Takutai Kāpiti.

Kāpiti Coast DISTRICT COUNCIL
Me Huri Whakamuri, Ka Titiro Whakamua

Minutes:
Online Mini-CAP Meeting– Paekākāriki Adaptation Area: Excluding Options from the Long List

Date: Wednesday, 17 January 2023

Location: Online (MS teams–link in invite)

Time: 2.00 pm – 3.00 pm

Attendees: Jim Bolger (Chair), Jerry Mateparae, Donald Day, Martin Manning, Susie Mills, Moira Poutama, Olivia Bird, Kelvin Nixon, Stephen Daysh, Kate MacDonald, Derek Todd, Iain Dawe, Jason Holland, Sandhira Naidoo, Yvonna Chrzanowska, Oskar Temel, Alfred Lison, Heather Patterson and Abbey Morris

Observers: Sean McKinley

Apologies: John Barrett, Deanna Rudd, Kris Pervan, Sophie Handford, Michael Moore, Mark Taratoa and Glen Olsen

Agenda Item	Comments
Opening & Introductions	**Opening Karakia** by Abbey **Welcome** by **Jim Bolger, Chair** Jim welcomed Sean McKinley from the Paekākāriki Community Board, who is an observer.
Excluding Options from the Long List for Paekākāriki Adaptation Area	**Stephen Daysh, Mitchell Daysh and Kate MacDonald, Jacobs** *(Facilitated discussion session resulting in CAP decision required)* • Kate explained the purpose of today's session is to review the long list of potential options and actions in the context of the Paekākāriki Adaptation Area (PAA), and then exclude undesired options to create a short list. This short list will then be used by the Technical Advisory Group (TAG) to form starter adaptation pathway options for CAP's determination at the next CAP meeting. • Kate explained that TAG has excluded some of the options for CAP based on experience and knowledge of the feasibility of these options in a context like Paekākāriki. She added that TAG's commentary and reasons for excluding certain options has been provided to CAP in the Excluding Options from Long List for PAA document. **Note: A copy of this referred document, with CAP's additions, are included in Appendix 1 to these minutes.** • Kate continued by outlining the reasons that options may have been excluded, such as whether the option has a good track record of being successful in environments similar to Paekākāriki, especially as the area has insufficient or limited space to implement options. Kate added that TAG did not exclude any options based on whether they achieve the PAA objective as the CAP will determine the PAA objective at the next CAP meeting. • Kate noted that the options for PAA are similar to the Raumati Adaptation Area as they are very similar environments - they are both sediment deprived areas with very structured shorelines. She added that because the shoreline is predominantly structured there is no real opportunity for the dune and wetland enhancement/resilience option, except for Ames Street Reserve area and a bit of

	the area north of Wainui Stream. There is approximately 300 metres of unprotected shoreline within the Paekākāriki area. • Kate described that while TAG did not exclude any Enhance options, when looking at the broad scale options the enhancement of dunes is not going to protect the properties or the key infrastructure along the coastline in PAA. • Kate explained that there were no reasons to discount any of the options under 'Accommodate'. She added that the inundation hazard in Paekākāriki is quite localised, so addressing adaptation on a property-to-property basis could be a reasonable approach to addressing the inundation hazards there. • Abbey clarified that inundation is not the primary hazard for Paekākāriki. Kate confirmed that this was correct, adding that erosion is the primary hazard. Inundation risk is localised to the low lying Wainui Stream area and the coastal land in front of that. Kate explained to CAP that when developing the adaptation pathways, there will be more diverse options available for the erosion hazard, with fewer pathway options available for addressing inundation hazards. She added that when CAP is presented the risk assessment for the area, CAP will see that the coastal erosion risk could be quite high and extreme over the longer time periods. • Kate explained that for the Protect category, TAG has excluded the beach drainage and beach scraping options from the 'Soft Engineering' sub-category, due to not being suited to existing beach conditions and would be technically unfeasible. Beach scraping requires more sand on the lower beach to move up to the higher beach, than there currently is for PAA. Kate noted that beach scraping was excluded from NAA, CAA, and RAA due to the negative impact it would have on the shellfish on the foreshore and was another reason for excluding for PAA. • Kate explained that the renourishment and dune reconstruction options have not been excluded but would need to be paired with something else to be effective. For example, set back retreat would allow space for dune reconstruction which would create a more natural shoreline, or where renourishment could be paired with groynes to trap that sediment. • Kate outlined the excluded options under the Hard Engineering sub-category. Groynes have been discounted, as the purpose of groynes are to trap sediment and build up protection but there is not much sediment around the area to trap. While groynes could still be paired with an option like renourishment, TAG wouldn't recommend it for PAA. • Kate explained that vertical permeable sills has been excluded due to having a poor track record of being effective, and they are more effective in a coarse gravel beach environment, whereas Paekākāriki is a sandy beach environment. Kate explained that the detached breakwater option has been excluded for the same reasons as it was discounted in RAA - the lack of sediment supply to the area means, there would be limited benefits in undertaking this option as it was unlikely the beach would build up behind the breakwater. She added that while the detached breakwater would help break up wave energy getting to the seawall, this would result in having two layers of defence leading to increased infrastructure maintenance. It is a large undertaking when you already have the seawalls built. • Kate explained that controlled/planned mouth openings of lagoons or rivers has been excluded, because cutting open a river mouth in a coastal storm allows storm surge to enter inland areas. She noted that for the Wainui Stream there are situations when the stream mouth could be cut, but in the context of coastal inundation it would not be efficient. Kate shared that flood gates and storm surge

