HENDERSON-MASSEY CLIMATE CHANGE SYNTHESIS

Group 6: Arson Rashidmardani, Ben Jones, Brian Yong, Dylan Tam, Yijun Xu

Climate Hazards in Auckland

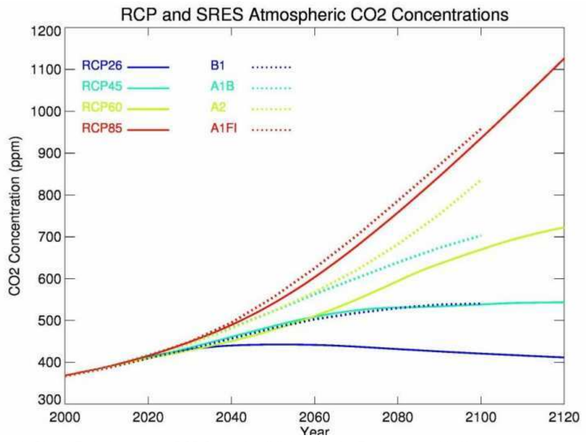

Figure 1: Global Emissions under RCP Scenarios (Ministry for the Environment, 2018)

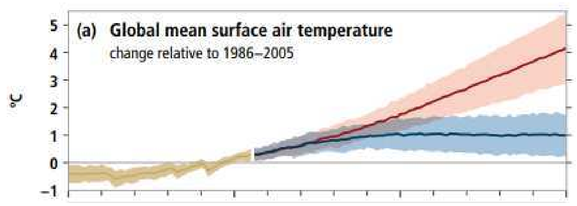

Figure 2: Global Mean Surface Air Tempature Under RCP8.5 & 2.5 Scenario (Pörtner et al., 2019)

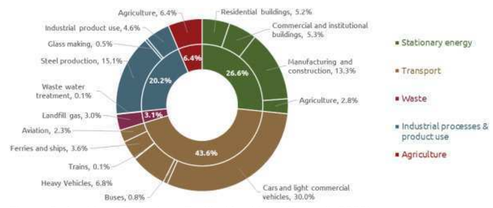

Figure 3: Auckland Emissions Profile (Auckland Council, 2020)

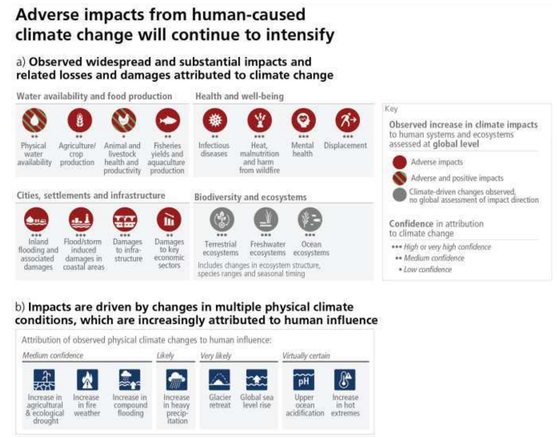

Figure 4: Cliamte Change Impacts (Calvin et al., 2023)

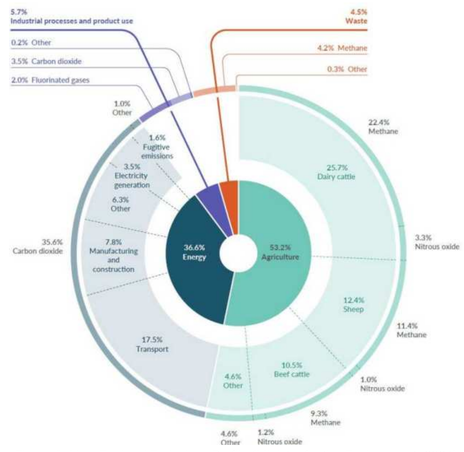

Figure 5: New Zealand Emissions Profile (Ministry for the Environment, 2024)

Climate Hazards in Auckland

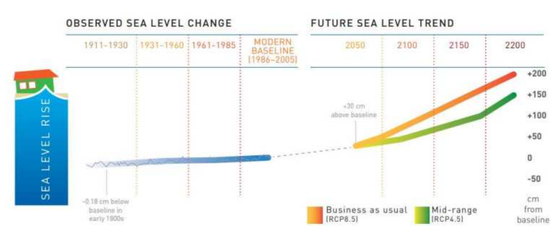

Figure 8: NIWA Projection for Sea Level Rise in Auckland
(Auckland Council & National Institute of Water and Atmospheric Research, 2018)

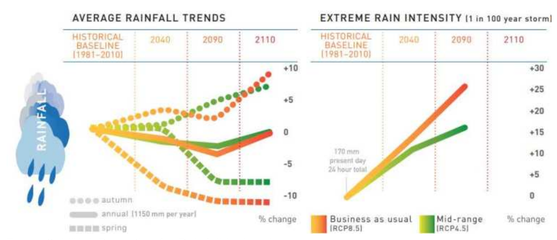

Figure 9: NIWA Projection for Rainfall in Auckland
(Auckland Council & National Institute of Water and Atmospheric Research, 2018)

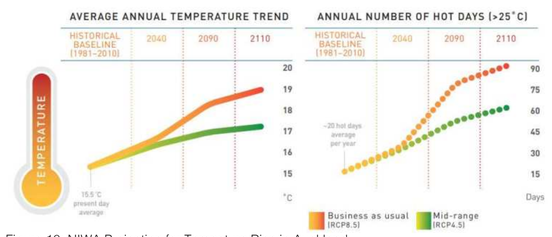

Figure 10: NIWA Projection for Tempature Rise in Auckland
(Auckland Council & National Institute of Water and Atmospheric Research, 2018)

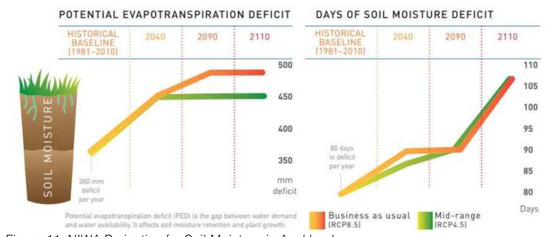

Figure 11: NIWA Projection for Soil Moisture in Auckland
(Auckland Council & National Institute of Water and Atmospheric Research, 2018)

