

BEFORE THE HEARINGS PANEL

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of proposed Plan Change G: Aokautere Urban
Growth to the Palmerston North City Council
District Plan

**SUPPLEMENTARY STATEMENT OF ALLISON REIKO BAUGHAM ON BEHALF OF PALMERSTON
NORTH CITY COUNCIL**

STORMWATER

Dated: 11 March 2024

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SUPPLEMENTARY STATEMENT OF ALLISON REIKO BAUGHAM

A. INTRODUCTION

- [1] My full name is Allison Reiko Baugham.
- [2] I prepared a s 42A report dated 15 September 2023 (**s 42A Report**) and reply evidence dated 28 November 2023 (**Reply**) on stormwater matters for PCG.
- [3] My experience and qualifications are set out in my s 42A Report.
- [4] I repeat the confirmation given in my s 42A Report that I have read and will comply with the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2023, and that my supplementary report has been prepared in compliance with that Code.

B. SCOPE

- [5] My supplementary statement responds to the following matters raised by the Hearing Panel as part of the hearing in the week of 4 December 2023.
- [6] Specifically:
- (a) Setback requirements for stormwater detention ponds;
 - (b) Geotechnical setback lines as they relate to future streambed erosion in the gullies;
 - (c) Stormwater pond functionality;
 - (d) Flexibility of stormwater pond locations;
 - (e) Implications of not including raingardens within the roading cross-section of Urban Connector E; and
 - (f) Proposed rezoning of the area marked 'Area A' for rural-residential development, as requested by submitter s45, PNIRD.

C. STORMWATER POND SETBACKS

- [7] The Hearing Panel queried if a prescribed setback distance or buffer area from the edge of the slope for the stormwater ponds would be appropriate to manage downstream effects as they relate to slope stability and secondary flow paths. This was of particular concern to the downstream residents in Moonshine Valley.
- [8] Siting of stormwater detention ponds is dependent on a multitude of variables.¹ These include, but are not limited to: the catchment topography, geotechnical conditions, receiving network constraints, ecological effects, visual amenity impacts, and safety in design considerations. The latter includes the risks posed by the detention pond during construction, operation and decommissioning, and would include an assessment of the potential for pond failure and the effects of this occurring.
- [9] I am of the opinion that imposing a setback line at this stage could create unintended consequences or conflict when the required site-specific investigations are subsequently carried out as part of the subdivision process. Site specific investigations will provide more detailed information to inform the optimal location of the ponds. This includes information relating to the variables identified above. A fixed setback would remove flexibility in the location (and design) of the ponds at the time of development, with the risk of poor outcomes and inefficient use of space.

D. GEOTECHNICAL SETBACKS AND FUTURE STREAM BED DOWNCUTTING

- [10] The 20-degree and 30-degree setback lines shown in Map 10.1A² are based on slope stability, accounting for future potential erosion and downcutting in the gullies. Any proposal for development within these setback lines (which would include any proposed detention ponds), would trigger the site investigations and assessments necessary to identify and mitigate adverse effects on the downstream environment. I am satisfied that the requirements for these site investigations and assessments are set out in the relevant performance standards in the proposed subdivision and land use

¹ This was recognised in the additional hearing statement from Mrs. Rosemary Gear dated 13 December 2023.

² As updated and appended to the s 42A Report – Geotechnical.

rules - for example: R7.15.2.1 (c), (f) and (v); R7A5.2.2 (a) (xv), (xix), (xxi), and (g); R10.6.1.5 (j) and (k); and R10.6.3.3 (vii) and (xii).

[11] Following the Hearing, further review of the proposed provisions highlighted potential for ambiguity around the reasons for the revised 20-degree and 30-degree setback lines in the updated Map 10.1A. Although this was addressed with the revised Figure 7A.1, I considered it would be appropriate to provide an explanation within the provisions. I have recommended wording for an advice note referencing the Stream Erosion Assessment Summary (GHD, 22 June 2023), which I understand has been included by Ms Coplestone in the amended provisions attached to her Reply.³

E. STORMWATER POND FUNCTIONALITY

[12] Mr Phillips' Statement of Reply⁴ discusses relocating playgrounds to avoid these being located in close proximity to the stormwater detention ponds. I note that further discussion was held with Mr Phillips following the Hearing, and the functionality of the ponds was clarified with him. I understand his recent statement reflects this discussion.

