Pongakawa Plan Change

Pencarrow Estate, Arawa Road, Pongakawa

Natural Hazards Risk Assessment

8 December 2022

MOMENTUM
PLANNING AND DESIGN

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1.0 Bay of Plenty Regional Policy Statement

The Bay of Plenty Regional Policy Statement (RPS) is a higher order planning document that District Plans need to be consistent with. The RPS in Appendix L sets out a methodology to be followed for the assessment and consideration of natural hazards.

Policy NH 4B requires greenfield development areas to achieve a low natural hazard risk after completion of the development, without increasing natural hazard risk to other land.

Policy NH 9B requires an assessment of natural hazard risk at the time of land use change and subsequent subdivision of that land. This plan change application triggers the need for that assessment, particularly as land encompassing the plan change has an area greater than 5 hectares. For the purpose of this policy we have assumed that this relates to the developable land area as the policy relates to an urban site. The plan change area is 12.37ha of which approximately 8.15ha is classified as future developable land.

Policy NH 8A requires the assessment of the natural hazard risk to be completed at the time of plan development, and it is appropriate to consider those risks as part of this plan change process.

Context of Proposed Plan Change and Proposed Land Use Change

The application site has a developable area of 8.15 ha and is located within the Western Bay of Plenty District and accessed via Arawa Road, a local road that connects to State Highway 2 via a tee intersection. There is a small existing rural settlement, which is zoned Residential and has approximately 100 houses. The plan change is proposed to establish another 8 hectares of residential land with a small commercial zoned site of 2000m2 for a general store and doctors' surgery.

Pongakawa has reticulate water but no reticulated wastewater or stormwater systems. For the new Plan Change area, a package wastewater treatment system is proposed that will treat the wastewater from the dwellings and also from the waste from the commercial site. Stormwater is proposed to be treated via a stormwater wetland that will discharge to the farm drain to the west of the plan change area.

The land area is flat with some undulations which are proposed to be used as ponding areas during large scale flood events and will also function as overland flow paths. They will have a secondary function as passive open space for the residents of the plan change area and the existing Pongakawa community.

2.0 Identification of Hazards potentially affecting the Land

Appendix L of the RPS identifies a methodology for assessing the risk of natural hazards and proposes a methodology for quantifying the risk and likelihood of the natural hazard occurring. A secondary assessment relates to assessing the consequences of the risk sufficient to determine an overall risk classification low, medium or high.

Table 20 identifies the types of natural hazards and also prescribes the likelihood of the AEP event occurring[1].

Table 20[11] Likelihoods for risk assessment

Hazard	Column A: Likelihood for initial analysis+ AEP (%)#	Column B: Likelihood for secondary analysis+ AEP (%)#
Volcanic hazards (including geothermal)	0.1	0.2 0.005
Earthquake (Liquefaction)	0.1	0.2 0.033
Earthquakes (Fault rupture)	0.017	0.2 0.005
Tsunami	0.1	0.2 0.04
Coastal erosion	1	2 0.2
Landslip (Rainfall related)	1	2 0.2
Landslip (Seismic related)	0.1	0.2 0.033
Flooding (including coastal inundation)	1	2 0.2

The Western Bay of Plenty District Council has recently modelled the flood hazards for the area at and around Arawa Road Pongakawa. The flood model is called the Rural Areas and Small Settlement Flood Model (2021) and the flood event model is the 1% AEP event in the year 2130 including a 1.25m sea level rise, which is consistent with Table 20 above. As can be seen from the flood hazard map (Attachment 1), there is approximately 2 hectare of land that is subject to flooding. The structure plan design recognises these hazard areas and the landform in this area will generally be maintained and no dwellings will be located within the flood hazard area.

The site is located several kilometres inland and does not suffer from coastal hazard risk or risk from Tsunami, which have been modelled and mapped on Council's Mapi. The Tsunami mapping is for the 1 in 1000-year event (0.1% AEP event). The site is located 120m outside the Tsunami risk area and elevated approximately 2m above the affected land.

[1] We understand that BOPRC is conjunction with TA's within its region are reviewing the return period events for natural hazards assessments.

