Before the Independent Hearings Panel
at Waimakariri District Council

under: the Resource Management Act 1991

in the matter of: Proposed private plan change RCP31 to the Operative Waimakariri District Plan

and: **Rolleston Industrial Developments Limited**
Applicant

Summary of evidence of Ben Throssell

Dated: 3 August 2023

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SUMMARY OF EVIDENCE OF BEN THROSSELL

1 My full name is Benjamin Graham Throssell. I am a Senior Engineer with Pattle Delamore Partners Limited (*PDP*), an environmental consulting firm specialising in water matters.

2 I hold a Bachelor of Engineering (Hons) (Natural Resources Engineering) from the University of Canterbury. I have 12 years of experience specialising in water resources engineering, with particular expertise in assessing flood hazard and constructing 2D hydraulic models. I have prepared and presented expert evidence at Council hearings on flood hazard matters around the Waimakariri District and the wider Canterbury region.

SUMMARY

3 I oversaw the construction of a flood model which has been employed to determine the effects of flooding from the proposed development for the 200-year flood event (the *PDP Model*).

4 I consider that enabling the conveyance of floodwaters through the site without diverting them to other locations will ensure off site effects are minimised. One way to achieve this is minimising development in areas where the existing conveyance of floodwaters is significant.

5 To assess the difference in flood elevations, I have taken all building footprints, not just habitable dwellings, and extracted the average water level over each footprint for both the post-developed and pre-developed water levels. I take the difference between these two water levels to be the effects on the building footprint.

6 The updated PDP Model has demonstrated that there is a viable subdivision layout which ensures the effects of the proposed subdivision on flood levels will not exceed 20 mm for any habitable dwelling. I consider this effect is less than minor.

7 I accept Mr Bacon's recommendation at his paragraph 19 on freeboard requirements for the proposed development. I understand the applicant has agreed to adopt this recommendation.

8 I accept Environment Canterbury (ECan) evidence that further modelling will be required across a range of events at the consenting and detailed design stages.

9 I conclude that Ōhoka is prone to low hazard flood events, similar to those experienced in June 2014, July 2022 and July 2023. I note the magnitude of these events at Ōhoka was probably between a 10-year and 50-year event. The stormwater solution within the site

will provide mitigation of any additional stormwater generated by the development for events of these magnitudes.

10 For more significant events, modelling of the 200-year event shows the flood hazard is still low for areas south of Mill Road/downstream of Whites Road and moderate for areas north of Mill Road. I note the PDP Model predicts limited increases greater than 10 mm (but no greater than 20mm) for areas north of Mill Road and no increase greater than 20 mm for habitable dwellings elsewhere within the PDP Model.

CORRECTION TO EVIDENCE IN CHIEF

11 Paragraph 98 of my evidence in chief contains a minor continuity error. My evidence reports that *"437 of these footprints could be habitable dwellings"*. It should read *"394 of these footprints could be habitable dwellings"*.

RESPONSE TO SUBMITTER EVIDENCE

12 I have read the evidence of Ms Joanne Mitten and Mr Callum Margetts on behalf of ECan.

13 I note the concerns raised on behalf of ECan in Joanne Mitten's evidence regarding smaller events (mean annual flood) and consideration of spring fed contributions and groundwater.

14 The stormwater solution described by **Mr O'Neill** will provide mitigation of events up to the 50-year event including the mean annual flood. This is described further in his evidence.

15 I note Ms Mitten summarises that:[1]

> *"PC31 is consistent with the natural hazard provisions set out in the CRPS. Specifically, Policy 11.3.2 sets out that development should be avoided in areas subject to inundation in a 200 year occurrence level flood event."*

16 I accept that a more detailed assessment which accounts for a range of events and conditions will be required. I consider the appropriate time to complete this more detailed assessment is at the consent application stage when effects on flooding will be considered in further detail.

17 I will now address a recent flood event (following the filing of my evidence in chief) that is likely to be raised in the presentations of submitters.

[1] At [156].

