BEFORE THE HEARING PANEL
APPOINTED BY TIMARU DISTRICT COUNCIL

In the matter of	The Resource Management Act 1991 (the Act)
And	
In the matter of	The Timaru Proposed District Plan

Statement of Evidence of Benjamin Graham Throssell on behalf of Harvey Norman Properties (N.Z.) Limited

Flooding

8 April 2025

Qualifications and Experience

1. My full name is Benjamin Graham Throssell. I am a Senior Engineer and Service Leader 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 14 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 for numerous resource consent, (private) plan changes at Council hearings and in Environment Court on flood hazard matters around New Zealand. My recent experience includes developing flood hazard models for the Esk Valley following the catastrophic Cyclone Gabrielle flood events in 2023 as well as leading a team to quantify the severity of the 2023 Auckland Anniversary flood events on behalf of Auckland Council.

3. I prepared the report titled "Timaru District Council Flood Assessment Areas" (9 Dec 2022) which investigated the potential change to the flood assessment areas due to the upgrade of the SH1 and railway culverts. I am familiar with the provisions of the Proposed Timaru District Plan.

Code of Conduct

4. I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. I have complied with the Code of Conduct in preparing this evidence and agree to comply with it while giving oral evidence before the Hearing Commissioners, as if this were a hearing before the Environment Court. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express. This evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

Introduction

5. I appear in relation to Submission No. 192 by Harvey Norman Properties (N.Z.) Limited, the owner of the Site.

6. The submission made by Harvey Norman covers matters associated with the Planning Maps, Part 1, Part 2, and Part 3 of the Proposed Plan.

7. The particular matter and submission point that this evidence addresses relates to the flood assessment area.

8. In preparing this evidence, I have read the s42A report prepared by Andrew Willis, including Appendix 8 (Nick Griffiths) and Appendix 9 (Kevin Kemp).

The Submission

9. The Harvey Norman site is described by **Mr Treacy** in his evidence in chief.

10. The s42A report prepared by **Mr Willis**, which refers to the technical assessment undertaken by **Mr Kemp,** recommends that the submission to reduce the extent of the Flood Assessment Area overlay be rejected. This recommendation is made based on:

(a) An updated hydraulic model constructed by WSP of the 0.5% AEP[1] rain event with an allowance for climate change (RCP 8.5[2] 2090);

(b) Localised flooding of the site predicted by the model ; and,

(c) Flooding within the Harvey Norman building itself predicted by the model. Mr Kemp considers this level of flooding may be plausible for the ground floor, warehouse level of the site.

11. For the design event (0.5% AEP with climate change), comparison of the PDP and WSP flood models shows similar predictions for flood hazard and flood levels in the vicinity of Te Ahi Tarakihi Creek and at the Harvey Norman site. The model builds are also similar, utilising the same design rainfall and similar hydraulic constraints. I have not completed a detailed comparison of the two models, but I am satisfied they predict very similar flood levels and flood hazards.

12. The discrepancy in flood assessment area arises from the interpretation of the model results. I have delineated the flood assessment area using the fluvial source (Te Ahi Terakihi Creek) and without the pluvial[3] source (localised flooding within the building itself). Mr. Kemp includes the pluvial flooding within the delineation of the flood assessment area. For clarity, I have marked the fluvial and pluvial sources on **Attachment 1.** This attachment uses the WSP design model results (0.5% AEP with climate change).

13. In this specific location, the predicted pluvial flooding within the building footprint appears to be primarily caused by a discrepancy in the Digital Terrain Model (DTM) used in the WSP hydraulic model. Hydraulic models simulate water flow based on three main inputs:

(a) Boundary conditions, which control how water enter and exit the model. For this model, water is applied via a rainfall event and exits at the downstream boundary (Creek/Tidal interface);

(b) Digital Terrain Model (DTM), this is a bare earth 3D model. Bare earth means that buildings, vegetation and other above ground features have been digitally removed; and,

(c) Roughness values, this represents the surface land use. The higher the roughness value, the more impeded the flow will be. For example, thick vegetation has a higher roughness value than a car park.

