

Climate change adaptation The Case for New Funding Instruments

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Outline

1. The climate change challenge
 - ▶ Impacts of concern
 - ▶ Scale and scope of impacts
 - ▶ Adequacy of policy framework
 - ▶ Decision-making challenges
2. Goals and principles for policy reform
3. Adaptation funding options
4. A Climate Change Adaptation Fund
5. Conclusions

The impacts of concern

- Drought
- Fire
- Pests and diseases
- Sea-level rise-erosion and inundation, rising groundwater, increased liquefaction risk
- Shift in rainfall patterns
- Increased rainfall intensity- storm water and ponding
- More frequent extreme events
- Increased flood risk- rivers and surface water
- Increased wind strength
- Decrease in snowfall accumulation

Scope and scale of problem

- *Slowly and early emerging, then accelerating impacts*—sea level rise, plant and animal pests and diseases
- *Widening climate variability*— increased temperature ranges, flood and coastal storm frequency
- *Extremes*—coastal storm flooding, intense rainfall, wind, drought
- *Surprises*—accelerated sea level rise, intense localised flooding
- *Combined* impacts
- *Compounding* interconnected impacts
- *Cascading* impacts within and between economic, social and environmental domains

What is exposed?

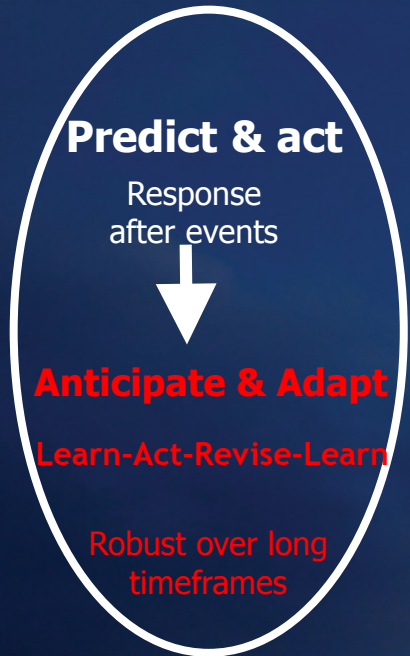
All sectors

- People and assets in low-lying land—reclaimed land, ports, airports, cities, towns
- Transport networks
- Underground infrastructure
- Human activities
- Rural infrastructure
- Tourism
- Water availability and quality
- Human health
- Natural habitats and endangered species
- Forests
- Oceans and marine food chains
- Fisheries

Decision-makers challenge

- ▶ Adaptation poses unprecedented technical, administrative and political challenges for current governance arrangements, planning frameworks and funding instruments
- ▶ Impacts will be large in scope, scale and duration - especially from sea-level rise and high intensity rainfall
- ▶ The costs of damage and losses to people, property, infrastructure, social and environment will be large
- ▶ The costs will fall unevenly, often arbitrarily and in a non-linear manner
- ▶ Effective adaptation can reduce the long-term costs by reducing exposure and vulnerability
- ▶ Pro-active planning, supported by good coordination can reduce risks over long timeframes
- ▶ Adaptation such as climate-proofing, new infrastructure design and managed retreat will require significant funding
- ▶ The biggest challenges are arguably political rather than technical

