported on page 11) which is not the intent of typical configuration of a rainwater harvesting system. Rather the initial 0.5 mm would be diverted to the diverter (with leaf litter) with subsequent rainfall discharging directly to the tank. It is

noted that this 0.5mm depth is the same as the typical 0.5 mm initial abstraction applied to roof areas when modelling rainwater capture.

46. Points raised in Section 5.2 of the report relate to operational issues and maintenance. Whilst the report provides a useful summary of required activities it appears to overstate the operational challenges with rainwater reuse tanks.

47. As part of Hamilton’s ongoing work program to understand the performance of existing private stormwater assets, and to meet requirements for the comprehensive stormwater discharge consent with Waikato Regional Council around long term performance of the overall stormwater network, a program of site audits has been undertaken over the past three years. This includes the visual inspection, data collection and engagement with home occupiers on the condition and function of devices including rainwater reuse tanks, detention tanks, raingardens and on lot soakage. From these audits it was determined that where rainwater reuse tanks had been installed properly (noting that many early examples were not installed correctly) they were operating well, and residents were well aware of the purpose and performance of these. In contrast, detention tanks with restricted outlet orifices, were often non-functional (due to blockages) and remained full. Similarly private raingardens were found to often be in poor condition whereas private soakage devices (in particular those designed in accordance with new standards) were all operating as intended.

48. This audit process has been used by HCC to inform revisions to design guidance (practice notes and RITS) to apply lessons from previous poor implementation and operation.

49. Comments around maintenance in Section 5.2.3 are not considered valid given that it would be expected that Kainga Ora would already engage contractors to undertake periodic inspections of properties who

would readily be in a position to also visually inspect on site retention tanks and systems. This is easily supported by clear and repeatable methodology that requires limited training to implement.

50. It is noted that the historical lack of meaningful hydrological and water quality management across Hamilton has resulted in significant costs to the environment (including both tangible and intangible costs) but also significant costs to HCC in response to persistent erosion/scour and the need to retrofit more expensive options into the public realm to align with increasing requirements for network stormwater discharge consents.

51. Section 6.0 provides commentary and analysis around cost implications. Whilst I would agree with most of the costs presented it does not reflect the fact that detention tanks require the same provision to manage particulate matter (and are more susceptible to blockage) with very comparable annual maintenance costs if undertaking in accordance with best practice. Therefore, other than the additional up-front cost at the time of construction ($5,500 - $8,500) and the related pump maintenance/running costs the cost analysis is equivalent for either a tank connected to reuse or solely for detention.

52. The option evaluation presented in Section 8 considers reuse tanks against detention tanks. It is noted again that detention of frequent flow stormwater runoff does not provide meaningful environmental protection and in many instances will make outcomes worse through the extended duration of elevated flowrates and fluctuations in stream flow depths. Aside from a number of concerns I would raise with regards to the assessment applied in the MCA, I believe it is a redundant comparison as it does not evaluate two comparable outcomes. For clarity it could have been beneficial to compare rainwater reuse tanks against alternatives that achieve a similar level of stormwater retention such as the use of green roofs on dwellings or centralised stormwater harvesting and third pipe reticulation (i.e. a separate non potable water

supply throughout the development).

53. Discussion on alternatives to reduce water supply demand are interesting but perhaps do not reflect the fact that the proposed rainwater reuse in PC12 is primarily intended to provide environmental outcomes and any reductions in water supply considered a secondary benefit. Whilst the reticulated mains supply does come from extraction from the Waikato awa, and the volumes potentially saved due to non-potable reuse are very minor relative to the river's overall flowrate, there does need to be recognition of the merits of extracting natural river flow, treating it to drinking water standards in the municipal treatment plant and pumping it to dwellings to be used to flush toilets and wash dirty laundry. The provision of a more fit for purpose water source for these non-potable demands (such as the PC12 rainwater reuse) should be considered alongside the vision for the Waikato awa encapsulated in TTW.

54. Discussion in Section 9.0 (and in particular 9.3.1) appears to mis-represent the impact of changes in frequent flow hydrology which result in adverse environmental impacts through a range of drivers. Whilst the report mentions erosive forces/shear stresses it does not mention the impacts of repeated changes in water level (resulting in drag forces on stream banks) or frequent wetting/drying of immediate stream edges which exacerbates instability. It is important to understand that it is the instability caused by frequent changes in flow patterns that prevents the establishment of stable riparian vegetation that then leaves the streambanks prone to larger failures due to shear stress in peak runoff events. In natural streams, the lack of flow variability in frequent small rainfall events means that stream riparian margins are stable and able to pass infrequent large storm events without the widespread scour, incision and slumping observed and recorded in unmitigated urban streams.

55. Other impacts on biota from sustained elevated flowrates, flushing of

invertebrates from upper intermittent waterways and lateral flood benches and combined impacts from other well understood urban water quality are all key contributors to the well-researched decline in biodiversity in our urban streams.

56. The comment from TR2013/035 appears to support the stance adopted by HCC being to reduce runoff volumes 'as far as technically feasible' noting that even with the proposed rainwater reuse it will not be realistic to match the natural flow patterns across all regimes but rather approximate it to the extent that the freshwater receiving environment is adequately protected from future development impacts.

Mr Fraser Guy McNutt – Pragma Holdings Limited

57. Mr McNutt raises points largely related to matters outside of the scope of my rebuttal which are not commented on here. I have read his full evidence for completeness.

58. In Section 3.22, Mr McNutt questions the minimum 3,000 L tank requirement with a particular focus on high density residential where alternatives such as shared communal tanks may be preferable. Hamilton City Council are currently finalising a technical practice note for the use of rainwater reuse to achieve required stormwater retention in high density multi-unit development. Given the potential high number of residents relative to the roof area this includes analysis and recommendations on optimal configurations to provide the retention targets in an efficient and effective manner. This includes recommendations for shared tanks and partial connections (i.e. only needing to provide harvested rainwater to a smaller number of units based on contributing impervious areas).

CONCLUSION

59. I have reviewed the evidence provided for the stormwater retention

components of PC12 specific to the evidence statements of:

a) Mr Philip Thomas Jaggard on behalf of Kāinga Ora; and

b) Mr Fraser Guy McNutt on behalf of Pragma Holdings Limited.

60. After considering these statements, I would see no justification to amend provisions.

61. Analysis provided by Mr Jaggard on behalf of Kainga Ora seeks to compare the use of rainwater reuse tanks for retention with an alternative of deploying simple detention tanks to provide ecological outcomes. It is noted that such comparison is not appropriate given the fundamental difference between detention and retention.

62. Comparison of cost, maintenance and performance would be more suited to consider other more equivalent alternatives such as green roofs or centralised stormwater harvesting.

63. Considerations of costs need also consider the costs of a business-as-usual approach which ultimately imposes costs to council through remedial stream works and erosion protection alongside costs to design and develop centralised end of pipe solutions which are significantly restricted by a lack of available unencumbered space.

64. It is also noted that submitter evidence has failed to appropriately recognise other tangible and intangible benefits and costs that are supported through rainwater reuse.

Stuart James Edgar Farrant

Principal Ecological Engineer, Morphum Environmental

14 August 2024