[1] AEP: Annual Exceedance Probability, the probability that an event will be exceeded in any given year

[2] RCP: Representative Concentration Pathway, 8.5 allows for a warming scenario of 8.5 w/m^2 and is generally considered a conservative climate change scenario

[3] Pluvial: Flooding from localised rainfall

14. The DTM is typically derived from LiDAR. LiDAR measures surface elevation using laser pulses. Standard processing is required to create a 'bare earth' DTM, involving automated algorithms to digitally remove features like buildings and dense vegetation. This process can sometimes introduce inaccuracies, particularly around complex features or where older algorithms were used. In the Assumption and Limitations of the WSP document provided[4] by Mr Kemp, it states: *"Ground level information used in preparing this model is based on LiDAR flown in 2010 (Timaru urban); includes the modification for the Showgrounds area and the Harvey Norman development; and extended with Canterbury LiDAR (2018-2019 and 2020-2023) from LINZ Data Service."* The large majority of the Harvey Norman site is only covered by the 2010 LIDAR.

15. It is my opinion that the algorithm applied to the 2010 LiDAR appears to have overcompensated when removing the Harvey Norman building footprint. This appears to have inadvertently created an artificial localised large depression in the DTM where the building is situated, causing the model to predict pooling of water in that location.

16. This interpretation is supported by interrogating the 2010 LiDAR surface which indicates that:

    (a) Mapped depression areas (locations where water would theoretically pond based on the 2010 LiDAR surface) align closely with the building footprint and the areas of pluvial flooding predicted by the WSP model (shown in **Attachment 1**);

    (b) Calculated overland flow paths, derived from the 2010 LiDAR, show water being directed into these artificial depression areas within the building footprint;

    (c) The contributing catchment areas feeding these specific overland flow paths are relatively small, totalling approximately 4 ha (shown on **Attachment 2**)

17. **Attachment 3** further illustrates this DTM anomaly using cross-sections derived from the 2010 LiDAR. Both Section A (west-east) and Section B (north-south) show abrupt, artificial drops in elevation within the DTM that coincide directly with the Harvey Norman building footprint.

18. In contrast to the 2010 LiDAR DTM, **Attachment 4** provides actual ground-truth data from a topographic survey conducted in 2022. This survey confirms the site is well-graded and slopes gently from north to south, with no evidence of the significant depression indicated by the older LiDAR processing. (Note: The 2022 survey uses NZVD 2016 datum, while model elevations use LVD37, but the relative topography is clear).

19. Visual confirmation is provided **in Attachment 5**, a Google Street View image of the Harvey Norman building and surrounding site. This clearly shows:

    (a) Site topography consistent with the 2022 survey, appearing to drain towards the south; and

    (b) No visual indication that the building sits within a depression, contradicting the elevation in the processed 2010 LiDAR DTM.

[4] Email from Kevin Kemp (TDC) to Ben Throssell (PDP) on 03/04/2025

20. Based on this analysis, while the WSP model accurately simulates flow based on the DTM it was provided, the DTM itself appears erroneous in the specific area of the Harvey Norman building due to how the 2010 LiDAR was processed.

21. The actual site topography, confirmed by the 2022 survey and visual inspection, does not support the model's prediction of significant pluvial flood water accumulation within the building footprint.

22. Furthermore, even if minor surface flows were directed towards the building area, the contributing catchments are small (approx. 4 ha total). A rational method calculation[5] estimates peak flows of approximately 200 L/s per catchment during the design event (0.5% AEP with climate change). These are relatively minor flows for such an event and would typically be expected to be conveyed via existing site drainage, parking areas, and road corridors on a well-graded site, rather than causing inundation of the Harvey Norman building.