[13] The detention ponds, as shown in the Structure Plan, are intended to be dry and only fill during rainfall events. The actual design of these ponds could incorporate benching and other formwork to enable the wider footprint of the pond to be utilised for other purposes. During the frequent, smaller rainfall events, only a small area of the pond will fill, and the larger footprint would only be underwater in the larger, less frequent rainfall events. For this reason, I am of the view that at least part of the area could be used for recreational purposes if that was considered appropriate by the Council.

F. STORMWATER POND SITING

[14] The Hearing Panel queried the level of prescriptiveness around the detention pond locations and if the locations shown on the Structure Plan should be 'fixed' or 'flexible'.

[15] As discussed above in paragraph [8], pond siting is contingent on a detailed site-specific assessment. For the purposes of the Plan Change, ponds have been sited at a conceptual level based on existing topography. That is, the size and location of the pond

³ See Note to Plan Users under R7A.5.2.1.

⁴ Statement of Reply Evidence – Parks and Reserves, Aaron Phillips, 28 November 2023 from [27].

may change depending on geotechnical investigations (for example if the soil is not suitable) or the development layout and associated earthworks.

[16] In my opinion fixing the pond locations is not necessary to achieve the design criteria set by the Stormwater Management Strategy (being a design that is capable of managing adverse effects from stormwater flows, erosion, and incremental erosion impacts and discharges beyond the PCG boundary, for a 100-year lifespan). The Structure Plan and District Plan provisions should allow for a process of modification if detailed site investigations and design determine a change is required, provided the proposal will achieve the same level of mitigation today and in 100 years' time.

[17] The Structure Plan has been updated to show the stormwater ponds in a more stylised form, so as to demonstrate the indicative nature of the pond locations shown. I am satisfied that proposed Policy 5.1B in the amended provisions attached to Ms Coppleson's Reply will ensure that the outcomes sought for the stormwater ponds will be achieved, whilst still enabling some flexibility to respond to the matters I mention in paragraphs [15] and [16].

G. REMOVING RAIN GARDENS FROM THE CROSS SECTIONS

[18] During the Hearing the cross sections included in the Structure Plan were discussed, and there was a question as to whether removing the rain garden shown on Urban Connector E Roads to provide more space for cyclists would affect the stormwater management strategy.

[19] Stormwater treatment is required for all stormwater runoff. While the provision specifying the requirements for individual stormwater management plans (which are required in support of subdivision and development proposals) list roadside bioretention facilities (raingardens) as a method for managing water quality, this particular treatment method is not prescribed by the PCG provisions.⁵ This provides flexibility to incorporate alternative water sensitive design solutions. The raingardens

⁵ See R7A.5.2.2, performance standard (g) Water Sensitive Design in the Aokautere Greenfield Residential Area

presented in the notified cross sections are one acceptable solution to meet water quality design requirements.

[20] While reviewing the need for raingardens in Urban Connector E roads, I identified the need for some amendments to some of the other cross-sections. The cross-sections have subsequently been updated (to reflect my advice) to provide some flexibility for alternative treatment methods, including whether there is flexibility around providing treatment on both sides of the carriageway.

[21] Ms. Coppleson has provided amended cross-sections attached to her Reply in accordance with the below comments:

- (a) Urban Connector E - has been revised to show that it is not necessary to have a raingarden on both sides.
- (b) Urban Connector C – This section is located at the bottom of the gully. Runoff from the road will need to be treated prior to discharge to the adjacent stormwater detention pond. This could be facilitated by raingardens or high-flow biofiltration devices, depending on the camber of the road (to ensure all runoff is treated). This cross section has been updated to include a raingarden or treatment swale, with an accompanying note that the road camber will need to ensure all runoff is treated prior to discharge to the adjacent stormwater detention pond. The raingarden is now shown on the left side only, as this will be adjacent to the pond.
- (c) Urban Connector D – This cross-section is for the road sections descending into the gullies. Runoff from these sections of the roading network could either be treated at the bottom of the road (via Urban Connector C), or could be treated through a series of cascading treatment swales along the entire length. The requirement to incorporate roadside treatment within this cross-section is considered to be flexible, as long as the runoff is treated prior to discharge to the gully (i.e., treated in Urban Connector C). As such, the berm between the shared path and carriageway has been adjusted to show a flexible (0-2.1m) terraced treatment swale.