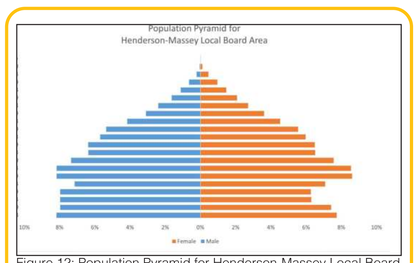

Figure 12: Population Pyramid for Henderson-Massey Local Board Area (Statistics New Zealand, 2018a)

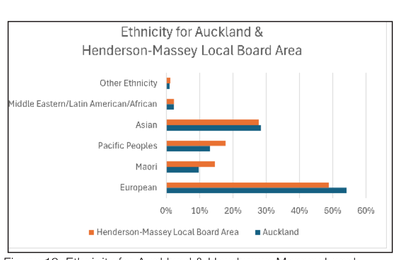

Figure 13: Ethnicity for Auckland & Henderson-Massey Local Board Area (Statistics New Zealand, 2018a)

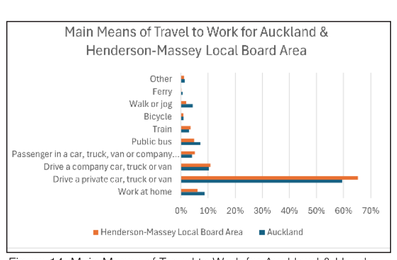

Figure 14: Main Means of Travel to Work for Auckland & Henderson-Massey Local Board Area (Statistics New Zealand, 2018c)

Figure 15: Population Projection for Henderson-Massey Local Board Area (Statistics New Zealand, 2022)

Figure 16: Income for Auckland & Henderson-Massey Local Board Area (Statistics New Zealand, 2018d)

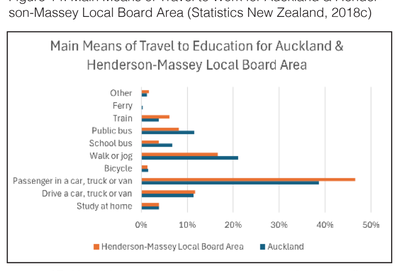

Figure 17: Main Means of Travel to Education for Auckland & Henderson-Massey Local Board Area (Statistics New Zealand, 2018b)