Conclusion

23. The WSP hydraulic model, generally predicts similar results to the previous PDP assessments. The WSP model identifies localised pluvial flooding within the Harvey Norman building footprint for the 0.5% AEP climate change scenario.

24. My investigation concludes that this specific prediction of internal pluvial flooding appears to result from the processing of the 2010 LiDAR data used for the model's DTM. This dataset appears to have incorrectly interpreted the building footprint as a topographic depression (**Attachments 2 and 3**). This depression collects localised rainfall from the upstream catchment.

25. More recent and more accurate site information, including a 2022 topographic survey (**Attachment 4**) and visual site inspection (**Attachment 5**), demonstrates that the site is well-graded, slopes generally south, and the building is not situated within a depression.

26. Furthermore, the contributing catchments for any such localised pluvial flow are minor (approx. 4 ha total), generating relatively small peak flows in the design flow event, which would likely be managed by site drainage and surrounding paved areas.

27. Consequently, it is my professional opinion that the risk of pluvial flooding within the Harvey Norman building, as predicted by the model due to the LiDAR anomaly, is negligible and does not reflect the actual site conditions or hazard.

28. I therefore support the submission's request (Submission No. 192) to amend the Proposed Plan's Flood Assessment Area overlay to remove the extent derived from this erroneous prediction of pluvial flooding within the building footprint.

[5] Christchurch City Council Waterway Wetland and Drainage Guide

Ben Throssell
BE (Hons)

