

# APPENDICES MINUTES

**Raumati Community Board Meeting** 

Tuesday, 14 May 2024

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#### Raumati Bike Bus

#### Progress Report May 2024

#### Introduction

In August (?) 2023 the Raumati Community Board made an initial contribution to start the work on the Raumati Bike Bus Project – the project is a cycle to school initiative being organised through the Kāpiti Cycle Action Group. Additional funding was subsequently provided by KCDC and the work started in September 2023 and Kāpiti Cycle Action contracted SmartSense Ltd to undertake the planning, consultation and publicty to implement a ride to school Bike Bus programme for all three primary schools in the Raumati area – Raumati Beach, Raumati South and Te Ra.

Planning work and has continued with the schools and with the assistance of council and so far over 30 students have registered with around half attending training arranged through Pedal Ready. To date only one parent has voluntered to be trained along with five KCA volunteers. Long term the support of parents is required to grow and sustain the Bike Bus.

The two participating schools (Raumati Beach and Raumati South) have requested that any adult volunteer marshall be subject to the same level of Police vetting that volunteers for school activities need to comply with. Although we are not a school activity we agree that this is a prudent and responsible step to take. Police vetting takes 6-7 weeks and has recently been completed for the first tranch of volunteers.

We are therefore pleased to report that first Raumati Bike Bus ran two weeks ago and the three volunteers delivered five students from the northern end of the Raumati Ward to both schools. This was repeated this week.

With the Bike Bus now operating we are planning to allow it to grow by encouraging students along the existing route (Alexander Road) to join and publicising the Bike Bus again in school newsletters. The recent Kapiti News article has already generated a fresh round of interest.

Securing parent or other local volunteers to act as marshals is the most urgent and important part of the getting the Bike Bus embedded into the community. We will also be using the KCDC comms team to spread the word through council channels. At the present the aim is to have Bike Busses running every week and increase frequency as demand and volunteers ramp up.

To date over \$1000 (more than the Raumati Community Board contribution) has spent on publicity printing and safety equipment including hi-vis vests and bells.

Other areas of Kāpiti have expressed interest in rolling out Bike Busses for other schools and we will be supporting them by producing a 'how to' guide for KCDC and providing practical assistance and funding request support.

We are grateful for the Raumati Community Board support and are happy to answer any questions.

Three routes are currently planned and will launch when sufficient volunteer support is obtained.

1. Northern Route to Raumati Beach School starting in Avion Terrace and primarily using the airport shared path and Alexander Road.

- 2. Eastern Route to Raumati Beach School starting on Manawa Rd and primarily using the Wharemauku Shared path and Kiwi Rd.
- 3. Central Route to Raumati Beach School starting on Menin Road and primarily using Glen Rd and Tiromoana Rd.

These three routes run close to all but three of the households registered.

The first Raumati Bike Bus



Each route has been risk assessed and whilst a supervised ride on shared paths and on quiet roads is a relatively low risk activity we have identified a range of risks that require assessment and where necessary some mitigation.

**Northern Route** 2.5km route from the Reserve by 14 Avion Terrace along airport perimeter path.



Figure 1 Route plan with initial Bike Bus people

Northern Route - to Raumati Beach School	Leaving	Transit Time
Avion Terrace, Reserve Entrance by 14	08:20	
141 Alexander Rd Airport perimieter path	08:23	00:00:03
20 Waikare Rd - Airport perimieter path	08:26	00:00:03
26 Anaru St Ngaio Rd. Junction	08:29	00:00:03
14 Ngaio Rd Alexander Rd. Junction	08:30	00:00:01
46 Alexander Rd - Tui Rd. Junction	08:33	00:00:03
20 Alexander Rd - Karaka Grove Junction	08:35	00:00:02
8 Alexander Rd - Kowhai Grove Junction	08:38	00:00:03
Weka Park - Crossing Weka Rd.	08:41	00:00:03
Raumati Beach School	08:44	00:00:03

#### 1. Eastern Route

This will be the second route to start and a detailed risk assessment has been undertaken for this. At this time there are insufficient parent volunteers to run this route but it is hoped that as momentum builds on the northern route that this route will follow on.