- (d) Local Street B – This cross section is for the local roads adjacent to the gullies. The cross section previously only showed stormwater treatment adjacent to the properties, but not on the opposite side of the road. Depending on the camber of the road, raingardens may be required on the gully-side to treat runoff from the road surface. This cross section has been amended to specify a raingarden / treatment swale instead of a simple swale.
- (e) Local Street E – This cross section is for the road sections along the proposed Wetland feature. This wetland feature does not provide any stormwater treatment function, which is in line with Rangitāne’s expectations⁶ of not using wetlands for treatment. The cross section has been amended with a note saying that all stormwater treatment is to be provided in the designated raingarden/treatment swale, and not within the Wetland feature.

H. ZONING OF A PORTION OF LAND ON TURITEA ROAD (‘AREA A’)

[22] It is understood that submitter PNIRD (S45) has requested that a portion of land off Turitea Road (referred to as ‘Area A’) be zoned rural-residential.

[23] I have reviewed the plan *Rural Area A Existing Contours – PNIRD* by Resonant, dated 15 January 2024. The plan has identified approximately 2.3 hectares of developable land within the larger area of approximately 7.5ha, north of Turitea Road, across from Ngahere Park Road. Area A is located on a lower terrace, through which the Turitea Stream flows parallel to Turitea Road on the southern side. As such, I am of the view that flood risk should be considered as part of any rezoning of this land.

[24] Horizons Regional Council’s flood plain mapping indicates that the Turitea Stream is not predicted to cross Turitea Road in the 200-year average recurrence interval (or 0.5% AEP). However, some ponding is predicted in this area due to overland flow. A screenshot is provided below for reference.

⁶ Rangitāne’s submission raised concerns regarding the use of wetlands for stormwater treatment, and stated their preference to keep them separate.

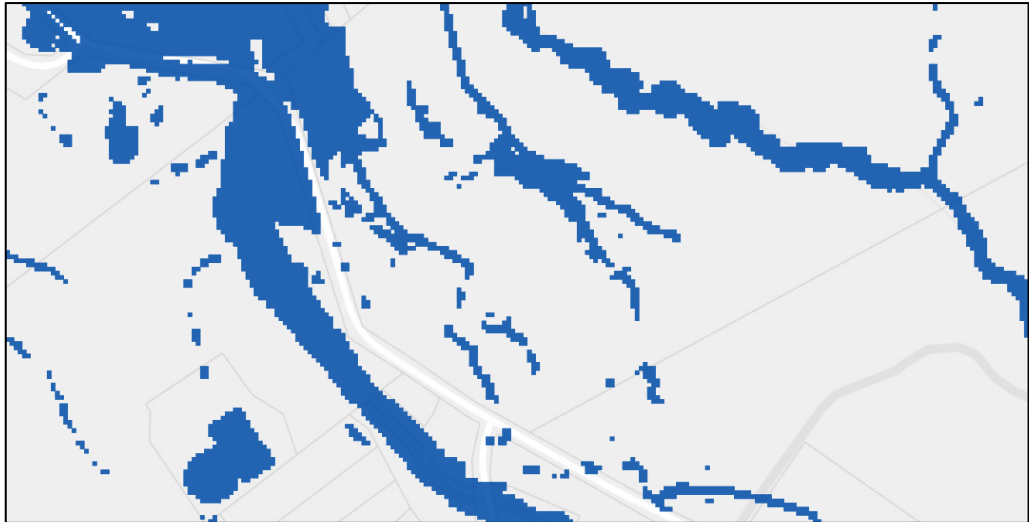


Figure 1 Horizons flood plain mapping at Turitea Road and Ngahere Park Rd (Horizons Regional Council, <https://www.horizons.govt.nz/flood-emergency-management/flood-plain-mapping/flood-plain-mapping-portal>, accessed 9 February 2024)

- [25] Palmerston North City Council (PNCC) previously engaged Tonkin and Taylor to carry out stormwater hydrological modelling for the Fitzherbert / Summerhill area using TUFLOW modelling software. Although this model has not been validated, it does provide an indication of flood prone areas. A screenshot of Area A in the 1% AEP rainfall event (plus climate change) is provided below.