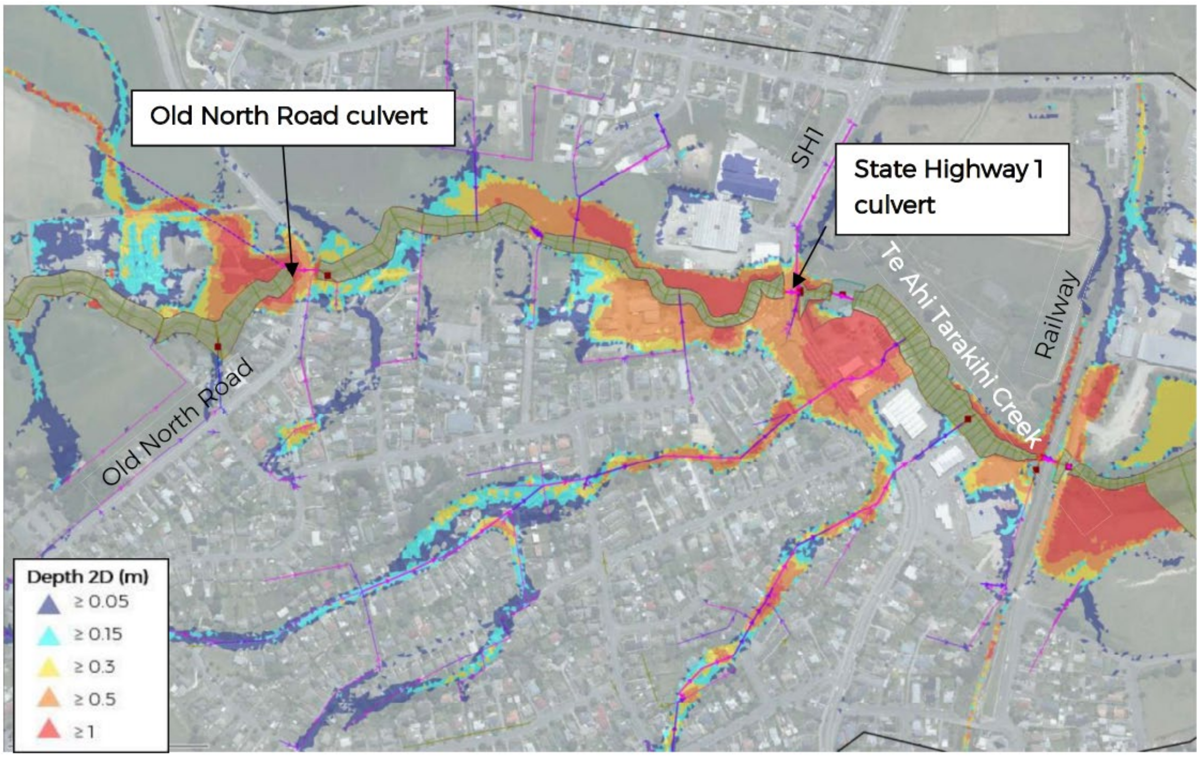
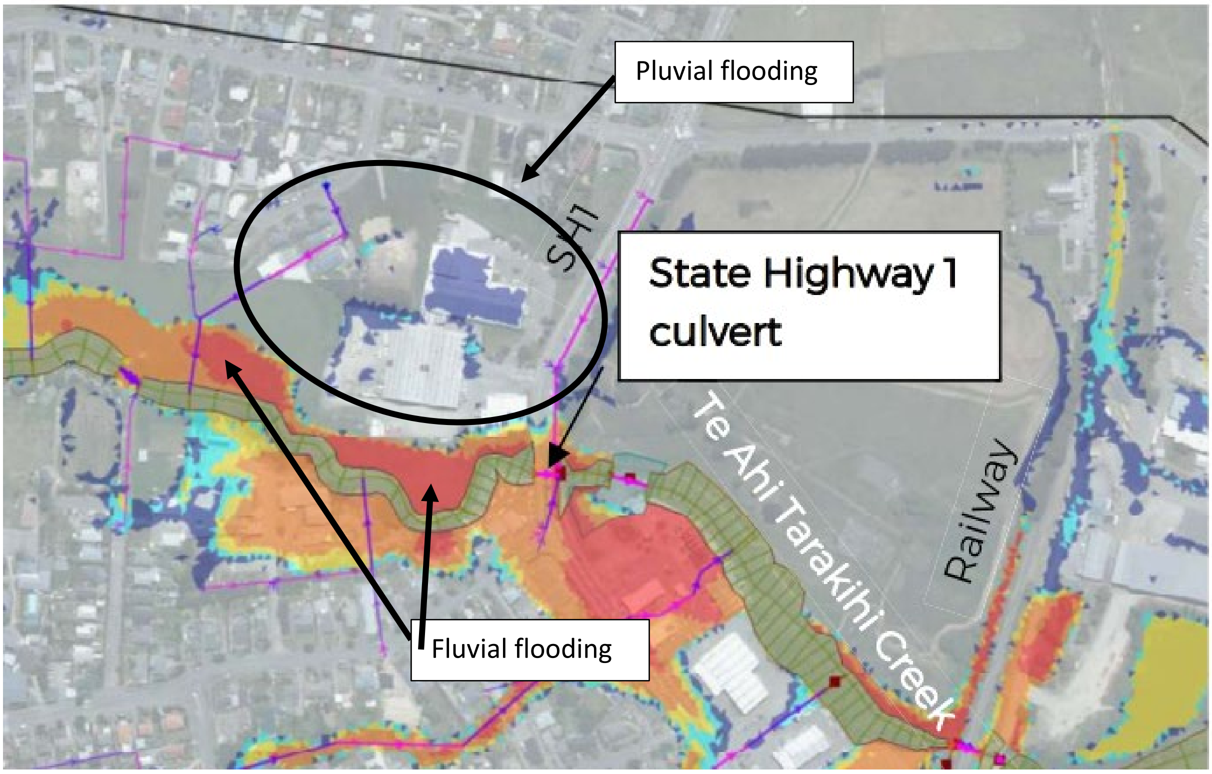