PESTEL & Casual Loop

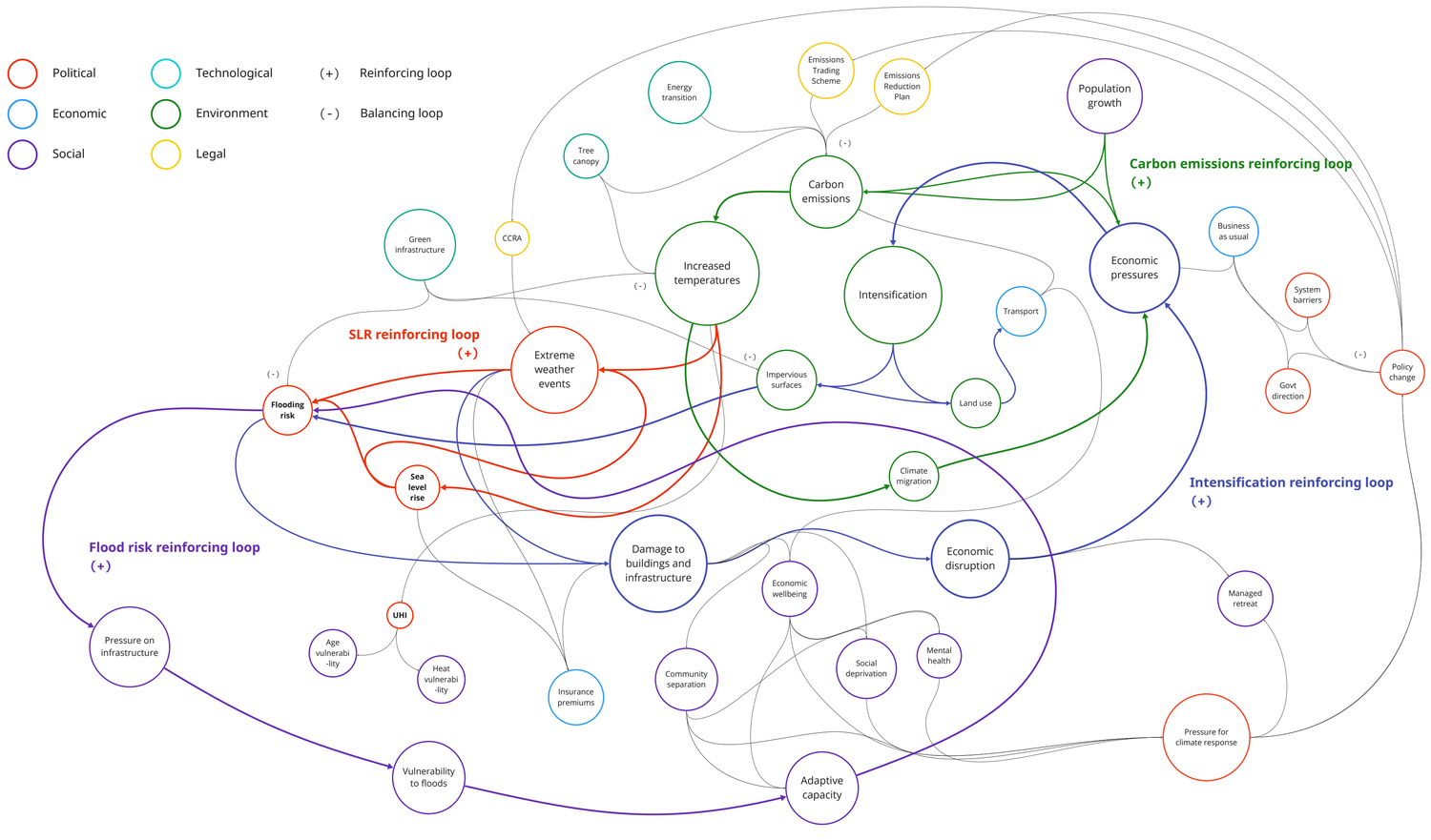

Figure 21: PESTEL & Casual Loop

Political	Economic	Social
System barriers Short political cycles Frequent political change Central government direction Economy vs environment prioritisation Intensification vs greenfield development Opposition to climate spending Lack of funding Resistance to increased rates Lack of appetite for reform	Insurance Property damage Infrastructure damage Climate spending Managed retreat Economic disruption Profit incentive Deregulation Cost of emissions reduction Emissions Trading Scheme	Population growth Migration Climate refugees Economic wellbeing Social deprivation Climate vulnerability Adaptive capacity Community infrastructure Crime Age vulnerability Health Mental health Cultural values Kaitiakitanga Mana Whenua Kai security Access to employment Access to amenities
Technological	**Environment**	**Legal**
Lack of data Dificulty predicting climate change path-ways and impacts Energy: Renewables Reduced energy demand Decentralised energy production Electrification Cooling technologies Ecosystem services Green infrastructure Rain gardens Green roofs Bioswales Wetlands	GHG emissions Ecosystem services Biodiversity Climate effects: Increased temperatures Flash flooding Sea level rise Urban heat island effect Extreme rainfall Biodiversity loss Landslips Erosion Drought Urban environment Impervious surfaces Tree canopy coverage Biodiversity Land use Intensification	Pro development & intensification legislation: RMA Auckland Unitary Plan NPS-UD Pro environment, protection legislation: Urban Ngahere Strategy Emissions Reduction Plan Auckland Climate Plan Zero Carbon Act Climate Change Response Act State of the Environment NPS Biodiversity NPS Freshwater

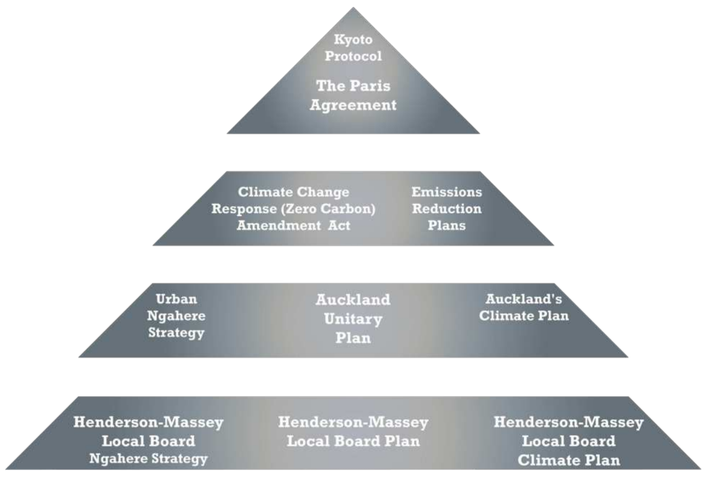

Figure 6: Legal & Political Context

Community Impacts:

Existing Adaptation and Mitigation Measures

Current mitigation strategies include emissions reductions addressed at the national level by an emissions trading cap and trade scheme, and at the regional level thorough transportation mode shift, decarbonisation and the integration of land use and transport through transit-oriented developments. Current adaptation measures include an ongoing urban-ngahere programme and potential stormwater system upgrades in Te Atatu Peninsula and Henderson.

Figure 7: Development Pattern (Auckland Council, n.d.-a)

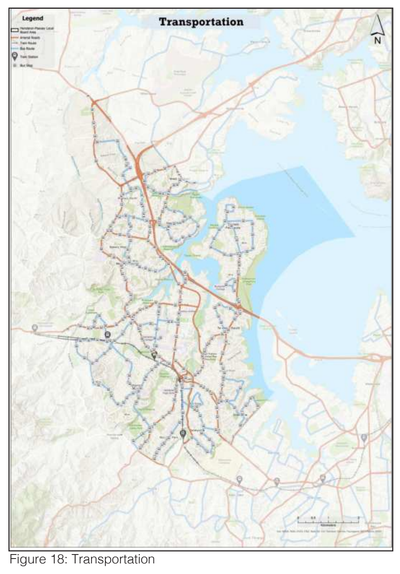

Figure 18: Transportation

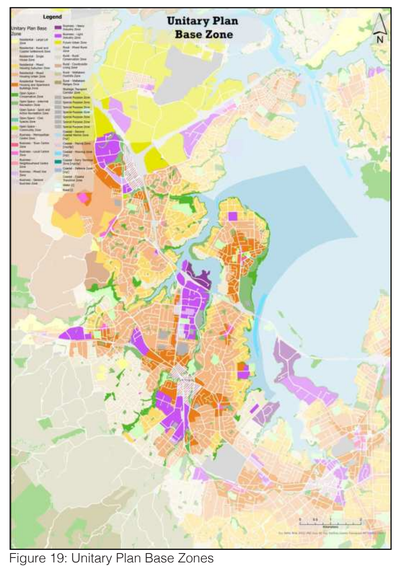

Figure 19: Unitary Plan Base Zones

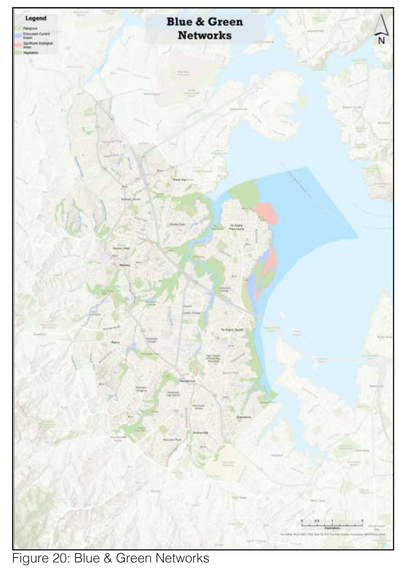

Figure 20: Blue & Green Networks

Weather Patterns

Projections illustrate that rainfall will become more intense and less frequent, with more frequent drought, reducing soil moisture, and icnreasing risk of flooding from extreme rain events, coupled with sea level rise and Auckland's coastal nature, climate change impacts will be severe for Auckland. (Auckland Council & National Institute of Water and Atmospheric Research, 2018)

Future Development

National level policies such as the National Policy Statement on Urban Development and the Medium-Density Residential Standard that aim to intensify existing urban areas, curtailing sprawl, and encourage mode shift and a compact urban form have been passed by central government and will be implemented by Auckland Council through plan change 78. The proposed changes would significantly increase the density in the walkable catchment area of the Henderson Train Station.

