Memorandum

To:	Gina Sweetman	**Date:**	28 May 2022
From:	Kate Purton	**Our Ref:**	4293304-67661593-3658
Copy:			
Subject:	Private Plan Change 28 Maitahi Bayview – Stormwater and Flood Risk		

INTRODUCTION:

1. My full name is Katherine Michelle Purton. I am employed as a Technical Director – Civil Engineering at Beca Ltd (**Beca**).

2. I have prepared this memorandum on behalf of the Nelson City Council (**Council**) in respect of technical related matters arising from the submissions and further submissions on the Private Plan Change 28 request (PPC28) to the Nelson Resource Management Plan (**NRMP**).

3. Specifically, this memorandum relates to stormwater management and flood risk management.

4. I am authorised to provide this memorandum on behalf of the Council.

QUALIFICATIONS AND EXPERIENCE

5. I hold the qualifications of Bachelor of Civil Engineering with Honours (BE(Hons)) from the University of Canterbury, and am a Chartered Professional Engineer (Civil, Environmental).

6. I am a Chartered Member of Engineering New Zealand, a member of Water New Zealand and the immediate past chair of the Water NZ Stormwater Group, and a member of the Engineering NZ Rivers Group.

7. I have previously worked for Hastings District Council and Christchurch City Council, and have worked for Beca for 13 years.

8. I have 21 years' experience as a three waters civil engineer with the last 12 years specialising in stormwater and flood risk management.

9. My experience in stormwater and flood risk management is from a wide range of projects and includes stormwater management planning and the design of stormwater conveyance, treatment and attenuation systems, waterway upgrades, and river engineering. I have also independently peer reviewed stormwater designs for residential and commercial developments, roads and motorways.

10. I am familiar with plan change and resource consent processes from my work as an employee at councils (Hastings District and Christchurch City Council) and my work at Beca as a consultant working both for councils and for applicants.

Code of conduct

11. I have read the Code of Conduct for Expert Witnesses set out in the Environment Court's Practice Note 2014. I have complied with the Code of Conduct in preparing this

memorandum and will continue to comply with it while giving oral evidence before the Environment Court. My qualifications as an expert are set out above. Except where I state that I rely on the evidence of another person, I confirm that the issues addressed in this memorandum 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

12. My memorandum addresses the following matters:

    a. Background
    b. Information provided and reviewed
    c. Nature of the request
    d. Stormwater management and flood risk issues
    e. Comments on the information provided
    f. Stormwater Management Plans
    g. Additional information required
    h. Reasons for the level of information required
    i. Proposed plan provisions
    j. Submissions
    k. Conclusions
    l. Recommendations

BACKGROUND

13. I was engaged by NCC and started work on the project on April 2021.

14. I visited the site on 4 May 2021, in a joint site visit by the applicant's and NCC experts.

15. I have discussed PPC28 with the applicant's engineers (Tonkin & Taylor) and the other relevant experts providing evidence for NCC.

16. I participated in expert conferencing on stormwater and flooding on Friday 29 April 2022 and Friday 6 May 2022. Two Join Witness Statements have been produced for this conferencing: JWS Flooding (2) and Stormwater (2) dated 6 May 2022; and JWS Flooding (3) dated 25 May 2022.

INFORMATION PROVIDED AND REVIEWED

17. I have reviewed the following information provided in the PPC28 request (including additional information provided in response to requests for further information):

    a. Landmark Lile Ltd Resource Management, Private Plan Change Request to the Nelson Resource Management Plan, Request to: Nelson City Council, Request from: CCKV Maitai Dev Co LP and Bayview Nelson Limited, Pursuant to: Clause 21, First Schedule of the Resource Management Act 1991, Dated: 24 August 2021 (amended)
    b. Attachments B, Structure Plan and Planning Maps

c. Attachment C6, Morphum Environmental Ltd, Preliminary Structure Plan Environmental Review, Maitahi & Bayview Development Private Plan Change Request, Document Status (Final), Prepared for CCKV Maitai Dev Co LP and Bayview Nelson Ltd by Morphum Environmental Ltd

d. Attachment C7, Infrastructure and Flooding Report - Tonkin & Taylor, Private Plan Change Request Infrastructure and Flooding Report, Prepared for CCKL Maitai Dev Co LP & Bayview Nelson Ltd, Prepared by Tonkin & Taylor Ltd, Date March 2021, Job Number 1012397.1000.v6

e. Attachment C7 Infrastructure Further Information Response - Tonkin &Taylor letter, Private Plan Change Request 28 - Maitahi Bayview, Response to Request for Further Information, dated 20 August 2021.

f. Tonkin & Taylor letter, Additional flood hazard information – PC28, dated 5 May 2022[1].

NATURE OF THE REQUEST

18. From a stormwater and flood risk perspective the site is separated in two distinct catchments by the ridge. The part of the site on the north side of the ridge in the Brooklands, Malvern Ave and Bayview catchments is upstream of existing residential development and discharges to the Haven. The part of the site on the south side of the ridge is in an existing rural area in the Kaka Hill Tributary catchment (which flows into the Maitai River) and the Maitai River catchment, including in the Maitai River floodplain and close to an area of existing erosion along the river bank.

19. Should PPC28 be approved, the future development on both sides of the ridge will increase stormwater runoff (both volume and peak flows), concentrate discharges, and increase contaminant loads, compared to the existing (pre-development) situation. On the north side of the ridge the stormwater discharge will be into an area of existing development with an existing stormwater network which has not been designed to accommodate runoff from this development. On the south side of the ridge the stormwater discharge will be into the Kaka Hill Tributary or directly to the Maitai River.

20. For the Kaka Hill Tributary catchment, there is the possibility of future development occurring within the existing overland flow paths and the waterway flow path which have not been modelled and therefore not been mapped.

21. At its downstream end, prior to its confluence with the Matai River, the Structure Plan shows the Kaka Hill Tributary being realigned and the request refers to it being naturalised, within the Open Space Recreation Zone proposed in the Landscape Overlays. The request notes that a separate resource consent would be required to realign the tributary.

22. The request also refers to a possible instream detention pond (dam) on the Kaka Hill Tributary to provide attenuation storage[2].

[1] This report was only made publicly available on 26 May 2022 by way of JWS Flooding (3) dated 25 May 2022.

[2] T&T, Infrastructure and Flooding Report, section 6.1 Kaka Hill Tributary catchment 5th and 6th paragraphs, and section 6.1.5.1 Instream detention pond

23. A higher density residential zone is proposed for the Maitai River floodplain on the valley floor. The applicant has advised that this would require filling within the floodplain when development occurs. Excavation within the floodplain to provide additional flood storage to offset that lost due filling (offset storage) was also proposed in the request[3], however it is understood that this is no longer proposed and instead the applicant intends to limit the filling within the floodplain so that offset storage is not required.

STORMWATER MANAGEMENT AND FLOOD RISK ISSUES

24. In my opinion, the key stormwater and flood risk issues as a consequence of the rezoning of the site for future development are:

    a. The potential for progressive development of individual subdivisions (or stages) which could be consented individually and may not adequately account for the cumulative effects of the whole development on stormwater and flood risk.

    b. Increased runoff peak flows and volumes and concentrated discharges, which could increase flood risk at nearby sites and/or downstream, and increase erosion in overland flow paths and waterways, on both the north and south sides of the ridge.

    c. Increased contaminant loads discharged from the development area to the catchments, including temporary increase in sediment loads associated with vegetation clearance and earthworks.

    d. The proposed stormwater management system(s) (to provide treatment and mitigate the effects of changes in hydrology with the development), which will also change the hydrological response of the catchment and will have effects downstream.

    e. Development and filling within the Maitai River floodplain, which if unmitigated would increase flood levels.

    f. Possible excavation within the floodplain to provide offset storage (to mitigate the effects of filling in the floodplain) which would change the performance of the floodplain and may also affect wider flood levels.

    g. Realignment of the Kaka Hill Tributary upstream of its confluence with the Maitai River, including waterway capacity, location, form/cross-section, effects on sediment transport, fish passage, in-stream ecology and riparian planting.

    h. Understanding the geomorphology of the existing waterways and existing catchment sediment loads for both sides of the ridge, and the increases in stream erosion and sediment supply from development. Also the effects of the existing and future sediment loads on both sides of the ridge on the proposed stormwater and flood management system, the downstream stormwater system, and the flow paths and waterways both within the PC site and downstream.

    i. The existing erosion in the Maitai River, including adjacent to the site, and the risk of future development exacerbating erosion in the Maitai River from changes in hydrology including increased runoff with the development.

    j. Possible new development within the existing overland flow paths or the flow paths of the Kaka Hill Tributary and its tributaries.

[3] T&T, Infrastructure and Flooding Report, section 5.3.1 Floodplain storage neutral

k. Possible in-stream storage (dam) on the Kaka Hill Tributary to provide attenuation storage, which would change the existing flow paths and flood extents, and could create a dam break flood risk downstream.

l. The cumulative effects of staged development on the above issues, and the lack of a validated stormwater management plan comprehensively addressing those cumulative effects and their mitigation.

25. These stormwater and flood risk issues at the site are complex and inter-related and need to be addressed at a catchment level. Careful assessment and design will be required to ensure that the proposed rezoning is appropriate and the consequential cumulative effects of the development are appropriately managed.