18 Noting that much of the data available for this event is still preliminary and has yet to still be fully validated, I have reviewed rainfall data from six nearby recorders and the flow data from the Cust Main Drain for the recent 23 July 2023 flood event.

19 My analysis of the nearby (2.5 km from Ōhoka) Threlkelds Road Rainfall recorder (noting the Ōhoka dataset was unavailable at the time of writing) shows the sub-daily rainfall data (**Attachment 1**) as follows:

19.1 Maximum rainfall intensities were 14 mm/hr, this is around twice the maximum intensity recorded at Threlkelds Road for the 2014 and 2022 events.

19.2 a maximum depth of 63.0 mm recorded over a six-hour duration, about a 40-year event (62.1 mm) according to HIRDS V4;

19.3 a maximum depth of 87.5 mm was recorded over a 12-hour duration, about a 40 (85.5 mm) to 50-year (89.5 mm) event according to HIRDS V4, and,

19.4 a maximum depth of 117.0 mm was recorded over a 24-hour hour duration, about a 50-year (119 mm) event according to HIRDS V4.

20 **Attachment 2** shows the location of the Threlkelds Road recorder and proximity of five other recorders to the PC31 site. **Attachment 2** shows the maximum rainfall depths (mm) recorded at each location over a 6-hour period and a 24-hour period.

21 For the 6-hour event, which I estimate is approximately the critical duration for Ōhoka (and the proposed development site) flood levels, the largest rainfall depths were recorded at the Threlkelds Road recorder (63 mm) and the Rangiora recorder (56 mm). All other recorders assessed showed lower rainfall depths.

22 For the 24-hour event, maximum rainfall depths (117 mm) were recorded at the Threlkelds Road recorder. Again, all other recorders assessed showed lower rainfall depths.

23 Therefore, I conclude the most intense rainfall for this event was likely located over Ōhoka and Rangiora, and intensities for this event appear to decrease in the north, south and west directions. This means that within the upper catchment of Ōhoka, rainfall intensities may have been lower.

24 The flow recorded in Cust River peaked at 92.677 m^3/s. My flood frequency analysis (prepared prior to this event) shows that this

flow has a return period of somewhere between 10-years (84 m^3/s) and 20-years (102 m^3/s).

25 Critical rainfall duration for Ōhoka is likely to be around 6-hours, therefore I conclude the rainfall event for the Ōhoka catchment was likely between a 20-year and 50-year event. Similarly, for flood levels in Ōhoka, I consider that this event was likely between a 20-year and 50-year event.

26 I have reviewed a number of flood photos of the event including site photos provided by **Mr Carter** and aerial imagery captured by ECan. I also visited the site and Ōhoka on Tuesday the 25th July and spoke with the current owner and occupier (Mr Sherriff) of the proposed plan change site following the event.

27 Mr Sherriff conveyed that it in his opinion, the flooding experienced in both the 2023 and 2022 flood events was similar. He noted that maintenance of drains and partially blocked culverts has been an ongoing issue that has likely exacerbated flooding for both events, as has been touched on in the evidence of **Mr McLeod**.

28 ECan flew over Ōhoka on Monday the 24th July at approximately 1:30 pm, approximately 24 hours after the peak of the event. The location and directions of these images are presented in **Attachment 3**.

29 **Mr Carter** took a number of photos along the boundaries of the site, location and directions of these images are also presented in **Attachment 3**. These were taken between 11:25 and 11:35 AM on Sunday the 23rd July. **Attachment 1** shows this is approximately six hours after the peak of the event. Time of concentration for Ōhoka is expected to be around six hours and therefore water levels in these photos are expected to be at or close to the maximum levels of the event.

30 Selected ECan and site photos (from **Mr Carter**) are presented in **Attachment 4A to 4D** and **5A to 5K** respectively. Not all photos available are presented, in general, I have selected photos which show flooding and water levels in drains/waterways.