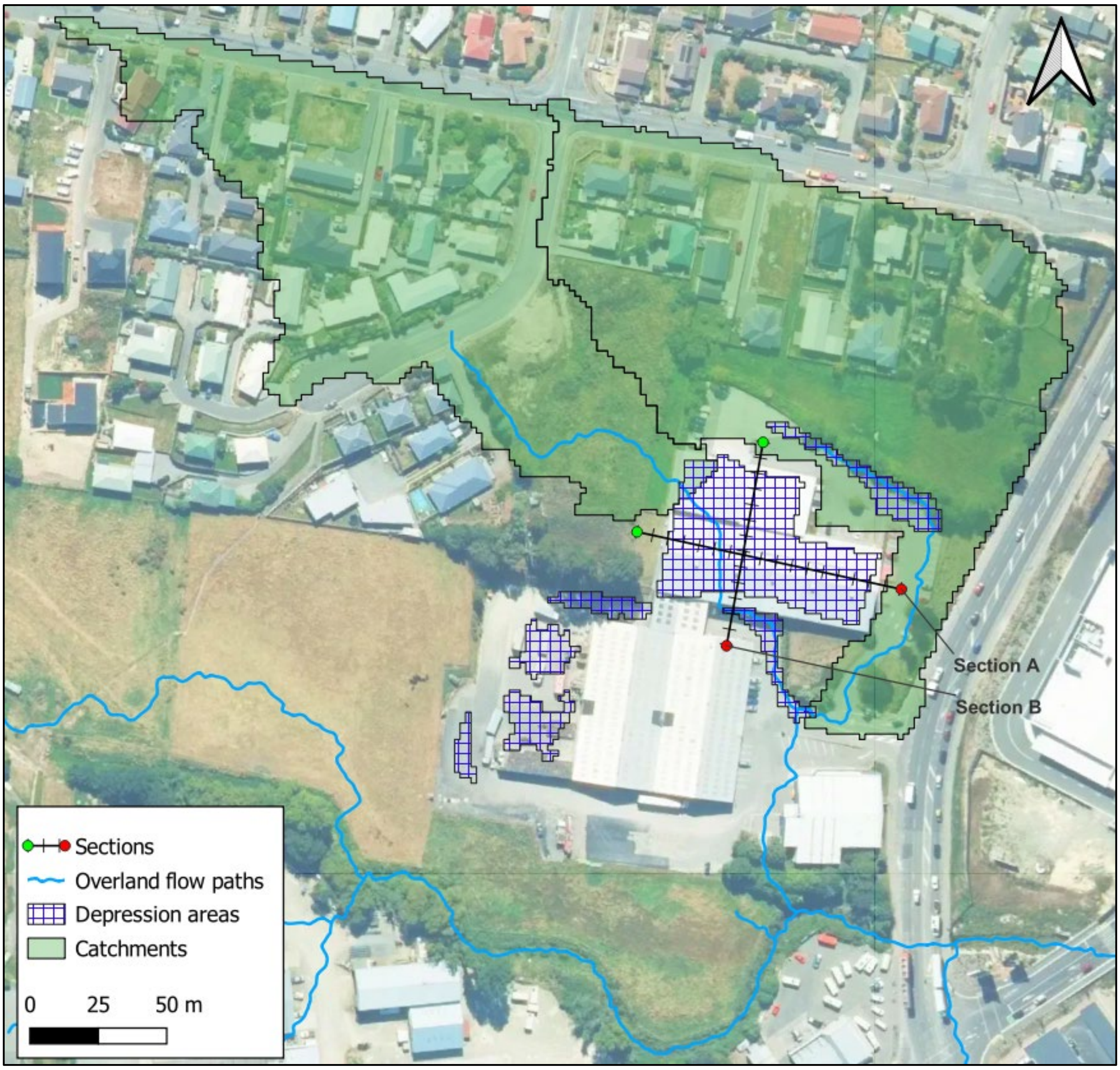