Focus on sea level rise



Sea-level rise
Flood events
Droughts
Fire



We are using old tools for old problems

Sea level rise is foreseeable

Near certain to mid century

Rate of change uncertain beyond that

Depends on how quickly emissions reduce globally

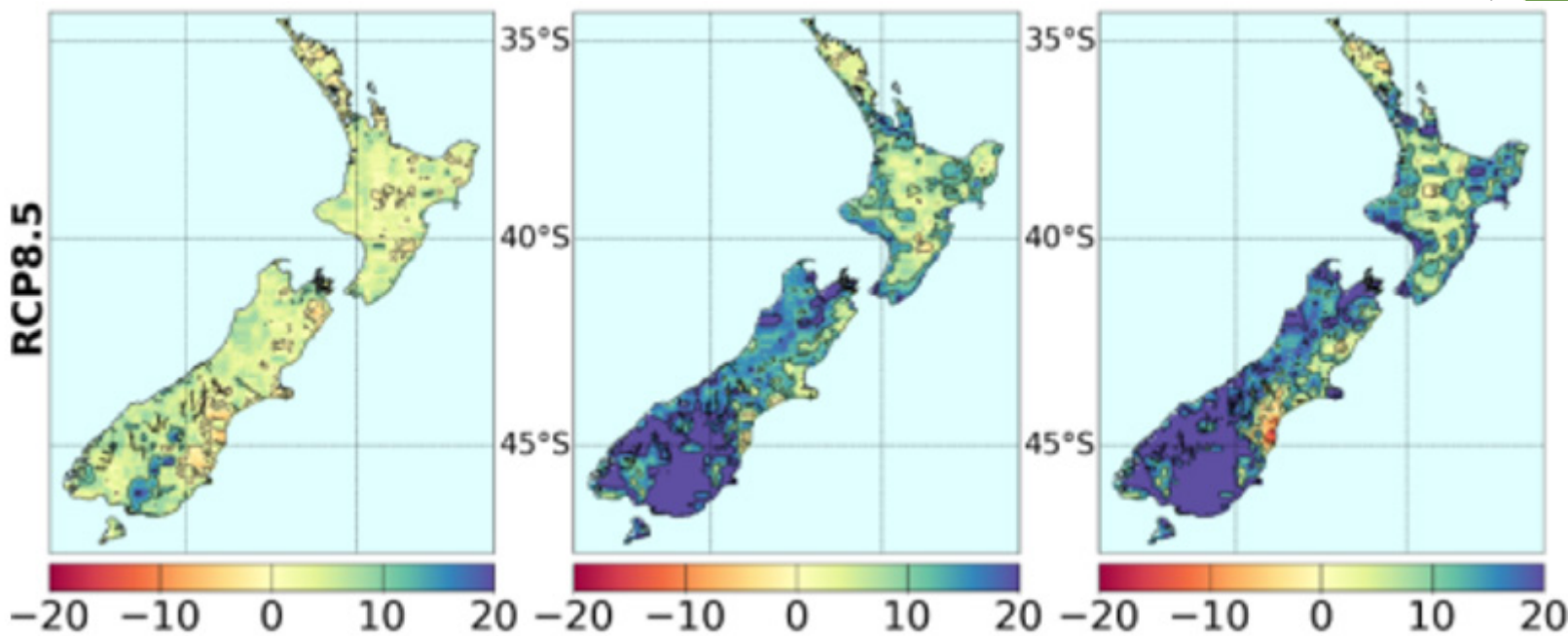
More extreme precipitation changes

(99th percentile: ~ 1 day per year would exceed this threshold)

2040

2090

2110



Key risk - flooding

- Already significant risk and cost from flooding
- ‘Adaptation deficit’: events with much less than 1% AEP (present) will cause significant damage
- Widespread increase in flood exposure, but uncertain amount of change
- More severe end of changes would pose significant challenges