COMMENTS ON THE INFORMATION PROVIDED

26. While the PPC28 request acknowledges most of the issues above, it is proposed that these issues will be addressed at subdivision consent stage rather than Plan Change stage, and only high-level information has been provided on the possible stormwater and flood risk management options as part of the Plan Change process. Apart from the proposed filling within the Maitai River floodplain, where the feasibility of an option has been assessed (refer paragraph 34 of this memorandum), no preferred development-wide options have been identified and no feasibility assessment of the options has been carried out.

27. There is no stormwater master plan or catchment management plan (or other spatial plan) for the future development under PPC28 on either side of the ridge showing the constraints, indicative arrangement and scale of the future development, proposed stormwater management and flood risk management, and interaction with other disciplines.

28. A 40 m wide esplanade reserve is proposed for the Kaka Hill Tributary including the realigned reach. However, the stream has not been modelled and limited information is provided on the design of the proposed realignment and ecological enhancement. It is not clear if the 40 m width will be sufficient for a meandering channel providing for capacity, ecology, landscape and other values. The realignment will require multi-disciplinary design and will need to be designed as a single entity across to full length of the realignment (potentially through several individual subdivisions).

29. The PPC28 request refers to the need for water quality and quantity management for the proposed PPC28 and the future development.

a. For water quality, first flush stormwater treatment is proposed in the request for both sides of the ridge.

i. The Morphum Preliminary Structure Plan Environmental Review report refers to first flush water quality treatment of all developed site runoff[4] (assumed to mean on both sides of the ridge) and the T&T Infrastructure and Flooding Report refers to treatment in the Kaka Hill catchment[5] (south

[4] Morphum, Preliminary Structure Plan Environmental Review report, section 4.2 Water Quality 2nd paragraph, and section 5 Plan Provisions/Principles, item 5.

[5] T&T, Infrastructure and Flooding Report, section 6.1 Kaka Hill Tributary catchment, 4th paragraph.

side of the ridge) but is not clear whether treatment is included in the stormwater management for the Atawhai catchment (north side of the ridge).

ii. I agree that requiring first flush stormwater treatment for the proposed PPC28 and future development is good practice. Stormwater treatment is not currently required under the Nelson Tasman Land Development Manual 2020 (**NTLDM**) for low traffic roads in residential developments, painted roofs or pervious areas. Refer paragraph 68.

iii. However, from the information provided in the request it is not clear how the proposed treatment will be provided nor what the proposed design standards are. This is discussed further below.

b. For water quantity, retention and detention/attenuation of post-development flows is proposed in the request, both for channel forming flows (smaller storms) to mitigate erosion risk and larger storms (10% AEP[6] and 1% AEP) to mitigate flood risk.

i. For smaller storms, the Morphum Preliminary Structure Plan Environmental Review report refers to erosion mitigation through "…retention of post developed stormwater flows…"[7] and "mimic pre-development hydrology through retention and detention…"[8].

ii. For larger storms, the T&T Infrastructure and Flooding Report notes that "the NTLDM requires that retention and detention shall be provided so that post development peak flows shall not exceed pre-development peak flows for both the 10% AEP and 1% AEP events"

iii. I agree that providing retention and detention/attenuation to mimic pre-development hydrology in smaller storms (to mitigate erosion) and in larger storms (to mitigate flood risk) is an appropriate approach. As noted in the T&T report the NTLDM requires detention so that post-development peak flows do not exceed pre-development peak flows for the 10% AEP and 1% AEP events.[9] The NTLDM also requires extended detention for development of greater than 50 m² impervious area directly discharging to a stream[10]. The extended detention requirements are that storage is provided for the runoff volume from the 50% AEP 2-hour event, slowly released over 24 hour. It does not explicitly require that the

[6] Annual Exceedance Probability (AEP) – the probability (expressed as a percentage) of a particular storm event being equalled or exceeded in any given year.

[7] Morphum, Preliminary Structure Plan Environmental Review report, section 4.4 Erosion Susceptibility/Mitigation of Channel Forming Flows 3rd paragraph.

[8] Morphum, Preliminary Structure Plan Environmental Review report, section 5 Plan Provisions/Principles, item 4.

[9] For greenfield development that results in additional impervious area where the downstream system has insufficient capacity and/or where there is know flood risk. NTLDM, Table 5-9 Detention Requirements Summary, 3rd row.

[10] NTLDM, Table 5-8 Extended Detention Requirements, 2nd row.

pre-development hydrology is to be mimicked, although the extended detention requirements are intended to have this general result.

iv. However, from the information provided in the request it is not clear how the proposed retention and detention will be provided nor are the proposed design standards. This is discussed further below. If the proposed standards are not defined in the PPC28 provisions the requirements will default to the NTLDM standards.

30. For treatment and attenuation within the Kaka Hill Tributary catchment the T&T report refers to "…a number of different ways that this may be achieved…"[11], and notes that these options can be combined. The options identified and described in a general manner are: individual onsite detention and treatment, meandering swales and channels (which may have flood benches/check dams), riparian and catchment planting, stormwater wetlands, detention in the lower catchment area with a single in-stream detention pond and/or off-stream detention ponds.

31. For the Kaka Hill Tributary and Maitai Valley catchments no indicative proposed stormwater facility locations or stormwater layout has been provided apart from a "potential instream detention pond location" indicated on Figure 6.1 and two "potential off stream pond locations" indicated on Figure 6.2. No information is provided on the required size of these stormwater facilities or how they fit within the steep topography and with slope stability/geotechnical risks. It is also not clear whether a facility falling within one future subdivision area would need to be designed to accommodate runoff from other future subdivisions. Therefore, it is unclear if either the in-stream or the off-stream option is feasible.

32. For the catchments on the north side of the ridge, the Infrastructure and Flooding Report, which refers to these as the Atawhai Hillslope catchments, notes that an initial assessment indicates that there is no spare capacity in the existing system and that "…options for the management of stormwater runoff will need to be incorporated in all catchments…".[12] Two options are discussed generally: the provision of stormwater detention storage (either individual on-site detention or centralised detention or a combination); and a new or upgraded pipe network through the existing residential area.

33. For Atawhai Hillslope catchments, no indicative proposed stormwater facility locations or stormwater layouts are provided, showing how these will fit within the steep topography with slope stability/geotechnical risks, and no sizing information is provided. Therefore, it is unclear if either is feasible.

34. The Tonkin & Taylor letter, Additional flood hazard information – PC28, dated 5 May 2022, provides flood modelling information for one scenario of filling in the Maitai River floodplain, and concludes that this does not increase flood levels outside of the site (by more than 50 mm). However, there are some limitations of this analysis as set out below.

[11] T&T, Infrastructure and Flooding Report, section 6.1 Kaka Hill Tributary catchment, 5th paragraph.

[12] T&T, Infrastructure and Flooding Report, section 6.2 Atawhai Hillslope catchments, 2nd paragraph.

a. Under PPC28 and the NRMP, the extent of filling is not limited to this modelled scenario and consent could be sought for more extensive filling.

b. While post-development hydrology is addressed later in this letter, the results presented in sections 1 and 2 of the letter are with the existing (pre-development) hydrology. They do not include allowance for the future development as proposed in PPC28.

c. The results presented in section 3 of this letter are with synthetic or assumed post-development hydrographs (flow varying over time) from the Kaka Hill tributary catchment. These include significant assumptions that the post-development peak flows within the Kaka Stream catchment can be attenuated to pre-development flow rates (with no assessment of the volume of attenuation storage required or where this would be located) and the relative timing of Kaka Stream and Maitai River peak flows.

d. Rather than making such assumptions, the post-development hydrology should be assessed, the developed stormwater system should be designed to a concept design level (footprint, volume, inflow and outflow characteristics), and performance of the post-development system and the effects analysed in a hydrological and hydraulic model. The effects considered should include the peak flows, relative timing of peaks, and downstream flooding.

35. As noted above, the applicant is proposing that these issues will be addressed at subdivision consent stage, rather than at Plan Change stage. This approach relies on the PPC28 plan provisions, the existing plan provisions in the Nelson Resource Management Plan (NRMP) and the requirements of the NTLDM being able to address all development-wide issues.

36. The issues with this approach are that:

a. The opportunity for site-wide master planning and catchment-scale stormwater planning, including interdisciplinary coordination, is lost.

b. It is difficult to assess and mitigate catchment-scale effects and cumulative effects of staged development on an individual subdivision basis of only a limited part of the plan change area.

c. The proposed provisions, the existing provisions in the NRMP and requirements of the NTLDM together may not be sufficient to address the effects of development, especially the catchment-scale and cumulative effects, and also where existing controls (e.g. flood overlays) are based on the existing development will not correctly reflect the future developed form and flood extent.

37. From my experience, working for councils as an employee and at Beca for a wide range of clients (both councils and applicants) around New Zealand:

a. It is common practice for councils to require that master planning and catchment or stormwater management planning (including hydraulic modelling) are undertaken at plan change stage. Refer to **Appendix 1** for a figure from Auckland Council's Guideline Document 2015/04 (GD04) Water Sensitive Design[13] for Stormwater illustrating this.

