BEFORE INDEPENDENT HEARING COMMISSIONERS APPOINTED BY THE WAIMAKARIRI DISTRICT COUNCIL

IN THE MATTER OF	The Resource Management Act 1991 (**RMA** or **the Act**)
AND	
IN THE MATTER OF	Hearing of Submissions and Further Submissions on the Proposed Waimakariri District Plan (**PWDP** or **the Proposed Plan**)
AND	
IN THE MATTER OF	Hearing of Submissions and Further Submissions on Variations 1 and 2 to the Proposed Waimakariri District Plan
AND	
IN THE MATTER OF	Submissions and Further Submissions on the Proposed Waimakariri District Plan by **Mark and Melissa Prosser**

EVIDENCE OF DAVID DELAGARZA ON BEHALF OF MARK AND MELISSA PROSSER REGARDING STREAM 12 REZONING OF LAND

DATED: 5 March 2024

Presented for filing by:
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INTRODUCTION

1 My name is David Patrick Delagarza.

2 I am a Senior Stormwater Engineer and an Associate in Aurecon's Christchurch office.

3 I hold the qualifications Bachelor of Science in Civil Engineering and Professional Engineer.

4 I have 20 years of experience in stormwater and floodplain engineering. This includes design of stormwater quality and flood attenuation facilities, infiltration basins and conducting floodplain assessments and stormwater assessment and design for large residential developments.

5 My role in relation to the proposed Waimakariri District Plan (**Proposed Plan / pWDP**) is as an expert witness to Mark and Melissa Prosser on stormwater and flood management matters.

6 I have read the Environment Court's Code of Conduct and agree to comply with it. My qualifications as an expert are set out above. The matters addressed in my evidence are within my area of expertise, however where I make statements on issues that are not in my area of expertise, I will state whose evidence I have relied upon. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in my evidence.

SCOPE OF EVIDENCE

7 In my evidence I present my assessment of the stormwater and flood management effects of Mark and Melissa Prosser's rezoning submission under the Proposed Plan.

8 My evidence will deal with:

a) Description of the management of stormwater within the proposed Site;

b) A summary of my assessment methodology and further model updates;

c) An assessment on the flooding hazard effects; and

d) The conclusions of my stormwater management and flooding assessment.

9 In preparing my evidence, I have reviewed the following documents and evidence:

a) Mandeville North-East Development Area Outline Development Plan - 524072-W00001-DRG-US-0002, dated 28 November 2023;

b) Concept Layout Plan Proposed Subdivision of Lot 6 DP 2038 & Lot 8 DP 314202- 524072-W00001-DRG-US-0001, dated 28 November 2023;

c) Waimakariri District Flood Mapping, available on Waimakariri District Natural Hazards Interactive Viewer (https://waimakariri.maps.arcgis.com/apps/MapSeries/index.html?appid=16d97d92a45f4b3081ffa3930b534553),

d) Natural Hazards Risk Assessment – 2 Ashworths Road, Ohoka, ref 502044 dated 19 July 2021;

e) Services Report, Ohoka Farm, Ashworths Road, Eliot Sinclair, ref 502044, dated 20 July 2021; and

f) Canterbury LiDAR 1m DEM (2020-2022), Toitu Te Whenua Land Information New Zealand.

g) Mandeville Area Drainage Improvements – Bradleys Drain Catchment Memorandum from Peter Carter to Flood Team PCG, dated 6 August 2014

h) Flood Response in the Waimakariri District by Kate Purton and Gerard Cleary, for the 2015 Asia Pacific Stormwater Conference

i) Mandeville Resurgence Channel Upgrades consultation web site (https://letstalk.waimakariri.govt.nz/mandeville-resurgence-channel-upgrades)

10 I address the following issues:

(a) Stormwater Quality

(b) Stormwater Management

(c) Flood Management

(d) Groundwater Resurgence Management

11 I have assessed these issues based in methodology and criteria established in:

(a) Waimakariri District Council Engineering Code of Practice; and

(b) Christchurch City Council Waterways, Wetlands and Drainage Guide.

CONTEXT

12 My evidence relates to the proposed rezoning of approximately 73 ha of land north of the Mandeville North village (2 Ashworths Road – Lot 6 DP 2038) from Rural Lifestyle (RLZ) to Large Lot Residential (LLRZ) in the pWDP.

SUMMARY OF EVIDENCE

13 The proposed rezoning of 2 Ashworths Road, Mandeville (Lot 6 DP 2038) from Rural Lifestyle Zone to Large Lot Residential Zone in the proposed Waimakariri District Plan (**pWDP**) can be supported from a stormwater and flood management perspective, and there are multiple options that can be employed as needed.