31 I find that the photos show that outside of watercourses, the flooding is low hazard flooding which is consistent with available flood modelling (PDP Model and WDC District Wide Model) and the conclusions set out in my evidence in chief.

32 The photos show most flooding occurred along Whites Road which acts as an embankment, blocking the passage of water except through culverts. This causes water levels to pond and increase before overtopping the road. Minimal flooding was experienced

below Bradleys Road. This is consistent with the flooding predictions made by the PDP Model.

33 The photos show that areas of ponding or flooding within the plan change site are either located within existing watercourses or areas where development will be minimised (**Attachment 1** of my evidence in chief).

34 As expected, the PDP flood model predicts more extensive flooding compared to the flooding observed in this recent event. The PDP model employs a 200-year event with an allowance for climate change whilst this most recent event was probably between a 20-year and 50-year event, noting that the data used to derive this return period is still subject to review at the time of writing.

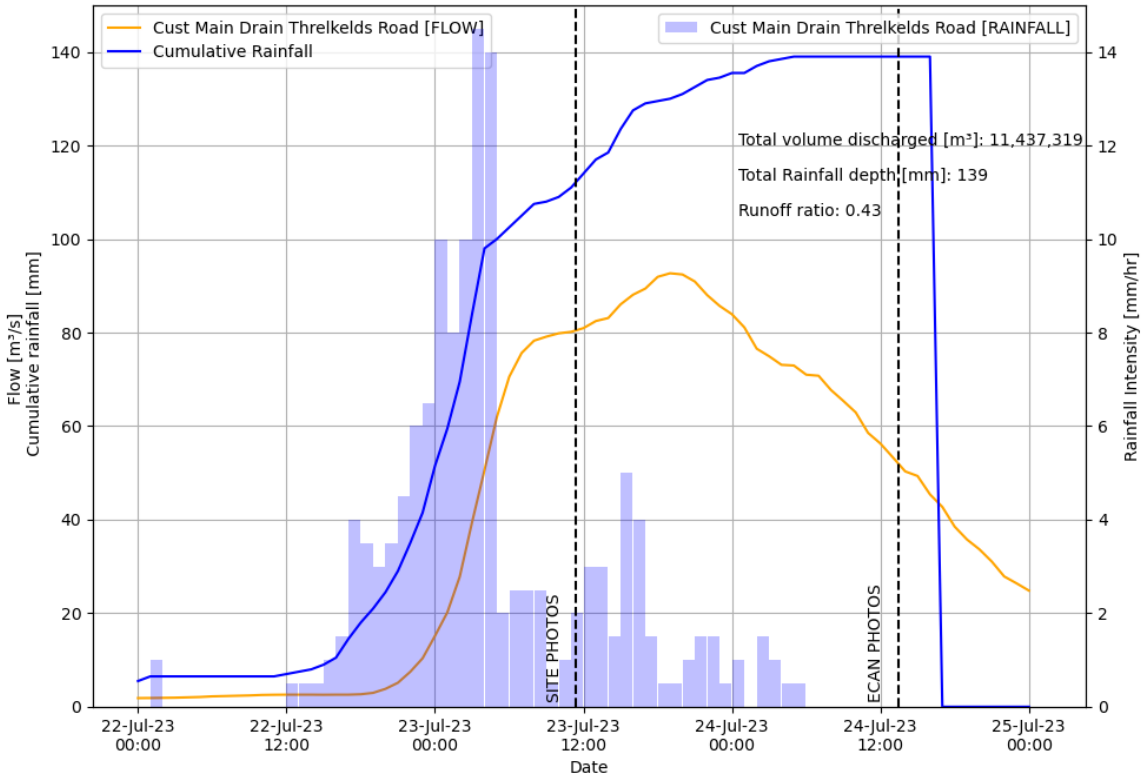
35 Given the return period of this event, I note the stormwater solution within the site will provide mitigation of any additional stormwater generated by the site for events of these magnitudes.

36 I consider that my previous conclusions stated in my evidence in chief are still correct and the flooding experienced in this recent event is consistent with my flooding assessment.