Emerging flood & groundwater impacts

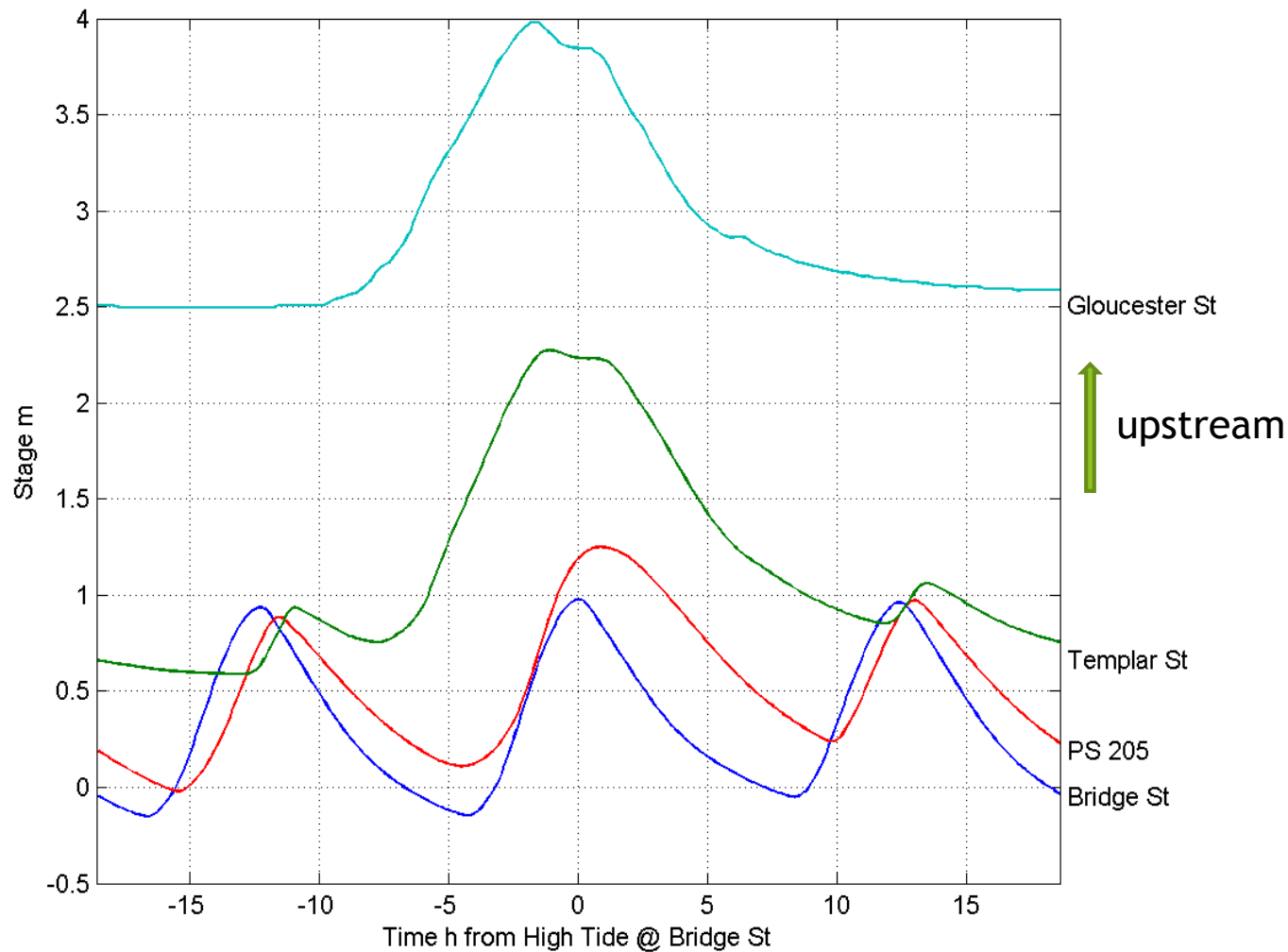
Urban flash flooding from high-intensity rainfall events