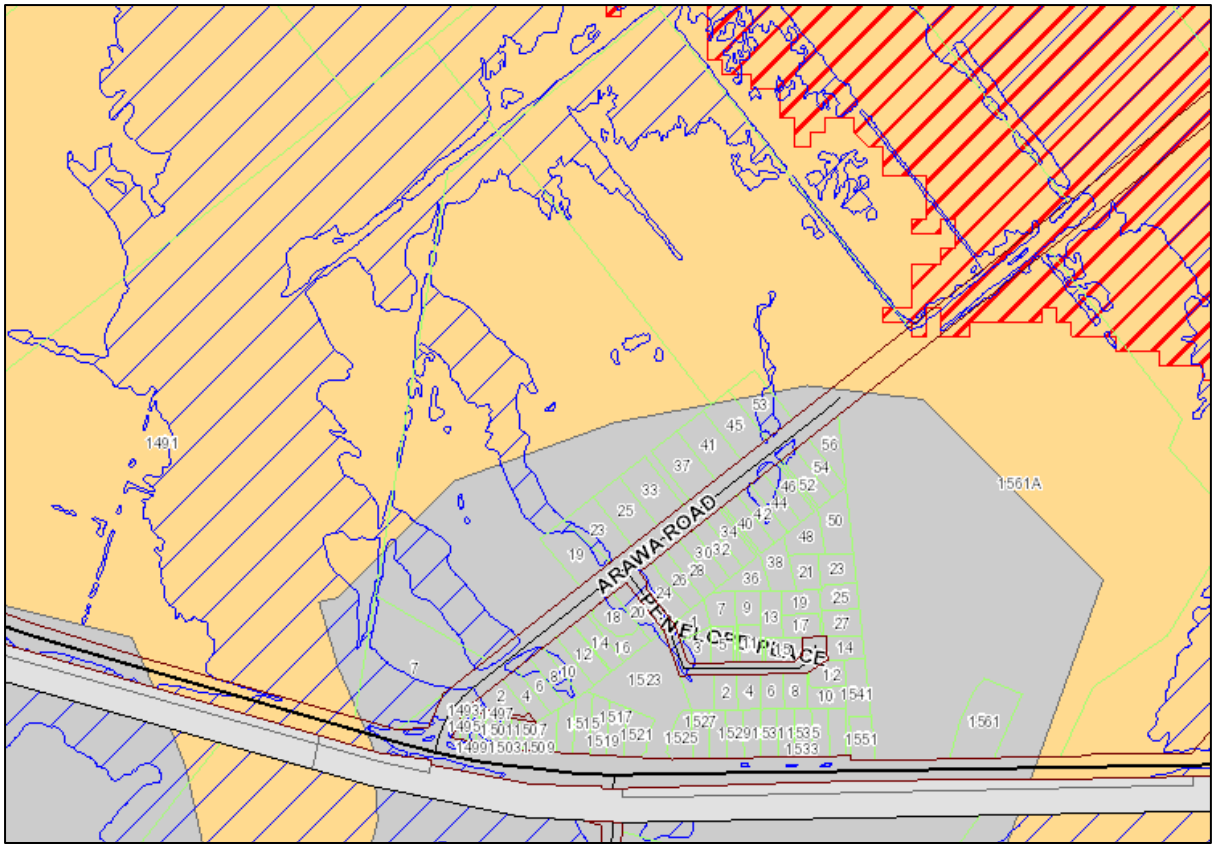


Figure 1: Tsunami Risk (red crosshatch) Liquefaction (orange)

The CMW Geoscience (CMW) geotechnical report supporting the plan change has considered the risk of liquefaction in addition to the Council map overlay. This responds to site investigations including CPT tests, bore logs, and investigation pits. They have concluded that the surface soils that are considered to be a non-liquifiable crust range from 3m to 7m and a 6m non-liquifiable crust thickness is required to satisfactorily conclude that liquefaction risk during an ULS event does not occur. To mitigate this liquefication risk CMW have recommended the adoption of a TC2/TC3 hybrid foundation solution as outlined in Section 15.4.6 of the MBIE Part C Canterbury Technical Guidance (See CMW report Section 7.2).

There is a very low risk of land slip, either seismic or rainfall related due to the flat contour of the ground (See CMW report Section 7).