Demographics Summary

Henderson-Massey is a rapidly growing urban center projected to contain 160,000 residents by 2018. The area contains a higher than average proportion of Maori and Pasifika, and less than average population of Pakeha.The income of residents are on average lower than wider Auckland. The majority of residents travel to work and school by private vehicles, on average higher than wider Auckland.

Transportation

The area is served by State Highway 16, the Western Line, and a variety of bus routes. With infrequent service, service unreliability, and frequent infastructure damage, the area is rather poorly served by transit, as evidenced in the higher than average proportion of car ridership. The City Rail Link and associated Rail Network Rebuild promise to reduce travel times to the CBD, whilst doubling frequencies and providing cross-town routes. Coupled with upzoning near Henderson Train Station's walkable catchemnt area, the area is sure to see intensification.

HENDERSON-MASSEY CLIMATE CHANGE SYNTHESIS

Group 6: Arson Rashidmardani, Ben Jones, Brian Yong, Dylan Tam, Yijun Xu

Flooding

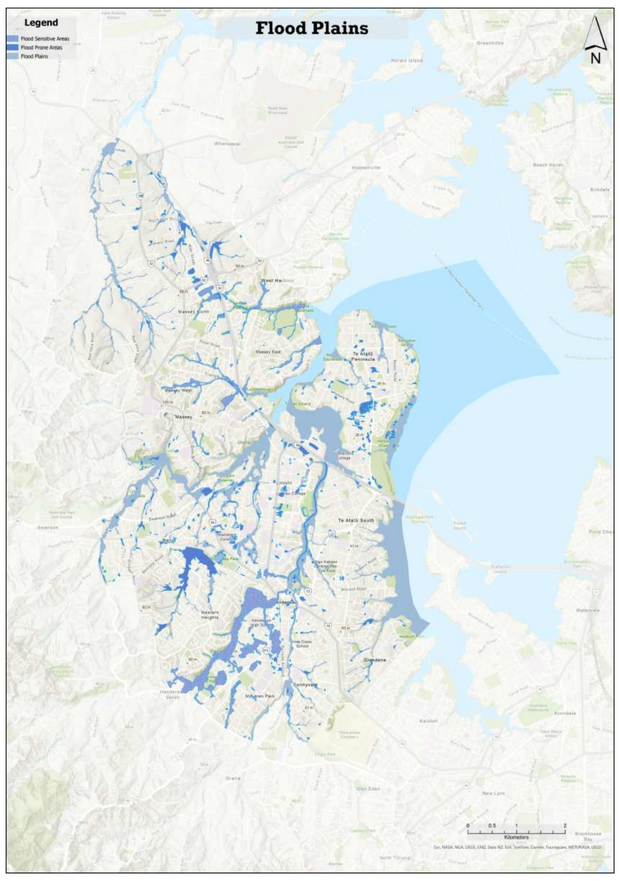

Figure 22: Flood Plains

Large parts of Henderson-Massey are flood prone. The majority of flood plains concentrate around river catchments. However large urban areas of Te Atatu, and Ranui are flood prone. Furthermore, a large area of Henderson, a vital communtity point is sensetive to flooding.

Figure 23: Projected Sea Level Rise

Projected sea level rise will inundate coastal areas. The large estuaries in Henderon-Massey mean that lots of in-land areas are also at risk from sea level rise. Furthermore, State Highway 16, a vital connection for the community is also at risk of inundation.

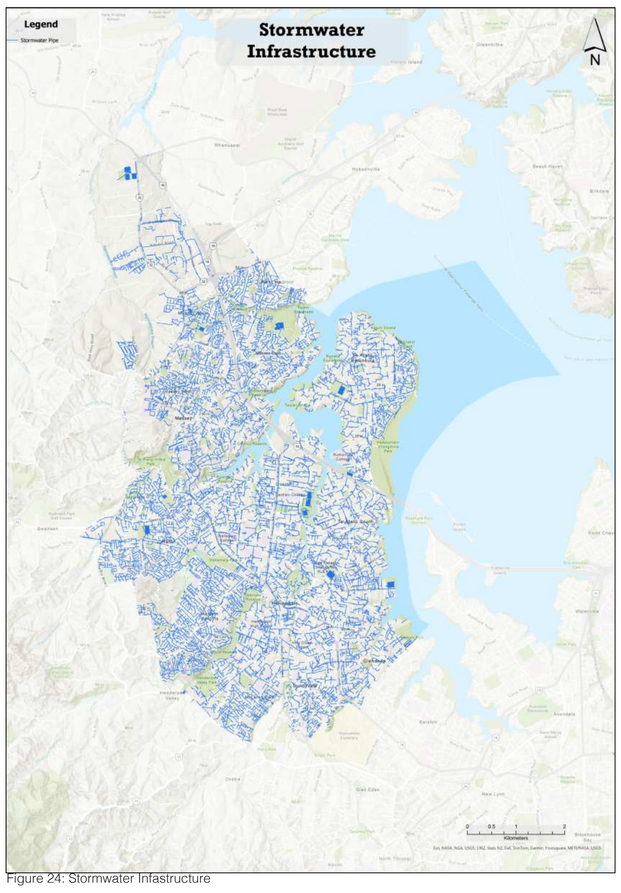

Figure 24: Stormwater Infastructure

Henderon-Massey contains a multitude of stormwater pipes. As rainfall intensity increases the systems will be pushed past their limits. A current adaptation process by Auckland Council is underway to improve stormwater management in the Te Atatu Peninsula. (Auckland Council, n.d.-b)