Figure 2 Eastern Route to Raumati Beach School

Eastern Route - to Raumati Beach School	Leaving	Transit Time
29 Manawa Ave - Playground	08:20	
1 Manawa Ave - Rata Rd. junction	08:23	00:00:03
Wharemauku Stream Path from Manawa Ave.	08:25	00:00:02
91 Kiwi Rd exit from Wharemauku Stream shared path	08:30	00:00:05
64 Kiwi Rd. Kaka Rd. Junction	08:33	00:00:03
50 Kiwi Rd Tui Rd. Junction	08:34	00:00:01
14 Kiwi Rd Huia Rd. Junction	08:36	00:00:02
2 Kiwi Rd Raumati Rd. Junction	08:39	00:00:03
Raumati Beach School	08:43	00:00:04

#### 2. Central Route - to Raumati South School

A detailed risk assessment will be undertaken on this route after the establishment of the northern route and a review of lessons learned to date from the operation of that route.



Figure 3 Central Route to Raumati South School

Total Distance 1.4km

Central Route - to Raumati South School	Leaving	Transit Time
125 Matai Rd.	08:25	
50 Menin Rd Matai Rd. Junction	08:26	00:00:01
44 Menin Rd Hillcrest Rd. Junction	08:28	00:00:02
38 Menin Rd Dale Rd. Junction	08:30	00:00:02
31 Dale Rd.	08:33	00:00:03
31 Tiromoana Rd Junction with Dale Rd.	08:36	00:00:03
63 Tiromoana Rd Junction with Matai Rd.	08:38	00:00:02
Raumati South School	08:41	00:00:03



## Coastal Advisory Panel Update to Raumati Community Board

(14 May 2024)





## Takutai Kāpiti Coastal Advisory Panel

• What's new since last update

## **The CAP's Decision-Making Process**



## **MCDA Weighting & Analysis**

#	Criteria	Weighting		Score
1	Ecology	3		
2	Landscape	2		1. Highly
3	Te ao Maori Values	3		Undesirable
4	Community, Social &	3	x	2. Undesirable
	Economic Wellbeing			3. Neutral
5	Public Access & Recreation	3		4. Desirable
				5. Highly
6	Consenting & Risk	1		Desirable
7	Coastal Erosion	3		
8	Coastal Inundation	3		

## **MCDA Final Scores**

Dathway	Sub-A	rea 9A	Sub-Area 10A					
Palliway	Interim	Final	Interim	Final				
1	37		37					
2	40	52	45	57				
3	37		40					
4	47	53	43	52				
5	42	48	47	53				
6	40	52						

## Pathways Template

Sub-area: 9A Raumati (North of Wharemauku Stream)



Management Unit	Pathway	Short term	$\rightarrow$	Medium term	$\rightarrow$	Long term		
Management Unit: 10A Raumati (North of Wharemauku Stream) erosion unit	Pathway 2	Enhance existing protection structure <sup>2</sup> , Community Education and Emergency Management <sup>4</sup> (Enhance)	$\rightarrow$	Sea wall <sup>12</sup> (Protect – Hard Engineering)	$\rightarrow$	Re-establish the line with a setback sea wall <sup>9</sup> (Retreat & Protect)		
	Pathway 4	Enhance existing protection structure <sup>2</sup> , Community Education and Emergency Management <sup>4</sup> (Enhance)	$\rightarrow$	Re-establish the line with a setback sea wall <sup>9</sup> & Dune reconstruction <sup>11</sup> (Retreat & Protect)	$\rightarrow$	Beach renourishment <sup>10</sup> (Protect – Soft Engineering)		
	Pathway 6	Sea wall <sup>12</sup> (Protect – Hard Engineering)	$\rightarrow$	Re-establish the line with a setback sea wall <sup>9</sup> (Retreat & Protect)	$\rightarrow$	Enhance Sea wall <sup>12</sup> (Protect – Hard Engineering)		

pathways at all timeframes to include "Avoid" option through land-use planning (e.g short term is new coastal hazard provisions in Coastal Environment Distric an Change).

