

BEFORE THE HEARING PANEL

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of Proposed Plan Change 8 to the Operative Rotorua District Plan

**STATEMENT OF EVIDENCE OF SIMON JAMES AIKEN
ON BEHALF OF ROTORUA LAKES COUNCIL
(Flood hazard)
Dated 13 March 2026**

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INTRODUCTION

1. My full name is Simon James Aiken and I am Group Manager (Water), Project Director and Principal Water Resources Consultant at Tonkin & Taylor Limited (T+T).

Qualifications and experience

2. I hold a Bachelor of Science (Environmental Science and Physical Geography) and a 1st Class Master of Science (Physical Geography) from the University of Auckland (2009).
3. I have been employed as a Water Resources Consultant at T+T since 2016. My previous experience includes roles at Auckland Council as a stormwater catchment planner in the Infrastructure and Environmental Services Group and prior to that as a hydrologist with the University of Auckland.
4. My technical skills and experience directly relevant to my assessment include:
 - (a) Preparing stormwater flood hazard models and interpretation of model outputs and results.
 - (b) Assessment of engineering options to manage the effects of development, flood risk and floodplain management.
 - (c) Assessment of hydrological changes due to land cover change, including the impact of climate change on stormwater runoff.
 - (d) Preparing Assessments of Environmental Effects (AEEs) as they relate to stormwater discharges, including water quality and flood risk.
5. I was engaged by Rotorua Lakes Council (Council) to provide technical advice on flood hazards for Council's Proposed Plan Change 8 (Natural Hazards) (PC 8).

Code of conduct

6. I have read the Environment Court Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2023 and agree to comply with it. I confirm that the opinions expressed in this statement are within my area of expertise except where I state that I have relied on the evidence of other persons. I have not omitted to consider materials or facts known to me that might alter or detract from the opinions I have expressed.

Scope of evidence

7. My evidence responds to submitter concerns about fluvial and pluvial flood hazard mapping affecting specific properties, which has resulting implications for the rules and policies that apply to these properties.
8. In preparing this evidence, I have:
 - (a) Reviewed the *Western Catchment Flood Hazard Mapping Model Build Report* (T+T, March 2025) (Western Catchment Flood Model) to confirm the hydrological and hydraulic parameters applied to the district-wide modelling. I have also reviewed the technical reporting for the Bay of Plenty Regional Council's (BOPRC's) *Greater Utuhina Catchment Model* (or GUCM) to understand the boundary conditions and distinct fluvial mechanisms relevant to the Trade Central site.
 - (b) Assessed the specific technical issues raised in the submissions of Mitch Collins and Tamson Armstrong (Submission 17), Fonterra Limited (Submission 43), and Pukeroa Oruawhata Trust (Submission 55), including the *Engineering Services Report* by Cheal Consultants submitted in support of 72 Sophia Street.
 - (c) Undertaken a desktop review and analysis of the hazard layers, LiDAR topography, and stormwater network data to verify the validity of the mapped extents against the physical terrain.

9. As part of previous engagements with Council which have included catchment walkovers, I am familiar with the sites discussed as part of my evidence.

EXECUTIVE SUMMARY

10. My evidence assesses submitter concerns regarding the validity of flood hazard mapping affecting specific properties. I conclude that the Western Catchment Flood Model provides a robust basis for identifying district-scale flood hazards.
 - (a) **72 Sophia Street:** I consider the current mapping accurate as it reflects the physical reality of the existing landform. The site is located well within the model domain, negating concerns regarding edge effects. While mitigation works are consented, they are physically incomplete, and the supporting engineering design relies on superseded rainfall data (HIRDS v3) rather than the current HIRDS v4 data used in the Council's model.
 - (b) **40 Marguerita Street:** I find no evidence of error in the LiDAR or modelling. The mapped ponding coincides with physical depressions and on-site catchpits where inlet capacity would likely be exceeded in a 1% AEP event. These areas remain after data cleaning, confirming they represent genuine depression storage rather than data artifacts.
 - (c) **Rotorua Central Mall and Trade Central:** Differences between the Western Catchment Flood Model (T+T) and the Regional Council's Greater Utuhina Catchment Model reflect distinct flood mechanisms. The T+T model correctly simulates pluvial (direct rainfall) risk and local drainage constraints, which is a valid hazard separate from the fluvial (riverine) risk shown in Regional Council modelling.

11. Overall, it is my opinion that the concerns raised do not demonstrate fundamental errors in the modelling methodology or its application.