THE RECEIVING ENVIRONMENT

14 The existing land use on the site is agricultural, consisting predominantly of irrigated crops.

15 The site is generally sloped from west to east. Rainfall that falls onto the site predominantly infiltrates to ground. Excess runoff is discharged through a series of on-site drains to three discharge points (identified as 1, 5 and 4 in figure one, below), and discharged to a series of swales and channels which drain stormwater to the east.

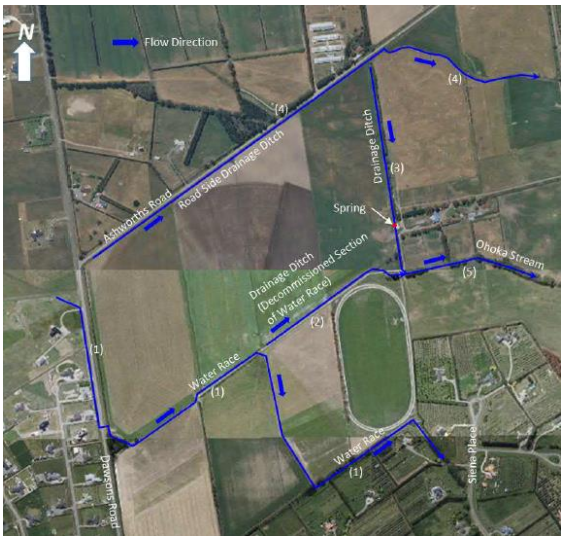

Figure 1. Existing Site Drainage Network (Elliot Sinclair Servicing Report)

16 Portions of the site are prone to flooding, as identified on Waimakariri District Council's localized flood mapping (refer Figure Two). This mapping indicates that flood flows cross the site from west to east in a series of shallow depressions, generally forming three overland flowpaths. The indicated 200-year flood depths are generally less than 250mm with isolated areas of up to 500mm of flood depth. There is no flooding indicated from the Ashley River breakout scenarios.

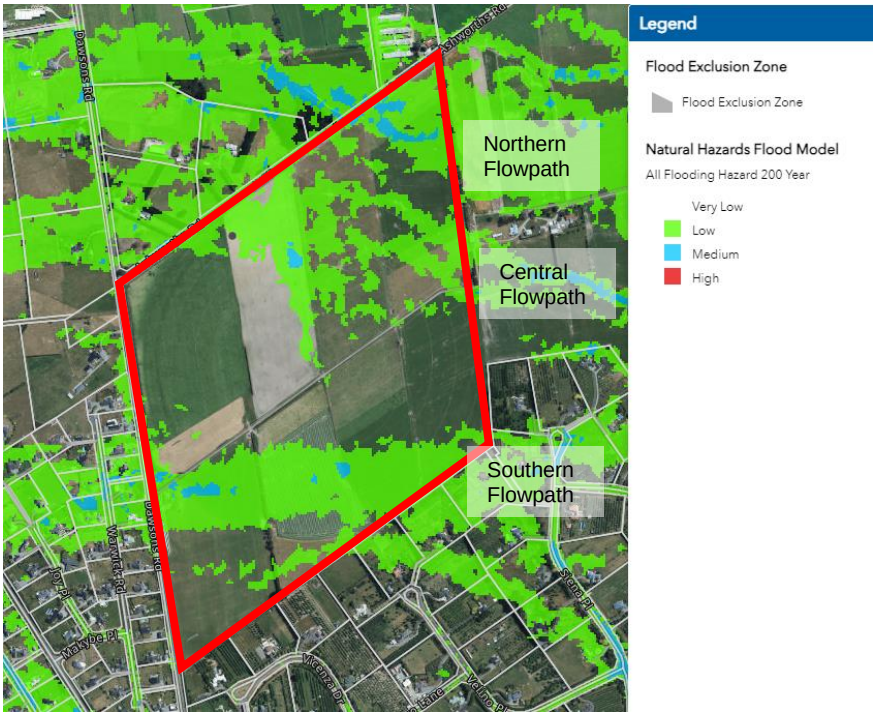

Figure 2. WDC Flood Risk Map (WDC Natural Hazards Map)

17 Waimakariri District Council's flood risk map indicates that majority of the site is located within a "low" or "very low" flooding hazard area. There are only isolated areas of "medium" flood hazard.