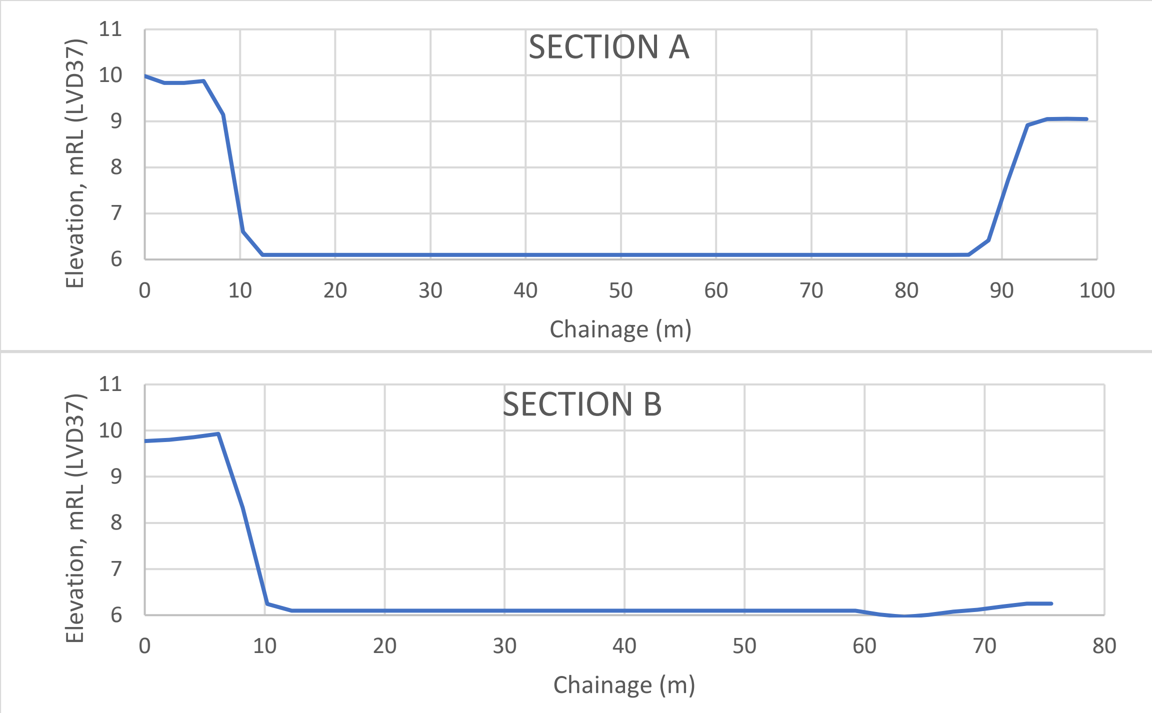
Figure A-10 Existing (no bunds) flood extent for the 0.5% AEP event (RCP8.5 2100 climate change).