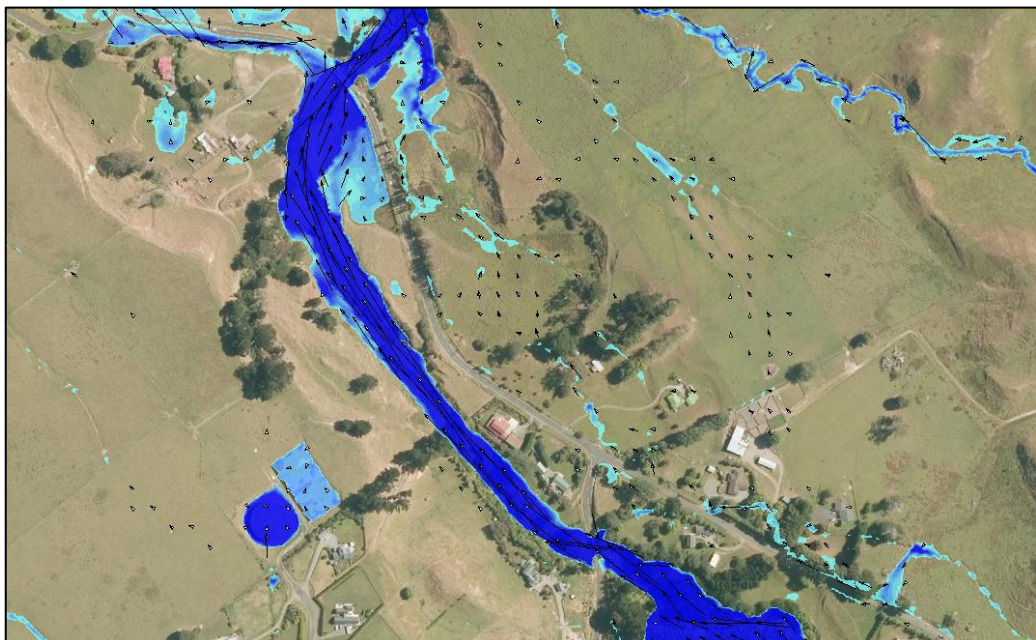


Figure 2 PNCC 2021 TUFLOW stormwater model for the 1% AEP event

- [26] Both sources show that the Turitea Stream is not expected to cross Turitea Road into Area A, with the exception of the area adjacent to the Turitea Stream at the northern end. There is also some localised ponding predicted within the specified developable area. Areas of localised ponding caused by depressions in the ground will likely be mitigated through re-grading of the site and can be addressed during the resource consenting stage. However, the northern corner of Area A that is subject to inundation from the Turitea Stream would require further assessment if any earthworks were proposed in that area that could impact flooding. This includes using that area for stormwater detention, as it is not recommended to have a stormwater pond in an area prone to flooding in the design events. The results support limiting the developable area to the southern end.
- [27] Velocity vectors generated by the TUFLOW model (also shown in Figure 2) indicate overland flow paths that traverse through the site. A high-level review of the topography indicates that the catchment to the north of Turitea Road drains through Area A before discharging to the Turitea Stream. This is presented in the figure below, which shows the elevation as per the 2018 LiDAR data. Area A is outlined in red, and the upstream catchment is shown hatched. Ground levels are shown as a gradient from high (brown) to low (white).