Under existing RMA legislation, the success of planning actions is limited to re-developments and new developments by existing use rights. For re-development this is dependent on the "turn-over" of building stock.

Seawall is a coordinated approach, yet to be determined if it publicly or privately funded.



## Pathways Template

Sub-area: 10A Raumati (South of Wharemauku Stream)



Management Unit	Pathway	Short term	$\rightarrow$	Medium term	$\rightarrow$	Long term
mati (South of osion unit	Pathway 2	Status Quo <sup>1</sup> (Current new seawall as outlined in LTP) and Community Education and Emergency Management <sup>4</sup>	$\rightarrow$	Enhance existing protection structure <sup>2</sup> , Community Education and Emergency Management <sup>4</sup> (Enhance)	$\rightarrow$	Re-establish the line with a setback sea wall <sup>9</sup> & Dune reconstruction <sup>11</sup> (Retreat & Protect)
Management Unit: 10A Raum Wharemauku Stream) ero	Pathway 4	Status Quo <sup>1</sup> (Current new seawall as outlined in LTP) and Community Education and Emergency Management <sup>4</sup>	$\rightarrow$	Re-establish the line with a setback sea wall <sup>9</sup> (Retreat & Protect)	$\rightarrow$	Enhance Sea wall <sup>12</sup> (Protect – Hard Engineering)
	Pathway 5	Status Quo <sup>1</sup> (Current new seawall as outlined in LTP) and Community Education and Emergency Management <sup>4</sup>	$\rightarrow$	Re-establish the line with a setback sea wall <sup>12</sup> & Dune reconstruction <sup>11</sup> (Protect – Soft Engineering)	$\rightarrow$	Beach renourishment <sup>10</sup> (Protect – Soft Engineering)

e proposed works for the Raumati seawall upgrade will have a design life of 25 years. Under 'status quo' it is assumed that these works will go ahead, and prefore will provide protection along this section of coastline for the next 25 years.

All pathways at all timeframes to include "<u>Avoid</u>" option through land-use planning (e.g short term is new coastal hazard provisions in Coastal Environment District Plan Change).

Under existing RMA legislation, the success of planning actions is limited to re-developments and new developments by existing use rights. For re-development this is dependent on the "turn-over" of building stock.



## Pathways Template

Sub-area: 9B Raumati (Inundation unit)

Management Unit	Pathway	Short term	$\rightarrow$	Medium term	$\rightarrow$	Long term		
aumati	Pathway 1	Status Quo <sup>1</sup> and Community Education and Emergency Management <sup>4</sup>	$\rightarrow$	Enhance Existing Inundation Protection <sup>3</sup> and Community Education and Emergency Management <sup>4</sup> (Enhance)	$\rightarrow$	Additional Hard Protection (e.g. Stopbanks <sup>13</sup> , Culverts <sup>14</sup> , Pumpstations <sup>15</sup> ) (Protect)		
it Unit B: Ra dation Unit	Pathway 2	Status Quo <sup>1</sup> and Community Education and Emergency Management <sup>4</sup>	$\rightarrow$	Enhance Existing Inundation Protection <sup>3</sup> and Community Education and Emergency Management <sup>4</sup> (Enhance)	$\rightarrow$	Flood proofing buildings and infrastructure <sup>5</sup> and/or Elevate floor levels of buildings <sup>7</sup> (Accommodate)		
Manageme Inun	Pathway 3	Status Quo <sup>1</sup> and Community Education and Emergency Management <sup>4</sup>	$\rightarrow$	Additional Hard Protection (e.g. Stopbanks <sup>13</sup> , Culverts <sup>14</sup> , Pumpstations <sup>15</sup> ) (Protect)	$\rightarrow$	Enhance New Inundation Protection <sup>3</sup> (Enhance)		

All pathways at all timeframes to include "Avoid" option through land-use planning (e.g short term is new coastal hazard provisions in Coastal Environment District Plan Chang Under existing RMA legislation, the success of planning actions is limited to re-developments and new developments by existing use rights. For re-development, this is dependent on the "turn-over" of building stock.