	barriers have been excluded as the scale of works required would be quite extensive given the limited inundation hazard in this area. She added that protection could be achieved via outfalls, small bunds, stopbanks and pump stations, and these would be suitable in relation to the lower inundation risk for PAA. • Kate noted that for Retreat, options at this stage are being looked at as a broader concept, rather than looking into exactly how a retreat option could be implemented. Retreat options could be paired with renourishment and dune reconstruction, and that the re-establish the line option is included as an option. • Kate finished with the Avoid option, noting that transferable development rights has been discounted after discussions with KCDC staff on whether it would be feasible. Kate added that this option has now been excluded from all adaptation areas. • Jim thanked Kate for all her work. He raised the question of why Avoid isn't the number one option. Jason replied that when it comes to constraining development in areas that have proven levels of risk then the Avoid options are critical. In the planning dedicated CAP meeting last year, CAP received advice that suggested that constraint on development should be based on the extent of risk. The higher the risk, the higher the constraint – a risk-based planning approach. CAP endorsed this approach. Jason added that there are the limitations of what a district plan change can actually achieve where there is already existing development. For example, if someone has already lawfully established a dwelling, then under the RMA, a district plan change cannot force that person to take the established dwelling away – this is existing use rights. A future district plan change can only constrain additional development over and above what has already occurred. • Jim replied that is seems totally logical to not build in areas that will be flooded in one or 10- or 50-years' time. Stephen added that Avoid is being implemented across all the pathways as a given through the planning processes which is why it doesn't appear as a dedicate option within pathways. • Iain added that there has been an acknowledgement both regionally and nationally about the need to avoid building in high hazard areas as identified through robust hazard assessments. Iain continued that there has been a lot of work to try and get risk-based planning rules into district plans to avoid building in high hazard areas. areas. Iain acknowledged the importance of Jim's statement on the importance of avoiding high hazard areas. • Martin also noted that the Ecoreef option that CAP has discussed is not being considered in the options, noting that it is different to the options listed. He stated that not including this option closes it off prematurely and this is unwise. Abbey clarified that seawalls as a broad definition includes an Ecoreef like option. Martin responded that "new types of seawalls" like Ecoreef need to be added as a specific separate option. • Abbey offered for an amendment to be made to the seawall wording to reflect the type of Ecoreef structure. Stephen agreed that the option has not been closed off, rather the details of the seawall design will be determined later. He added that the minutes can note CAP's interest in this design and any other future opportunities for these types of structures. • Iain acknowledged Martin's interest in that style of seawall development and suggested that it likely falls under the interlocking seawall type. Iain agreed similar structures to Ecoreef are not off the table. Derek reconfirmed what Iain has said and noted that Stephen and Abbey have alluded to regarding the

	interlocking wall option. This definition covers a range of designs, and he suggested that the overall summary would not need to be adjusted. He suggested that Ecoreef could be included as an example in the background notes instead. Stephen agreed this could be included. • Kelvin asked about the definition for interlocking seawall and CAP reviewed the wording. Kate offered a wording adjustment to the 'Interlocking pre-cast concrete block seawall' action to replace 'solid vertical barrier' to 'solid stepped or vertical barrier constructed by concrete shapes'. Kate agreed to broaden the definition to encompass the Ecoreef type build. Stephen noted to use the CAP commentary column to note that CAP is interested in the Ecoreef example. • Martin questioned whether a stepped barrier could still be classed as a seawall as it does not block the sea and is more of a buffer zone that dissipates the energy. He added that Ecoreef is deliberately not a seawall. Iain responded that Ecoreef will dissipate large wave energy, but if you've got small waves (30 – 50cm high) that are seen in the district regularly, steps of 0.5 – 1m high, there is still going to be some reflection of wave energy. Iain added that in storm conditions a structure like Ecoreef will be more dissipative in the same way a rock revetment is. He added that Ecoreef still has a hardened shoreline with a reflective nature, so is a subset of a seawall. If defined as a more intermediary dissipative option, it would align more closely to an engineered revetment. • Kate agreed with Iain that as Ecoreef dissipates but also has reflectiveness of a seawall, and stated that it still falls under a subset of a seawall, as it serves as a physical barrier between the sea and the land, with the objective to hold the shoreline in position. Kate noted that it would be worth it to encapsulate some of those added benefits you can have from varied designs. • Olivia added that the disadvantages look quite different for the Ecoreef compared to the traditional seawall. • Kate noted that previously when seawalls have been discussed, it has been high level, with reference to a generic hard protection barrier along the coast. The seawall discussions to date have also included extra aspirations that CAP has of incorporating as much ecological and social benefits within those structures as possible. • Martin further expressed that he does not believe that an Ecoreef like structure is a seawall. • Abbey noted that the CAP recommendations are CAP's to make and if they wish explore defining that they believe there is a difference between a seawall and an Ecoreef type structure, TAG could explore this. CAP all requested such. • Abbey asked CAP if they wanted to add comments to the PAA long list document. Kelvin noted these options are similar to what CAP has excluded in RAA. Martin said that the difference between RAA and PAA is the density of housing. He noted that until CAP have the economic analysis of the options it is difficult to prioritise. Stephen reminded Martin that the economic analysis is part of the process after the top three pathway preferences are identified. Abbey confirmed that the CAP meeting in April 2024 is where CAP will be presented the economic analysis of their preferred pathways. This is where CAP will then have the opportunity to reconsider their draft recommendations in light of the economics. • Kelvin commented that there will be a tight turnaround for completing the report by May. Stephen replied that this what the Hawke's Bay coastal panel did, and it is an achievable timetable. • Stephen proposed to CAP that apart from the separation of a stepped Ecoreef like structure, is CAP is comfortable to accept the long list for PAA. Jim checked

	• with CAP, who all accepted the recommended shortlist of actions for Paekākāriki Adaptation Area, with the amendments for an Ecoreef type structure to come. • Sean added that the process he observed is good. His only concern is the reference to Raumati South and Paekākāriki being similar. He added that the issue of flooding does happen in Paekākāriki, and noting in Raumati that the space where the bowling club is used to be a lake. • Stephen thanked Sean for attending noting that involvement of the Community Board Chairs is beneficial when developing pathways.
Next Steps	**Abbey Morris, KCDC** • CAP have an upcoming meeting with Council management for the project. • Next CAP meeting is on 9th February.
Closing Karakia	By **Moira**

ATTACHMENTS
• **PAA Excluding Long-List Actions Presentation** • **Excluding Long-List Actions Paekākāriki Adaptation Area**

Appendix 1: Excluding Options from Long List for PAA

From Takutai Kāpiti Decision-Making Framework: Phase 2, Task 3: Excluding from long list of actions

The Takutai Kāpiti Decision-making Framework outlines the following tasks for this part of the decision-making process.

Using the long list of options confirmed by the CAP (Coastal Advisory Panel) in Phase 1, the CAP will be tasked with excluding any adaptation options and actions that would not be suitable for the Adaptation Area under consideration. This will be done in a workshop environment where the CAP, along with technical advice from the TAG (Technical Advisory Group), will determine whether an action is not practical for the Adaptation Area, and therefore should be discarded. Reasons for excluding the action from the long list will be recorded in this table.

For simplicity of record against the long list, the following reasons for excluding (A-F) should be considered and recorded where appropriate for excluding. If there are reasons other than these, then they should also be recorded as G - Other:

A. Will not provide for the objectives defined by the CAP
B. Does not have a good track record of being successful in this environment
C. Insufficient or limited space to implement the action
D. Not suitable for the environment is it being applied to
E. It is not a practical solution
F. Limited benefits
G. Other

The remaining actions deemed relevant for application within the Adaption Area by the CAP will form the 'short list' of actions, which can then be used to form adaptation pathways.

This Document: Excluding of long-list options for the Paekākāriki Adaptation Area

This document provides a record of the reasons for excluding long-list areas for the Paekākāriki Adaptation Area (PAA) from both the TAG advice and the CAP's discussion in the workshop.