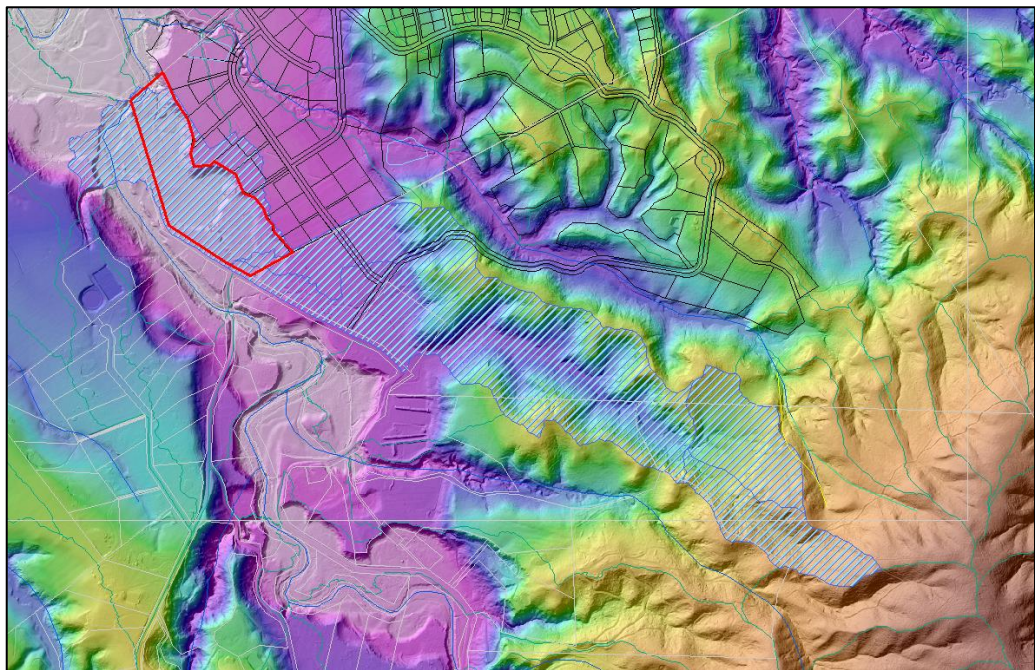


Figure 3 Area A stormwater catchment area

- [28] Although the maximum ponding depth does not appear to exceed 100mm in the 1% AEP (plus climate change) for the area specifically identified to be developed, the overland flow paths through the site are considered significant and would need to be addressed (at the very least) through the resource consenting process. That is, any development would need to show that there is no impact on the existing overland flow paths and that the design is considerate of these.
- [29] Area A is also downstream of the Turitea Dams. In 2018 PNCC engaged Stantec to complete a Potential Impact Classification (PIC) study⁷ for the Lower and Upper Dams. The study showed Area A to be inundated in the Upper Dam Sunny Day Breach scenario, as shown in the figure below. The Upper Dam Rainy Day Breach scenario also showed the area to be fully inundated, but with depths less than 1 metre. The study recommended further refinements to the model to confirm the Population at Risk (PAR) and Potential Loss of Life (PLL), but stated that such model refinements would not change the PIC or inundation maps.

⁷ *Turitea Dams Potential Impact Classifications*, Rev 3, Stantec, 10 June 2019.