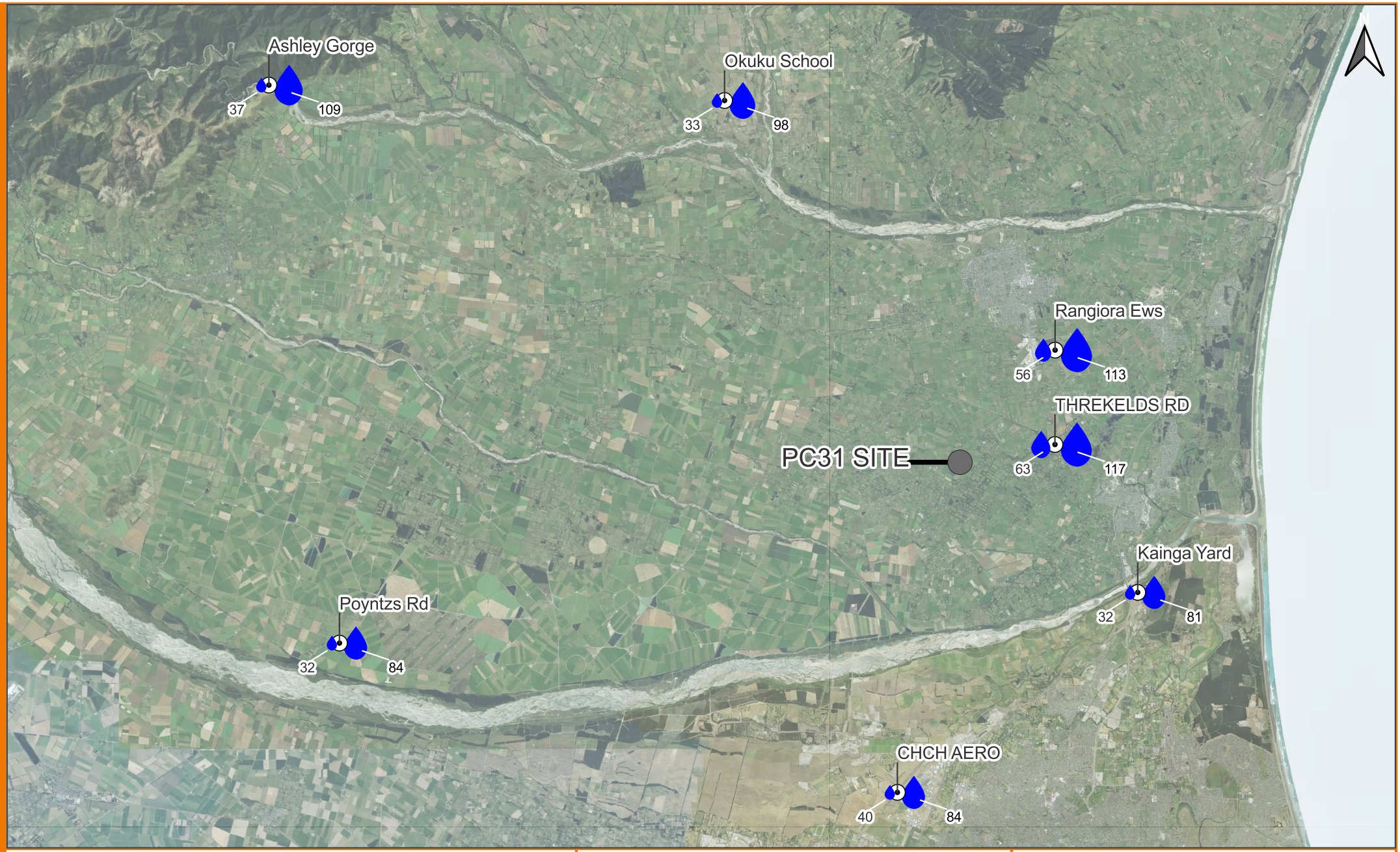
37 I am happy to answer any questions the Panel may have regarding my evidence.