Extreme Heat

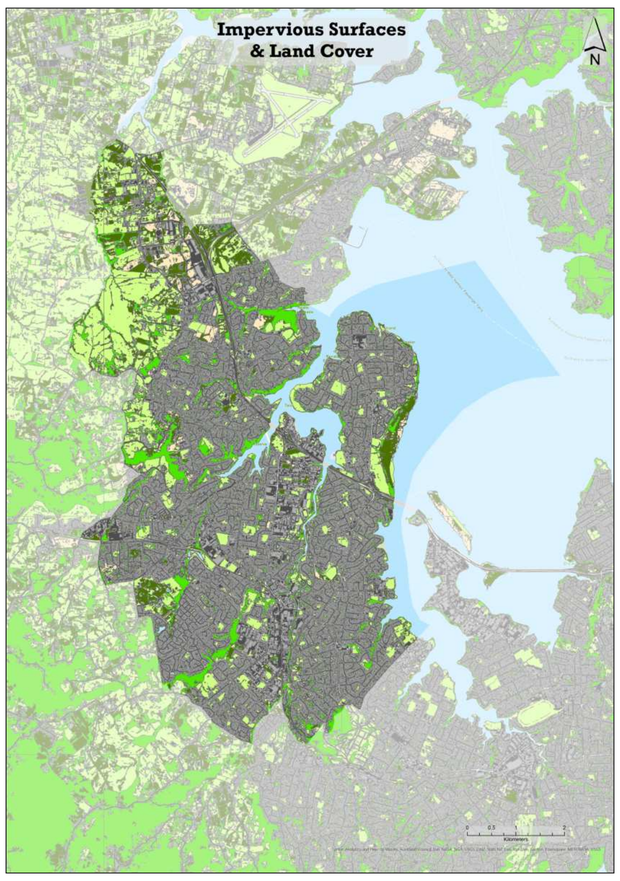

Figure 25: Impervious Surface & Land Cover

idership. The City Rail Link and associated Rail Network Rebuild promise to reduce travel times to the CBD, whilst doubling frequencies and providing cross-town routes. Coupled with upzoning near Henderson Train Station's walkable catchemnt area, the area is sure to see intensification.

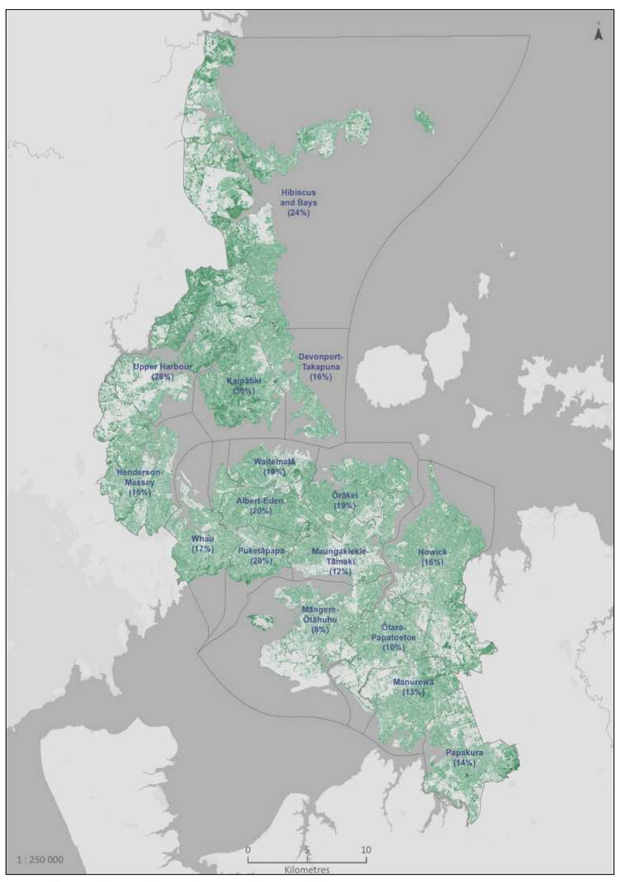

Figure 26: Tree Canopy Cover (Auckland Council, 2021)

The treee canopy of Henderson-Massey is 15%, the minimum set out by the Auckland urban ngahere plan. An ongoing adaptation project by the local board aims to improve the tree canopy cover of the area to 30% by 2050. (Henederson-Massey Local Board, 2022)

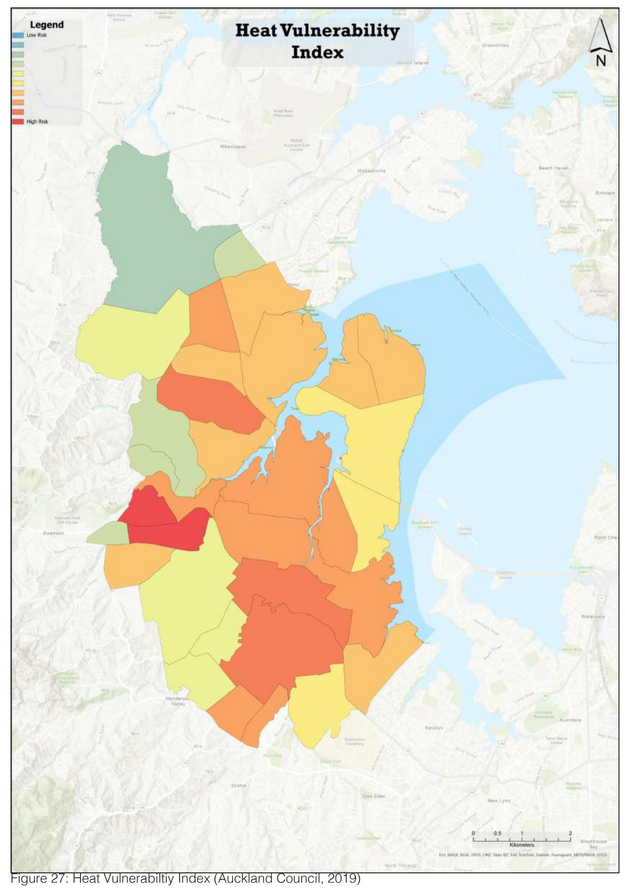

Figure 27: Heat Vulnerabiltiy Index (Auckland Council, 2019)

The heat vulnerability index takes into account multiple variables, including access to greenspace, ethnicity, burden rent, age, rental tenure, deprivation and more. Henderson-Massey contains an areas of very high vulnerability, and most areas are relatively vulnerable. (Auckland Council, 2019)