The CMW report has also considered lateral spread risk and identifies that the anticipated lateral spread from and ULS earthquake event would be less than 100mm. This classifies the land to the northern slope as Technical Category TC2. Recommendations regarding the wastewater disposal system include ground improvements or the use of a pressurise drip fed irrigation system.

Overall, the CMW Report concludes that, subject to the recommendations of their report, that the land is suitable for rezoning to Residential use.

In summary the following natural hazards may affect the Plan Change site.

Flooding – for defined areas of the site in the 1%AEP event climate adjusted to 2130 with sea level rise affects the site. Designing the structure plan and future building platforms outside this flood area will avoids the flood hazard.

Liquefaction – there is a risk of liquefaction due to the potentially liquifiable crust, which is proposed to be mitigated by adopting a TC2/TC3 foundation design for buildings and will therefore have low risk.

Lateral Spread – The risk of lateral spread has been measured to be low (<100mm) and is not anticipated to cause buildings to functionally be compromised.

Fault Rupture - CMW has identified that the nearest faults are >20km from the site and therefore highly unlikely to affect the site.

Coastal Erosion – Due to the proximity of the site to the coast, coastal erosion is not anticipated to affect the site for the 1% AEP event.

Tsunami – The site is located outside the modelled Tsunami hazard risk area for the 0.1% AEP event.

Landslip – Due to the contour of the ground being flat no land slip hazards are considered to affect the site.

Given the above natural hazards including flooding, liquefaction and lateral spread are anticipated to affect the site but have effects that are insignificant or able to be mitigate to an extent that they will be insignificant.

3.0 Determining Potential Consequences

The RPS Appendix L methodology requires an assessment of the consequences of the natural hazard occurring (See table 21).

Of the 3 natural hazards that may potentially affect the site the following assessment has been completed to confirm the consequences. This draws on the geochemical report by CMW and also hazard modelling that has been completed for flooding by the District Council.

AS/NZS 1170.0.2002 is the Australian and New Zealand Standard for Structural Design Actions and identifies consequences of failure and considers the importance levels for buildings. Single family dwellings and buildings where the occupancy is below certain levels are classified as importance level 2 in Table 3.2 of the standard.

CMW has confirmed that the effects of earthquake (liquefaction, lateral spread and structural integrity of buildings) are able to withstand a ULS earthquake provided a TC2/TC3 foundation design is used to mitigate these earthquake hazard risk. This classification would also apply to the small commercial buildings proposed due to the limited occupancy rates of those buildings.

With respect to the wastewater disposal system CMW have recommended ground improvements to reduce the effects of wastewater disposal. Alternatively, a shallow drip irrigation system is recommended by CMW.

Taking into account Table 21 of Appendix L RPS the following conclusions are reached.

Structure Type	Comment	Consequence Level/Health & Safety
Buildings	Using appropriate foundation design the buildings are anticipated to stand up during a ULS earthquake event	Assessed as minor based on the technical reports supporting the plan change application.
Lifeline Utilities	Following the recommendation of the geotechnical experts the wastewater system is likely to be able to withstand an earthquake and have minor damage.	Assessed as minor based on the technical reports supporting the plan change application.

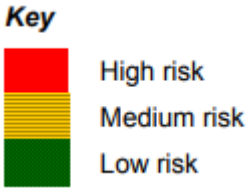
Note there are no critical buildings, or social or cultural buildings associated with this Plan Change.

4.0 Determine the Risk Level

Taking into account the likelihood of risk and the consequences of the hazard the overall risk analysis has been completed using the Risk Screening Matrix in the RPS Appendix L.

Risk Screening Matrix

Likelihood[12] (AEP %)	Consequences: Insignificant	Minor	Moderate	Major	Catastrophic
≥2					
<2–1					
<1–0.1					
<0.1–0.04					
<0.04					



Applying the assessed likelihood of an event occurring and analysing the consequences taking into account the recommended mitigation measures (all being minor), the overall hazard risk is calculated as low risk based on the risk screening matrix.

5.0 Iterate Risk Assessment and Calculation of Annual Individual Fatality Risk (AIFR)

Using the Appendix L Table 20 column B likelihood for secondary analysis AEP rates we make the following comments in respect to each hazard risk recognising there are no critical buildings or social/cultural buildings as defined in Table 21. In the absence of any modelled events for these scenarios, we have made qualitative assessments of natural hazard risk.