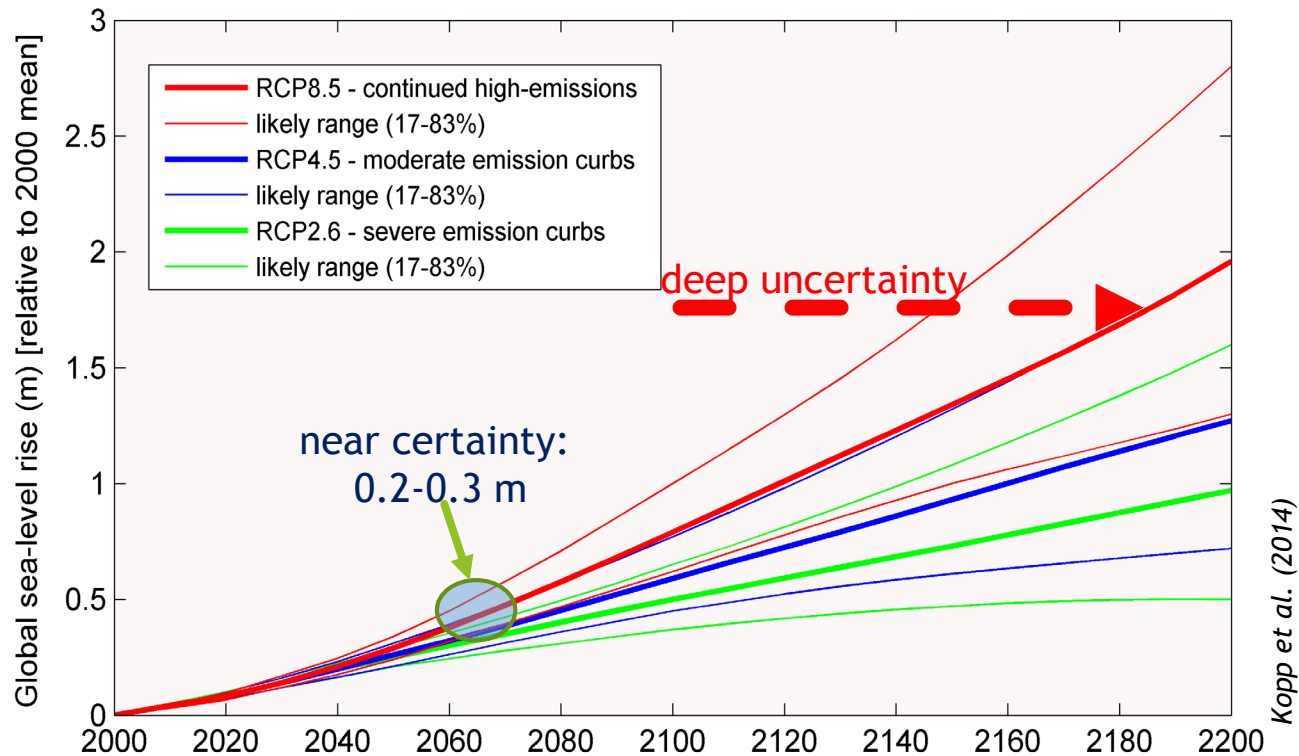
Groundwater at the coast with climate change

Particulates/sediment & pollutants (more pulses, dry build-ups)

Complex combined hazards

Storm-tide and river flood - timing critical in some systems!





- ⇒ PCE 2015 report= 0.1- 0.3 is already significant exposure in low-lying areas
- ⇒ Need to test response options or actions with a range of scenarios

Emerging urban drainage impacts

- Escalation in frequency of coastal flooding events
- Compounding effects from rainfall and coastal events
 - Legacy storm water networks - often gravity systems
 - Decreasing levels of service
 - More intense rainfall with climate change
 - Decrease in level of service: existing storm water system
 - Infiltration of sewerage systems (more combined sewage overflows plus saltwater)
- Groundwater and drainage at the coast-gravity drainage increasingly problematic
- Increasing coastal erosion - especially sand spits



credit: Chris Loufte

Increase in frequency

1:100yr event today becomes annual with modest sea level rise
(by around 2050-60s): **low uncertainty**
2.9m spring-tide range 1.4m spring-tide range

SLR	Auckland	SLR	Wellington
0cm	Every 100 years	0cm	Every 100 years
10cm	Every 35 years	10cm	Every 20 years
20cm	Every 12 years	20cm	Every 4 years
30cm	Every 4 years	30cm	Once a year
40cm	Every 2 years	40cm	Every 2 months
50cm	Every 6 months	50cm	Twice a month
60cm	Every 2 months	60cm	3 times a week
70cm	Every month	70cm	Every tide
80cm	Every week	80cm	Every tide
90cm	Twice a week	90cm	Every tide
100cm	Every day	100cm	Every tide

Types of costs of climate change

1. Disruption to normal business activity - output losses
2. Loss of private land and physical assets, both residential and commercial (e.g. due to coastal erosion and inundation)
3. Damage to public infrastructure and other assets
4. Loss of taonga, sense of place, amenity, community
5. Risk-reduction measures, including avoidance, mitigation by hard and soft structures, managed retreat, future-proofing infrastructure, etc.
6. Compensation for losses

What is at risk in NZ?