CONTEXT FOR EVIDENCE

12. PC 8 proposes to retain the rules to manage flooding that were introduced by Plan Change 9 – Housing for Everyone and extend these to the Lakes A Zone. Under these rules:
 - (a) Most new buildings would need to meet minimum floor levels designed for the 1% AEP flood event with an allowance for climate change for RCP8.5 to the year 2130 (or the most recent national or regional guidance) and freeboard (Rule NH-R4(2)).
 - (b) Resource consent and a flood risk assessment would be required for new buildings in areas where flood depths exceed 300mm in a 1% AEP flood event with allowance for climate change for RCP8.5 to the year 2130 (or the most recent national or regional guidance) (NH-R4(4)).
13. As described more fully in the evidence of Paula Meredith, implementation of these relies upon the description of the design flood, rather than the adoption of hazard maps in the District Plan. There are several sources of potential flood hazard information to assist with implementation of the District Plan, including:
 - (a) Council’s urban flood model(s);
 - (b) BOPRC’s Greater Utuhina Catchment Model and other emerging catchment modelling by BOPRC;
 - (c) BOPRC’s lake design levels recommendations;
 - (d) The emerging regional flood hazard model by Waikato Regional Council;

- (e) The National Flood Tool developed by NIWA (although noting it is not intended as suitable at a property scale); and
 - (f) Information commissioned to support specific developments.
14. The best models, in that they represent the most current and best available information readily and practicably accessible to Council are:
- (a) Council's urban flood model(s) and
 - (b) BOPRCs Greater Utuhina Catchment Model

EVALUATION OF SUBMISSIONS

15. Three submitters have raised concerns about the hazard mapping that is shown over specific properties:
- (a) Mitch Collins and Tamson Armstrong (submission 17.1) oppose flood hazard mapping at 72 Sophia Street. The submitters consider that this hazard layer is derived from a generic city-wide flood model that relies on outdated topographic data from a 2020 LiDAR survey, which captures the property in its pre-development state but fails to take into account subsequently constructed swale and on-site soakage systems and raised ground levels that form part of the 'consented environment', which are legally required to be constructed (to achieve consent notice requirements relating to minimum building platform levels and stormwater disposal on-site for a 10% AEP storm event). The submitters also state that stormwater drainage infrastructure on the adjacent golf course is not considered in the modelling and introduces a further, unquantified error into the model's simulation for this specific location. Additionally, the property is at the fringe of the modelling area, where model accuracy is less than in areas where more granular Council network data was made available.

- (b) Fonterra Limited (submission 43.1) is concerned about the accuracy of the Western Catchment Flood Model and the resultant resource consenting implications. With respect to its Farm Source site at 40 Marguerita Street, it notes that the modelling shows "puddles" with depths 0.1-0.3m, which they do not understand since these are over a 'completely flat concrete manoeuvring and parking area'. Fonterra questions whether these "puddles" should have been removed in the cleaning process discussed in the model build report. Fonterra is concerned that it would unnecessarily need to submit a flood risk assessment to support potential future development of the site under Rule NH-R4.
- (c) Pukeroa Oruawhata Trust (submission 55.1) is concerned about flooding overlays affecting its sites at Rotorua Central Mall and Trade Central. The submitter states that it is opposed to a scenario in which floodwaters may now pose a risk of inundating its buildings, disrupting tenant operations, resulting in revenue loss, triggering insurance claims, or necessitating costly mitigation measures such as retrofitting or raising floor levels. It notes that reclassification of these areas as flood-prone may adversely affect their insurability, posing further financial and operational risks.

72 Sophia Street

16. The submitters oppose the inclusion of the flood hazard overlay on their property at 72 Sophia Street. They submit that the mapped hazard is incorrect for two key reasons:
- (a) Firstly, that the reliability of the hazard mapping is questionable because the site is allegedly located on the boundary of the model, potentially subjecting it to computational edge effects.
- (b) Secondly, that the Council possesses "better information" in the form of approved Subdivision Consent SD19-016607 and the

associated Cheal Consultants engineering design, which details specific flood mitigation works.