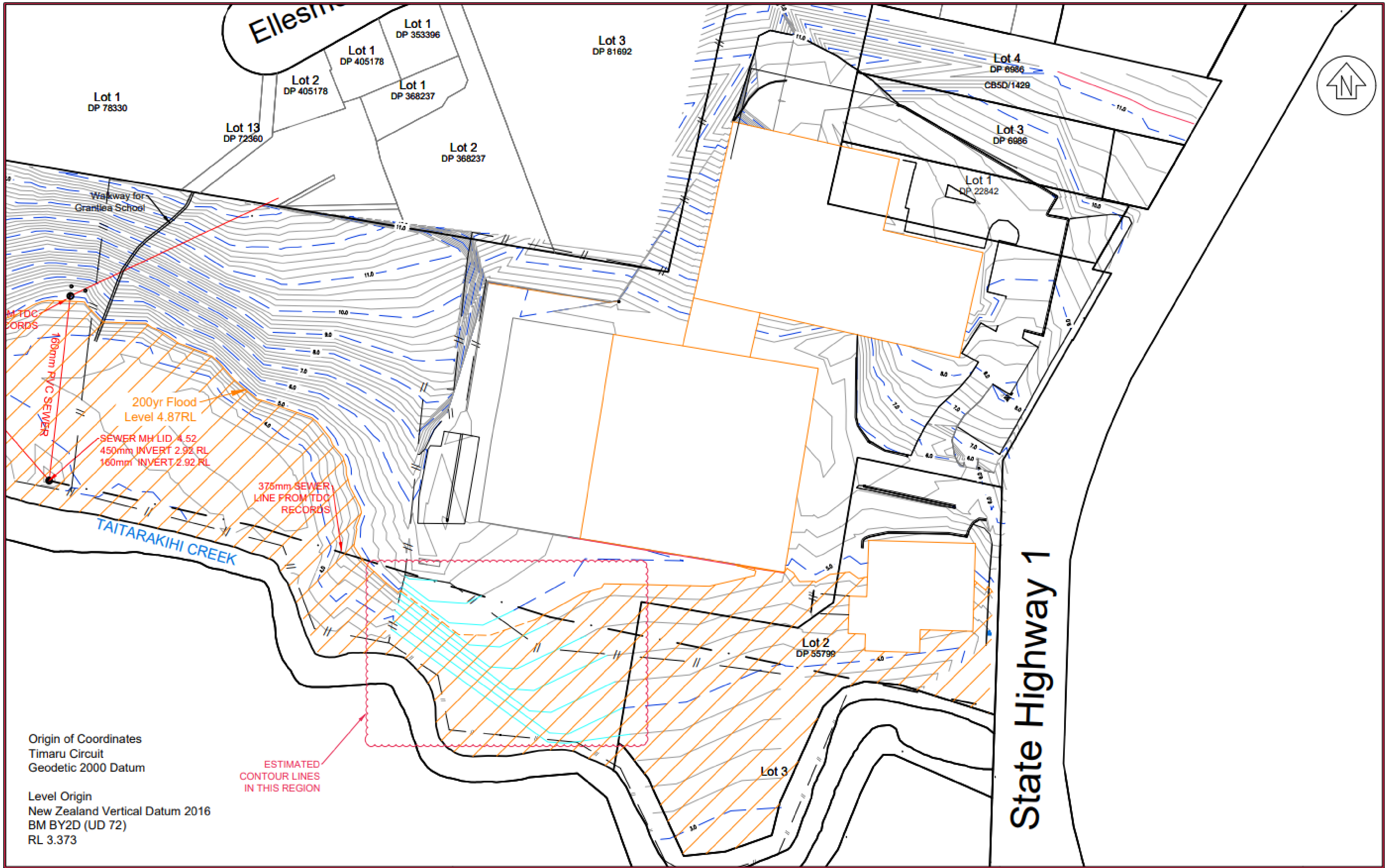
Attachment 1: Catchment wide (top) and site specific (bottom) flood depth maps. Flood depth maps are provided by WSP (via Mr Kemp). The fluvial and pluvial flood sources for the Harvey Norman site are annotated on the lower figure.



Attachment 2: Overland flow paths, depression areas, section lines and catchments



Attachment 3: Section lines A and B. The location of the section lines are shown in Attachment 2.



SCALE 1:1000 @A3 | Date :November 2022

Applicant: Harvey Norman Properties (NZ) Limited
C/- Haines Planning PO Box 90842
Victoria Street West AUCKLAND 1142

Surveyed BH
Drawn BH
Amended BTD Dec. 2022
Amended

Topographical Survey 226 Evans Street State Highway 1 ,Timaru
Lots 3 ,3A, 4 & 4A DP 6986,Lot 1 DP 22842 ,Lots 1 & 2 DP 55799

milward finlay lobb
PLANNERS | SURVEYORS | ENGINEERS

6 THE TERRACE
PO BOX 434
TIMARU 7940
PH 03 684 7688
ADMIN@MFLNZ.CO.NZ
WWW.MFLNZ.CO.NZ

Client/Job No.
168271/03
Sheet 2 of 4

Attachment 4: 2022 Topographic Survey by Milward Finlay Lobb

Attachment 5: Google street view of the Harvey Norman building from SH1. Approximately taken from the end of Section 1 (Attachment 2)