[13] https://content.aucklanddesignmanual.co.nz/regulations/technical-guidance/Documents/GD04%20WSD%20Guide.pdf

b. Without a stormwater management plan is difficult to provide for a continuous integrated system through multiple subdivisions, such as a waterway realignment through more than one subdivisions and treatment and/or attenuation facilities which also receive runoff from the upstream subdivision.

c. It is not uncommon for progressive development of multiple subdivisions with no overarching stormwater management plan to lead to problems with stormwater and flood risk management through the development stage, and to leave councils with residual issues to address once vested.

d. Examples of these issues include:

   i. Providing insufficient primary and/or secondary flow capacity and attenuation storage for stormwater runoff from upstream development.

   ii. Neglecting to assess the combined effects of multiple subdivisions or stages of development on flows, velocities and flood risk downstream.

e. Such issues can arise despite requirements in the council's design guidelines and despite the best intentions from all parties.

STORMWATER MANAGEMENT PLANS

38. In my opinion a stormwater management plan should be provided for the future development for each side of the ridge, at Plan Change stage.

39. In general terms, a stormwater management plan should include the following elements. While some of these relate to other disciplines, and are therefore outside the immediate scope of my evidence and my area of expertise, they need to be addressed as part of a multi-disciplinary spatially integrated stormwater management plan:

a. A catchment plan or plans including: the catchment boundary; natural features; sites of cultural and/or historical significance; surface water bodies; existing stormwater infrastructure; existing road network, three waters services and utilities; existing development and land uses; proposed future development and land uses; the existing infrastructure and waterway system that has been assessed.

b. A description and indicative conceptual plans of the future development and land use intensification within the catchment, including anticipated yield.

c. An assessment (including plans) of the baseline or existing state of the catchment and stormwater receiving environment/s including: topography; natural hazards (including geotechnical); soils; hydrogeology; ecology including ecological sensitivity; landscape; waterways and stormwater infrastructure; erosion; sediment transport; water quality; hydrology; flooding (including overland flow paths); any relevant existing resource consents.

d. A description and plans of the future works affecting natural water bodies and the proposed stormwater and flood risk management system (including water sensitive design), including concept design layouts and sizing and basis of design. In particular, sufficient engineering assessment is needed to be confident in the land footprints required, so that adequate land is set aside as reserve as part of the PPC for future works affecting natural water bodies and there is adequate land is available for the future stormwater and flood risk management.

e. An assessment of the environmental effects, including cumulative effects over time, on the receiving environment of the future development under PPC28 and stormwater and flood risk management works, stream diversions, and any other works affecting and

surface water bodies. This should include effects on: natural features; sites of cultural and/or historical significance; landscape; surface water bodies; groundwater; flood hazards including overland flow paths; other natural hazards including geotechnical; receiving water body hydrology, erosion, sediment, and water quality; receiving water riparian vegetation, habitat, fish passage, ecology and ecosystem health.

f. The analysis informing the assessment of the effects on waterway hydrology, erosion and flood risk should use hydrological and hydraulic modelling.

40. Note that in preparing the list in paragraph 39 I have referred to Hamilton City Council's Three Waters Manage Practice Note HCC10 Integrated Catchment Plans[14] which I have included as **Appendix B**, Auckland Council's GD04, and information on Structure Plans from the Quality Planning website[15].

ADDITIONAL INFORMATION REQUIRED

41. More specifically for this site, in my opinion the following additional conceptual information is required at Plan Change stage in order to:

a. Demonstrate the feasibility of the proposed stormwater and flood risk management system and its ability to mitigate the effects of the future development.

b. Inform the outcomes or critical elements required to mitigate the effects of the future development and therefore the Plan provisions required for the PC to guide and manage the effects of the future development of this site.

42. The proposed stormwater management system for the Brooklands/Bayview/Atawhai catchments (north side of the ridge), including proposed: development arrangement; treatment method and sizing; stream erosion mitigation; attenuation storage location(s), form, size(s) and footprint(s); pre- and post-development peak flows; existing stormwater network alterations and discharge points.

43. The proposed stormwater management system for the south side of the ridge/Kaka Hill Tributary catchment, including proposed: development arrangement; treatment method and sizing; stream erosion mitigation; attenuation storage location(s); form, size(s) and footprint(s); pre- and post-development peak flows; discharge points; filling and offset storage within the Maitai River floodplain; and cumulative effects downstream.

44. The proposed Kaka Hill Tributary realignment including proposed location, capacity, form/cross-section and footprint, effects on sediment transport, how fish passage and habitat

[14] https://www.hamilton.govt.nz/our-council/council-publications/manuals/Documents/Three%20Waters%20Management%20Practice%20Notes/Three%20Waters%20Practice%20Note%20-%20HCC10%20-%20Integrated%20Catchment%20Management%20Plans%20-%20Version%203%2020160912.pdf

[15] Quality Planning website - Structure Plans - https://www.qualityplanning.org.nz/node/1134. The Quality Planning website was established in 2001 and is a partnership between the New Zealand Planning Institute (NZPI), the Resource Management Law Association (RMLA), Local Government New Zealand (LGNZ), the New Zealand Institute of Surveyors (NZIS), the New Zealand Institute of Architects (NZIA) and the Ministry for the Environment (MfE)

will be provided, and the width of corridor required to achieve all environmental, ecological and access outcomes.

45. An assessment of the geomorphology of the existing waterways and sediment transport. The effects of the existing sediment loads in the waterways on the proposed stormwater and flood risk management system, including the Kaka Hill Tributary realignment. The potential increase in stream erosion and sediment supply due to increased volume and frequency of runoff, and the effects of this on the proposed system.

46. An assessment of how the proposed stormwater systems (on both sides of the ridge) will provide treatment to reduce contaminant loads, and mitigate the effects of the discharge of contaminants to the coastal environment and freshwater.

47. A description of how the proposed stormwater system in the Kaka Hill Tributary and Maitai River catchments will mimic existing stream hydrology to mitigate downstream erosion and flood risk. This should include extended detention and attenuation of peak flows in smaller events (e.g. 50% AEP and 20% AEP) to mitigate downstream erosion. This is good practice and a common requirement from other councils to mitigate downstream erosion[16]. It should also include other events between the 10% AEP and 1% AEP event (e.g. 5% AEP and 2% AEP) to mitigate flood risk in all events up to the 1% AEP event.

    a. Note that depending on the results of the hydraulic modelling (refer paragraph 49), developed individual subdivisions or stages may require sufficient attenuation storage to achieve an outflow of less than the pre-development peak flow in order to mitigate cumulative downstream flows and therefore downstream effects. The NTLDM requires that post-development flow is attenuated to 100% of pre-development peak flow (which is what has been assumed by the applicant). However, in the absence of catchment-wide modelling of effects, attenuation of post-development flows to 80% of pre-development peak flow (which requires more attenuation storage) is good practice and a requirement in other councils' guidelines[17] to address the cumulative downstream flows and cumulative effects of multiple developments (or independent stages of development).

48. An indication of the future extent of filling allowed under the PPC, volume of floodplain lost to filling and offset storage (if any) proposed within the Maitai River floodplain. This should be accompanied by an assessment of the frequency of ponding in this new cut area and implications for vegetation and proposed land uses, as well as the effects of this on wider flood risk (via modelling).

49. Hydraulic modelling of:

    a. The Kaka Hill Tributary added into the existing Maitai River model, to understand the existing flow paths, flood levels and flood extents and to provide a baseline for

[16] For example, Waikato Local Authority Shared Services, Regional Infrastructure Technical Specification (RITS), dated May 2018, requires retention, extended detention and attenuation of the 2-year (50% AEP) and 10-year (10% AEP) peak flows (refer RITS, Table 4-3).

[17] For example, Waikato Local Authority Shared Services Regional Infrastructure Technical Specification (RITS), dated May 2018, requires attenuation of post-development to 80% of pre-development peak flow where there is downstream flood risk.

assessing the effects of the proposed PPC and future development both within the PPC area and on the Maitai River.

b. The Kaka Hill Tributary and Maitai River with the proposed PPC and future development, stormwater system (including attenuation), Kaka Hill Tributary realignment, floodplain filling and offset storage, and the effects on stream hydrology, flood levels and flood risk at the site and in the wider area.

c. The proposed PPC28 and future development, stormwater system and downstream existing system in the Brooklands/Bayview/Atawhai catchments (north side of the ridge) to demonstrate the performance of the proposed system and effects on the existing stormwater network and overland flow paths.

50. Assessment of the existing Maitai River bank erosion and migration of the Maitai River bank in the loop north of Maitai Road, the effects of the proposed PPC and future development and any proposed mitigation on this erosion and migration, and how the reserve/esplanade width has been established.

51. Relevant cross-discipline integration on the above items, including civil/earthworks, geotechnical, ecological, landscape design, and landscape and visual assessment, including spatially overlaying these assessments.