## **Economic Analysis**

### Top three pathways included in the economic analysis



#### **Economic Analysis - Methodology** Inputs: **Outputs**: Top three pathways for each management unit (from MCDA scoring) **Economic Analysis** A series of economic metrics for each Further definition and mapping of adaptation pathway options/actions pathway: Calculation of costs and losses for a Pathway Cost baseline pathway (e.g. no additional interventions from current practice) Cost + Loss • Costing of options at each timeframe Value for Money (implementation costs and ongoing maintenance/operational costs) **Damage Avoided** Calculation of residual losses for each pathway (property and selected Cost Benefit ratio • Council infrastructure only) Number of properties still exposed in 2130

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## Sub Area: 9A Raumati (North of Wharemauku Stream)

ray	Short term	•	Medium term	•	Long term	MCDA1 Score	MCDA Ranking	Pathway total PV cost (\$m)	Cost + Loss² (\$m)	Cost + Loss Ranking	VFM <sup>3</sup> (\$ '000/point)	VFM Ranking	Damages avoided <sup>4</sup> (\$m)	Damages avoided ranking	Number of properties still exposed 2130
0	Baseline							18.0	188.7						204
4	Enhance	÷	Re-establish the line with a setback seawall and dune reconstruction	->	Renourishment	53	1	269.6	337.6	2	6371	2	102.7	2	4
2	Enhance	->	Seawall	->	Re-establish the line with protection structure	52	2	272.4	339.5	3	6529	3	103.6	1	14
6	Seawall	->	Re-establish the line with protection structure	4	Enhance Seawall	52	2	254.5	325.5	1	6260	1	99.7	3	14

Iti Criteria Decision Making Analysis score determined by the CAP

st + Loss is equal to the cost estimate (operational and capital costs) for the full 100 year pathway + residual losses due to events that exceed a 1 in 100 year chance of occurrence.

ue for Money - How much it costs to 'purchase' each MCDA point based on the MCDA score and total cost estimate (operational and capital) of each 100 year pathway

mages avoided - The difference between the losses from a baseline pathway of no additional future adaptation actions or effort from the current management practices over the full 100 year time frame and adaptation pathway.

## Sub Area: 10A – Raumati (South of Wharemauku Stream)

Pathway	Short term	-	Medium term	•	Long term	MCDA <sup>1</sup> Score	MCDA Ranking	Pathway total PV cost (\$m)	Cost + Loss <sup>2</sup> (\$m)	Cost + Loss Ranking	VFM <sup>3</sup> (\$ '000/point)	VFM Ranking	Damages avoided <sup>a</sup> (\$m)	Damages avoided ranking	Number propertie still exposed 2130
PW-0			Baseline					8.4	377.4						548
PW-5	Status Quo & Enhance	-	Re-establish the line with a setback seawall and dune reconstruction	4	Renourishment	53	2	437.8	579.4	3	10933	2	227.4	2	7
PW-2	Status Quo & Enhance	÷	Enhance seawall	->	Re-establish the line with a setback seawall and dune reconstruction	57	1	422.4	561.5	1	9850	1	229.9	1	7
PW-4	Status Quo & Enhance	4	Re-establish the line with a setback seawall	->	Enhance Seawall	52	3	431.8	574.4	2	11046	3	226.4	3	7

<sup>1</sup>Multi Criteria Decision Making Analysis score determined by the CAP

<sup>2</sup>Cost + Loss is equal to the cost estimate (operational and capital costs) for the full 100 year pathway + residual losses due to events that exceed a 1 in 100 year chance of occurrence.