An incomplete view

Sea level rise	Buildings	#people	Replacement cost
1.5 m	43,683 homes 1,448 commercial	133,000	NZ\$20 billion (2011 costs)
3.0 m		280,000	NZ\$ 50 billion (2011 costs)

Transport and energy systems, water services, ports, airports, roads, and railway lines, many critical-facility buildings will be significantly impacted –

Public infrastructure is not accounted for in the costs above

Sea levels will not stop rising in 2100 or at 1.5m!





Tamaki Drive,
Auckland

NZ's current adaptation framework

Fit for purpose? No:

1. No overarching national plan, strategy or framework (c.f. UK, Canada) to guide adaptation, fragmented regulatory system, statutes poorly aligned, inconsistent planning horizons, mandates unclear leading to perverse outcomes, entrenched risk, inflexible responses
2. Funding arrangements *ad hoc*, focus on reactive *post-event* responses (post-disaster assistance and recovery), insufficient *pre-event* planning for resilience, risk minimization and cost-effective adjustments and transitions

Lessons from NZ funding mechanisms

- EQC funds address readiness, response & recovery
 - Does not fund 'betterment', thus entrenches risk at same location
 - Not well linked with RMA which can reduce exposure to and accommodate risk and the effects of climate change
- SC & RC Act focuses on risk management by protection measures and has benefit rating for funding
- LG Act can fund sustainability of infrastructure over 30 years, LTPs, National Infrastructure Plan appropriations, benefit assessments s101(3)
- **Public expenditure on pre-event risk reduction is more cost-effective than expenditure on post-disaster recovery(3:1 ++)**

NZ's current adaptation framework

- Inadequate mechanisms to share adaptation costs equitably, inter-generationally or intra-generationally
- Mismatch between local government resources and capabilities and the scope and scale of adaptation challenges
- Inadequate resources for fair and consistent compensation for those required to relocate, will increase public opposition to timely managed retreat leading to greater overall costs
- Risk of moral hazard - due to public expectations of governmental post-event assistance (e.g. under-insurance, investments in vulnerable areas, etc.)
- Private insurance transfers risk, it does not reduce risk; not an efficient or equitable solution to climate change, but is necessary and valuable
- 'Betterment' provisions are lacking in insurance and EQC arrangements, so we rebuild in harms way

Managed retreat will be a core part of an adaptation framework

- ▶ Deliberate, intentional, coordinated, planned
- ▶ Permanent risk reduction
- ▶ Since 1980s approx. 1.3 million people in 22 countries relocated through managed retreat - both in pre- and post-disaster contexts and both voluntarily and involuntarily
- ▶ Upfront and intangible costs can be addressed through staging of how this is done and with community engagement to address loss of place and values

Definition

“the application of coastal zone management and mitigation tools designed to move existing and planned development out of the path of eroding coastlines and coastal hazards”

(quoted in Hino, et al., 2017)

New Jersey Coast - Post Hurricane Sandy, October 2012



Overall goals for adaptation

1. Sound anticipatory governance - proactive, preventative, prudent, precautionary, participatory ...
2. An effective, fair, coordinated and flexible planning framework, based on a durable, multi-party agreement
 - ▶ periodic national adaptation plans, subject to review
 - ▶ clear assignment of decision rights
 - ▶ adequate resources to achieve goals
 - ▶ tailored processes for public engagement
 - ▶ mechanisms that are flexible to enable review and course correction as risk profiles change

Goals for funding pre-event adaptation costs

1. Minimize long-term adaptation costs by facilitating policy decisions that reduce climate change risk exposure (to lower future damages, insurance costs, EQC costs, etc.)
2. Share burdens equitably, both inter- and intra-generationally
3. Ensure a durable, consistent and predictable approach - minimize uncertainty, delays and transaction costs
4. Ensure credibility and legitimacy
5. Ensure transparency and accountability re. public funds
6. Ensure fiscal prudence and sustainability
7. Minimize moral hazard
8. Complement existing funding and insurance mechanisms