The first eight columns of the following Table are from the original Long List Adaptation Actions presented to the CAP at their July 2022 CAP workshop, with some amendments based on conversations with the CAP on options for the NAA, CAA, and RAA. In the following Table there are an additional two columns added to the right-hand side of the long list Table. The second to right column contains pre-workshop commentary by the TAG for actions which in their opinion should be considered to be removed from the list for the technically feasibility reasons given above (Reasons B to E) and other (Reason G). Since the Coastal Adaptation Objectives for the Paekākāriki Adaptation Area have not been confirmed yet, the above excluding reason A - not provide for the objectives of the Paekākāriki Adaptation Area, has not been part of the TAG consideration.

Commentary and decisions from the upcoming CAP workshop will be recorded in the right-hand column during the workshop. It is recognized that additional adaptation actions may be excluded from the long-list at the workshop as a result of the discussions and confirmation of the adaptation objectives for the Paekākāriki Adaptation Area.

It is also recognised that the actions remaining on the list may be used at a range of timeframes over the 100 years of the assessment, with some being better implemented in the short term and others in the longer-term as indicated in Column 5 of the Table.

It is further recognised that not all of the remaining actions may be used in a short-listed adaptation pathway which the CAP will be undertaking in Task 4: Develop Pathways (February 2024 CAP Workshop).

Enhance: We maintain and improve what we are already doing

Enhancement actions utilise existing infrastructure, assets, knowledge and information to build on and improve. These actions involve physical works, such as strengthen existing protection structures or dune planting and reshaping; district wide initiatives to increase community awareness around hazards; improvements to environmental monitoring; and improvements to emergency management in large events. These actions build on systems, information, and assets that we already have.

Option	Action	Hazard	Description	Approximate timeframe it could be used for (Short term/ Medium term/ long term)	Optimal environment/setting to be applied	Advantages/Positive	Disadvantages/Limitations	TAG commentary for excluding	CAP commentary
Enhance	Enhance and strengthen existing structures	Erosion	Adding material to existing structures to increase the level of protection (from both overtopping inundation and erosion).	Short term. Could be a medium-long term option following the construction of a new protection structure in an earlier epoch.	Existing structures that are adaptable and can still be utilized, where there is space for increased structure footprint.	▪ Can be low cost ▪ Can be easier to consent than replacement/new protection.	▪ May not have certainty in the asset's performance ▪ Difficult to meet design requirements of material size and shape to provide necessary level of protection. ▪ Long term durability of existing structures not addressed. ▪ May not address other issues (e.g. access, aesthetics). ▪ Limited ability to be adapted in the future to provide for sea level rise.	▪	▪
	Enhance existing inundation protection	Inundation	Increase existing stop banks to provide greater protection from storm surge inundation. Incorporate SLR and higher intensity events into the design of stormwater management when it is being upgraded.	Short to medium term.	Coastal/fluvial environments.	▪ Can be designed or adapted for longer term protection with future sea level rise ▪ Stopbanks/bunds can be grassed over and planted to look more natural along the banks edge. ▪ Utilises existing structures so could be lower cost relative to building new stopbanks.	▪ Depending on how extensive stopbank network is, it could be an expensive exercise due to the length required. ▪ May cause some backing up of the river/lagoon water levels, which may divert the flooding further upstream. ▪ If stopbanks are overtopped water can be trapped with no pathway back to the sea/river.	▪	▪
	Access steps and ramps	Erosion/ Inundation	Structures that provide pedestrian and/or small boat access to the coast.	Short to medium term	Anywhere where access is required to the coast	▪ Allowing for access to the coast (NZCPS alignment) ▪ Way to encourage pedestrians to use access, rather than to walk across dunes and ruin vegetation. ▪ Providing safe access to ensure pedestrians do not need to climb down or over hard structures.		▪	
	Dune and wetland enhancement/resilience	Erosion/ Inundation	Dune enhancement by building wind trap fences on the seaward side of an existing dune to trap sand and promote dune growth, vegetation planting to stabilise dunes, and/or making artificial dunes. Wetland enhancement by managing coastal wetlands and riparian planting. Pest control, weed control and continued maintenance of plantings.	Short to medium term, depending on the level of hazard.	Dune and wetland environments with good sediment supply, with land area behind the beach suitable for planting and enhancement.	▪ Promotes vegetation planting to stabilise the dunes/wetland and dune/wetland growth. ▪ Enhances the dune/wetland ecosystem ▪ Natural beach is a good aesthetic outcome. ▪ Low-cost option ▪ Will increase longevity of the dune/wetland. ▪ Limited consenting required.	▪ Depending on local conditions, it may not be an effective long-term (100 year) solution against sea level rise, particularly on narrow beaches with limited capacity for retreat behind the dune.	▪ The shoreline in PAA is predominantly structured, and therefore no real opportunity for enhancement of dunes or wetlands, except at the Ames Street Reserve, where there is approximately 300m of unprotected shoreline and a small existing patch of existing duneland. The only infrastructure directly landward of the reserve is SH59 which is setback 100m from the coast. ▪ This option would not be a fundamental way to protect the properties and infrastructure within the wider PAA, however would be applicable to this small stretch of shoreline.	▪
	Continue emergency management	Erosion/ Inundation	Emergency management, including the creation of hazard maps, evacuation plans, civil defence emergency management, and temporary accommodation and protection measures continues.	Short to long term	District wide.	▪ Increased preparation and knowledge behind hazards. ▪ Already have systems in place to further develop and enhance. ▪ Increasing community awareness and knowledge will help them become more aware and accountable for risks.	▪ Does not address the risks to assets and infrastructure.	▪	▪

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Enhancement actions utilise existing infrastructure, assets, knowledge and information to build on and improve. These actions involve physical works, such as strengthen existing protection structures or dune planting and reshaping; district wide initiatives to increase community awareness around hazards; improvements to environmental monitoring; and improvements to emergency management in large events. These actions build on systems, information, and assets that we already have.