Vulnerability

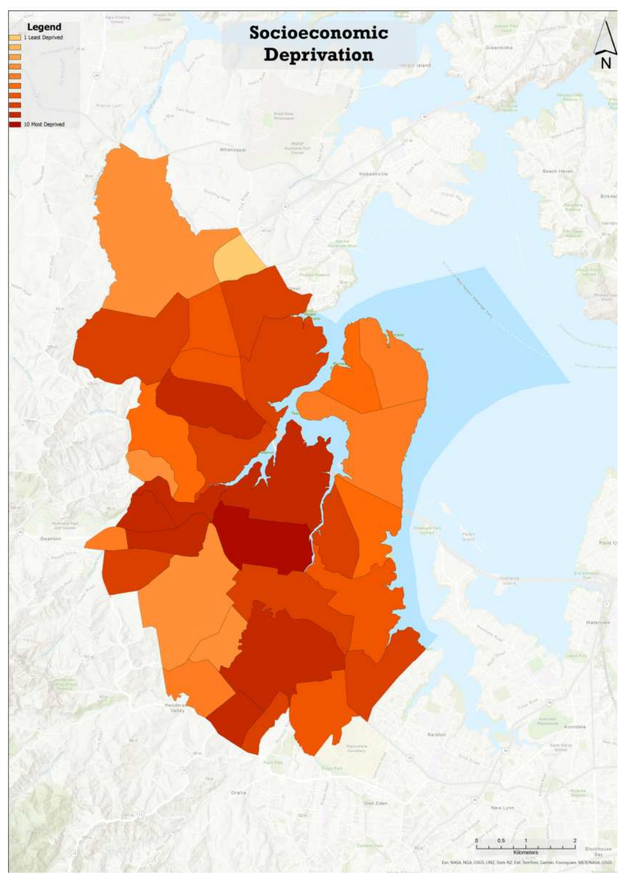

Figure 28: Socioeconomic Deprivation (University of Otago, 2018)

The New Zealand Deprivation Index 2018 illustrates that large areas of socioeconomic deprivation are highly deprived. Socioeconomic deprivation is a key factor in vulnerabiltiy to climate change impacts. (Environmental Health Intelligence New Zealand, n.d.)

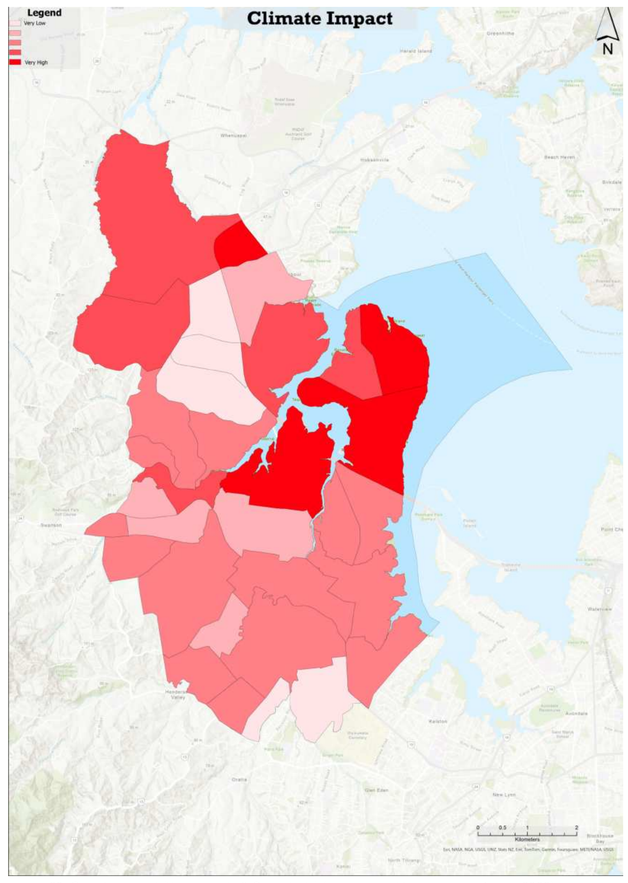

Figure 29: Climate Impact (Vulnerability & Sensetivity) (Henderson-Massey Local Board, 2020)

Te Atatu Peninsula is projected to have very high climate impacts. The majority of the local board area is likely to have medium impact, with few areas of low impact.

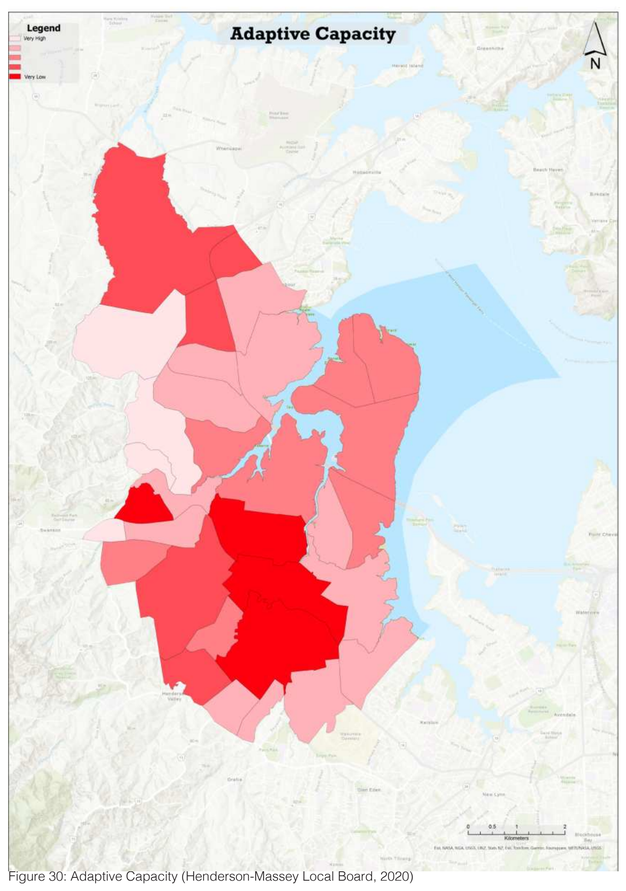

Figure 30: Adaptive Capacity (Henderson-Massey Local Board, 2020)

Adaptive Capacity measures how well a population can respond to climate impacts. Adaptive Capacity is a key factor in asessing vulnerabiltiy. The western portions of the local board area have very little adaptive capacity, increasing vulnerabiltiy. (Henderson-Massey Local Board, 2020)

HENDERSON-MASSEY CLIMATE CHANGE SYNTHESIS

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Problem Statement

Henderson-Massey faces increasing flooding risks from extreme weather events due to the impacts of climate change. This worsening issue will displace the residing communities, exacerbating existing social deprivation and increasing vulnerability. Intensification will reinforce flooding effects, driven by economic pressures and climate migration.