18 Geotechnical investigations have indicated that although there are some areas with poorly drained surface soils (i.e. clay and loam), the site is underlain by sandy gravels, with groundwater levels approximately 1-2 metres below ground level (based on surrounding Environment Canterbury Groundwater Measurement Bores). Based on these conditions it is expected that the vast majority of rainfall on the site infiltrates to groundwater.

19 The three flowpaths flow across the site as described above are generally split into two catchments (the northern and central flowpaths combine just east of the site) both of which eventually discharge into the Waimakariri River via the Kaiapoi River and Ohoka Stream.

20 The catchment that receives the northern and central flowpaths flows to a well-formed channel which flows east away from the site, crossing Bradley's Road approximately 1700 meters east of the site.

21 The southern flowpath flows toward Siena Place, which intercepts runoff and discharges flood flows to the southeast.

22 Resurgent groundwater has occurred within the site in the past. Resurgence following a sustained period of heavy rains in June and July of 2014 resulted in flooding to properties to the south and east of the site. This flooding mainly occurred as a result of uncontrolled discharges and insufficient capacity in the downstream drains.

THE PROPOSAL

23 Mark and Melissa Prosser of Ohoka Farm Holdings Limited (**OFHL**) seek to rezone 2 Ashworths Road to Large Lot Residential in the pWDP, with an outline development plan **(ODP**) applied to the site. The rezoning would enable development of the land down to a minimum allotment area of 2,500m², with an average allotment area of 5,000m². Accounting for the space required for civil infrastructure including roading, stormwater facilities and greenspace, an approximate yield of 115 households is anticipated.

24 I have reviewed and provided feedback on the ODP (Figure 3, below) to ensure that the internal layout site will maintain the status quo for stormwater and groundwater runoff to the greatest extent possible. Key features of the ODP related to stormwater and flood management are:

a) The proposed swale network will utilise existing site topography and overland flowpaths along the road network to manage the stormwater and groundwater run-off to fall towards the proposed Stormwater Management Areas (SMAs);

b) Two SMA areas are identified and located with consideration of the natural fall within the Site to accommodate road run off / stormwater:

i. One to the east (referred to as the eastern SMA) of the site will be 1.50ha in size and positioned along the boundary of the existing rectangular Lot 8 DP 314202. This eastern SMA will incorporate an existing stream, which will be retained and protected by a 5m setback and riparian planting.

ii. The second SMA 1.07ha (referred to as the southern SMA) is positioned along the middle of the southeastern boundary of the Site adjoining the San Dona development.

Each SMA will contain infiltration basins that are engineered to ensure an overall neutrality in the balance between surface and groundwater.

c) An existing spring along the northeastern boundary with further OFHL owned land is located about 140m from the eastern SMA reserve and flows into an existing stream along the Site boundary, which then connects into a stream beyond the Site. This existing stream will be naturalised with 5m riparian planting along both sides of the banks;

d) A second existing spring is also located along the northeastern boundary. Again, this will be maintained and protected with by a 5m no build setback;

e) Future impervious surfaces within each large lot residential lot will be routed to individual soakpits, which will be sized to infiltrate up to the 10 year ARI event.

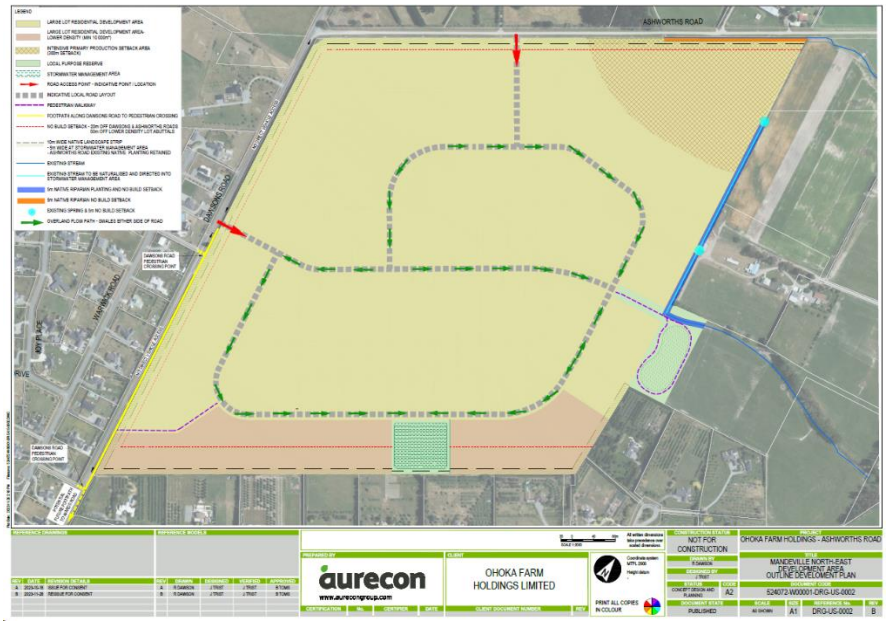

Figure 3. Outline Development Plan

f) A detailed groundwater investigation will be undertaken to understand and quantify the groundwater patterns on site. The investigation will seek to quantify the degree to which rainfall currently infiltrates and runs off, the depth to groundwater under various rainfall events, and the location and magnitude of groundwater resurgence on the site.