Option	Action	Hazard	Description	Approximate timeframe it could be used for (Short term/ Medium term/ long term)	Optimal environment/setting to be applied	Advantages/Positive	Disadvantages/Limitations	TAG commentary for excluding	CAP commentary
						▪ Being prepared will increase the safety of people during large events (e.g. being able to evacuate).			
	Continue environmental monitoring	Erosion/Inundation	Environmental monitoring may include topographic and bathymetric surveys, shoreline mapping, storm events, ecological surveys, structural assessments, and morphological change assessments	Short to long term	District wide in the coastal environment	▪ Allowing monitoring of triggers for understanding of hazards. ▪ Increase understanding of the risks as new information develops ▪ Can be citizen Science based to give community involvement in environmental monitoring	▪ Can be resource intensive over a long timeframe. Requires commitment to establish useful long-term datasets. ▪ Does not directly address the risks to assets and infrastructure.	▪	▪
	Continue to increase community education and risk awareness	Erosion/Inundation	As people build an understanding of the impacts of climate change it is seen to encourage changes in their attitude and behavior, and helps them adapt to climate change. Education and awareness also allows people to make informed decisions and play a role in both climate change mitigation and adaptation. This can be done through organized events, engagement with schools, updating and sharing online resources.	Short to long term	District wide	▪ Increasing awareness ▪ Allowing people to take ownership of their risks as their understanding of the hazards increases.	▪ Can be resource intensive.	▪	▪
	Private owner's responsibility	Erosion/ Inundation	Through planning tools (district and regional), Council allows for owners of private structures to own and maintain their own structures.	Short to long term depending on provisions.	Where there are good condition structures and consistency in materials and level of protection over several property lengths, and there is commitment from land owners to provide and maintain protection.	▪ No cost to council or rate payer ▪ Private owners can manage their own risks	▪ Costs might be too high for private property owners. ▪ Having ad hoc structures could lead to weak spots which could lead to damage of individual properties.	▪	▪

Accommodate: We live with the hazard

Accommodation is about adapting our buildings and infrastructure to be able to withstand the consequences of the hazards. These actions are generally involve works done to individual properties (i.e. flood proofing, raising floor levels), making buildings adaptable and relocatable so they can be removed either temporarily in an event or permanently during retreat a low cost; or increasing the resilience of existing infrastructure where it already exists.

Option	Action	Hazard	Description	Approximate timeframe it could be used for (Short term/ Medium term/ long term)	Optimal environment/setting to be applied	Advantages/Positive	Disadvantages/Limitations	TAG commentary for excluding	CAP commentary
Accommodate	Relocatable buildings	Erosion/ Inundation	Buildings can be relocatable to move away from the hazard, which can lower the cost of retreating in the longer term.	Short to long term solution, depending on the level of hazard.	Individual property basis, new builds.	▪ Can be applied to individual properties, so can be considered a suitable option where only a few properties/assets are likely to be affected. ▪ Lowers the cost of retreat in the future if buildings are relocatable.	▪ Likely to only be applicable to new builds so does not address risk to existing buildings.	▪	
	Building Design – Raising minimum floor levels of existing buildings	Inundation	Raising the floor levels of existing properties which are at risk from inundation.	Short to long term solution, depending on the level of hazard and how much the floor has been raised.	Buildings that are at high risk of frequent flooding.	▪ Can be a low-cost option if only a few buildings are likely to be affected in an isolated area. ▪ Can directly change the flood risk of an individual property.	▪ Can be an expensive option if lots of buildings require raising floor levels. ▪ May not be possible/practical for some buildings. ▪ Can divert the flood risk to neighboring properties. ▪ Increasing floor levels increases the height of the building which can become aesthetically unpleasing for neighboring properties.	▪	
	Flood proofing buildings	Inundation	Flood proofing measures are best applicable to coastal areas with a small inter-tidal range and where flood depths are low. This involves wet-proofing or dry proofing a building: Wet proofing – allowing water to enter the structure but minimizing the structural damage through using flood resistant materials or elevating structures. Dry proofing – making buildings water-tight so that water cannot enter.	Short to medium term solution	Buildings that are at high risk of frequent flooding.	▪ Wet proofing can be a low-cost option for areas where the flood depths and risks are low. ▪ Will ensure that a new/ existing building will be protected from small flood events.	▪ Only addresses the risk at an individual property basis. ▪ May not be possible/practical for some buildings.	▪	
	Flood proofing infrastructure	Inundation	Flood proofing infrastructure such as wastewater, stormwater and drinking water infrastructure, telecommunication infrastructure, and roads. This may involve modifying existing infrastructure or designing new or replacement infrastructure to withstand coastal hazards.	Medium-long term solution.	Existing or new infrastructure that is at high risk of frequent flooding, or consequences of being flooded are unacceptable.	▪ Flood proofing existing infrastructure will be a lower cost than replacement as it utilises existing material. ▪ By flood proofing the infrastructure it could reduce the need for maintenance over the lifetime of the asset.	▪ Designing new or replacement infrastructure will be expensive	▪	

Protect: We keep the hazard away

Protection of our people, values, assets and infrastructure from the hazards generally is in the form of soft or hard engineering actions. Soft engineering actions generally involve utilizing natural resources to reshape beaches, add material to systems, or enhance the environment to build resilience. Hard engineering actions are generally in the form of designed protection structures which can be placed along a shoreline.

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Protect	Beach drainage	Erosion	Beach drainage (also referred to as coastal drainage or beach dewatering) involves the placement of drains parallel to the shoreline, under the exposed beach face, which are connected to a well so that water which enters the system can be pumped out. Beach drainage lowers the water table and therefore increases the depth of the unsaturated zone under the ground. This lowering of the ground water table also encourages sediments to be deposited on the beach and reduces the sea-ward transport of sediment and therefore accretes sediment at the shore	Medium to long term, depending on the intensity of the erosion hazard.	Sand beaches where there is mild upper beach and dune erosion.	▪ Encourages sediments to be deposited on the beach and reduces the sea-ward transport of sediment. Can promote accretion on the beach. ▪ Can provide a natural looking aesthetic outcome.	▪ Not as well known and tested of a technique, certainty in success is unknown. ▪ Drain may be exposed during storms.	▪ (B) Does not have a proven track record of being successfully implemented. ▪ (C) Limited space/environmental conditions to implement the option successfully.	▪
	Beach scraping	Erosion/ Inundation	Redistribution of sediment across a beach profile to increase the dune/crest elevation on the beach from taking material from the lower beach and moving it to the upper beach profile.	Short to medium term	Sand or gravel beaches with lowered crests.	▪ Natural beach is a good aesthetic outcome. ▪ Provides good access to the beach. ▪ No adverse effects on coastal processes. ▪ Doesn't cut off any future adaptation pathways that could involve putting in more permanent (soft/hard) engineered structures.	▪ High energy environment will likely move the sediment away from the shoreline fairly quickly, and therefore unlikely to be a long-term solution unless end containments barriers (e.g. small artificial headlands) are included along with regular maintenance top ups and replacements. ▪ There would be on-going whole of life costs involved in continuously providing increasing maintenance requirements. ▪ Disturbance of dune/crest ridge vegetation and ecology. ▪ Ecological impacts of beach scraping in tidal zone on shellfish populations.	▪ (D) Not suitable for the environment it is being applied to – would require the beach to have some surplus material which required redistributing to provide better protection – this is not the case where there are sea walls present. ▪ (E) This is not a practical solution. ▪ (G) This option was removed from consideration by the CAP in NAA, CAA & RAA due to the potential impact on shellfish on the foreshore.	▪
	Dune Reconstruction	Erosion/Inundation	Redistribution of sediment across a beach profile to increase the dune/crest elevation on the beach. This can sometimes require additional sand it be brought into the system to help build up volume if there is not enough sand locally available. The new dune can be replanted to help build resilience and encourage further growth of the dune.	Short to medium term	Sand beaches with lowered crests	▪ Natural beach is a good aesthetic outcome. ▪ Provides controlled access to the beach. ▪ No adverse effects on coastal processes. ▪ Doesn't cut off any future adaptation pathways that could involve putting in more permanent (soft/hard) engineered structures.	▪ High energy environment will likely move the sediment away from the shoreline fairly quickly, and therefore unlikely to be a long-term solution unless end containments barriers (e.g. small artificial headlands) are included along with regular maintenance top ups and replacements. ▪ There would be on-going whole of life costs involved in continuously providing increasing maintenance requirements. ▪ Disturbance of dune/crest ridge vegetation and ecology	▪ If undertaken by itself it would not be appropriate because - (D) it is not suitable for the environment it is being applied to, as there is not space or existing dune environment to undertake reconstruction; and ▪ (C) Insufficient or limited space to implement the action. ▪ **However, there is potential for this option to be paired with setback/retreat, where a dune could be constructed in the increased coastal margin area.**	▪
	Renourishment (sand, gravel, cobbles)	Erosion	Adding sediment to the beach system, either onshore or in the nearshore.	Short to medium term	Lower energy coastal environment which can retain sediment in the	▪ Natural beach is a good aesthetic outcome. ▪ Provides good access to the beach	▪ High energy environment will likely move the sediment away from the shoreline fairly quickly, and therefore unlikely to be a long-term solution unless end containments barriers (e.g.	▪ (B) Does not have a good track record of being successful in this environment – Was historically trialed further	▪