<sup>2</sup>Value for Money - How much it costs to 'purchase' each MCDA point based on the MCDA score and total cost estimate (operational and capital) of each 100 year pathway

\*Damages avoided - The difference between the losses from a baseline pathway of no additional future adaptation actions or effort from the current management practices over the full 100 year time frame and adaptation pathw

## Sub Area: 9B – Raumati Inundation

athway	Short term	-	Medium term	•	Long term	MCDA <sup>1</sup> Score	MCDA Ranking	Pathway total PV cost (\$m)	Cost + Loss² (\$m)	Cost + Loss Ranking	VFM <sup>3</sup> (\$ '000/point)	VFM Ranking	Damages avoided <sup>4</sup> (\$m)	Damages avoided ranking	Number o buildings still exposed 2130
PW-0	Baseline							6.9	8.0						106
PW-1	Status Quo & Enhance	÷	Enhance	->	Additional Hard Protection	54	2	19.7	20.1	3	373	3	0.6	1=	34
PW-3	Status Quo & Enhance	<b>→</b>	Additional Hard Protection	<b>→</b>	Enhance	51	3	7.7	8.4	1	165	1	0.3	3	48
PW-2	Status Quo & Enhance	4	Enhance	÷	Accommodate	55	1	16.2	16.6	2	302	2	0.6	1=	29

<sup>1</sup>Multi Criteria Decision Making Analysis score determined by the CAP

<sup>2</sup>Cost + Loss is equal to the cost estimate (operational and capital costs) for the full 100 year pathway + residual losses due to events that exceed a 1 in 100 year chance of occurrence.

Value for Money – How much it costs to 'purchase' each MCDA point based on the MCDA score and total cost estimate (operational and capital) of each 100 year pathway

<sup>4</sup>Damages avoided - The difference between the losses from a baseline pathway of no additional future adaptation actions or effort from the current management practices over the full 100 year time frame and adaptation pathway.

### **MCDA Scored Pathways vs Economic Ranked Pathways**

#### **Erosion Management Units**

Unit	Top MCDA Scoring Pathway	Top Economic Ranked Pathway	Explanatory Notes
9A	Pathway 4 (53)	Pathway 6 (52)/ Pathway 2 (52)	Pathway 2 ranks highest for 'Damages Avoided', Pathway 6 ranks highest for 'Cost + Loss' and 'Value for Money'. <b>However,</b> all economic metrics are within the same order of magnitude and only small differences change the rankings.
10A	Pathway 2 (57)	Pathway 2 (57)	

#### **Inundation Management Units**

Unit	Top MCDA Scoring Pathway	Top Economic Ranked Pathway	Explanatory Notes
9B	Pathway 2 (55)	Pathway 2 (55) / Pathway 3 (51)	Pathway 2 ranks highest for 'Damages Avoided'; Pathway 3 ranks highest for 'Cost + Loss' and 'Value for Money' as it is a lower cost pathway.

## Signals, Triggers & Thresholds

= Signals and triggers determined by CAP to transition from one action to the next.

Note: This process will be covered in the 3 April 2024 CAP workshop for whole Kāpiti Coast District.



## **Examples of Thresholds**

Threshold Name/Subject	Parameters
Insurance	X properties not able to get insurance in x years First property loses insurance Insurance premiums increases to become unaffordable
Inability to access beach to launch private boats	
Road access reduced due to inundation	X times in x years that people loose road access to their property
Septic tanks	Septic tank unable to be used x times in x years
Properties being damaged by inundation	X house x times in x years
Mahinga kai	Reduction in ability to gather shellfish

## **Going Forward**

### CAP -

- Finalise pathways
- Late May complete our report to Council
- June Present Report to Council Post CAP
- Council initiate next phase



## **KCDC - Post Cap**

- Next 12 18 months
  - drafting planning rules and provisions
  - community consultation

**BEFORE** ANY IMPLEMENTATION DECISIONS ARE MADE

- LTP 2024-2034 existing adaptation projects funding continued
- LTP 2027 2037 new adaptation options considered

Source: Everything Kapiti – 23 April 2024



https://haveyoursay.kapiticoast.govt.nz/hub-page/takutai-kapiti https://www.kapiticoast.govt.nz/environment/coastaladaptation/coastal-science/

# **Questions ? ? ?**





Raumati shoreline. Photo by Duncan Thomson.