REASONS FOR THE LEVEL OF INFORMATION REQUIRED

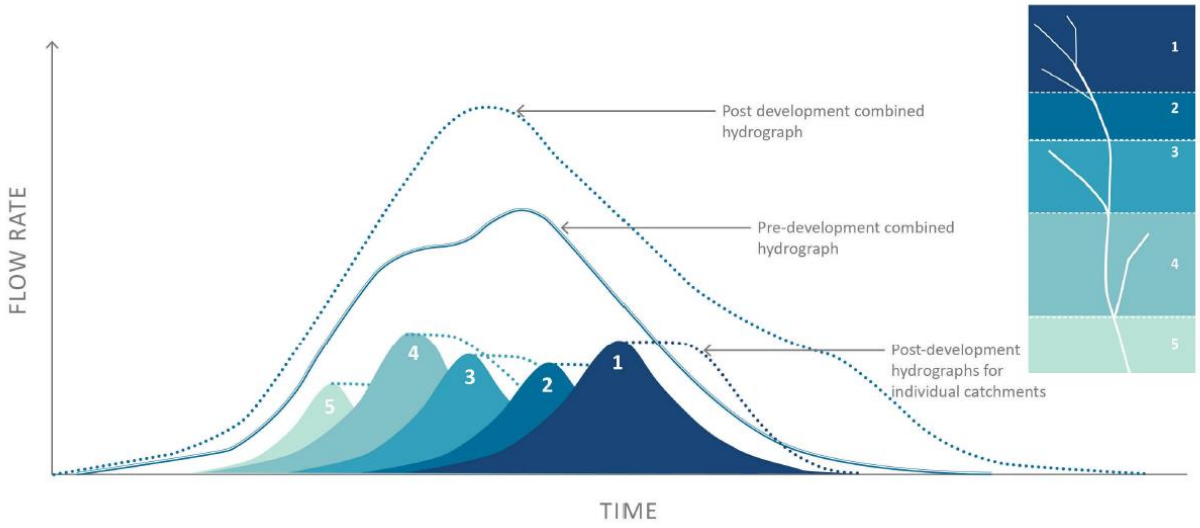
52. As noted earlier, the stormwater and flood risk issues for this site are complex and inter-related. PPC28 proposes rezoning of the site in a manner that would provide for development upstream of existing residential development; development on steep hill slopes with geotechnical hazards; development in the Kaka Hill Tributary catchment and including adjacent to the Kaka Hill Tributary which has not been modelled (so flood extents are not known); realignment of the Kaka Hill Tributary; and development in the Maitai River catchment where there is existing flooding and erosion, including future development within the floodplain.

53. The form of the site with steep slopes on both sides of the ridge, geotechnical hazards, existing waterways and flow paths, and much of the valley floor being within the Maitai River floodplain, makes it challenging to find appropriate locations for stormwater treatment and attenuation facilities. On the steep slopes it could be difficult to find suitable areas to fit stormwater facilities due to the topographical constraints and geotechnical/land stability risks (which could be exacerbated by stormwater storage). On the valley floor it could be difficult to find locations downstream of development but outside the floodplain. Also for stormwater facilities on the valley floor, if the land is prone to liquefaction, there may need to be a buffer around the facility to mitigate lateral spreading risk to the sites.

54. The PPC28 request has assumed that it will be possible to treat and attenuate stormwater from the development, but has not demonstrated that this is feasible within the constraints of the site. The indicative future development and future stormwater system layout, and the locations and sizing should be developed to concept design to demonstrate that this is practicable. Hydraulic modelling should also be provided to demonstrate the performance of the concept design and its effects.

55. As noted above (refer paragraphs 47 and 49) the attenuation requirements cannot be confirmed without modelling of the proposed system. This is because if separate attenuation

facilities for multiple subcatchments each attenuate peak flows to 100% of pre-development peak flow, the increased volume discharged from each attenuated subcatchment will result in flows being high for longer. Downstream where flows from multiple subcatchments combine, the discharge hydrographs (flow varying over time) will accumulate and depending on the timing this may lead to a higher total peak flow from the whole catchment than pre-development. This is illustrated in the figure below, Figure 9 from Auckland Council's GD04.



56. As noted above, rezoning of land within the floodplain is proposed, which would need to be filled in order to be developed. This filling would affect flood levels nearby and potentially downstream. Depending on the extent of the filling offset storage may be required to mitigate the effects. (As noted in paragraph 34, the applicant has put forward an option where only part of area is filled and their expert's assessment there are no off-site flooding effects. However, there are no provisions proposed in PPC28 limiting the filling to these extents, and I have some reservations about the analysis as noted in paragraph 34.)

57. If required, providing offset storage to mitigate the effects of filling in the floodplain is complex. Even if an equivalent volume of storage is provided to that lost, with a different level-volume (stage-storage) relationship this cut and filled floodplain will behave differently to the existing floodplain. The maximum possible extent of filling under the Plan Change and offset storage to mitigate this should be modelled to understand the effects and demonstrate performance. This includes the effects on wider flood risk. This work should be carried out at plan change stage to ensure sufficient land is set aside for offset storage.

PROPOSED PLAN PROVISIONS

58. I have reviewed the relevant existing provisions of the NRMP (as described below), changes to the NRMP and additional provisions proposed in the PPC28 request (as set out in section 4.0 of the application including changes to maps, additions to objectives and policies, and addition of a new Schedule X Maitahi Bayview Area), and the requirements of the NTLDM, with respect to stormwater and flood risk management, and have the following comments.

Existing NRMP Provisions

59. For buildings or earthworks within the Flood Overlay (Rule REr.82.4):

    a. This rule applies within the Flood Overlay area and only part of the site (based on an earlier assessment of the existing Maitai River flood extents, with existing development in the catchment) is within this Flood Overlay. It does not include the Maitai River flood extents with the future development in place, or the existing or future flood extents of the Kaka Hill Tributary or overland flow paths (as these have not been modelled). The PPC28 provisions should apply these requirements to all areas within the PPC site where there is floodplain or overland flow paths. If these areas are not established by modelling at Plan Change stage, then in my view, these provisions should apply to the whole PPC28 site.

    b. Clause (b) only refers to flood effects on "adjacent sites". This does not explicitly cover other nearby sites which are not immediate neighbours, and does not cover downstream effects. The PPC28 provisions should also require off-site and downstream flood effects to be addressed.

    c. Clause (c) requires consideration of "the ground level or floor level height required to give protection from a 1 in 50 year event" (2% AEP event), however under the NTLDM. Inundation Practice Note a minimum flood level of 1% AEP plus freeboard is required. The PPC28 provisions should specifically require floor levels to be above the 1% AEP event plus freeboard, and require that this is established by post-development catchment-wide modelling. Refer also to my comments on the Inundation Practice Note floor level requirements in paragraph 68d.

60. For subdivision within the Services Overlay (Rule REr.108.4):

    a. This applies to the whole site (as the Services Overlay is proposed to be extended).

    b. Clause (a) is vague in requiring consideration of "whether the disposal of storm water or wastewater from the site, or supply of water, can be done effectively without risk to human health or the environment, natural hazards or adjoining properties." However there are more specific rules about stormwater in the Freshwater chapter.

    c. Clause (b) refers to "the minimum standards and the matters in the NCC Land Development Manual 2010". Refer to paragraph 68 for my comments on the NTLDM 2020 (superseding the NLDM 2010).

61. For stormwater discharges to freshwater (Freshwater Rule FWr.22) (regional rule):

    a. This applies for point source discharges to freshwater, and has rules for permitted, controlled and non-complying activities.

    b. If such stormwater discharges are not via a Council stormwater system then they are a controlled activity under FWr.22.2 (2) if they meet the requirements of clauses (2)(a) and (b). Clause (a) sets out what the discharge must not do (e.g. discharge chemicals, oils, grease, colour, sediment-laden water) and clause (b) requires that "the best practicable option (e.g. oil separation, screening, filtering or settlement devices, or diversion to the sewerage system or a combination of these options) is taken at source to ensure that contamination of stormwater is minimised". The NCC Stormwater Bylaw 2006 is referenced as a guide for compliance with (b), however this has since been repealed.

    c. This rule does not include any more specific standards for stormwater treatment design, so the requirements of the NTLDM would apply.

62. For the realignment of a river (Freshwater Rule FWr.10.4):

    a. It is assumed that this would apply to the Kaka Hill Tributary realignment.

    b. Clauses (a) though (k) require consideration of a range of factors with regard to the form, natural character, ecology (including fish passage), and the capacity/hydraulics. These appear to cover the relevant issues, however it does not specifically require a comprehensive design of a full stream realignment and could allow for piecemeal realignment through multiple subdivisions. This should also be addressed in the PPC28 provisions for the Kaka Hill Tributary realignment.

Proposed PPC28 Changes to Objectives and Policies

63. There is one new objective and several new policies proposed in the PCC28 request which refer to sustainable development, freshwater management and values, ecology, sustainable infrastructure, and low impact stormwater design. These are all important aspects stormwater management.

64. Flood risk management is also an important consideration, particularly for this site, and should also be included in these objectives and policies.

Proposed PPC28 Schedule X Maitahi Bayview Area Rules

65. I understand that the applicant is currently revising the proposed PPC28 provisions but provide the following comments on the proposed provisions as included in the PPC28 request.

66. Rule X.3 Subdivision – General (Residential Zone) lists a number of requirements for subdivision to be a restricted discretionary activity, amongst these is complying with the mandatory requirements of the NTLDM. Refer to paragraph 68 for my comments on the NTLDM requirements.