17. The submission states that the property is "located on the boundary of the model" and suggests the data may be unreliable due to edge effects. I do not consider edge effects to be a concern in this case as 72 Sophia Street is situated well within the active domain of the model, with the actual catchment boundary located several kilometres away. Consequently, the mapped flood extents are derived from stable hydraulic calculations and are not subject to boundary-related computational errors.
18. The submitters assert that the Council's model is superseded by "better information" contained in the Cheal Consultants report. In my opinion, the Council's modelling represents the most current and accurate assessment for two primary reasons:
 - (a) The flood hazard mapping is based on a 2020 LiDAR survey which captures the property and surrounding catchments in its current physical state. While the consent authorizes earthworks as part of the flood mitigation works the submission explicitly acknowledges that "the substantial physical earthworks required to implement these consent conditions are yet to be completed."
 - (b) The hydrological inputs underpinning the Cheal design are not consistent with current best practice. The Cheal report utilized HIRDS v3 rainfall data, which was appropriate at the time but has since been superseded by the HIRDS v4 data used in the Council's model.
19. I acknowledge the submitter's photographic evidence indicating that the grassed swale drain has been constructed. While this demonstrates progress toward the consented solution, it represents only one component of the required flood mitigation strategy.

20. The engineering design supporting the onsite swale uses HIRDS v3 rainfall data, which has since been superseded by the HIRDS v4 rainfall data used in the Council's current modelling. HIRDS v4 generally predicts higher rainfall intensities for the critical storm duration(s) relevant to a catchment of this scale. The higher rainfall intensities predicted by HIRDS v4 would generate greater peak flows than HIRDS v3, resulting in increased flow depths within the fixed channel geometry. This would consequently reduce the available freeboard. While I have not undertaken a re-calculation of the swale design, the change in hydrological standards will have implications for the swale's hydraulic performance. I would note that the consented minimum building platform level is RL301.12m (Moturiki Datum 1953) for any future habitable building, which is approximately 0.47m higher than the flood levels predicted by the Western Catchment Model for the site.
21. The submitter also relies on the presence of on-site soakage systems as part of the flood mitigation strategy. The Cheal engineering design confirms these private systems are sized only for the 10% AEP event and rely on superseded HIRDS v3 rainfall data. The Council's model utilizes current HIRDS v4 rainfall data, which generally predicts higher rainfall depths and intensities. Consequently, the storage capacity of these systems is likely overstated relative to current hydrological design standards, meaning they would be overwhelmed earlier in a storm event than originally anticipated. The Council's model explicitly accounts for ground infiltration using a calibrated "continuing loss" rate of 33 mm/hr for the 1% AEP climate-adjusted event (Table 3-3 of the Model Build Report). During a 1% AEP storm, rainfall intensities significantly exceed this infiltration rate. Once the private soakage storage is filled (which occurs early in the event), the system's capacity is limited to the natural infiltration rate of the surrounding soil, which the model already captures. Consequently, the specific private soakage devices would be fully saturated and hydraulically insignificant during the peak of the flood. Excluding them from the district-wide model does not create an error;

rather, it reflects that these systems are overwhelmed during the 1% AEP event.

22. Based on the above it is my opinion that Council's flood model remains the most applicable for 72 Sophia Street. The swale and earthworks that have yet to be completed will be incorporated as a matter of course in future LiDAR updates and reviews of the hazard mapping.

40 Marguerita Street

23. Fonterra Limited opposes the flood hazard mapping at 40 Marguerita Street. The submitter questions the accuracy of the Western Catchment Flood Model, noting that it depicts "puddles" with depths of 0.1m - 0.3m across what they describe as a "completely flat concrete manoeuvring and parking area." Consequently, the submitter queries whether these mapped areas are errors in the LiDAR data or artifacts that should have been removed during the model's data cleaning process.
24. On this basis I have reviewed the flood hazard mapping for 40 Marguerita Street. In my opinion, there are no apparent errors in the modelling or the underlying LiDAR data (such as spurious data points striking gully traps), I explain further below:
 - (a) While the area may appear flat, a desktop review of the site indicates local variations in topography. This correlates to where water is accumulating in the flood model.
 - (b) There is evidence of overland flow directed towards the onsite catchpits. These assets are not currently recorded on the Council's GIS Viewer and, consequently, may not have been explicitly included in the model's pipe network or were excluded as the connecting pipe diameters were less than 225mm. Regardless, the inclusion of these catchpits would unlikely alter the presence of a flood hazard overlay as these small drainage features are typically designed to cater for the smaller 10% AEP event. In a 1%

AEP event the inlet and connecting pipe capacity would likely be exceeded and therefore would be ineffective resulting in the ponding / overland flow currently shown in the hazard map. In my opinion this approach is acceptable for a 'city-wide' model and consistent with similar models throughout New Zealand and Australia. Appendix A and Appendix B of my evidence illustrate points 24(a) and 24(b) in further detail.