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Option	Action		Hazard	Description	Approximate timeframe it could be used for (Short term/ Medium term/ long term)	Optimal environment/setting to be applied	Advantages/Positive	Disadvantages/Limitations	TAG commentary for excluding	CAP commentary
						system (e.g. won't be immediately shifted away).	▪ No adverse effects on coastal processes ▪ Doesn't cut off any future adaptation pathways that could involve putting in more permanent engineered structures.	small artificial headlands) are included along with regular maintenance top ups and replacements. ▪ There would be high on-going whole of life costs involved in continuously providing increasing maintenance requirements. ▪ Need readily available source of renourishment material near to the site.	north in Raumati at Marine Parade and was unsuccessful due to natural sediment deficit. ▪ (D) Not suitable for the environment it is being applied to – current shoreline is structured and has erosion projected in the future. ▪ (F) There would be limited benefits based on what we know about natural processes occurring in the PAA. ▪ **Could be paired with groynes** (artificial headland) **to reduce losses of sediment; and also post dune reconstruction to increase resilience of the dune.**	
	Vertical Sea wall	Buried Terminal wall	Erosion	A buried wall (concrete, rock, gabion baskets, timber) at the landward limit of where it is acceptable for the beach to retreat to at some time in the future. Normal beach processes would continue in the intervening years, with the wall slowly becoming exposed until it was acting as a fully functional protection structure holding the shoreline in place.	Medium to long term	Beaches which do not have an immediate erosion hazard, but assets landward of the beach need to be protected in the longer term.	▪ Provides certainty in future proofing erosion, particularly where dynamic short-term shoreline movements are a major issue. ▪ Could be designed to be adapted into a bigger structure once exposed. ▪ Can act as a trigger to show when erosion is becoming a significant issue requiring other planning actions (e.g. managed retreat) ▪ Beach could erode up the structure then reform in the front again as it recovers. ▪ Provides a final line of defense for erosion, generally to protect assets which are located at the back of the beach. ▪ Would allow for access to the beach whilst it is still buried.	▪ Structure is generally small in size so that it can be buried, once exposed may require raising. ▪ Significant land disturbance required in burying the wall, which may disturb existing infrastructure (roads, pipework etc). ▪ Requires good tie in at the ends of structure to reduce future end effects erosion. ▪ Still likely to suffer beach losses from in front of the seawall once it was exposed.		▪
		Vertical Gabion wall	Erosion	Porous structure (wire basket filled with cobble sized boulders), which allows water to pass into and potentially through the structure with sediment movement being restricted by the use of geotextile fabric behind the gabion basket.	Short to Medium term	Low energy coastal environment (e.g. river mouth/lagoon environment).	▪ Porous nature allows absorption of some wave energy from vertical face resulting in less wave reflection and run-up than other vertical wall types, hence less lowering of beach and/or nearshore bed and less wall height required. ▪ Occupies a relatively small footprint. ▪ Very easily adapted for longer-term protection with future sea level rise by adding additional gabion units. ▪ Less expensive than sheet pile or concrete vertical sea wall options.	▪ Site works and ground disturbance for construction required. ▪ Some beach and/or nearshore bed lowering likely to occur. ▪ Less durable than other vertical wall types with performance relying on the integrity of the wire mesh reliance, therefore whole-of-life costs may be higher.	▪ (D) Not as suitable for the open coast environment as the other proposed materials and would lack resilience in high energy environments. Wires and cobbles can breakdown in coastal environments and require ongoing maintenance and replacement.	▪
		Vertical sea walls (concrete, timber, sheet piles)	Erosion/ Inundation	Solid vertical barrier along shoreline which prevents the passing of water and sediment between the hinterland and the sea.	Medium to long term	Higher energy coastal environments (e.g. exposed open coast).	▪ If the wall is of sufficient height, it is very effective at preventing erosion (and inundation) of the hinterland. ▪ Occupies a relatively small footprint.	▪ Poor wave energy absorption from vertical face results in: 1) Reflection of energy resulting in lowering of the beach and/or nearshore estuary bed which over		▪