Dated: 3 August 2023

Ben Throssell



Attachment 1: Recorded flows and depths for Cust River at Threlkelds Road for 22 July to 26 July 2023



ATTACHMENT 2: JULY 2023 RAINFALL DEPTHS. SHOWING MAXIMUM 6HR (LEFT) AND 24HR (RIGHT) DEPTHS AT AVAILABLE RECORDERS

PLAN CHANGE 31: FLOOD HAZARD

NOTES:
1. AERIAL IMAGERY SOURCED FROM THE LINZ DATA SERVICE [https://data.linz.govt.nz] AND LICENCED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.

0 5 10
KILOMETRES

SCALE : 1:200,000 (A4)

REVISION: 01 | DATE: JULY 23 | BY: BT
CLIENT: ROLLESTON INDUSTRIAL DEVELOMENTS LTD

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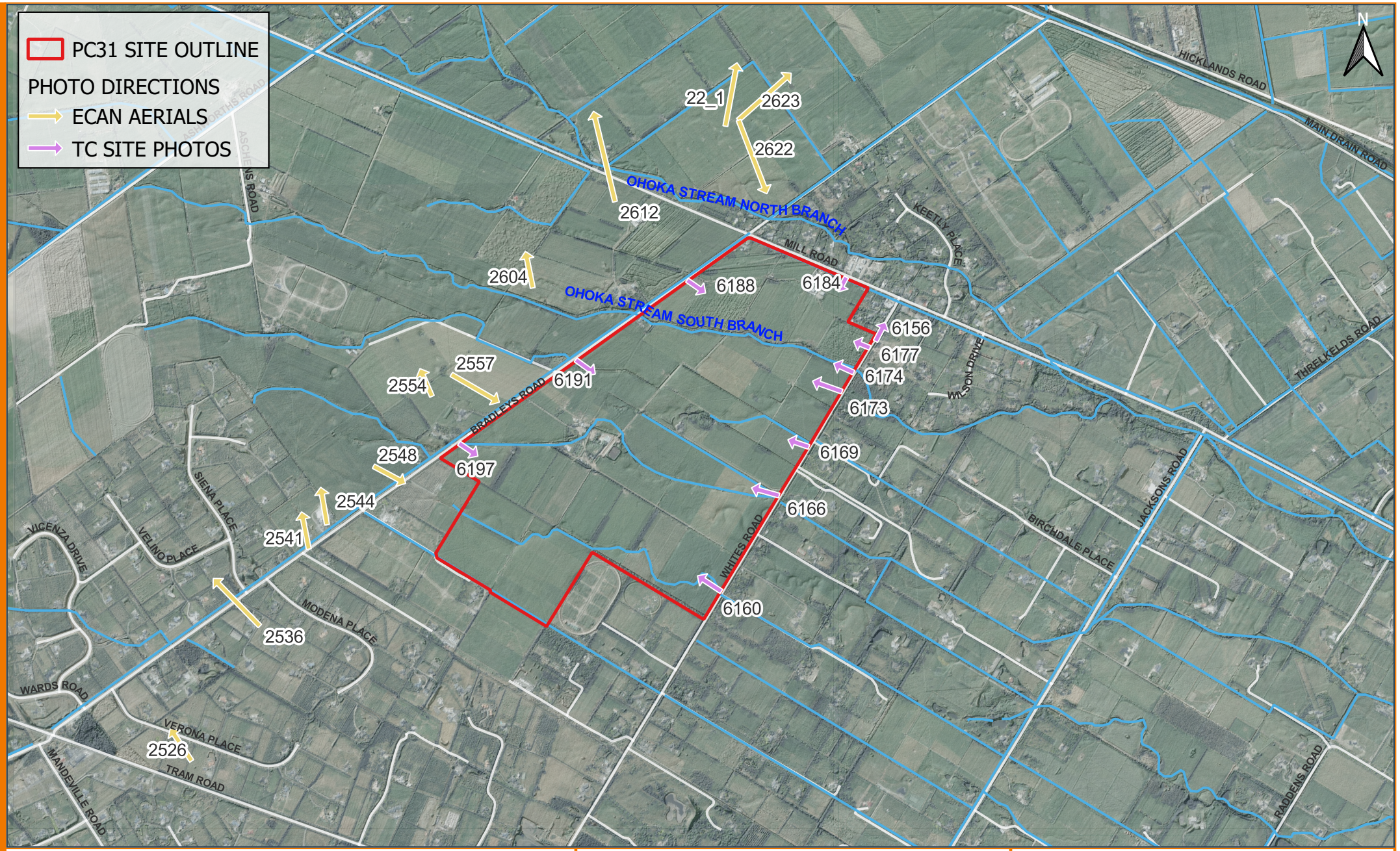