25. It is important to note that the Western Catchment Flood Model utilizes a "cleaning" methodology to remove spurious data points common in rain on grid models. This process typically filters out flood extents based on a combination of depth (removing depths <100mm) and area (removing small, isolated puddles). Consequently, the fact that the ponding at 40 Marguerita Street remains visible in the final published hazard layers confirms that these are not minor data artifacts. They represent hydraulically connected depressions where flood depths and extents exceed the cleaning thresholds.

Rotorua Central Mall and Trade Central

26. I have reviewed the flood hazard mapping for Rotorua Central Mall and Trade Central using both the Greater Utuhina Catchment Model (GUCM) and the Western Catchment Flood Model. The submitter has not raised specific issues or provided alternative modelling to dispute the mapped extents.
27. It is important to clarify the distinction in model coverage between the two properties. The Trade Central site is located within the extents of both the Western Catchment Flood Model and the GUCM. In contrast, the Rotorua Central Mall falls outside the primary floodplain of the Utuhina Stream and is therefore covered only by the Western Catchment Flood Model. The differences in model extents are shown in Appendix C of my evidence.

28. As part of this review, it is important to acknowledge that some differences between the Western Catchment Flood Model and the GUCM are expected and reflect their different modelling methodologies. The Western Catchment Flood Model is a pluvial (direct rainfall) model designed to identify local runoff hazards, depression storage, and the exceedance of stormwater network capacity across the urban catchment. The GUCM is a fluvial (riverine) model specifically calibrated to simulate catchment-wide flows and channel breakout events from the Utuhina Stream.
29. My visual review of the mapped floodplain extents confirms that the Trade Central site is subject to two distinct flood mechanisms:
- (a) The GUCM indicates the site is within the primary overland flow path of the Utuhina Stream, predicting extensive inundation during a river breakout event.
 - (b) The Western Catchment Flood Model shows less extensive, localised ponding consistent with depression storage and local runoff interacting with the site's internal drainage.
30. The variation in flood extents, where the Western Catchment Flood Model shows widespread localised ponding and the GUCM shows contiguous floodplain inundation is a function of simulating different flood mechanisms (rainfall versus river breakout) and application of a freeboard allowance to the GUCM results rather than an error in either model.
31. Regarding the Rotorua Central Mall, I have undertaken a visual inspection of the site topography and stormwater network in relation to the model results. The mapped hazard extents appear valid, accurately identifying ponding in low-lying parking areas and overland flow paths consistent with the topography. This validity is further reinforced by the comparison at the adjacent Trade Central site; the fact that the Western Catchment Flood Model produces results that are compatible with the detailed

GUCM (once flood mechanisms are distinguished) provides confidence in the model's accuracy and application to the nearby mall site.

32. I consider that the mapped extents are comparable when accounting for these different mechanisms and the application of freeboard in the Regional Council modelling. On this basis, I consider the Western Catchment Flood Model to be fit for purpose. It provides a reasonable representation of the pluvial flood hazard that complements, rather than conflicts with, the fluvial hazard information provided by the Regional Council's GUCM modelling.

CONCLUSION

33. I have assessed the submissions from Mitch Collins and Tamson Armstrong, Fonterra Limited, and Pukeroa Oruawhata Trust regarding the flood hazard mapping for their respective properties.
34. For 72 Sophia Street, I consider that the current flood hazard mapping represents the physical flood risk of the existing landform. While a resource consent authorizes earthworks mitigation works, these have not yet been completed. Updating the hazard map prior to the physical implementation and verification of these works would inaccurately represent the current risk.
35. Regarding 40 Marguerita Street, I find no evidence of error in the underlying LiDAR or modelling. The mapped ponding areas coincide with physical depressions on the site. These areas remain flooded in the model even after standard data cleaning is applied, indicating they represent genuine depression storage during extreme rainfall events where the inlet capacity of private drainage would be exceeded.
36. For Rotorua Central Mall and Trade Central, the difference between the Western Catchment Flood Model and the Regional Council's Greater Utuhina Catchment Model reflects their different purposes (pluvial vs. fluvial). The Western Catchment Flood Model appropriately identifies

local rainfall runoff and drainage constraints, which is a distinct and valid hazard separate from the riverine flood risk shown in the Regional Council modelling.

37. Overall, I consider that the Western Catchment Flood Model provides a robust and reasonable basis for identifying flood hazards at a city scale. The specific concerns raised by these submitters do not demonstrate fundamental errors in the modelling methodology or application.

Simon James Aiken
Dated 13 March 2026

Appendix A



Figure 1: Aerial Photo (source Bayleys Real Estate listing #2451404) of 40 Marguerita Street. Note the staining of the concrete on the aerial photograph as overland flow is directed towards the onsite catchpits, indicating the direction onsite flows.