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Option	Action		Hazard	Description	Approximate timeframe it could be used for (Short term/ Medium term/ long term)	Optimal environment/setting to be applied	Advantages/Positive	Disadvantages/Limitations	TAG commentary for excluding	CAP commentary
							▪ Has good durability, particularly sheet piles and concrete.	time results in reduction of intertidal vegetation habitat and potentially erosion and instability of the toe of the wall. 2) Higher wave run-up, resulting in need for increased structure height to prevent overtopping and back-scour compared to other engineering options. ▪ Need for relatively large-scale site works and ground disturbance for construction (compared to other engineering options). ▪ Difficult transition from vertical walls to other protection options. ▪ Relatively expensive compared to other engineering options, particularly for sheet piles and concrete. ▪ Does not look natural in a coastal environment.		
	Stepped sea wall	Stepped concrete block wall	Erosion	Stepped concrete blocks placed along the shoreline to provide required crest height to prevent overtopping and prevent erosion.	Medium to long term	Low energy coastal environment (e.g. river mouth/lagoon environment).	▪ Provide a designed level of protection. ▪ Will provide good protection against scour along a shoreline.	▪ Not suitable in high energy environments as blocks are not interlocked, so could be displaced easily.		▪
		Geotextile Sand Containers	Erosion	Stepped solid barrier made of geotextiles along shoreline which prevents overtopping and scour.	Medium to long term	Low energy coastal environment (e.g. river mouth/lagoon environment).	▪ Can be placed over existing raised banks, scarps and bunds to enhance protection. ▪ Longshore flexibility to fit to shoreline shape. ▪ Can be designed or adapted for longer-term protection with future sea level rise. ▪ Damage/failure releases sand back onto beach	▪ Larger footprint than vertical seawalls. ▪ Would require a local sand supply to fill the containers. ▪ Does not look natural in the coastal environment and can deteriorate over time. ▪ More easily damaged than hard units and can be vandalized		▪
		Interlocking pre-caste concrete block seawall	Erosion/ Inundation	Hard protection structure. Solid, stepped or vertical barrier constructed by interlocking concrete shapes normally constructed within the beach footprint to 'hold' the shoreline in a fixed location and prevent further shoreline retreat for a considerable timeframe depending on design and cross shore location. Depending on height, it could also reduce/eliminate wave overtopping in storm events, hence also provide protection from coastal inundation.	Medium to long term	Higher energy coastal environments (e.g. exposed open coast).	▪ Occupies a relatively small footprint. ▪ Has good durability. ▪ Can be easily designed or adapted for longer-term protection with future sea level rise. ▪ Irregular shape variations in the front face breaks up wave run-up onto structure reducing overtopping potential and reflection of energy back onto the foreshore, therefore reducing beach losses in front of the wall. ▪ Can be tiered to reduce wave impacts, and can be placed over existing raised banks, scarps and bunds to enhance protection. ▪ Flat top and width of the interlocking wall allow for pedestrian provide access along the structure. ▪ Can provide opportunities for flora development in the steps	▪ Need for relatively large-scale site works and disturbance of the beach to ensure the structure is well founded against toe scour. ▪ Requires good tie in at the ends of structure to reduce end effects erosion, which is common issue with seawalls on open coasts. ▪ Still likely to suffer beach losses from in front of the seawall, potentially reducing beach recreational value (e.g. ability to walk along beach at all tides), but this will be at slower rates than for vertical seawalls. ▪ Difficult transition from this type of structure other protection options in the future. ▪ Initial construction costs likely to be relatively expensive compared to soft engineering options.		▪ CAP is interesting in innovative stepped and interlocking protective structure in addition to traditional seawalls.

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								▪ Difficulty in providing access over seawalls - limited to fixed locations of steps. ▪ Does not look natural in the coastal environment.		
		Reno Mattress	Erosion	Sloping wire basket filled with cobble sized boulders. Placed at steeper slopes to protect the edge and at lower slopes below the edge to prevent lowering of the beach/upper intertidal nearshore.	Short to medium term	Low energy coastal environment (e.g. river mouth/lagoon environment).	▪ Porous nature allows absorption of some wave energy resulting in less wave reflection and run-up than other vertical wall types. ▪ If overtopped, water can flow back through the structure to the sea. ▪ Could be adapted for longer-term protection with future sea level rise by adding additional mattresses or gabions. ▪ Likely to be less expensive than other sea wall options. ▪ Flat top and width of the reno mattress allow for pedestrian access along the structure.	▪ Does not look natural in the coastal environment. ▪ Less resilient than other vertical wall types with performance relying on the integrity of the wire mesh baskets in an abrasive saltwater environment, with structural failure position with the failure of one gabion basket. Therefore, lifetime of the structure likely to be less, and whole-of-life costs may be higher. ▪ The use of the top of the structure for pedestrian access is likely to increase the wear on the wire baskets, reducing lifetimes and increasing maintenance costs. ▪ Need for relatively large-scale site works and disturbance of the beach/coastal environment to ensure the structure is well founded against toe scour. ▪ Requires good tie in at the ends of structure to reduce end effects erosion, which is common issue with seawalls on open coasts. ▪ Likely to be some localised scour around the base of the structure.	▪ (D) Not suitable for the environment being applied to – Reno Mattresses are generally effective in lower lying, low energy environments. Unlikely to have a long life span on the open, high energy coast. ▪ **May be suitable in combination with sea walls as toe scour protection but wouldn't consider them suitable on their own.**	▪
		Rock Revetment	Erosion	Large sized rock placed on design slope on a shoreline to provide required crest height and mass to prevent overtopping or movement of individual rock units that would expose edge to erosion.	Medium-long term	Higher energy coastal environments (e.g. exposed open coast).	▪ Can be placed over existing raised banks, scarps and bunds to enhance protection. ▪ Good durability, particularly if using high density rock types (e.g. basalt). ▪ Easy maintenance in adding additional rocks as required. ▪ Can be designed or adapted for longer-term protection with future sea level rise.	▪ Needs suitable rock availability and need to sort rock to design size/grade. ▪ Larger footprint than vertical seawalls, greater potential impact on foreshore habitats. ▪ Cost depends on rock availably and distance to source. ▪ Need for site works and disturbance of the beach to ensure the structure is well founded against toe scour. ▪ Requires good tie in at the ends of structure to reduce end effects erosion, which is common issue with seawalls/revetments on open coasts. ▪ Still likely to suffer beach losses from in front of the seawall, potentially reducing beach recreational value (e.g. ability to walk along beach at all tides), but this will be at slower rates than for vertical seawall options. ▪ Difficulty in providing access over revetment. ▪ Does not look natural in the coastal environment.		▪