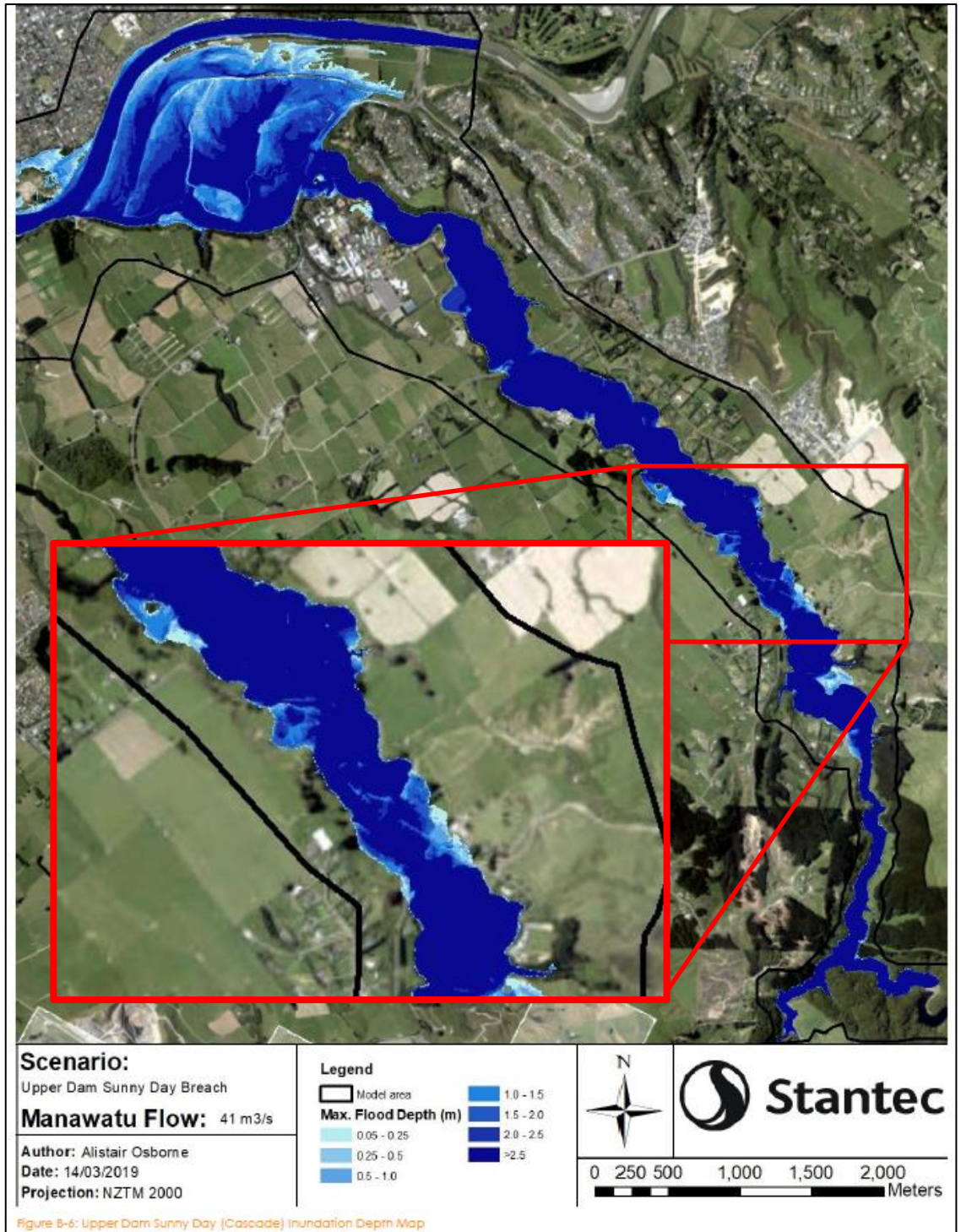


Figure 4 Upper Dam sunny day (cascade) inundation depth map (Stantec, 2019)

[30] Both the Lower and Upper Turitea Dam are classified as having a ‘High’ PIC in Stantec’s study. Following consultation with my colleague Scott Galloway,⁸ it is my understanding

⁸ Scott Galloway, CPEng (Civil, Geotechnical), IntPE, Lead Engineer – Dams and Hydropower, GHD.

that this means that any further development downstream of the dam will not change its 'High' PIC classification, as it is already at the highest level. Under the NZ Dam Safety Guidelines (2015), owners of 'High' PIC dams are directed to prepare dam safety assurance programs (DSAPs) and meet certain design criteria. Currently these are only guidelines, however the Building (Dam Safety) Regulations are due to come into effect in May this year, which will make these assessments a statutory requirement. Despite the current non-regulatory status of the Dam Safety Guidelines, it is understood that PNCC have already adopted the guidelines and have a Dam Safety Management System already in place.

- [31] The Stantec report states that the Upper Dam was built in the 1950's and the Lower Dam was originally built in 1907, with modifications made in 1913 and 1997. Due to the age of the dam, condition assessments are a key factor of informing the probability of a dam break. As part of PNCC's Dam Safety Management System, Annual Dam Safety Reviews (ADSR) are carried out as an Intermediate Dam Safety Review in accordance with NZ Dam Safety Guidelines. The ADSR from 2021⁹ was provided by PNCC, which stated there was "no evidence of initiation of a credible failure mode" for both the Upper and Lower Dams.
- [32] In addition to the ADSR, monthly satellite scanning is carried out to evaluate the rate of movement of the dam, which speaks to the dam's stability. Based on the scan carried out for February 2024, PNCC has indicated that "*both dams are in a stable condition*".¹⁰
- [33] In terms of the risk and consequence of a dam break as it relates specifically to Area A, dynamic modelling would be required to determine the timing / amount of warning in a dam breach scenario. However, this modelling would not change the dam PIC classification, nor would it change the safety standards to which the dam is required to be held to.
- [34] The identified 'developable area' of Area A does appear to be within the inundation zone under an upper dam breach scenario, but given the current dam condition assessment and PIC of the dam, the probability of dam failure is considered very low.

⁹ *Turitea Dams 2021 Dam Safety Review – Review Period: 1 September 2020 to 31 August 2021*, issue 2.0, Dam Safety Intelligence Ltd., 17 October 2022.

¹⁰ Email communication 7 March 2024 from Wayne Venter, Water Services Manager, PNCC

In fact, the standards applied to the Turitea Dams are exactly the same as Clyde Dam, New Zealand's third-largest hydroelectric dam located in Central Otago.

[35] In summary, based on the modelling to date, the 'developable area' identified by the submitter in Area A does not appear to be at risk of inundation from rainfall within the catchment in a 1% AEP event or from the level in the Turitea Stream in the 0.5% AEP event. As mentioned in paragraph [28], there are significant overland flow paths through the site which would need to be maintained and addressed as part of resource consenting. Based on the High PIC classification, the dam condition assessments, and the low yield predicted for Area A (approximately 2.3ha is proposed to be zoned rural residential, which would likely yield only 1 or 2 lots), there is no reason that the identified 'developable area' should not be rezoned as part of the plan change. As part of the resource consent stage, the appropriate mitigation can be determined (i.e., minimum floor levels, designated overland flow paths, evacuation routes, etc.). However, based on the modelling described above, I do not recommend that the low-lying area outside the 'developable area' is zoned for rural-residential use.

11 March 2024

Allison Reiko Baugham