Appendix B

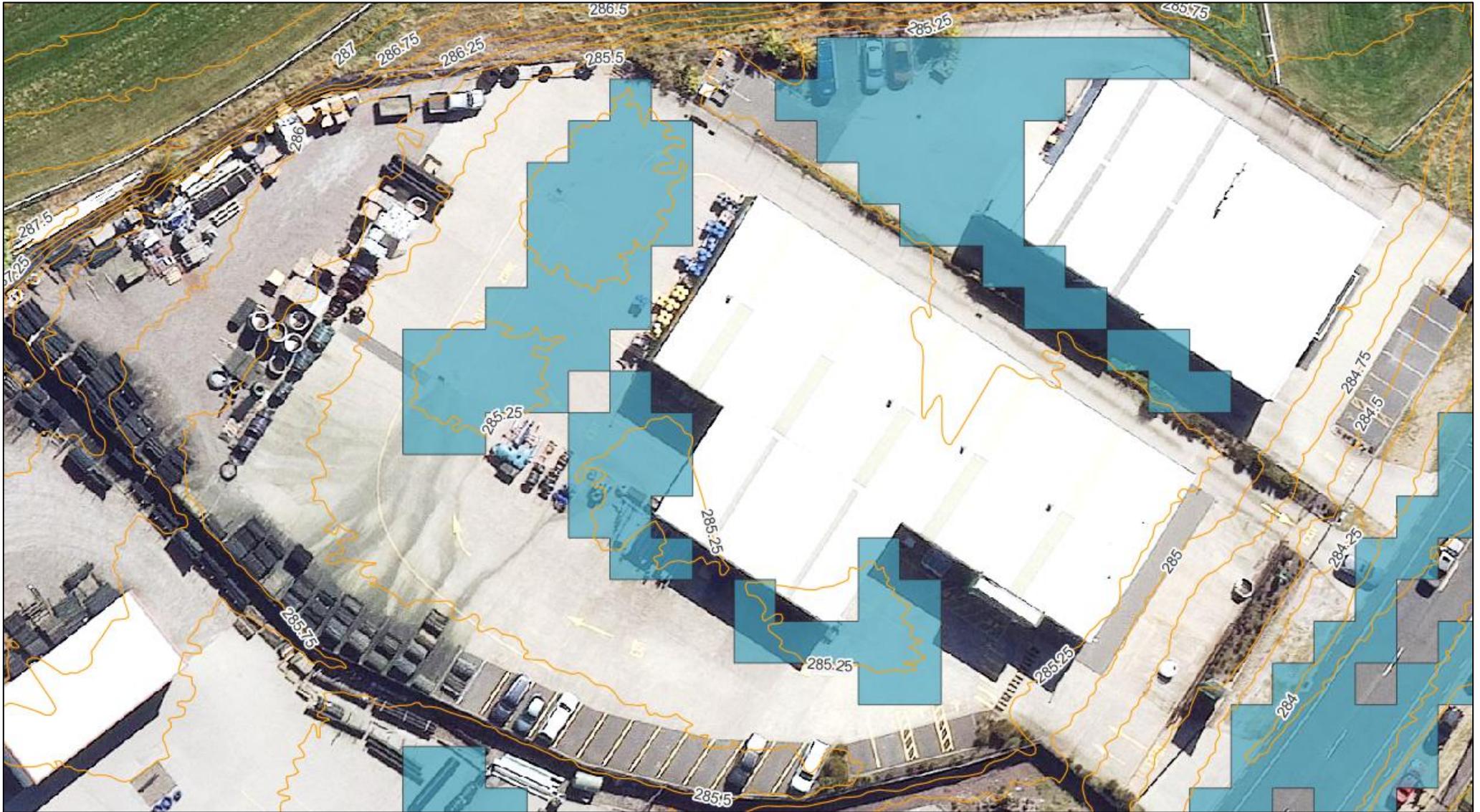


Figure 2: Aerial photograph of 40 Marguerita Street, including the 1% AEP RCP 8.5 flood extent overlay and local (LiDAR derived) contours. As shown in Figure 1 (Appendix A) staining of concrete pad is evident where overland flow discharges to two onsite catchpits, which correspond to the areas of ponding or other areas associated with the 285.25m RL contour.

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Appendix C



Figure 3: Figure showing the boundary (dashed red line) of the GUCM model alongside the 1% AEP RCP 8.5 flood depths from the Western Catchment Model. The Trade Central (western box) and Rotorua Mall (eastern box) site extents are also shown (orange and yellow dashes, respectively).

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