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	Groynes		Erosion	A groyne (or artificial headland) is a structure built perpendicular to the shoreline out into the sea to intersect sediments that are transported along the coast by longshore drift. Can be built out of rock, timber, concrete materials.	Short to long term	Lower energy coastal environment with known longshore sediment transport mechanisms and good sediment supply.	▪ Can be durable depending on the material used (e.g. rock). ▪ Can promote accretion and buildup of sediment, but only in a localised area.	▪ For maximum efficiency and length of coast protected, needs to be of sufficient length to cross the surf zone to avoid sediment leakage around the structure(s). ▪ To protect sufficient length of coast at each settlement would require a multiple groyne field ▪ Does not look natural in a coastal environment. ▪ Can have downstream effects by stopping sediment supply reaching the downdrift of the groynes. ▪ Unlikely to be effective in a high energy coastal environment.	▪ (E) Not a practical solution as it moves any coastal erosion issues along the coast due to trapping of longshore sediment ▪ (D) There is not a strong sediment supply to this area of the coastline, and therefore would require pairing with renourishment to effectively trap sediment.	▪
	Vertical permeable sill		Erosion	A structure within the gravel beach that dissipates wave energy, reducing erosion losses through backwash and longshore drift and promotes the retention of gravel behind the structure.	Short to medium term	Gravel beach environment	▪ Promotes the retention of gravel behind the structure. ▪ Reduces erosion losses through backwash and longshore drift	▪ Uncertainty around how successful it may be. ▪ Will not look natural in a coastal environment.	▪ (B) Uncertainty on success as no track record. ▪ (D) Not suitable for the sand beach environment	▪
	Detached breakwaters and artificial reefs		Erosion	Offshore structure placed in the nearshore close to the shore to reduce the wave energy that is reaching the shore through dissipation, reflection and diffraction of oncoming waves. This creates a low-energy environment in the lee of the structure that encourages the deposition of sediment and the localised build-up of a wider beach.	Medium to long term	Lower energy coastal environment (e.g. low energy wave climate or sheltered environment)	▪ Reduces the wave energy that is reaching the shore through the dissipation, reflection and diffraction of oncoming waves. ▪ Creates a low-energy environment in the lee of the structure that encourages the deposition of sediment and therefore the localised build-up of a wider beach. ▪ Utilising good design material, there can be opportunities for habitat creation and enhancement (e.g. oyster reefs).	▪ Unlikely to be effective in a higher energy environment as structure could be easily displaced or damaged. ▪ High cost. ▪ Likely down drift effects from disruption of sediment supply past the breakwater structure.	▪ (D) It is not suitable for the environment it is being applied to along a structured coastline. ▪ (F) Limited benefits – the lack of sediment supply to this section of coast means that there would most likely be little to no formation of salient beaches, and therefore reduces benefits of these structures.	▪
	Flood controls	Controlled/ planned mouth openings of lagoons and rivers	Inundation	Controlled openings of lagoons and stream mouths which naturally close with beach sediment building up across the mouth. Planned opening of the mouths will allow water to flow out to the sea/ lagoon in large fluvial events and reduce water backing up in tributaries further upstream.	Short to medium term.	River mouth environments.	▪ Can be done on an 'as required' basis before forecasting large rainfall events to increase the efficiency of the discharge in the event. ▪ Low cost. ▪ No aesthetic effects from structures.	▪ Potential to allow sea water into the lagoons/river mouth during large coastal storms, which could result in sea water inundation. ▪ Requires reliable information around storm intensity, duration and timing as well as predicted coastal conditions to allow informed decision prior on opening prior to the event. ▪ Potential Health and Safety issues if attempting to open once storm has arrived.	▪ (D) Not suitable in the environment it is being applied to, typically helps fluvial/pluvial flooding, and could let storm surge into the estuary and exacerbate the hazard. ▪ (F) Limited benefits for coastal flooding.	▪
		Flapped culvert outfalls at smaller inlets	Inundation	Construction of culvert outfalls with flap gate valve at the entrance of a small inlet which would allow water to flow out of the inlet, but not in from the sea.	Short to medium term	Existing culverts or stormwater infrastructure.	▪ Can be effective at restricting sea water coming into a lagoon or wetland environment.	▪ Only cost effective to undertake the works on smaller inlets. ▪ Requires some elevation difference between the lagoon/wetland and sea to get water to flow through the flap valve. ▪ Sediment transport across and along the shore could block the flap valve for culverts on the beach. ▪ Requires frequent maintenance to ensure pipe does not get blocked with debris		▪

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								▪ For raised pipe culverts need to accommodate for beach erosion at seaward end of the structure. ▪ Would become less effective as sea level rises.		
		Flood gates	Inundation	Adjustable gates used to prevent storm surges from entering existing waterways, in turn preventing up-stream overtopping and flooding.	Medium to long term	River mouth environments	▪ Effective way to reduce effects of storm surges travelling up waterways.	▪ Can be high cost. ▪ Does not look natural in a river mouth environment.	▪ (D) Not suitable in the environment it is being applied to, likely disproportionate to the scale of coastal flooding. ▪ (F) Limited benefits for coastal flooding. There is only one small inlet in the PAA.	▪
		Storm surge barriers	Inundation	Storm surge barriers are hard engineered structures that are primarily designed to prevent inundation due to storm surges in tidal inlets, rivers and estuaries, while also decreasing reliance on other flood defenses inland of the barrier	Long term	River mouth environment	▪ Prevents inundation due to storm surges in tidal inlets, rivers and estuaries. ▪ Decreases reliance on other flood defenses inland of the barrier.	▪ Very high cost due to high requirements of construction work.	▪ (E) It is not a practical solution. ▪ (F) Limited benefits in relation to the scale of works. There is only one small inlet in the PAA.	▪
		Pump stations	Inundation	A pump station is a storage and collection chamber that lifts and distributes stormwater when it cannot naturally be carried by gravity. This helps discharge excess stormwater in large events.	Medium to long term	Low lying settlements which are flooded in large events	▪ Effective way to help manage the discharge of water in a large event. ▪ Can exclude tidal inflow to stormwater systems.	▪ Is not a preventative option which stops the area being flooded in the first place. ▪ Have a carbon cost associated with use and maintenance. ▪ Can have negative environmental effects.		▪
	Stopbanks		Inundation	Engineered stopbanks (most likely earth bunds), along the settlement boundaries to allow surface flooding to occur on the low-lying land around the settlement, but not allowing it to enter into the settlement. Crest height of the stopbanks would be informed through a design level for a specified flood frequency from both coastal and fluvial sources.	Medium-long term	Isolated communities/ settlements with land area around it which would be acceptable to allow to flood.	▪ Effective way of controlling water flow in an extreme event. ▪ Can be designed or adapted for longer term protection with future sea level rise. ▪ Can be grassed over and planted to look more natural along the banks edge.	▪ Depending on how extensive stopbanks were could be an expensive exercise due to length required. ▪ Would still result in some overland flooding to occur up to the settlement boundary, which could have an effect on landuse (e.g. saltwater effects on crop land). ▪ If stopbanks are overtopped water can be trapped with no pathway back to the sea/river. ▪ Difficult to consent.		▪
	Earth Bunds		Inundation	Continuous elongated structure designed to protect low-lying areas from inundation. Bunds are similar physical structures when compared to stopbanks and serve a similar purpose to reduce flood risk, they can be quickly built and generally use local materials, and only involve minor foundation preparations.	Short term	Low energy environment (e.g. ponding water, not high energy flows) which is trying to keep water out.	▪ Lower cost ▪ Quick to construct as require only minor foundation preparations.	▪ Shouldn't be placed in a high energy environment. ▪ Generally, a temporary measure.		▪

Retreat: We move away from the hazard

Retreat is generally a form of land acquisition by one party in a hazardous area in order to move people away from the hazard permanently. There are several mechanisms which can be used to do this which can allow for different levels of compensation (e.g. cost or land), as well as different timeframes for the land to be utilised for before retreat is required.