Adaptation Funding Options

1. Rely primarily on local government funding
2. Rely on ad hoc central government funding
3. Expand the role of EQC (Natural Disaster Fund) to include pre-event risk mitigation
4. Establish a dedicated Climate Change Adaptation Fund

► Brief assessment of these options

Purpose and role of a funding mechanism(s)

1. Goals:

- reducing long-term impacts and costs of climate change, and sharing the burden fairly

2. Scope:

- all types of adaptation impact versus some (e.g. those specifically related to sea level rise)
- new, additional and large versus ongoing adjustments
- major protective measures (but only when cost-effective)
- managed retreat (including compensation for losses)
- related infrastructure costs

3. Funds: a single fund or multiple funds

Design options - governance

1. Ministerial department or Crown entity
2. If a Crown entity, the board could include representatives of central, regional and local government
3. Issue of decision rights

Funding arrangements and sources

1. Pre-funding v pay-as-you-go
2. Full funding v partial funding of costs (with co-funding arrangements)
3. Source of funds (some mix of):
 - ▶ a carbon/emissions tax
 - ▶ an additional insurance levy (like EQC)
 - ▶ an additional rating levy
 - ▶ an dedicated tax (like ACC)
 - ▶ general tax revenue
4. Crown guarantee

Compensation - issues

1. Types and range of losses covered
 - ▶ Land, buildings, business disruption, etc.
 - ▶ Loss of 'place' and taonga
2. Eligibility criteria
 - ▶ Level of risk (as assessed by authoritative processes)
 - ▶ Level of compulsion
3. Level of compensation
 - ▶ Property value (assessment criteria)
 - ▶ Knowledge of risk
 - ▶ Ability to pay (absorb losses)
 - ▶ Discretionary rules
4. Minimum and maximum thresholds
5. Forms of compensation
 - ▶ Cash v alternative land/property

Wider policy implications

1. Spatial planning, policy processes and decision rights - who decides what, when and how
2. Infrastructure planning and service provision - water services, transport, power, etc.
3. Other public services - education, health care
4. Private insurance - implications for coverage during managed retreat; betterment provisions; requirements for cross-subsidization?
5. EQC's role and coverage

Climate Change Adaptation Fund

A possible model:

1. A statutory body under its own Act, arms-length from central and local government, with a board containing representative from across each tier of government
2. A mix of funding sources, including polluter-pays (e.g. a dedicated carbon tax), and a Crown guarantee
3. Funding for both private and public purposes (i.e. loss of private assets and future-proofing infrastructure)
4. Statutory principles and criteria for allocating funds - for compensation and protective structures
5. A period of pre-funding to create a pool of funds - to reflect intergenerational equity
6. Post-disaster funding continues via private insurance and EQC

Conclusion

1. Adaptation to climate change is inevitable regardless of the future path of global GHG emissions
2. The technical and political challenges are large
3. The financial and non-financial costs can be reduced significantly via sound anticipatory governance
4. New tailor-made funding and planning mechanisms will be essential for a cost-effective and equitable response
5. A national conversation about adaptation strategies and their funding is urgently required



Goals for funding red-zone properties in Christchurch

1. Certainty of outcome for property owners as soon as practicable
2. Create confidence for property owners to move forward
3. Create confidence in decision-making processes - for home-owners, business owners, insurers and investors
4. Use the best available information to inform decisions
5. Have a simple process to provide clarity and support those affected (avoid lengthy negotiations)
6. Fairness for all parties
7. Minimize moral hazard (e.g. incentives for people not to insure their properties in the future)

What is at risk in Dunedin?

