ANZ Centre, 267 High Street,
PO Box 13960, Christchurch,
8141, New Zealand
T: +64 3 366 3521 // **F:** +64 3 366 3188
E: info@beca.com // www.beca.com

Queenstown Lakes District Council
Private Bag 50072
Queenstown 9348
New Zealand

9 June 2023

Attention: Ian Munro

Dear Ian

Northlake Private Plan Change 54 Stormwater Review

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 letter on behalf of the Queenstown Lakes District Council (QLDC) in respect of stormwater management technical matters arising from Private Plan Change 54 request (PC54) to the Operative Queenstown Lakes District Plan (ODP).

Qualifications and Experience

3. 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).
4. 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.
5. I have previously worked for Hastings District Council and Christchurch City Council and have worked for Beca for 14 years.
6. I have 22 years' experience as a three waters civil engineer with the last 13 years specialising in stormwater and flood risk management.
7. 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.
8. I am familiar with plan change and resource consent processes from my work as an employee at councils (Hastings District Council and Christchurch City Council) and my work at Beca as a consultant working both for councils and for applicants.

Code of Conduct

9. I have read the Code of Conduct for Expert Witnesses set out in the Environment Court's Practice Note 2023. I have complied with the Code of Conduct in preparing this letter and will continue to comply with it while giving oral evidence before the Hearing Panel. My qualifications as an expert are set out above. I

confirm that the issues addressed in this letter 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.

Background

10. I have been providing stormwater advice to QLDC regarding Northlake since 2019.
11. I am familiar with the existing Northlake development and wider area. I have visited the existing Northlake site on several occasions, most recently in April 2022.
12. I have carried out stormwater peer reviews for QLDC for Northlake Stages 16 and 17. For Stage 16 this included reviewing the hydrological and hydraulic modelling and the design of the downstream Catchment A stormwater network to Outlet Road. This is the stormwater system that the PC54 area would discharge to (refer to paragraph 24).
13. Although not directly related to PC54, there has been ongoing disagreement between Northlake Investments Ltd (NIL) and QLDC as to the sufficiency of the Catchment A stormwater system.
14. I am aware of the erosion issues in the Rockabilly Gully downstream of the discharges from the existing Northlake and Hikuwai developments, and that Otago Regional Council (ORC) has issued QLDC with an abatement notice in respect of this issue. I have walked the gully from the outlets to the Clutha River. I am also providing advice to QLDC with regard to the possible causes of this erosion issue.

Nature of the Request

15. PC54 seeks a change to the ODP to provide
    a. A roading and infrastructure corridor from the Northlake Special Zone to the adjacent site known as Sticky Forest.
    b. Land for residential development in the north-western edge of the Northlake Special Zone. This could result in up to 63 net additional dwellings.
16. PC54 does not include rezoning of the Sticky Forest.
17. Future resource consents would be required to enable the road and the residential development in the north-western edge the Northlake Special Zone. The proposed infrastructure, including stormwater management, would be addressed as part of these resource consents. This relies on the PC54 changes to the ODP plan provisions, the existing plan provisions in the ODP, and the requirements of the QLDC Land Development and Subdivision Code of Practice (CoP) being able to address all stormwater-related issues.

Changes in stormwater runoff with development

18. Development of rural land to residential or commercial increases the impervious area (e.g. roads, roofs and hardstand) and decreases the pervious area (e.g. grass, gardens and parks). This increase in impervious area changes the nature of the stormwater runoff for any given rainfall event, resulting in more frequent runoff, larger volumes of runoff, and higher peak flow rates. If these effects are not mitigated, this can result in downstream flooding and erosion.
19. Detention basins (also called attenuation basins) with designed outlets can be used to buffer flows and attenuate (reduce) the higher post-development peak flow rates to match pre-development peak flow rates, for particular storm events, particularly helping in avoid increased flood risk.
20. Where there are multiple individual developments (or stages of development) in a catchment with detention basins providing peak flow attenuation, the cumulative effect of increased volumes and resulting increased coincidence of peak flows can result in higher than pre-development peak flows downstream. Achieving no net increase in peak flow downstream of all development requires that individual developments (or stages of development) be attenuated to a lower peak than pre-development (some guidelines recommend targeting 80% of pre-development peaks).