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Retreat	Buyouts/Land Acquisition	Erosion/ Inundation	Land buyout programs involve the local/national government acquiring land in at-risk areas by agreement, to reduce vulnerability to hazards. Buyouts involve the transfer of title to land and are typically only used in very high risk areas due to the cost associated with them.	Long term	Areas where the risk to hazards is intolerable (both flood and erosion)	▪ Removes the hazard risk by relocating people away from the hazard. ▪ Landowners receive a payment/compensation for their property.	▪ Potential to be a costly exercise for council/government. ▪ Generally, a last resort option for communities. ▪ Both the affected community and wider community perception of this option is generally negative as they are worried about the cost via rates/taxes. ▪ Results in dispersal of community to other areas of the country/district – Councils will need to have factored this into strategies.	▪ It is recommended that retreat is considered as a broad option by the CAP, and the details of the actions to implement the retreat are considered further after the Takutai Kāpiti process is completed.	▪
	Future Interests	Erosion/ Inundation	The acquisition of a future interest involves the purchase of a right to acquire land in specified circumstances in return for an agreed upfront fee. For example, it may be agreed upon that once a certain height of sea level rise has been reached, the holder of the future interest (usually a government agency or council) has the right to acquire the land.	Long term	Areas where the risk to hazards is intolerable (both flood and erosion)	▪ Removes the hazard risk by relocating people away from the hazard. ▪ Allows land to be utilised until the risk becomes intolerable. ▪ Landowners receive a payment/compensation for their property.	▪ Potential for it to be a costly exercise. ▪ Generally, a last resort option for communities. ▪ Community perception of this option is generally negative.		▪
	Land Swaps	Erosion/ Inundation	During a land swap, landowners in a hazard zone are given the opportunity to swap their title to land for a comparable sized parcel in a lower risk area. The land that has been swapped then acts as a buffer against coastal hazards	Long term	Areas where the risk to hazards is intolerable (both flood and erosion)	▪ Removes the hazard risk by relocating people away from the hazard. ▪ Landowners are compensated. ▪ Opportunity for community to stay together.	▪ Potential for it to be a costly exercise to local/national government.		▪
	Leasebacks	Erosion/ Inundation	Leasebacks involve the acquisition of at-risk land by local council/ national government with provision for it to be leased back to the former owner or a third party with terms and conditions that facilitate the management of hazards. The former owners or third party, now the lessee, pays rent and uses the land in accordance with the terms of the lease, but no longer owns the land	Long term	Areas where the risk to hazards is intolerable (both flood and erosion)	▪ Removes the hazard risk by relocating people away from the hazard. ▪ Allows land to be utilised until the risk becomes intolerable.	▪ Could be uncertainty around when people will need to relocate.		▪
	Re-establish the line with a setback seawall **(NEW from RAA)**	Erosion	Retreating the minimum number of properties possible and re-establishing the shoreline landward of the existing shoreline with a constructed sea wall. This is a hybrid approach of retreat and hard engineering.	Medium to long term	Areas where the risk to erosion hazards is intolerable	▪ Removes the hazard risk by relocating people away from the hazard. ▪ Allows land to be utilised until the risk becomes intolerable. ▪ Potential to creates space on the beach for re-establishment or natural defences.	▪ Could be uncertainty around when people will need to relocate. ▪ Costs associated with re-establishing the line (e.g. cost of retreat + hard engineering).	▪	▪

Avoid: We don't move into the way of the hazard in the first place

Actions which are considered to 'avoid' the hazard are generally planning tools which will help future-proof the district. These planning tools are generally low cost to implement and will help prevent putting assets and infrastructure in places which could be susceptible to hazards in the future, however they generally do not address the risk to existing infrastructure and assets.

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Avoid	Building design – Raising minimum floor levels of new builds	Inundation	Planning provisions in place for potentially susceptible areas to ensure floor levels are above design flood levels for new builds.	Medium-long term solution.	New builds in areas that are susceptible to flooding.	▪ Increase the life and reduce the need for regular maintenance of the asset. ▪ Increase safety for building occupants.	▪ Raising flood levels of new buildings will involve extra engineering and materials for construction resulting in increased costs. ▪ Can divert the flood risk to neighboring properties. ▪ Increasing floor levels increases the height of the building which can become aesthetically unpleasing for neighboring properties. ▪ May not be possible/practical for some buildings. ▪ Does not deal with access issues to property in flood events	▪	▪
	Reducing further intensification or development	Erosion/ Inundation	Planning restrictions to reduce further development or intensification within settlements that are likely to be affected by hazards in the future.	Medium-long term solution	New builds or developments.	▪ Will reduce the number of assets exposed to coastal hazards in the future. ▪ Low-cost option as is based on planning provisions rather than protection/infrastructure works.	▪ Does not deal with existing assets or properties that are at risk. ▪ Decreased area of land in the district which could be developed.	▪	▪
	Trigger-based or time limited land use consents	Erosion/ Inundation	Trigger based or time limited land use consents include conditions linked to hazards such as sea level rise, flood depths, or erosion rates that create a finite term for a particular land use. The land use consents allow development or redevelopment with the expectation that such uses can only continue until specified trigger points are reached or for a specified time period.	Short to long term	New builds, developments or land uses.	▪ Low-cost option ▪ Protects private property from erosion/inundation damage when the hazard reaches a certain level. ▪ Allows for land to be used whilst the risk is low.	▪ Costs associated to private owners for relocation at the end of consent. ▪ Costs involved for council to have to provide short term services to the property which would eventually need to be removed.	▪	▪
	Zoning and setback controls	Erosion/ Inundation	▪ Identifying and allowing increased development density in lower risk areas, and identifying areas where new development is not permitted. ▪ Changing future land uses in at-risk areas from low resilience to high resilience (e.g. from residential to public space) Using planning policy and rules (Regional and District) to prohibit hard shoreline protection structures and promoting natural shoreline protection measures that support inland ecosystem migration.	Medium to long term	New development in areas which could be susceptible to coastal hazards.	▪ Reduced risks of damage to buildings and infrastructure in the future. ▪ Low-cost option as is based on planning provisions rather than protection/infrastructure works	▪ Decreased area available for development could result in an increase in land costs. ▪ Does not deal with existing assets or properties that are at risk.	▪	▪
	Transferable development rights	Erosion/ Inundation	Transferable development rights (TDR's) are a mechanism that can be used to increase development potential in areas where development is desired, and decrease or eliminate the potential in areas that should be preserved, without requiring public investment. Development rights are separated from the land and can be transferred from one parcel over to land in an area where development is considered appropriate or is even desired. By	Long term	Areas where development is not desired, with rights transferred to an area where development is desired.	▪ Reduces future risk by not allowing development in undesirable locations.	▪ Only effects future development, not existing developments.	▪ (E) Not a practical solution – Unlikely to be implemented in the Kāpiti Coast District.	▪

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			purchasing development rights, a developer could increase the density of dwellings in their development; and land where the rights were transferred from would not be able to be developed any further.						