Risk Assessment

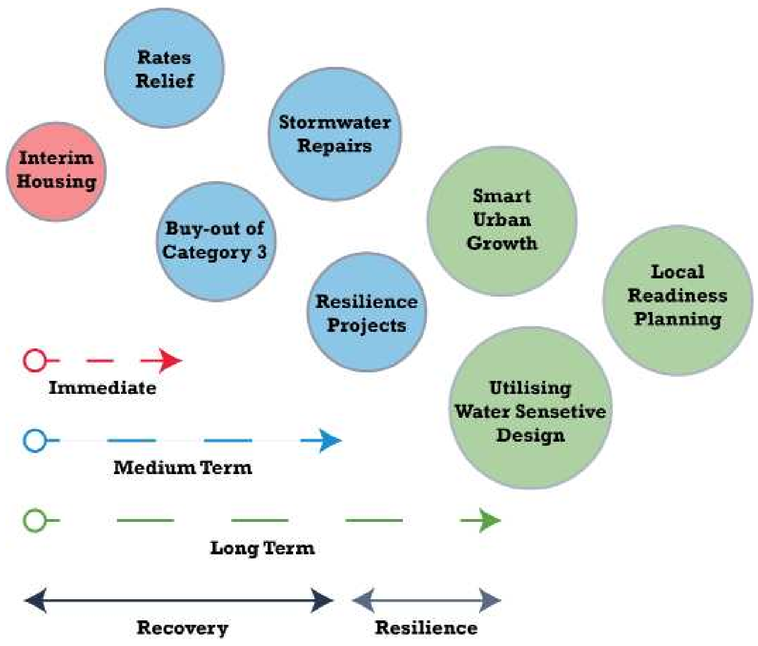


Figure 34: Auckland Recovery Plan (Auckland Council, 2024)

