Section 11 – Natural Hazards

11.1 Background

The District is exposed to a variety of naturally occurring events, such as flooding, erosion, earthquakes, landslides, storms, wind, subsidence, geological instability, rock falls, coastal erosion and tsunami. While these events are natural, their effects pose a risk to the community as people and property establish in areas susceptible to these events.

Some natural hazard events such as flooding and coastal erosion can be predicted using historical qualitative data and predictive modelling. This information guides the measures implemented to manage subdivision, use and development to reduce risk associated with these events. Other events which have a high impact but a low probability include tsunami, volcanic eruptions, earthquakes and debris flows. It is difficult to avoid or manage the risks of such events. However practical measures can be taken to avoid or mitigate the risk, including increasing our understanding of these events; where, when and how they occur; and by increasing community preparedness for such events. Decisions on land use and development also need to support community readiness, along with effective response and sustainable recovery.

This section applies to all natural hazard risks in the District, not just those that are identified on the Overlay Planning Maps. Any discretionary or non-complying resource consent activity, or plan change, that is potentially affected by natural hazard risk should take this section into account.

11.1.1 Natural Hazards Legislation

Three key pieces of legislation empower the Council to manage and control the effects of natural hazards: the Civil Defence Emergency Management Act 2002 (CDEM), the Resource Management Act 1991 (RMA) and the Building Act 2004 (BA). Under CDEM, local authorities are required to reduce the risks in their communities, coordinated through a CDEM Group Plan. RMA and BA decisions have a critical influence on land use management for natural hazards.

Under the RMA, the New Zealand Coastal Policy Statement (NZCPS) and the Regional Policy Statement (RPS), subdivision, use and development is required to avoid or mitigate the effects of natural hazards. The BA has similar responsibilities when granting building consents on land subject to natural hazards. The key is reducing the risk of effects on people, their property, community facilities and lifeline utilities.

11.1.2 Assessment of Acceptable, Tolerable and Intolerable Risk

The natural hazard provisions use the following risk terms: acceptable, tolerable, intolerable.

Likelihood	**Consequences**				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain 10%+ AEP (once every 1-10 years)					
Likely 9.9% - 1% AEP (once every 10.1 – 100 years)					
Possible 0.99% - 0.1% AEP (once in 100.1 – 1,000 years)					
Unlikely 0.099% - 0.01% AEP (once in 1,000.1 – 10,000 years)					
Rare <0.0% AEP (once in every 10,000+ years)					

To determine the consequence category, refer to the Consequences Table below. The highest Severity of Impact within the area actually affected by a natural hazard event determines the level of consequence in the Risk Table above, once existing mitigation factors are taken into account.

Severity of Impact	Built				Economic	Health & Safety
	Social/Cultural	Buildings	Critical Buildings	Lifelines		
Catastrophic (V)	≥25% of buildings of social/cultural significance within hazard zone have functionality compromised	≥50% of affected buildings within hazard zone have functionality compromised	≥25% of critical facilities within hazard zone have functionality compromised	Out of service for > 1 month (affecting ≥20% of the town/city population) OR suburbs out of service for > 6 months (affecting < 20% of the town/city population)	> 10% of regional GDP	> 101 dead and/or > 1001 injured
Major (IV)	11-24% of buildings of social/cultural significance within hazard zone have functionality compromised	21-49% of buildings within hazard zone have functionality compromised	11-24% of buildings within hazard zone have functionality compromised	Out of service for 1 week – 1 month (affecting ≥20% of the town/city population) OR suburbs out of service for 6 weeks to 6 months (affecting < 20% of the town/city population)	1-9.99% of regional GDP	11 – 100 dead and/or 101 – 1000 injured
Moderate (III)	6-10% of buildings of social/cultural significance within hazard zone have functionality compromised	11-20% of buildings within hazard zone have functionality compromised	6-10% of buildings within hazard zone have functionality compromised	Out of service for 1 day to 1 week (affecting ≥20% of the town/city population) OR suburbs out of service for 1 week to 6 weeks (affecting < 20% of the town/city population)	0.1-0.99% of regional GDP	2 – 10 dead and/or 11 – 100 injured
Minor (II)	1-5% of buildings of social/cultural significance within hazard zone have functionality compromised	2-10% of buildings within hazard zone have functionality compromised	1-5% of buildings within hazard zone have functionality compromised	Out of service for 2 hours to 1 day (affecting ≥20% of the town/city population) OR suburbs out of service for 1 day to 1 week (affecting < 20% of the town/city population)	0.01-0.09 % of regional GDP	<= 1 dead and/or 1 – 10 injured
Insignificant (I)	No buildings of social/cultural significance within hazard zone have functionality compromised	< 1% of affected buildings within hazard zone have functionality compromised	No damage within hazard zone, fully functional	Out of service for up to 2 hours (affecting ≥20% of the town/city population) OR suburbs out of service for up to 1 day (affecting < 20% of the town/city population)	<0.01% of regional GDP	No dead No injured

Acceptable risk is generally permitted, allowing people to manage the risk themselves. Tolerable risk generally requires a resource consent to mitigate the risk to life and property, including neighbouring properties.