21. Peak flow attenuation does not mitigate the increase in frequency of runoff or the increase in volume, both of which can contribute to increases in downstream erosion. This also needs to be addressed.

22. To mitigate the erosion effects of additional frequency of runoff stormwater retention or volume reduction and extended detention (significant attenuation to flow rates lower than the erosion threshold) can be used. Retention or volume reduction can include discharge to ground (where soils are suitable), roof rainwater tanks with reuse, and bioretention devices or raingardens with infiltration to ground. Extended detention involves storage of a defined volume of runoff, designed to drain down slowly (e.g. over 24 hours).

Stormwater management approach for PC54

23. A concept design for the stormwater management for PC54 is included as part of Document 7 *Infrastructure Report* of the request[1], to demonstrate that stormwater management is feasible. As noted in paragraph 16, the stormwater management and other infrastructure will be decided as part of future resource consents. The combined PC54 plan provisions, the existing plan provisions in the ODP, and the requirements of the QLDC Land Development and Subdivision Code of Practice (CoP) need to be able to address all stormwater-related issues

24. Figure 1 (Figure 2.1 from the *Stormwater Management Concept* report, included in Document 7 *Infrastructure Report*) shows the location of the PC54 area and the Northlake stormwater catchments.

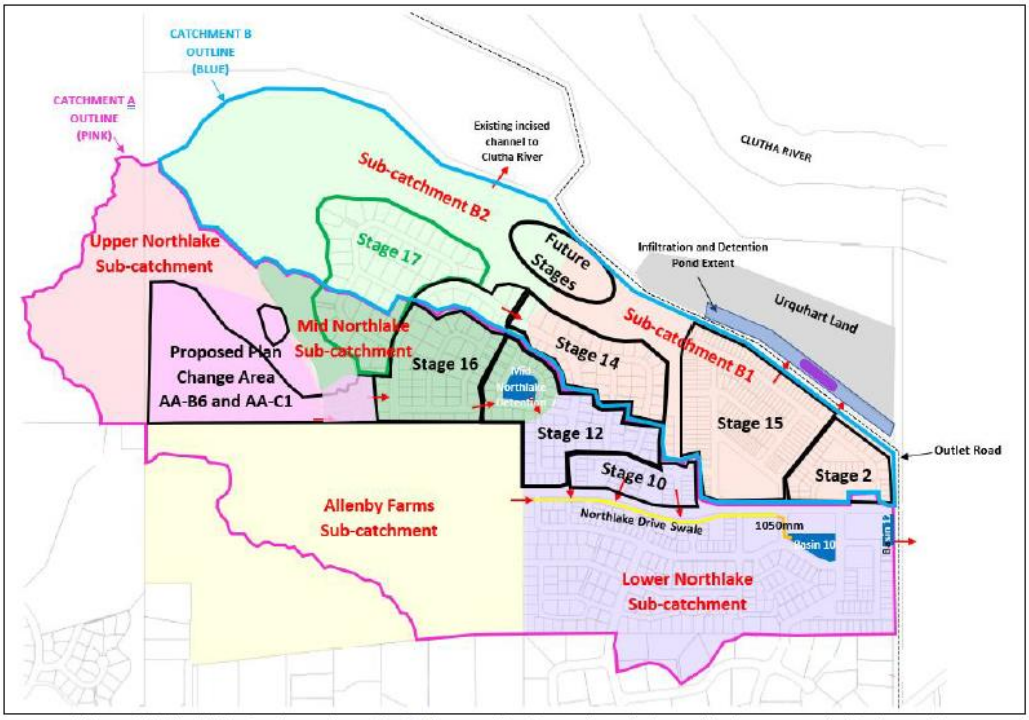

Figure 2.1: Northlake Catchment Location Reference (Catchment boundaries and lot layouts are indicative only)

Figure 1: Northlake stormwater catchments and PPC54 area

[1] Fluent Solutions (Fluent), *Stormwater Management Concept, Northlake Proposed Plan Change Area* report, dated January 2022, included as Appendix A of Paterson Pitts Group (PPG) *Northlake Investments Limited Private Plan Change Request, Infrastructure Report*, dated February 2022 (Document 7).