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ATTACHMENT 3: JULY 2023 FLOOD PHOTO LOCATIONS AND DIRECTION

PLAN CHANGE 31: FLOOD HAZARD

NOTES:
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KILOMETRES

SCALE : 1:20,000 (A4)

REVISION: 01 | DATE: JULY 23 | BY: BT
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Attachment 4A: Aerial image 2257. Taken looking south-east with much of the proposed plan change site in the foreground


WHITES RD
BRADLEYS RD

Attachment 4B: Aerial image 2548. Taken looking south-east with southern end of the proposed plan change site in the left foreground. This phot is taken to the south-west of the photo above

Attachment 4C: Aerial image 2554. Taken from Bradleys Rd looking north. This shows the upstream catchment


WHITES RD
MILL RD
BRADLEYS RD

Attachment 4D: Aerial image 2623. Taken from North of Mill Rd looking south over Ohoka and the proposed plan change site

Attachment 5A: Photo 6156 taken on 23 July at 11:30 am, around 6-hours after the peak of the rainfall event and therefore likely close to the maximum flood elevations for this event.

Attachment 5B: Photo 6160 taken on 23 July at 11:30 am. Taken from Whites Rd looking north over the plan change site. Water is close to top of bank in the foreground drain and flooding shown over the plan change site

Attachment 5C: Photo 6166 taken on 23 July at 11:30 am. Taken from Whites Rd looking north over the plan change site. Water is within the drain and minimal flooding is shown over the plan change site.

Attachment 5D: Photo 6169 taken on 23 July at 11:30 am. Taken from Whites Rd looking north over the plan change site. Water is spilling out of lower section of drain but contained within the upper section. Minimal flooding is shown over the plan change site.

Attachment 5E: Photo 6173 taken on 23 July at 11:30 am. Taken from Whites Rd looking north over the plan change site. Water is ponding over the PC site, and the trees along the Ohoka Stream can be seen in the background. Attachment 1 of my evidence in chief shows that development will be minimised in the flooded location.

Attachment 5F: Photo 6174 taken on 23 July at 11:30 am. Taken from Whites Rd looking north up the Ohoka Stream. Water is within the stream banks and no out of bank flow is observed.

Attachment 5G: Photo 6177 taken on 23 July at 11:30 am. Taken from Whites Rd looking north over the plan change site. Water is ponding over the PC site. Attachment 1 of my evidence in chief shows that development will be minimised in the flooded location.

Attachment 5H: Photo 6184 taken on 23 July at 11:30 am. Taken from Mill Rd looking south-west over the plan change site showing minimal flooding

Attachment 5I: Photo 6188 taken on 23 July at 11:30 am. Taken from Bradleys Rd looking south-east over the plan change site showing minimal flooding.

Attachment 5J: Photo 6191 taken on 23 July at 11:30 am. Taken from Bradleys Rd looking south-east over the plan change site showing minimal flooding from northern spring head which is bounded by the rushes.

Attachment 5K: Photo 6197 taken on 23 July at 11:30 am. Taken from Bradleys Rd looking south-east over the plan change site showing minimal flooding. Floodwaters are well contained within the drain and there is no out of bank flow.