# Raumati coastal hazards

SUMMARY

### **Key findings**

- Assuming that existing seawalls are not replaced in the future or no alternative protection measures are implemented, the Raumati shoreline is projected to be susceptible to coastal erosion over the next 30, 50 and 100 years.
- Based on the number of private properties potentially affected, Raumati is considered to be the most vulnerable area to coastal erosion along the Kāpiti Coast.
- Due to the higher land elevation, Raumati is less susceptible to coastal flooding except for around the Wharemauku Stream mouth under all RSLR projections, and for lower lying areas around the stormwater network under the higher RSLR scenario (1.25 m RSLR).

### Raumati coastal environment

Raumati coastal processes are influenced by the shape of the coast at Paraparaumu which extends west of the rest of the shoreline in a large delta shape. This acts as a natural barrier to longshore sediment transport, reducing the sediment supply to the Raumati shoreline. As result, the beach has experienced periodic large-scale erosion in significant storms. People have responded by building a near continuous line of ad hoc public and private coastal protection structures (seawalls) since at least 1955. Many of these structures failed in subsequent storms (e.g. 1976) as shown in photo A, and have since been rebuilt. These structures vary in length, type, and age but are mostly private rock revetment or council timber seawalls (B). Ground levels behind Raumati Beach are generally high, and above future extreme relative sea level rise (RSLR) water levels, except for some low-lying areas around stream mouths such as Wharemauku Stream (C).

## **Coastal hazards**

## Present-day erosion and flood hazards

The present-day erosion hazard is what could occur in an extremely large storm (which has a 1% chance of occurring each year in the immediate/ near future), and if the existing protection structures failed, as shown in photo A. Along the Raumati shoreline, this would 'most likely' result in 16 to 24 m of erosion.

Mapping shows the Raumati shoreline is not susceptible to flooding from the same sized event, but some locations are susceptible to local surface flooding from wave run-up.



Raumati coastal hazards summary | Kāpiti Coast District Council

A. Coastal erosion behind failed structures on Rosetta Road following a significant storm in 1976.

B. Structures along Old Coach Road.

C. Wharemauku Stream.



Future projections take into account the presence of current protection structures up to their estimated remaining life (10–30 years). After this it is assumed that the structures are not replaced, alternative protection measures are not implemented, and the beach reverts to a natural system.

Under these assumptions the Raumati shoreline is projected to erode across all timeframes under all RSLR scenarios. The following erosion distances are averages from the upper bound of the 'most likely' erosion position.

#### Raumati Beach

#### Projected to erode:

- 31 m by 2050
- 41 to 52 m by 2070
- 80 to 124 m by 2130

#### **Raumati South**

#### Projected to erode on average:

- 41 m by 2050
- 61 to 74 m by 2070
- 128 to 179 m by 2130



## Future coastal flood hazard

Along the Raumati shoreline, flooding could occur along the Wharemauku Stream and from the stormwater network which drains into local streams and the sea. Stormwater outfalls to the sea also provide potential flooding pathways to some lower lying areas in the dune ridge along the coastline.

#### 0.35 m and 0.45 m RSLR (~2070)

The area around the mouth of the Wharemauku Stream becomes susceptible to inundation in these two scenarios. The remainder of the Raumati shoreline remains generally unaffected except for smaller stormwater catchments which drain directly to the sea or to the Wharemauku Stream.

#### 0.85 m and 1.25 m RSLR (~2130)

Along the Wharemauku Stream the mapping shows an increased area susceptible to both direct inundation from the stream and through the stormwater network (e.g. Matatua Road for example) and as far upstream as the stormwater ponds on either side of the Kāpiti Expressway. Elsewhere along the coastline, the area susceptible to flooding through stormwater outfalls to the sea increases.