67. Rule X.9 Ecological Outcomes and Freshwater sets out a number of “best practice principles” to be used “alongside the NTLDM”, “in the subdivision and development design process, with an assessment from a suitably qualified person demonstrating the application of these principles”.

    a. The principles refer to a number of important matters and are a good start. The principles appear to have come from the Morphum report included in the request, section 5 Plan Provisions/Principles, the second paragraph of which notes “These suggested principles could be adopted as the basis for more quantitative Plan Provisions (including rules)…”.

        i. The principles are quite general in nature and do not provide clear guidance or explicit standards which need to be met, making them open to interpretation. This would make it difficult for future applicants and their designers to understand what standard is required, and difficult for council officers assessing an application to determine if these rules had been met.

        ii. This is compounded by a number of qualifying statements throughout the principles “where possible”, “where practical” and “where feasible”.

    b. The only exception to this is X.9 (5) which requires treatment of the first flush runoff.

        i. This requires “first flush to be based on treating 80-85% of mean annual volume or stormwater resulting from 3-month ARI rainfall event”. This definition of first

flush is from the Morphum report accompanying the request, however the basis of this definition of first flush or the effects of adopting it are not clear from the Morphum report. It is also an unnecessarily complex definition. A more common approach would be to state a first flush rainfall depth (e.g. 25 mm as per the NTLDM) and first flush rainfall intensity (e.g. 10 mm/hr[18] as per the NTLDM, Auckland Council's GD01[19] and Wellington Water's Water Sensitive Design guideline[20])..

ii. Also this rule only applies to "prior to discharge to the Kaka Stream, existing wetlands or Matai River". It does not apply (but should apply) to the development on the north side of the ridge which ultimately discharges to the Haven.

c. There are no clear standards relating to attenuation for smaller storms to mitigate stream erosion. X.9(4) states "Mimic predevelopment hydrology through retention and detention. Predevelopment channel forming flows in Kaka Stream to be managed to reduce risk of scour and sediment mobilisation." NTLDM requires extended detention for "direct discharges to streams" but it is not explicit for indirect discharges and it is not known if this will be sufficient to mitigate the effects for this site until it is tested via modelling. This needs to be much more specific.

d. The rule refers to "an assessment from a suitably qualified person demonstrating the application of these principles". With the range of issues covering several disciplines (e.g. stormwater including stormwater and flood modelling, water sensitive design, ecology and landscape) this need to be to be more than one person. Also due to the complexity of the site, a requirement for peer review could be written in the rule.

e. The PPC28 provisions should include rules so that in conjunction with the NTLDM they provide clear standards which if complied with will mitigate the effects of development. In my opinion these principles together with NTLDM do not provide clear requirements which will mitigate the effects. Refer to my comments in paragraph 68 regarding the NTLDM requirements.

NTLDM Requirements

68. The NTLDM 2020 (superseding the NLDM 2010) includes requirements for:

a. Treatment of high contaminant load generating surfaces. This does not apply to this development as the road will have an AADT of less than 5000 at full development. The Plan Change provisions should require stormwater treatment of the first flush runoff from all new development areas or at least all trafficable hardstand areas (i.e. roads and driveways) of new development. As noted earlier, the applicant is proposing that PPC28 future development treats stormwater runoff, i.e. a higher standard than required by the NTLDM.

b. Extended detention (Table 5-8) where there is "direct discharge into a stream" and greater than 50 m² additional impervious area, requiring "provide storage of the

[18] "10mm/hr of runoff" is noted in the NTLDM. It is not clear if this was the intent or if 10mm/hr of rainfall was intended.

[19] Auckland Council, Stormwater Management Devices in the Auckland Region Guideline Document 2017/001 (GD01), dated December 2017, Incorporating Amendment 2. https://content.aucklanddesignmanual.co.nz/regulations/technical-guidance/Documents/GD01%20SWMD%20(Amendment%202).pdf

[20] Wellington Water, Water Sensitive Design for Stormwater: Treatment Device Design Guideline, dated December 2019, Version 1.1 https://www.wellingtonwater.co.nz/land-development/water-sensitive-design/

extended detention volume (EDV) that is the equivalent of a 50% AEP event with a two-hour duration, slowly released over 24-hours". It is not clear what the "direct discharge" requirement means and whether this would apply when the discharge is indirect (e.g. via a pipe to a stream). If PPC28 does not include provisions regarding the mimicking of pre-development hydrology in the 50% to 20% AEP events as set out below, then the PPC28 provisions should adopt this requirement and apply it to all new development ultimately discharging to a stream (i.e. either directly or indirectly).

c. Attenuation of peak flows are required where there is a downstream flood risk, with the NTLDM requiring "provide detention so that post development peak flows shall not exceed pre-development peak flows for the 10% AEP (10-year ARI) and 1% AEP (100-year ARI)".

   i. As mimicking the pre-development hydrology to mitigate stream erosion is proposed by the applicant in the PPC28 request, the PPC provisions should include specific requirements on the attenuation of smaller events (50% AEP, 20% AEP) and events between the 10% AEP and 1% AEP (e.g. 5% AEP and 2% AEP) as well as the 10% and 1% AEP already required by the NTLDM.

   ii. Also, unless a concept design and modelling is provided at Plan Change stage demonstrating that attenuation to 100% of pre-development peak flows is adequate to mitigate cumulative effects, the Plan Change provisions should require post-development peak flows to be attenuated to 80% of pre-development peak flows to mitigate the cumulation of peak flows downstream. This is a relatively common measure used by other councils to mitigate the cumulative downstream effects of the increased volume and extended duration of peaks arising from development.

d. For minimum floor levels it refers to the Inundation Practice Note: Calculating minimum ground and floor levels for subdivision[21].

   i. This requires floor levels for new subdivisions to be above the 1% AEP event plus freeboard in accordance with Table 3: Minimum Freeboard Requirements, i.e. 0.5 m freeboard for habitable dwellings (including attached garages). This requirement should be included in the PPC28 provisions, referring to 1% AEP flood levels established by modelling with the future development and proposed stormwater management system in place, and apply to all new habitable dwellings (including attached garages) within the PPC28 area, so that the flood levels include the proposed PPC28 future development and it also applies to any new habitable dwellings constructed in the Plan Change area without subdividing.

Recommended Provisions

69. I recommend the following provisions are included in the PPC28 provisions. These may need to be added to or amended by other NCC experts so that effects in their area of expertise are also mitigated

[21] https://tasman.govt.nz/document/serve/Inundation%20Practice%20Note.pdf?path=/EDMS/Public/Other/Policy/Policies/NelsonTasmanLandDevelopmentManual/000000951886

Flood Risk

70. Minimum floor levels for all new habitable dwellings (including attached garages) shall be at the 1% AEP flood level plus 0.5 m freeboard. The 1% AEP flood level shall be determined from catchment-wide hydraulic modelling with the proposed PPC28 and future development (post-development case).

71. Any new structures or earthworks within the PPC28 area within a floodplain, waterway flow path, or overland flow path in a 1% AEP event shall be a *discretionary activity* with the following assessment criteria. The extent of the floodplain, waterway flow paths and overland flow paths shall be determined from catchment-wide hydraulic modelling with the proposed PPC28 and future development (post-development case). Assessment criteria:

    a. the ground level and minimum floor level required to give protection from a 1% AEP event.

    b. the extent of earthworks proposed (filling and cutting)

    c. any effects on waterway flow paths or overland flow paths.

    d. any effects of the works on the waterway or floodplain hydrology, ecology and landscape

    e. any effects on flood risk off-site or downstream.

72. Attenuate post-development peak flows to 80% of pre-development peak flows for the 10% AEP and 1% AEP event.

Stream hydrology and erosion

73. Provide extended detention in accordance with the NTLDM plus additional attenuation if necessary to mimic the pre-development hydrology, so that post-development peak flows do not exceed 80% of pre-development peak flows for the 50% AEP and 20% AEP.

Stormwater treatment

74. Provide stormwater treatment of runoff from all new development in the PPC28 area, by treating the first flush runoff. The first flush is defined as the runoff from 25 mm rainfall depth or a 10 mm/hr rainfall intensity.

Kaka Hill Tributary realignment

75. Any realignment of the Kaka Hill Tributary shall require a comprehensive design over the full length of the proposed realignment, including incorporating ecology and landscape. (Refer also to Freshwater rules regarding river realignment.)

Additional Recommended Provisions

76. In addition to the provisions described above, if a comprehensive stormwater management plan including modelling of the future development with the proposed stormwater management concept design is not carried out at PC stage, the PPC28 provisions should also include:

a. Any subdivision or development within the Kaka Hill Tributary or Matai Valley catchments, or any filling within the Maitai River floodplain, shall trigger stormwater concept design and stormwater/flood modelling of the effects of full development for the Kaka Hill Tributary or Matai Valley catchments, including filling up to the limits of the PPC28 zoning, the performance of the proposed stormwater management system and mitigation of any downstream effects.

b. Any subdivision or development within the Brooklands/Bayview/Atawhai catchment to trigger stormwater concept design and modelling for full development of the Brooklands/Bayview catchment (up to the limits of the PPC28 zoning), including proposed pipe network, any treatment and attenuation systems, and overland flow paths, and downstream effects.

c. Peer review of the above.

SUBMISSIONS

77. I have read the submissions which raise issues regarding to stormwater and flood risk management and provide comments below by topic.

Changes to the hydrology of the Kaka Hill Tributary and Maitai River

78. A number of submitters have raised concerns about the changes in the runoff (flows and volumes) and timing of peak flows in the Kaka Hill Tributary and Maitai River, and how this might affect the morphology of the stream (erosion and sediment transport) and flood risk.

79. I agree that without mitigation the development would increase the frequency of runoff, volume of runoff and peak flows, and shorten the response time (time to peak flow) in these catchments. If unmitigated this could result in significant erosion and increased flood risk downstream.

80. It is possible, with considered design including using modelling to test performance and downstream effects, for storage basins with multi-stage hydraulic outlet controls to be designed so that the post-development hydrology of a catchment mimics the pre-development, for a range of events from low flows to large storm events. I have designed systems which achieve this. However, this is a complex site.