25. The stormwater management concept proposed is a primary (pipe) system and secondary (overland flow paths along roads) system, leading to a detention basin, discharging via a pipe connection to the Stage 16 stormwater pipe system.

26. It is proposed that:

    i. The primary (pipe) system would be designed to accommodate the 5% AEP (20-year) event

    ii. The secondary system would be designed to accommodate the 1% AEP (100-year) event

    iii. The detention basin would attenuate post-development peak flows to match pre-development peak flows for the 10-year, 20-year and 100-year events.

27. Figure 2 (Figure 4.1 from the *Stormwater Management Concept* report included in Document 7) shows the proposed stormwater management system for the PC54 area as submitted with the request.

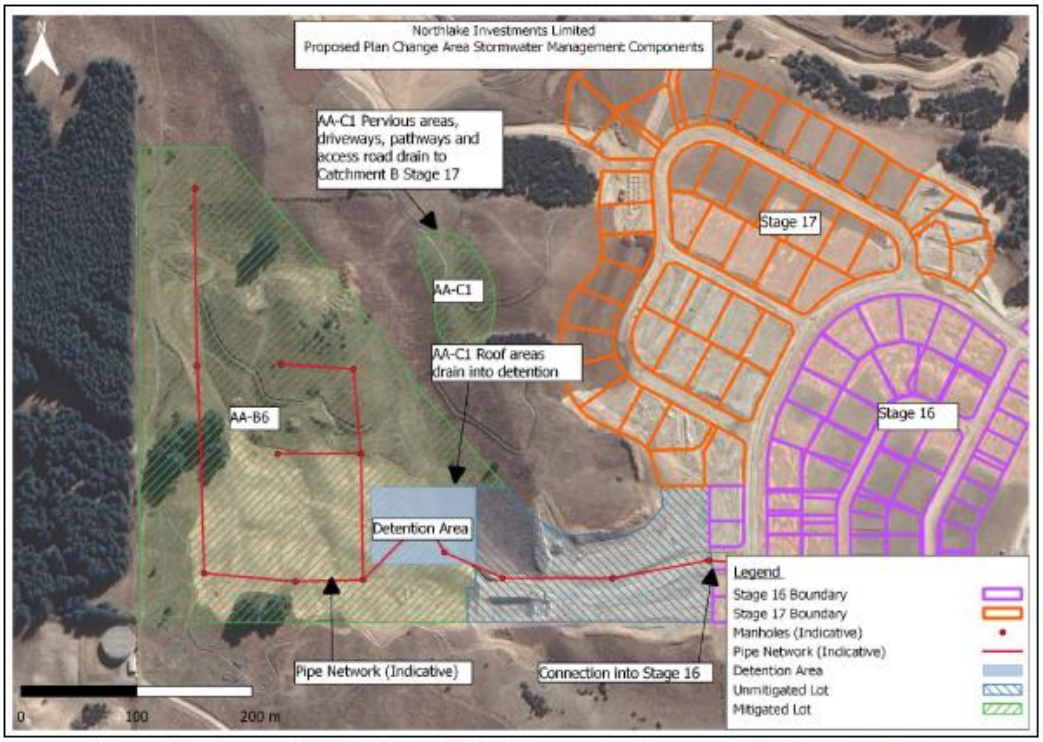

Figure 4.1: Proposed Plan Change Area Stormwater Management Components

Figure 2: Proposed PC54 stormwater management system

28. The proposed stormwater system would not address the increase in peak flow discharged in events smaller than the 10-year event. This means that it may increase the risk of downstream flooding in events smaller than the 10-year event (e.g. the 2-year and 5-year event). It would also not address the potential cumulative effects downstream from several detention ponds in multiple developments or stages of development.

29. The proposed stormwater management system would not address the increase in runoff frequency or increase in runoff volume from development in the PC54 area. This means that it would not mitigate the risk of downstream erosion caused by development in the PC54 area.

30. However as noted in paragraph 17, these issues will be addressed at resource consent stage, and it is the proposed PC54 changes to the ODP provisions, existing ODP provisions, and the CoP requirements which will determine the stormwater management requirements for the development at resource consent stage, not the concept design put forward to prove feasibility as part of the PC54 request.