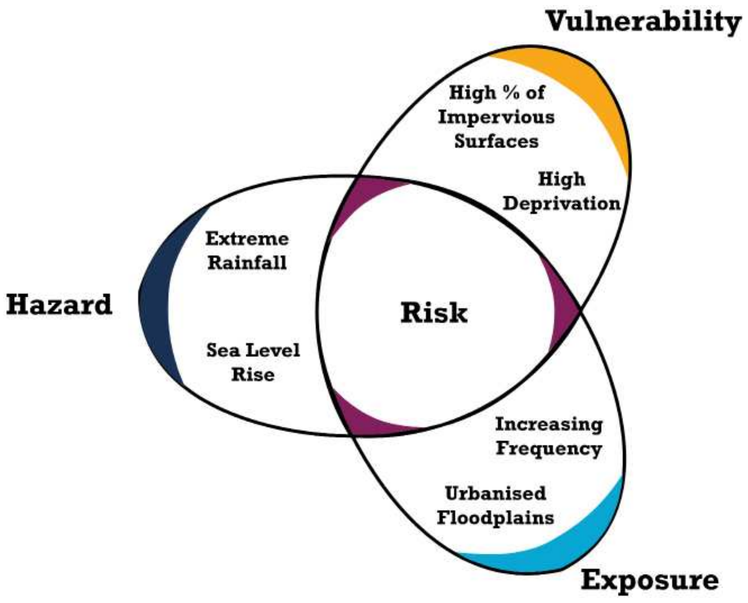


Figure 35: Risk Assesment

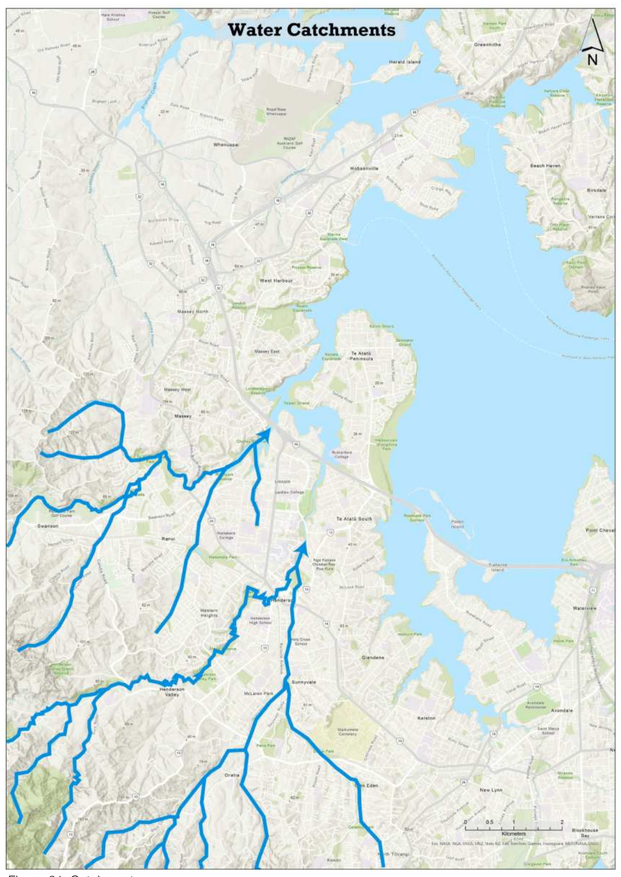


Figure 31: Catchments

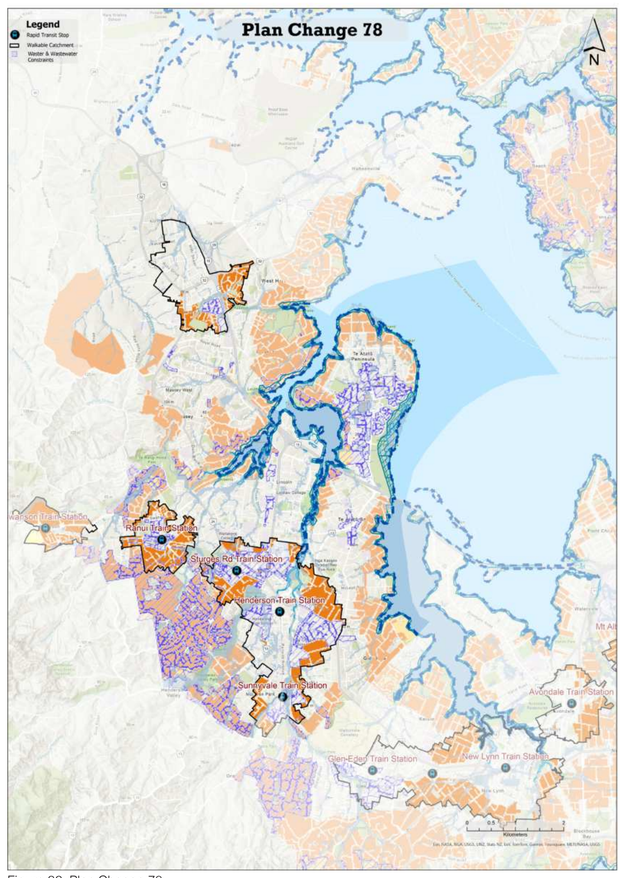


Figure 32: Plan Change 78

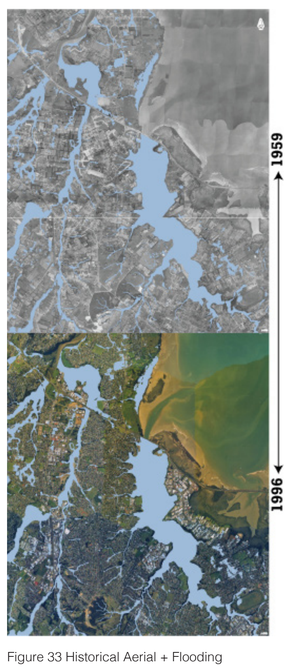


Figure 33 Historical Aerial + Flooding

Stakeholders

- Auckland Council
- Henderson-Massey Local Board
- Te Kawerau a maki (Local Iwi)
- West Auckland Business Group
- West Auckland is Flooding!
- Henderson-Massey Residents
- Auckland Transport
- Project Twin Streams

Flooding History

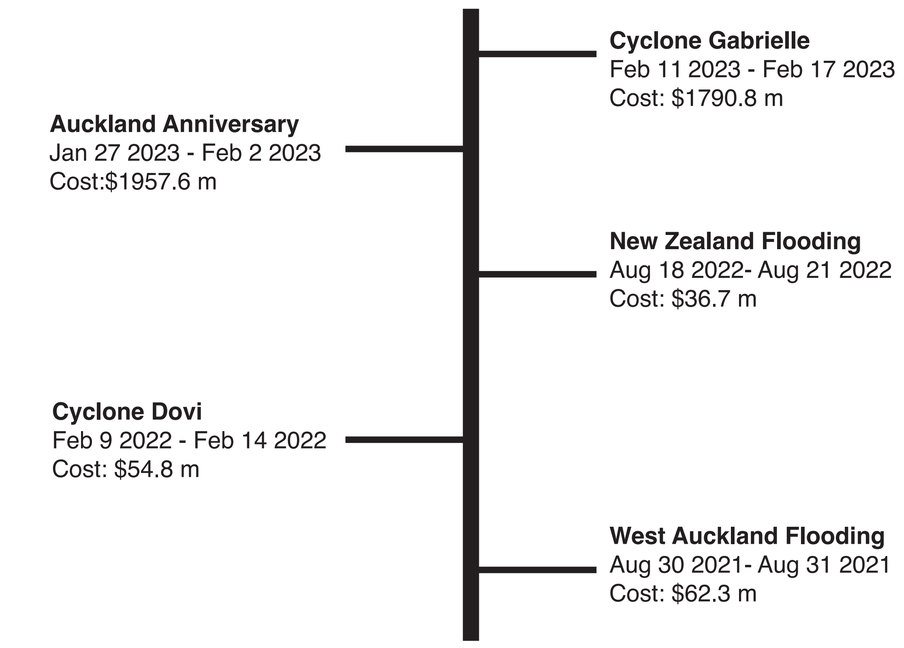


Figure 36: Flooding History (ICNZ, n.d)

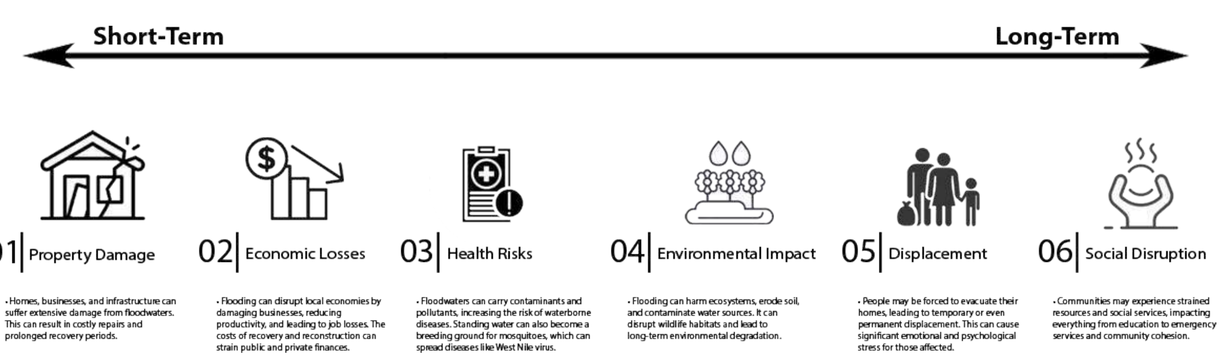
Cyclone Gabrielle Impacts

Results gathered from the impacts of Cyclone Gabrielle showcase the displacement of over 10,500 people, the destruction of 469 uninhabitable homes, and nearly 2,500 effectively unusable homes, with estimated economic costs ranging from $9 billion to $14.5 billion.

Figure 37: Cyclone Gabrielle impacts (RNZ, 2024)

Implications and Direction

Consequences of inaction



Next Steps

- Who will pay for managed retreat?
- New legislation?
- Private Insurance vs Public Investment?
- How will people react to managed retreat?
- When homes are inhabitable, who will pay for accomodation?
- How will we ensure long-term safety and effective expenditure?

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