81. I agree that the applicant has not provided sufficient information for Plan Change stage to demonstrate that providing storage to mimic the pre-development hydrology is feasible for this site, or shown how this will be achieved for any future development. As noted in paragraphs 42 to 53 of this memorandum, in my opinion concept design and modelling should be carried out and information provided at Plan Change stage.

Development and filling in the Maitai River floodplain and modification of the floodplain

82. Several submissions raised concerns about the proposed PPC28 and future development and filling in the floodplain.

83. The Inundation Practice Note under the NTLDM requires floor levels for new subdivisions to be above the 1% AEP event plus 0.5 m freeboard for habitable floors and attached garages. This is relatively common standard for councils around New Zealand. I note in paragraph 68d of this memorandum that I recommend that this requirement be included in the PPC28 provisions and applied to all new habitable dwellings within the PPC28 area, not just new

subdivisions or multi-unit developments, with a requirement that flood levels are established from post-development catchment-wide modelling. Without a specific requirement in the PPC28 provisions that the 1% AEP flood levels from the site (and therefore minimum floor levels) are established by comprehensive post-development modelling for the PPC28 site and wider catchments, the requirements would default to the Inundation Practice Note under the NTLDM but the flood level would not be accurately established.

84. The proforma submissions and several other submissions[22] have also raised concerns about the proposed excavation (or "engineered changes" as referred to in the proforma submission) within the floodplain to create offset storage. The submissions were concerned as to how this would affect the stream including some which were concerned with how this will affect the popular Dennes Hole (swimming hole and recreational area) immediately downstream.

85. As noted in paragraph 34 of this memorandum the applicant has now provided an assessment of scenario which the applicant's experts have assessed as not increasing flood levels beyond the development. However, in the Plan Change provisions the extent of filling is not constrained to the scenario in the letter. Also as noted in paragraph 34 I have some reservations about this analysis and in my opinion further work is required to understand the effects of this scenario. This means that offset storage may still be required in order to mitigate the effects of filling within the floodplain.

86. As noted in paragraphs e, 56 and 57 of this memorandum, creation of offset storage is complex, as it changes the performance of the floodplain and flood levels, and needs to be assessed by hydraulic modelling. This needs to include consideration of the effects on the hydrology of the stream and the frequency of flooding within the offset storage area, and effects of flood levels on nearby sites (including Dennes Hole) and downstream.

87. I agree that this issue has not been adequately addressed in the PPC28 request and additional letter provided and should be properly assessed at Plan Change stage as set out in paragraph 48 of this memorandum.

88. A number of these submissions also commented on the natural character effects of excavation within the floodplain, and this is addressed by Rhys Girvan in his Landscape evidence.

Effects of climate change

89. Several submissions have raised concerns that the effects of climate change with the increasing frequency of flood events with exacerbate the effects of the development. As noted in the T&T reports included in the PPC28 request, the T&T modelling to date has been based on climate change adjusted runoff to 2130. It is industry practice and required by the NTLDM to use climate change adjusted intensities for stormwater and flood design and modelling. The climate change adjusted rainfall is normally provided by NIWA via its HIRDS[23] system, and is based on analysis of historical rainfall data adjusted to account for

[22] CAN Nelson, Monica Clark-Grill, Friends of the Maitai, Jo Gould, Daniel Levy, Save the Maitai, Mike Tasman-Jones,

[23] NIWA, High Intensity Rainfall Design System (HIRDS), V4, https://hirds.niwa.co.nz/

temperature rises in accordance with IPCC[24] reports for various RCP[25] scenarios. Using RCP8.5 for 2081-2100 (as required by the NTLDM) is a common standard around New Zealand.

Water quality and sedimentation

90. The proforma submissions and several other submissions raised concerns about water quality[26], both from construction-related sediment and contaminants from urban stormwater runoff, on either or both sides of the ridge (i.e. discharging to the Haven or the Maitai River).

91. Erosion and sediment control during construction of the future development is not part of my scope of review and evidence, and is being addressed by Graeme Ridley in his evidence.

92. Water quality in the operational phase of the future development is being addressed by Paul Fisher in his evidence.

93. Treatment of the first flush runoff from the development is proposed by the applicant, and although some potential options have been set out in the PPC28 request, no details have been provided (refer my paragraph 29, 31, and 33).

94. Treatment of first flush runoff (i.e. all runoff in smaller storms and the initial runoff in larger storms) in facilities sized designed in accordance with good practice industry guidelines provides effective contaminant removal, mitigating effects on receiving water. However, the applicant needs to provide information showing that is feasible for in respect of the land that has been identified for future development under proposed PPC28.

95. In my opinion, additional information on stormwater treatment should be provided at Plan Change stage as set out in my paragraphs 42, 43, and 46.

Realignment of the Kaka Hill Tributary

96. The proforma submissions and several other submissions have raised issues with the proposed realignment of the Kaka Hill Tributary and noted that this will be a constructed (man-made) waterway and may constrain the stream and affect the flood plain.

97. I agree that the realignment of the stream, if not properly designed, could alter the hydrology of the stream and flooding, increase velocities and erosion and adversely affect ecology. As noted in paragraph 24g of this memorandum the proposed stream realignment is a key issue that needs a site wide assessment as part of the Plan Change.

98. The applicant has proposed a 40 m esplanade reserve along the stream corridor and has stated that the realigned stream will be designed to convey the 1% AEP event and to

[24] Intergovernmental Panel on Climate Change (IPCC)

[25] Representative Concentration Pathway (RCP) is a greenhouse gas concentration trajectory adopted by the IPCC

[26] CAN Nelson, Monica Clark-Grill, Friends of the Maitai, Jo Gould, David Jackson, Daniel Levy, Save the Maitai, Gwendolyn Struik Bray, Mike Tasman-Jones

"integrate hydraulic function with ecological habitat values. However little information has been provided (refer paragraph 28 of this memorandum).

99. In my opinion additional information is required at Plan Change stage, as set out in paragraph 44 of this memorandum.

CONCLUSIONS

100. In my opinion, the information which has been provided by the applicant is not sufficient to understand the stormwater and flood risk effects of future development should the site be rezoned through PPC28, the proposed stormwater and flood risk management system to mitigate these effects, and whether this is sufficient to mitigate the effects on the receiving environment. The existing NRMP provisions and proposed PPC28 provisions together do not provide sufficient control on future subdivisions to manage cumulative effects and mitigate the effects on the receiving environment.

RECOMMENDATIONS

101. For the reasons set out above, there is not sufficient information provided to demonstrate that the water quality, water quantity and flood risk from future development of the PPC28 site can be effectively managed and that the existing NRMP and proposed PPC28 plan provisions will provide sufficient control to mitigate the effects.

102. If the Plan Change is approved, then I recommend that the provisions included paragraphs 69 to 76 of this memorandum are included.

103. **Appendix 1 - Land Development Process Diagram from Auckland Council's GD04 Water Sensitive Design for Stormwater, March 2015**