Intolerable risk is generally not provided for. The activity needs to be relocated or redesigned to lower the risk.

For more detail about management of natural hazard risk, refer to the GNS Science Report *Risk-based land use planning for natural hazard risk reduction* GNS Science Miscellaneous Series 67 (September 2013).

11.1.3 Review of Risk Categories

The risk categories of "acceptable", "tolerable" and "intolerable" risk are based on examples from GNS Science, Waikato Regional Policy Statement policies and methods, and standards agreed through consultation on flood and coastal erosion risks.

Waikato Regional Council will work with the Council and communities to review these risk categories including likelihood (e.g. what is 'likely' or 'rare') and consequence (e.g. what is 'major' or 'minor'). This review will align with CDEM Group Changes and will be incorporated into this section by a plan change.

11.1.4 Cumulative Risk

Cumulative hazards involve multiple unrelated natural hazards affecting a site or area. It is unlikely that all of the natural hazards occur at one time. However, as the area is susceptible to multiple natural hazards there is a higher likelihood that the area will experience a natural hazard event. Cumulative risk is calculated using the following steps, along with an example below to illustrate the calculations.

Example of natural hazards affecting an area		
Natural Hazard	**Likelihood (years)**	**AEP**
Flooding	1:100	0.01
Tsunami (distant sources)	1:200	0.005
Earthquake (local)	1:500	0.002

Step 1:	Identify the hazards e.g. flooding, tsunami and earthquake
Step 2:	Calculate the combined probability. Using the values in the table above = 1 - (1 - 0.01) x (1 - 0.005) x (1 - 0.002) = 0.0169. This means there is a 1.69% chance of an event occurring in any given year.
Step 3:	Calculate the average recurrence interval for the area by the inverse of the probability, e.g. 1 / 0.0169 = 59. This means there is a likelihood of the area of land being affected by one of the above natural hazards on average once in every 59 years.

11.1.5 Cascading Risk

Cascading hazards involve multiple natural hazards that are affected by each other. For example, an earthquake may trigger a tsunami. To determine the risk levels from cascading natural hazards, apply the following steps.

Step 1:	Rank the hazards in order of their consequences. For example, with a fault rupture the ranking could be: fault rupture; liquefaction; tsunami.
Step 2:	Consider the individual consequences from each hazard. To avoid double counting, account for the consequences from the preceding natural hazards prior to consideration of the next hazard on the list. For example, the calculated consequences of a large earthquake would be removed from further consideration when assessing the consequences from liquefaction and tsunami on the remaining assets.
Step 3:	Add together the consequences of the three hazards as calculated in Step 2 to get the total consequence from the cascading natural hazards.
Step 4:	Use the likelihood of the trigger event for the likelihood of the cascading hazards.

When determining the risk from cumulative hazards, it is important to recognise that consequences from different sized cascading hazards may vary. For example, an off-shore fault movement may generate a large tsunami, whereas an on-shore fault rupture may generate a small tsunami but higher liquefaction damage.

11.2 Issues

1. The District is exposed to a variety of natural hazards that create risk of loss or damage to life, property, community facilities and lifeline utilities.
2. Intensification and development of land in hazard-prone areas increases the risk to people, their property and the environment.
3. There is a demand for settlement and building expansion and intensification in close proximity to the shoreline, which increases the risk of significant loss and damage from coastal erosion, tsunami and flooding.
4. There is a long-term risk of increasing natural hazards (coastal erosion and inundation, river flooding, drought etc.) due to the effects from projected climate change.

11.3 Objectives and Policies

Objective 1

Natural hazard risk to life, property, community facilities and lifeline utilities resulting from subdivision, use and development do not increase, and are at acceptable or tolerable levels.

Policy 1a

Subdivision, use and development shall ensure that life, property, community facilities and lifeline utilities, including on adjacent sites, are protected from the adverse effects of natural hazards to an acceptable or tolerable level of risk, in a manner that maintains the resilience of the natural environment.

Policy 1b

'Soft' coastal defences that defend existing dwellings, community facilities and lifeline utilities from coastal hazard risk should be encouraged where they do not increase coastal hazard risk to other sites.

Policy 1c

Subdivision, use and development in areas that benefit from natural hazard defences shall be controlled so that the risk of loss or damage to life or property through failure of the defence, or being subjected to greater than design events, is tolerable, while recognising the functional benefits of those defences.