STORMWATER ASSESSMENT

Stormwater Management

25 Stormwater generated from large lot residential use of the Site will be managed to ensure that hydraulic neutrality is achieved. The proposed development will result in the addition of up to 20% impervious coverage of the site. The runoff from the added impervious areas will be managed through infiltration via a combination of individual and catchment-level soakpits. This will ensure that existing infiltration capacity of the area will be maintained.

26 Any stormwater generated from impervious surfaces within each future residential lot will be routed to individual onsite soakpits, which will be sized to infiltrate up to the 10-year ARI event. This will allow for distributed infiltration to occur, in the same location as the existing natural infiltration. This distributed infiltration is intended to minimize the risk of contributing to changes in groundwater resurgence patterns by ensuring infiltration occurs as close as possible to where it falls.

27 Stormwater generated from the proposed road network and excess runoff from sections (i.e., in excess of the 10-year ARI event) will be routed through a series of roadside swales to appropriately sized infiltration soakpits within the SMAs. These soakpits will ensure that surface runoff from the development will not exceed pre-development runoff rates.

28 Each SMA will be installed with soakpits that are extended through any sandy or silty topsoil layers into the underlying gravel layers. The SMAs have been sized based on conservative gravel infiltration rates (250 mm/hr) to provide soakage capacity for all durations, up to 120 hours based on HIRDS V4, with RCP 8.5 2100 climate projections. While it is intended that water quality treatment will take place in the roadside swales, there is sufficient area in the SMAs to provide additional first flush treatment, if required.

29 In addition to the soakage capacity, the SMAs are sized to capture the full volumetric difference for the pre vs post development runoff for up to a 24-hour duration. This provides assurance that stormwater discharges can be attenuated to existing discharge rates, regardless of infiltration capacity.

30 Existing overland flowpaths will be maintained through the provision of swales on either side of the proposed roading network. This will allow for floodwaters flowing onto the site from the west to flow across the site, ultimately remaining within the existing catchments without diversion of floodwaters between catchments.

31 It is anticipated that stormwater will be managed using a hybrid infiltration-attenuation system that would infiltrate most stormwater but allow for attenuated discharges downstream. This system would allow for infiltration of smaller events, with attenuated surface water discharges occurring during large events or during periods of high groundwater.

32 Alternatively, a traditional full attenuation system would attenuate peak flows, ensuring that downstream discharges do not exceed predevelopment levels, without relying on infiltration.

33 The proposed SMA areas have been sized to allow sufficient area for both of the above options, ensuring that the proposed layout shown on the ODP is appropriate for any of the potential stormwater management approaches.

34 Overall, the stormwater management will be designed to ensure stormwater neutrality for the proposed large lot residential development.

Groundwater Resurgence

35 Groundwater resurgence has long been identified as a potential issue for the Mandeville and Ohoka area of the Waimakariri District. The potential adverse effects of groundwater resurgence include:

(a) Flooding of structures as a direct result of location within or immediately adjacent to the groundwater resurgence;

(b) Damage to roading infrastructure directly resulting from being within or immediately adjacent to the resurgence;

(c) Flooding to properties, both onsite and offsite, due to groundwater resurgence being unmanaged by drainage infrastructure or blocked flowpaths;

(d) Downstream flooding effects due to insufficient capacity in drainage networks to handle combined groundwater resurgence and flood flows; and

(e) Blocking or filling groundwater resurgence areas could result in redirection of groundwater and cause resurgence in offsite locations.

36 As noted above, a detailed groundwater study should be undertaken prior to any detailed design for future development of the Site to confirm groundwater levels, identify any potential resurgence locations and to inform groundwater and infiltration management approaches.

37 Where groundwater resurgence locations are identified, they, and their downstream flowpaths will be treated the same as overland flowpaths, with restrictions on fill and development activities that maintain their function and capacity. The flowpaths will maintain connectivity with the overall stormwater network to the points of discharge from the site. Formalising these flowpaths will have the benefit of significantly reducing the risk of unanticipated groundwater discharges impacting downstream properties.