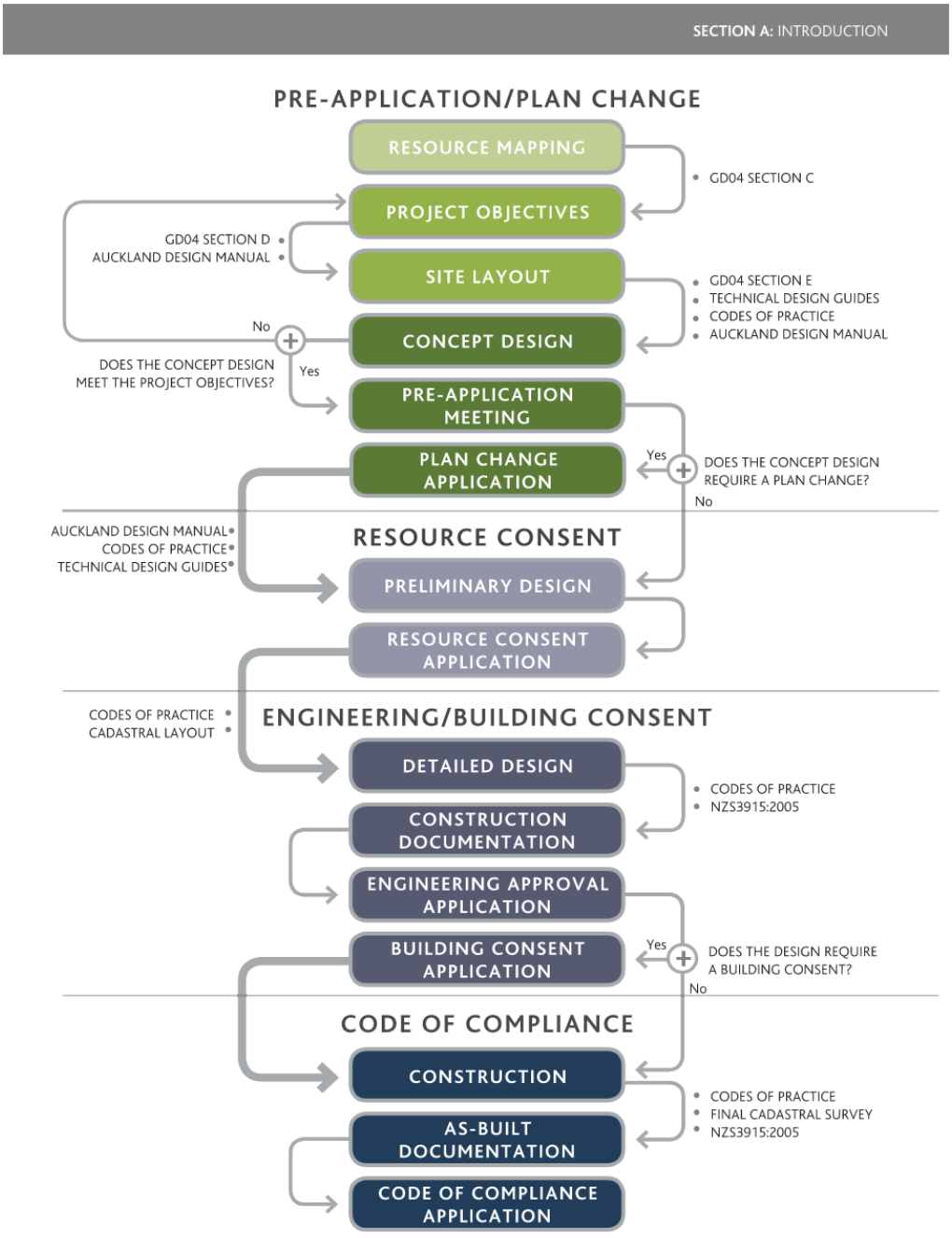


Figure 2: Project stages and regulatory checks required for development

Appendix 2 - Hamilton City Council's Three Waters Manage Practice Note HCC10 Integrated Catchment Plans

THREE WATERS MANAGEMENT PRACTICE NOTE

HCC 10: Integrated Catchment Management Plans:

1. INTRODUCTION

If you need to prepare an Integrated Catchment Management Plan ("ICMP"), then you will need to discuss this in detail with Hamilton City Council ("Council") staff. In the first instance, please contact Council's Duty Planner (phone (07) 838 6699) who will connect you with the relevant technical staff in Council who can help you.

This practice note[1] provides general guidance on ICMPs required in Hamilton City. It identifies:

- The purpose of ICMPs;
- Different types of ICMP;
- When an ICMP is required;
- Information required to be included in an ICMP;
- Information sources;
- Consultation required when preparing an ICMP;
- Requirements for certification or acceptance of ICMPs;
- Costs and benefits of ICMPs; and
- How to obtain further information about ICMPs.

2. THE PURPOSE OF ICMPS

The purpose of an ICMP is to integrate land use and three waters development so as to promote sustainable management of the City's natural and physical resources.

An ICMP is a planning tool. It aids decision-making about Three Waters infrastructure and management in relation to large-scale land use changes or intensification of land use, which have the potential to affect adversely the receiving environment or existing infrastructure.

Developers have always had the responsibility under the Resource Management Act to show how they are avoiding, remedying or mitigating the adverse effects of their developments. An ICMP fulfils this requirement with respect to effects on the Three Waters, while also addressing the requirements of the Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010 to restore and protect the health and wellbeing of the Waikato River.

2.1 Some specific, practical purposes

ICMPs will consider the following:

- Stormwater management to meet the needs of Council's comprehensive stormwater discharge consent;
- The availability of water and the effects of the proposed development on water pressure and fire-fighting flow; and
- The capacity of the wastewater network and the need to avoid or minimise wastewater overflows, taking into account the future needs of existing development.
- Minimising the whole of life costs of stormwater infrastructure, for example, by avoiding multiple wetlands/stormwater ponds being constructed within close proximity of each other, when a single larger one would be more efficient and cost effective.

2.2 Determining how to manage the three waters

In accordance with the District Plan[2], ICMPs shall be developed for structure plan areas to determine how to manage Three Waters in an effective and integrated manner including by:

i. Minimising the effects of urban development on downstream receiving waters.
ii. Managing the runoff from the different relief and soil types in an integrated manner.
iii. Sustaining groundwater levels in peat soils as far as practicable.
iv. Safeguarding and enhancing the natural functioning and ecological health of freshwater bodies and areas of indigenous vegetation, water features and habitats.
v. Retaining a hydrological cycle close to the pre-development hydrological cycle as far as practicable.
vi. Maintaining stormwater discharge from the catchment to at or below pre-development levels.
vii. Incorporating Low Impact Urban Design and Development (LIUDD) principles.
viii. Identifying and incorporating appropriate water sensitive techniques.
ix. Recognising social, economic, environmental and cultural objectives for the catchment.

3. TYPES OF ICMP

There are three different types of ICMP:

- Full catchment ICMPs ("full ICMPs");
- Sub-catchment ICMPs for greenfield areas; and
- Sub-catchment ICMPs for areas other than greenfield areas.

3.1 Full ICMPs

A full ICMP will address Three Waters management within an entire hydrological catchment. Council will be responsible for preparing full ICMPs, unless the full ICMP is required to support a private Plan Change, in which case the party promoting the Plan Change will be responsible for preparing the full ICMP. Council has a programme for preparing full ICMPs that will eventually cover the entire City. Any new Structure Plan must be supported by one or more full ICMPs; a full ICMP will be needed for each catchment a Structure Plan Area spans. Any relevant existing sub-catchment ICMPs[3] or Water Impact Assessments[4] will inform development of a full ICMP.

3.2 Sub-catchment ICMPs

Sub-catchment ICMPs will usually be prepared by developers to support applications for subdivision or land use consents for development of sites or areas that are not covered by a full ICMP. The District Plan specifies when a sub-catchment ICMP[5] is required. Sub-catchment ICMPs for Greenfield Areas[6] have fewer information requirements and will generally be of a smaller scale and scope than a full ICMP[7]. The information requirements for sub-catchment ICMPs for developments outside of Greenfield Areas are significantly less again[8].

If you are preparing a sub-catchment ICMP, it will be necessary to work with Council to define a sub-catchment boundary for, and the scope of, your study. ICMPs will need to assess the effects of the proposed development on a wider catchment than just your development site. This may include considering the effects of expected developments upstream of your site. The extent of the study area and the scope of the ICMP are determined by a range of matters including topography, the extent of actual or potential effects on the stormwater receiving environments and existing water, wastewater and stormwater infrastructure. Furthermore, some sites may fall within more than one hydrological catchment.

If you are preparing a sub-catchment ICMP, you will be required to develop Three Waters infrastructure proposals that are integrated with those for other development areas within the catchment. This may include providing additional stormwater detention and treatment capacity, and wastewater pump station capacity within your proposed development site to service other development areas within the catchment.

4. WHEN AN ICMP IS REQUIRED

An ICMP is required to be prepared at the Structure Plan stage in accordance with Chapter 3.3 of the Proposed District Plan[9].

If there is already an approved ICMP in place for the area within which you are proposing to develop, then you will need to comply with it; you won't need to prepare a new ICMP[10].

If an ICMP does not exist for the area you will be developing, you will need to prepare a sub-catchment ICMP if your development or subdivision involves[11]:

i. Creating more than 40 additional residential units on any site.
ii. Creating more than 40 additional allotments.
iii. Of any land involving more than 3 hectares.
iv. For any development of Stage 1 of the Rotokauri Structure Plan beyond the area identified in Figure 25.13.4a of the District Plan[12].

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[1] Three Waters Management Practice Notes are Hamilton City Council controlled documents and will be subject to ongoing review. The latest version can be downloaded from the Hamilton City Council Website: http://www.hamilton.govt.nz/our-council/council-publications/manuals/Pages/Three-Waters-Management-Practice-Notes.aspx

[2] Proposed District Plan (Appeals Version, September 2014), Policy 3.3.3b

[3] See section 3.2 below.

[4] See Proposed District Plan (Appeals Version, September 2014), Appendix 1.2.2.5.

[5] See section 4 below.

[6] "Greenfield Areas" are defined in Note 1 below Table 1 below.

[7] See section 5 below.

[8] See Table 3 below.

[9] Proposed District Plan (Appeals Version, September 2014), Rule 25.13.4.1 a)

[10] Ibid, Rule 25.13.4.1 b)

[11] Ibid, Rule 25.13.4.1 c)

Except that a separate ICMP is not required when all the information that it would otherwise include is incorporated into an approved Concept Plan for a Major Facility prepared under Rule 17.4 and the Concept Plan is accepted as satisfying the requirements of this rule.

5. INFORMATION REQUIREMENTS

ICMPs shall be developed in consultation with Council[13] and completed in accordance with the requirements set out below. The different types of ICMPs have different information requirements – see Table 1.

Table 1: Types of ICMPs and where to find their Information requirements

Type of ICMP	Where to find the information requirements
Full ICMP	Table 2 – including all rows
Sub-catchment ICMP for Greenfield Areas [See Note 1]	Table 2 – non-shaded rows only
Sub-catchment ICMP for areas other than Greenfield Areas	Table 3

Note

1. Greenfield Areas include the Future Urban Zone, Temple View Zone, Te Rapa North Industrial Zone, Large Lot Residential Zone and all Structure Plan Areas identified in Appendix 2 of the Proposed District Plan.