Proposed PC54 changes to ODP provisions and existing ODP provisions, and the CoP

31. The proposed PC54 changes to the ODP relate to Section 12.33 Northlake Special Zone objectives and policies, Section 12.34 Northlake Special Zone rules, and Section 15.2 Subdivision and Development rules.

32. None of the proposed PC54 changes to the ODP are to the objectives, policies and rules directly related to stormwater management.

33. I have therefore considered the sufficiency of the existing ODP provisions and the requirements of the CoP to address stormwater-related issues for PC54.

34. ODP Section 12.34 Northlake Special Zone – Rules, Rule 12.34.5.2 Assessment Matters sets out the matters which the Council shall have regard to in considering where or not to grant consent or impose conditions. Under item iii Restricted Discretionary Activity, these include with regard to stormwater:

> *"(f) In regard to **approaches to stormwater disposal***
> *(i) Whether, where practical, low impact design solutions are employed.*
> *(ii) Whether, where possible, safe and practical proposals to integrate stormwater management facilities into an attractive public realm and/or conservation corridors are proposed."*

35. ODP Section 15.2 Subdivision, Development and Financial Contributions - Rules, Rule 15.2.12.3 Assessment Matters for Resource Consents sets out matters which the Council shall have regard to in considering whether or not to grant consent or impose conditions in respect to stormwater disposal. With regard to managing stormwater to mitigate downstream effects, this includes the following matters:

> *"(i)The adequacy of the proposed means of collecting and disposing of stormwater from the roof of all existing or potential buildings and hard surfacing, in terms of the avoidance or mitigation of adverse effects on the site, other properties in the vicinity, or the receiving environment, whether land or water;"*
>
> *"(iii) Any adverse effects of the proposed subdivision on drainage on, or from, adjoining properties and mitigation measures proposed to control any adverse effects;"*
>
> *"(iv) The provisions of the Council's Code of Practice in respect to the construction and installation of the stormwater disposal system;"*
>
> *"(vii) The requirements of any Regional Rules or the need to obtain discharge permits from the Otago Regional Council;"*

36. The Northlake Special Zone Rule 15.2.12.3 referenced above refers to low impact design, and the Subdivision, Development and Financial Contributions Rule 15.2.12.3 referenced above refers to considering the effects on other properties and the receiving environment (matters (i) and (ii)), as well as Regional Council requirements (matter (vii)). However these rules do not provide specific requirements or guidance as to how to design stormwater management to mitigate downstream flood risk or erosion. The Subdivision, Development and Financial Contributions Rule 15.2.12.3 refers to the CoP (matter (iv)), which is the Council's design standard for land development.

37. The CoP sets out the required design approach for stormwater systems. While the CoP requirements are explicit regarding the primary and secondary system design standards (5% AEP and 1% AEP respectively), the requirements are not explicit for stormwater management to mitigate downstream flood risk including the cumulative effects of multiple developments and detention ponds or downstream erosion.

38. There is already significant erosion downstream following development in the catchment. It is therefore important that this is not exacerbated by the effects of further development not being appropriately mitigated.

39. I therefore recommend that the proposed PC54 provisions are modified to include the following requirements:

    a. To mitigate downstream flood risk, peak flow attenuation to limit post-development peak flow to 80% of pre-development peak flow for the 2-year, 5-year, 10-year, 20-yearand 100-year events.

b. To mitigate downstream erosion:

    a. Retention or volume reduction of at least 5 mm runoff depth in any storm, plus

    b. Extended detention storage draining down over 24 hours, for the difference between the pre- and post-development runoff volumes from the 95th percentile 24-hour rainfall event minus the 5 mm retention.

The above recommendations reflect accepted industry practice and are based on Auckland Council's GD01[2].

Yours sincerely

Kate Purton

Technical Director - Civil Engineering

on behalf of

Beca Limited

Phone Number: +6433743649
Email: Kate.Purton@beca.com

[2] GD01 (2017). Auckland Council, Guideline Document 2017/001 (GD01), *Stormwater Management Devices in the Auckland Region*, December 2017, Incorporating Amendment 2 February 2020.