Policy 1d

Land use intensification (e.g. more than one dwelling on a lot, community facilities, lifeline utilities) and new effluent disposal fields (where wastewater is not reticulated) shall be located outside the area projected to be at risk of coastal erosion and coastal inundation in 100 years' time. One dwelling per lot is tolerable where there is no current coastal hazard risk. Essential infrastructure can occur in this area if it cannot be located elsewhere, or will not increase coastal erosion or coastal inundation hazard risk.

Policy 1e

Community facilities, lifeline utilities and 'greenfield' subdivision and development shall be located in areas of acceptable natural hazard risk, including outside areas with projected coastal erosion and coastal inundation risk in 100 years' time, to avoid the need for any natural hazard defences or major mitigation work.

Policy 1f

Development in areas at intolerable risk from natural hazards shall not be intensified.

Policy 1g

Development should be ‘future proofed’ to allow retreat and/or relocation of structures and buildings where there is a potential future hazard risk in the next 100 years.

Policy 1h

Settlement growth in areas subject to natural hazards shall not occur where it is dependent on installation of natural hazard defences to lower natural hazard risk from intolerable to acceptable or tolerable.

Policy 1i
Rezoning of rural land below 10 m above mean sea level on the eastern seaboard to a Residential Area should consider the implications of tsunami risk.

Policy 1j
A precautionary approach should be adopted when assessing development proposals in areas subject to natural hazard risk where information about that risk is either absent or uncertain.

Policy 1k
The potential effects of future climate change over the next 100 years, including sea level rise, river flooding, drought and other, should be considered when assessing natural hazard risks.

Note:

1. *Consideration of climate change effects is explained in the NZCPS Policy 24, and should use the most recent national guidance on sea level rise projections as explained in RPS Method 4.1.14.*

Policy 1l
When a site is subject to two or more natural hazards, the cumulative or cascading risks shall be considered.

Objective 2
Natural hazard defences authorised by the Council, the Regional Council or their predecessors maintain their resilience from activities so they can protect against natural hazards for their designed life-span.

Policy 2a
The functionality and long-term stability of authorised flood and coastal defences, and stream channels, shall not be compromised or degraded by subdivision, use or development.

Objective 3
Landowners and the community are prepared for flooding, erosion and tsunami hazard risks and are aware of appropriate risk reduction measures they can take.

Policy 3a
The redevelopment of sites at risk from natural hazards shall be provided for if the risk is acceptable or becomes more tolerable than existing risk.

Policy 3b
Development of facilities for children, aged care facilities and hospitals within areas at risk of tsunami with a 0.1% AEP should have vertical evacuation areas that are sturdy enough to withstand a tsunami and elevated above expected tsunami inundation for a maximum credible tsunami event.

Policy 3c
Development should consider the risk of all known natural hazards where relevant.

Objective 4

New 'hard' coastal defences to reduce coastal hazard risk are not established in the coastal environment, except where no other option is available to safeguard life, existing dwellings, community facilities and lifeline utilities.

Policy 4a

Natural hazard mitigation measures and defences should be in keeping with the coast's natural character, landscape and continue to provide for recreational opportunities and public access, with 'soft' coastal defences preferred out of the practical options available.

Policy 4b

Subdivision, use and development adjacent to the coast shall enhance the ability of natural coastal environment defences, such as sand dunes, to strengthen natural character resilience against coastal erosion and coastal inundation.

Policy 4c

New subdivision, use and development in the coastal environment shall not occur where it is dependent on installation of new defences to make natural hazard risk tolerable, or may become dependent on installation of new defences to avoid increasing coastal hazard risk to intolerable levels over the next 100 years.

Policy 4d

Natural ecosystems in currently undeveloped areas shall be left alone to migrate inland as a result of dynamic coastal processes (including sea level rise as projected by current national guidance).

Policy 4e

Once a 'hard' coastal defence requires replacement or major restoration work, the structure should be replaced with a 'soft' coastal defence if this is feasible to maintain existing protection from coastal erosion and/or coastal inundation.

11.4 Non-Regulatory Methods

Method 1

1. Work with the Waikato Regional Council to identify the acceptable, tolerable and intolerable level of natural hazard risk through consultation with the community and local and regional Civil Defence and Emergency Management groups, including a review of the Consequence and Likelihood Tables in Section 11.1, and incorporating the projected impact of climate change.

Method 2

1. Consult with local and regional Civil Defence and Emergency Management groups and the community on the likelihood of hazards and what people can do, particularly for flooding, erosion and tsunami. This includes encouraging installation of vertical evacuation areas in major developments (e.g. schools, aged care, hospitals, apartments) in case of tsunami.

Method 3

1. Work with community groups, the Waikato Regional Council and New Zealand Transport Agency on sustainable coastal erosion defences, dune ecosystem restoration and beach enhancement.

Method 4

1. Review over time natural hazard policies and rules about tsunami and other natural hazards as new research and modelling become available.