Low-lying homes, businesses & roads in Dunedin

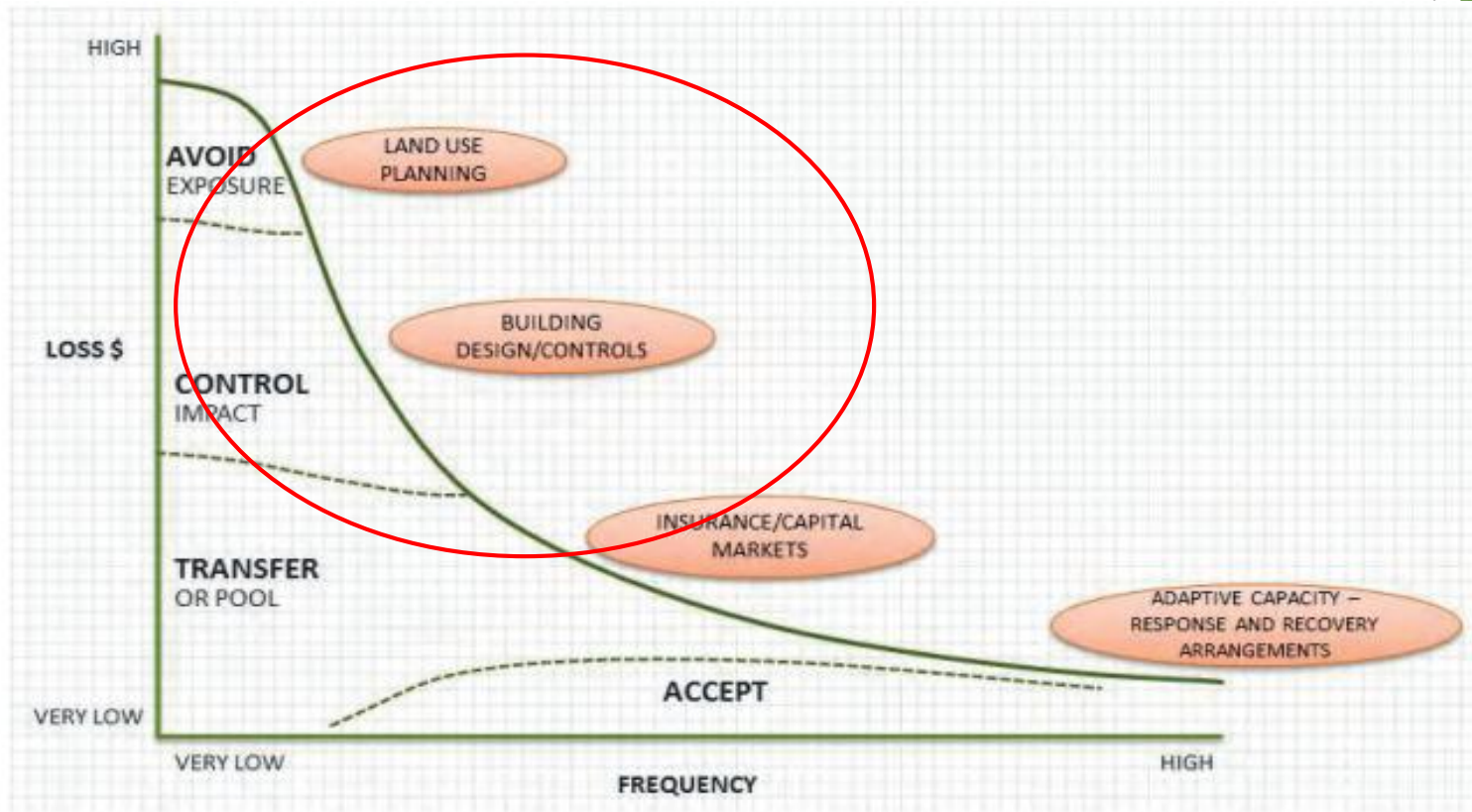
- relative to spring high tide mark

	0-50 cm	50-100 cm	100-150 cm	Total 0-150 cm
Homes	2,683	604	317	3,604
Businesses	116	29	40	185
Roads (kms)	35	17	20	72

Source: Parliamentary Commissioner for the Environment, *Preparing NZ for Rising Seas*, 2015, p. 54

Note: Of the nearly 2,700 homes that lie less than 50 centimetres above the spring high tide mark, over 70% (close to 2,000) are lower than half that elevation

A risk management approach



After Cowan et al 2016