Volcanic Risk – Due to the distance from the nearest volcano is over 20 km, the risk relates to ash fall and is unlikely to result in death unless the volcanic activity was over a long period of time. Air quality will likely be affected for a short period and will be dependent on the prevailing wind direction. Given this is southwest it is unlikely that volcanic ash will reach the plan change area in quantities that could affect human life. Assuming the consequences are moderate the overall hazard risk remains low risk.

Flooding – for defined areas of the site in the 0.2%AEP event climate adjusted to 2130 with sea level rise is still unlikely to affect the site as the developable areas of the plan change area are more than 2 meters above the 1% flood plain. The flood hazard is low risk.

Liquefaction – there is a risk of liquefaction due to the potentially liquifiable crust, which is proposed to be mitigated by adopting a TC2/TC3 foundation design for buildings and will therefore have low risk. During a 3000-year event (0.03% AEP) we assume that buildings could move substantially but are likely to move in one piece given the foundation design and ground improvements recommended by CMW. It is envisaged that damage to buildings would be moderate to major, especially for two storeyed buildings. However, using the risk screen matrix the hazard risk remains low.

Lateral Spread – The risk of lateral spread has been assessed by CMW to be low (<100mm) for the 1% AEP event. This would increase because of a 3000-year event. There could well be damage to buildings, and they may be uninhabitable. The consequences are considered to be moderate to major. Using the risk screen matrix the overall hazard risk remains low.

Fault Rupture - CMW has identified that the nearest faults are >20km from the site and therefore remains highly unlikely to affect the site. Using the risk matrix the overall risk remains low.

Coastal Erosion – Due to the plan change site being located over 5 km from the coast, coastal erosion is not anticipated to affect the site for the 0.2% AEP event (500 year).

Tsunami – The site is located 120m outside the modelled Tsunami hazard risk area for the 0.1% AEP event (1000 year event). The run up of the Tsunami for the 0.1% AEP event reaches only land at or about the 2m RL contour. It is anticipated that the developed residential land will have a finished contour of RL 5m or above and therefore Tsunami wave run up will likely displace to other low lying land. Using the risk matrix the overall risk remains low.

Landslip – There is no land slip risk. Using the risk matrix the overall risk remains low

Comment

In the above qualitative assessment, we have drawn on the technical reports and modelling of natural hazards as well as considered factual information such as land contours and distance from the source of natural hazards to make conclusions. Liquefaction is assessed as the biggest threat to human life having a low to moderate consequence. Assuming two storey buildings were established in the plan change area and built with foundations as recommended by CMW (TC3/TC3 designs) a building is still likely to withstand a 1/3000 year earthquake event. We have assumed that most buildings in this location would be single storey, as two storey buildings are usually more expensive to construct and section sizes are suitable for single storey dwellings. It has therefore been assumed the majority of dwellings will be single storey.

Using the AIFR formula the hazard risk remains low as there are no deaths anticipated as no buildings are anticipated to collapse and there is extremely low risk of inundation from flooding.

Conclusion and Mitigation

This assessment has been undertaken drawing on the already modelled hazard risks for flooding and Tsunami. Earthquake hazard risks have been assessed by CMW Geoscience in accordance with he primary and secondary analysis return periods as prescribed in the RPS Appendix. Qualitative assessment has ben completed with respect to fault rupture risks and also volcanic hazards, both of which are considered to be low risk due to the distance between the site and the nearest faults and active volcanoes. Coastal hazard risk is also considered to be extremely low risk given the site is located 5.5km inland. Overall, the risk from natural hazards is considered to be low and the land is suitable for urban use.

The following recommendation are drawn from the CMW report.

- That all future dwelling and building construction on the site use a TC2 or TC3 foundation design.

The plan change is therefore consistent with Policy NH 4B of the RPS for Greenfield urban development that will be enabled as a result of this plan change.

Bibliography

Regional Policy Statement Appendix L *Methodology for Risk Assessment* P369-378.

CMW Geoscience *Geotechncial Report Arawa Road* 2022

Western Bay of Plenty District Council Mapi – *Significant Fault Lines*

Western Bay of Plenty District Council Mapi – *Tsunami Flood Modelling 1000 year event*

Western Bay of Plenty District Council Mapi – *1% AEP Flood Event*