Table 2: Information requirements for Sub-catchment ICMPs for Greenfield Areas and Full ICMPs

a)	Plan/s identifying for the relevant hydrological catchment (or sub-catchment): i. The catchment boundary; Note: In the case of a full ICMP, this will be used in relation to determining future compliance with Rule 25.13.4.1(b)) of the Proposed District Plan; ii. Natural features, surface water bodies, existing drainage systems and infrastructure; iii. Existing development and land uses; iv. Proposed future development and land uses (see d) below); and v. The extent of the infrastructure networks that have been assessed and the location of any network constraints (see f) vi below).
b)	Classification of the surface water bodies within the catchment (or sub-catchment) as detailed in the Waikato Regional Plan;
c)	The social, economic, ecological, amenity and cultural objectives being sought for the catchment (likely to stem from a structure planning process).
d)	A description of proposed urban growth, development and land use intensification within the catchment (or sub-catchment).
e)	A list of the key stakeholders within the catchment (or sub-catchment), and details of their respective views on providing for new stormwater diversion and discharge activities within the catchment.
f)	An assessment of the current state of the catchment (or sub-catchment) and stormwater receiving environment/s, and the provision of catchment baseline information (including plans) on: i. Topography; ii. Soil; iii. Receiving environment - a. Classification/s b. Erosion c. Ecology, including any ecological sensitivity d. Water quality (including contaminant load) e. Sediment quality f. Hydrology; iv. Hydrogeology; v. Flooding (including overland flow paths); vi. Existing three waters infrastructure, including its capacity to appropriately service the proposed urban growth, development and landuse intensification within the catchment (or sub-catchment); and vii. All relevant existing resource consents (including, for example, consents issued by the Waikato Regional Council for water take, wastewater and stormwater diversion and discharge activities).
g)	An assessment of the environmental effects, including cumulative effects over time, of all proposed water take, wastewater management and stormwater diversion and discharge activities on the catchment (or sub-catchment) and stormwater receiving environment/s, in such detail as corresponds with the scale and significance of the effects on the catchment (or sub-catchment) including, but not limited to, effects on: i. Natural features, surface water bodies and aquifers; ii. Sites of cultural and/or historical significance; iii. Public health; iv. Flooding hazards, including overland flow paths and the effects of climate change; v. Receiving water hydrology, including base flows and peak flows in rivers and streams and long-term aquifer levels; vi. Receiving water sediment and water quality; vii. Receiving water habitat, ecology and ecosystem health, including an explanation of how they will be maintained and enhanced; viii. Receiving water riparian vegetation; ix. The extent and quality of open stream channels; x. Fish passage for indigenous and trout fisheries (refer to the Waikato Regional Plan Water Management Classes for applicability); xi. The natural and amenity values of stormwater receiving waters, including the management of litter that becomes entrained in stormwater; xii. Existing infrastructure[14]; and xiii. Existing authorised resource use activities.
h)	In response to the environmental effects assessment, a description and assessment of the available options for managing the effects of all proposed water take, wastewater management and stormwater diversion and discharge activities within the catchment (or sub-catchment).
i)	Identification of a recommended integrated catchment management approach that is based on the Best Practicable Option to avoid as far as practicable and otherwise minimise or offset actual and potential adverse effects of all proposed water take, wastewater management and stormwater diversion and discharge activities on the catchment (or sub-catchment) and its infrastructure.
j)	Education initiatives to support the integrated catchment management approach recommended in the ICMP.
k)	Plan/s, a description, and a prioritised schedule of the works to be carried out to implement the integrated catchment management approach recommended in the ICMP.
l)	A list of performance measures by which the implementation of the integrated catchment management approach recommended in the ICMP will be gauged.
m)	The need for any changes (including designations) or variations to the relevant District Plan, as a result of the findings and approach of the ICMP.
n)	Identification of the water sensitive techniques that are appropriate, and those that are unsuitable, within the catchment or any sub-catchment.
o)	All ICMPs shall be of sufficient scope and detail to inform development of Water Impact Assessments.

Table 3: Information requirements for Sub-catchment ICMPs for areas other than Greenfield Areas

A Water Impact Assessment in accordance with Appendix 1.2.2.5 of the Proposed District Plan that also includes details of how adverse effects arising from the following will be avoided, remedied or mitigated:
i) Flood hazards;
ii) Stormwater disposal;
iii) Discharges of contaminants; and
iv) Identified network constraints.

6. INFORMATION SOURCES

As part of the pre-application process, developers can obtain from Council any available information that could help with the development of a sub-catchment ICMP. This could include, for example, aerial photographs and LIDAR data, catchment mapping information, and Three Waters modelling and flood hazard data. If Council

[12] Ibid
[13] See section 7 below.
[14] Sub-catchment ICMPs will need to demonstrate that the development proposal will not adversely affect Council's Levels of Service for Three Waters infrastructure. Refer to Council's Infrastructure Technical Specifications for details of the Levels of Service.

would incur substantive costs in supplying this information, Council may charge the developer for this service.

If Council doesn't hold the required information, it may be necessary for further hydraulic modelling to be undertaken at the developer's expense to inform the sub-catchment ICMP. The following process will be followed:

1. As part of the consent pre-application meeting, work with Council's Duty Engineer or Duty Planner to ascertain what information is available and whether any additional information is required.
2. Confirm with Council the scope of any additional information required and the required modelling methodology.
3. Council approves the brief of work.
4. Developer engages an approved consultant to undertake the modelling.
5. The approved consultant provides the developer and Council the model outputs.

Information developers provide Council will inform Council's Three Waters model and inform future updates.

7. CONSULTATION

All ICMPs shall be developed in consultation with Council and other affected parties. Council encourages developers to undertake this consultation early in the ICMP development process, and to continue liaising with the parties as necessary throughout the process; this will help ensure that necessary prerequisite information is available on which to base the ICMP.

Consultation will help identify known issues, objectives for the catchment, the potential effects of a proposal, potential opportunities for integration of three waters infrastructure and, accordingly, the nature and level of detail of the information and assessment to be included in the full or sub-catchment ICMP. During consultation with Council, Council will identify for a developer the appropriate methodologies and deliverables for the technical components of an ICMP and how the information and assessments are to be presented.

The Waikato Regional Council is a key stakeholder in relation to the preparation of full and sub-catchment ICMPs and should be consulted as well.

8. ICMP APPROVAL OR ACCEPTANCE

Upon completion, an ICMP shall be lodged with Council for review.

Council will assess all full ICMPs and, if appropriate, technically certify that they satisfy the relevant information requirements in accordance with Council's ICMP Standard Operating Procedure. This certification is a separate process that lies outside of the District Plan.

A full ICMP will identify whether any changes (including designations) or variations to the relevant District Plan are needed as a result of the findings and approach of the ICMP. If necessary, Council staff will promote a variation to the Proposed District Plan, or a change to the Operative District Plan, in order to update any structure plan. Any decision to change or vary the District Plan would be made by the Council.

Any change or variation to the District Plan will be through the process prescribed in Schedule 1 of the Resource Management Act 1991. This process provides everyone the opportunity to make submissions on the proposed changes to the Plan, and, subsequently, to appeal to the Environment Court against the Council's decisions on those changes.

No formal approval or certification of sub-catchment ICMPs is required. However, sub-catchment ICMPs submitted in support of a subdivision or land use consent application will need to satisfy the relevant information requirements set out in the District Plan before the application is accepted. In addition, the application would need to demonstrate that any stormwater infrastructure would be able to achieve certification from Waikato Regional Council.

In addition, the components of any full ICMP relating to the management of stormwater will be subject to technical certification by the Waikato Regional Council that these components comply with the relevant conditions of Council's Comprehensive Stormwater Discharge Consent.

ICMP's do not remove the requirement for any consent to be obtained from the Waikato Regional Council under the Regional Plan, or from Council under the District Plan or Building Act.

9. REVIEW OF ICMPS

Council will formally review ICMPs every five to seven years. In some cases these reviews will be simply an update to reflect development over the intervening period.

An earlier review may be undertaken in the event of the following:

1. Monitoring identifies development has relevant adverse environmental effects that are more than minor; or
2. Relevant new or amended legislation or national, regional or local policies or plans.

Any significant changes to an ICMP will be subject to stakeholder consultation and Council's internal ICMP approval process, the same as for preparation of an original ICMP[15]. When necessary, certification of the changes will be sought from Waikato Regional Council.

10. COSTS AND BENEFITS

10.1 Costs

Council has a programme for the preparation of full ICMPs, which is funded via the 10 Year Plan. If you are required to prepare a sub-catchment ICMP[16], or a full ICMP in relation to a private plan change[17], you will need to undertake this work at your own expense.

Council cannot provide an indication of the likely cost of developing a sub-catchment ICMP, as there are too many variables at play; one sub-catchment ICMP may cost significantly more to develop than another.

10.2 Benefits

The benefits of preparing and implementing an ICMP include putting in place the best practicable infrastructure, water sensitive techniques and initiatives to:

1. Improve the quality of the receiving environment;
2. Coordinate development in a manner that recognises and provides for natural hydrological processes;
3. Provide greater certainty about the appropriateness of proposed developments within a catchment;
4. Ensure compliance with Council's Three Waters resource consents;
5. Achieve stormwater management objectives regarding the quality, volume and rate of discharge to the Waikato River;
6. Achieve the social, cultural, economic and ecological objectives identified for the catchment;
7. Encourage the reuse of water resources where appropriate; and
8. Optimise vested assets, which in turn will minimise their whole of life cost to the community.

11. FURTHER INFORMATION ABOUT ICMPS

If you have any further questions about ICMPs, these may be directed via email to: icmp@hcc.govt.nz

[15] See 7 and 8 above.
[16] See 4 above.
[17] See 3.1 above.