38 I have examined aerial imagery of groundwater resurgence flows within the site during the 2014 event. It is apparent that these flowpaths coincide with mapped flood paths, which are independent of groundwater flows. This indicates that groundwater management and flood management are complimentary and many of the measures undertaken to manage flooding hazards will also be effective in managing groundwater resurgence risks.

39 Should groundwater resurgence locations overlap with any planned roading, this can be managed through either locally realigning the road away from the resurgence areas, or providing an appropriate subgrade with subsoil drains as necessary to prevent damage to the roadway structure.

40 Future dwellings can be sited well away from any identified groundwater resurgence locations with the large lot sizes assisting with this. If required, suitable building platforms can be identified as part of any subdivision consent, with appropriate restrictions on development within groundwater resurgence zones and their downstream flowpaths. Based on rural residential development located within Mandeville, the average house size[1] is likely to be approximately 275m^2. Based on lots averaging 5000m^2 in area, future dwellings will have sufficient space within individual sections to be located

[1] Economic evidence of Mr Colegrave for OFHL

well setback from any identified spring and or groundwater resurgence locations.

41 While groundwater resurgence has resulted in issues due to insufficient capacity in downstream drains, this proposal will not adversely affect this – the existing groundwater resurgence flows will be managed without either increasing or redirecting groundwater resurgence.

42 I also note that the use of infiltration soakpits on each new lot would allow infiltration from impervious areas to occur as close to the point where the rain naturally falls as possible. This will ensure that existing infiltration patterns are maintained, without contributing to new groundwater resurgence issues.

43 Stormwater infrastructure would be designed to maintain its primary stormwater function during sustained periods of groundwater flows. All proposed drainage infrastructure (i.e. swales, culverts, and basins) can be sized to accommodate groundwater resurgence flows in addition to flood flows. Attenuation basins can be designed to include features that allow for bypassing groundwater resurgence flows, whilst maintaining their flood attenuation capacity.

44 The overall groundwater management strategy and the balance between attenuation and infiltration can be modified as needed to ensure neutrality in the balance between surface and groundwater, as informed by the results of groundwater investigations.

Stormwater Quality

45 Water quality will be provided through engineered grass swales adjacent to the roading network. The flat-bottomed swales will remove sediment and particulate contaminants prior to infiltration to ground or surface discharge in the SMAs. Swale treatment is a widely accepted methodology for removing a broad range of contaminants from stormwater which has been successfully used in similar low density developments.

46 The SMA areas are also sufficient to provide for additional first flush treatment of the stormwater, should additional treatment be required prior to discharge.

FLOOD MANAGEMENT ASSESSMENT

47 As detailed above, the proposed development will maintain existing overland flowpaths without causing diversion or impoundment. This will ensure that floodwater and groundwater continues to move across the site without adversely impacting surrounding properties.

48 The predominant "low" and "very low" flood hazard ratings[2] of the site indicate that development can occur within the site without imparting significant risk on people and property.

49 Where development occurs within existing flood areas and overland flowpaths, structures will be elevated with required freeboard above the modeled flood levels, dependent on the hazard category. As most of the site is rated "low" or "very low" risk, 300-400 mm of freeboard would be required at most locations. The resulting elevation above surrounding ground would generally be limited to 400-700 mm. Given the limited areas of the site with "medium" risk ratings, it is anticipated the site can be designed to ensure structures are located outside of these areas.

50 Based on the slow velocities of flood flows, relatively low maximum impervious coverage of 20%, and small size of the proposed building platforms in relation to the floodplain (maximum building coverage of 20% of the net site area) , there is no expected impoundment or diversion effect from the building platforms. In large floods it is expected that water would move around the building footprints.

51 Appropriate freeboard will be provided, by elevating the building platforms above the flood levels, in compliance with WDC guidelines. This can typically be accomplished with building platforms constructed less than 1 metre above the surrounding terrain.

CONCLUSION

52 In my view the proposed rezoning in the submission made by Mark and Melissa Prosser can be supported from a stormwater and flood management perspective, and there are multiple options that can be engineered to achieve

[2] Waimakariri District Natural Hazards Interactive Viewer (https://waimakariri.maps.arcgis.com/apps/instant/portfolio/index.html?appid=c6bc05f87d4f47ecae975e5241657913)

the required outcomes. I consider that there are no stormwater or flood management reasons why the proposed rezoning could not be approved.

53 Thank you for the opportunity to present my evidence.

David Delagarza
5 March 2024