Raumati coastal hazards summary

### 👤 Asset exposure

For council infrastructure, a water supply bore and 26 coastal stormwater outlets located along the Raumati shoreline are vulnerable to the coastal erosion hazard within the next 30 years. Some critical roads within the Raumati area also intersect with future shoreline projections under all RSLR scenarios: 1 km by 2050, 1.3-1.8 km by 2070, and 4.6-5.5 km by 2130 A large number of private land parcels intersect with the projected shoreline position within each timeframe: up to 280 in the next 30 years depending on the maintenance and upgrades to existing infrastructure, 320-345 within 50 years; and 590-833 within 100 years.

For flooding, key evacuation routes such as Raumati Road are not vulnerable to inundation in extremely large storms, even under the highest 1.25 m RSLR scenario in 2130.

## ?

### How these hazards have been assessed for Raumati

Coastal science experts from Jacobs assessed the susceptibility and vulnerability of coastal erosion and flooding hazards across the entire Kāpiti District.

Government guidance recommends that for detailed hazard and risk assessment, councils should assess the SSP2-4.5 'middle of the road' climate change scenario, and higher SSP5-8.5 'fossil fuel intensive' scenario.

#### **Coastal erosion**

The components used to calculate a potential coastal erosion distance along the Raumati coastline include:

- the natural long-term trend of the shoreline movement (i.e. eroding, growing, or stable)
- the amount of erosion which could occur as a direct result of the rise in sea levels compared to land level (termed the Relative Sea Level Rise (RSLR)) over time frames of 30, 50, and 100 years
- short-term storm erosion from an extremely large storm which has approximately a 1% chance of occurring in each year, based on observations from the September 1976 storm, and erosion from

dunes restabilizing to their natural stable slope following a large storm.

Jacobs used a 'probabilistic approach' to tie likelihoods to the erosion distances calculated for each scenario of RSLR. The 'most likely' range of shoreline positions has a 33–66% chance of occurring. The 'unlikely' shoreline position is where there is a 10% chance that the erosion would reach or be greater than this position.

#### **Coastal flooding**

To assess the coastal flood hazard for Raumati, Jacobs mapped the area which is susceptible to flooding by a large storm tide which has a 1% chance of occurring in any year. The maps show the flooding that could occur at the present time and in the future, for RSLR scenarios of +0.2 m; +0.35 m; +0.45 m; 0.85 m and +1.25 m. Jacobs used a simple 'bathtub' approach, where all land below the storm tide water level is mapped as susceptible to flooding, regardless of connection to the sea. The maps also show areas which could be affected by additional flooding due to wave run-up overtopping the dunes.



Full report at kapiticoast.govt.nz/coastal-science

Photos supplied by Jacobs New Zealand Ltd and Kāpiti Coast District Council.

March 2024





9B Inundation	Raumati Adaptation Area		Takutai Kāpiti.
Pathway 2	MCDA 55 MCDA Score 55 Ranking 1		
Short term Status Quo & Enhance	Maintain existing management infrastructure, increase community education and emergency management.	Cost + Loss <b>\$16.6M</b>	Total Pathway Cost
Medium term Enhance	Enhance existing inundation protection, and increase community education and emergency management.	Cost + Loss Ranking <b>2</b>	\$16.2M
Long term Accommodate	Pro-actively raise floors of homes which could be flooded, and/or flood proof homes and infrastructure.	Damages Avoided \$0.6M	Damages Avoided RankingNumber of Buildings Still Exposed (2130)1=29
Pathway 1	MCDA 54 MCDA Score 54 Ranking 2		
Short term Status Quo & Enhance	Maintain existing management infrastructure, increase community education and emergency management.	Cost + Loss <b>\$20.1M</b>	Total Pathway Cost
Medium term Enhance	Enhance existing inundation protection, and increase community education and emergency management.	Cost + Loss Ranking <b>3</b>	\$19.7M
Long term Additional Hard Protection	Installation of floodgates, pump stations and stopbanks to prevent sea water entering the settlements.	Damages Avoided \$0.6M	Damages Avoided Ranking <b>1=</b> Number of Buildings Still Exposed (2130) <b>34</b>
Pathway	MCDA 51 MCDA 3 Score 51 Ranking 3		
Short term Status Quo & Enhance	Maintain existing management infrastructure, increase community education and emergency management.	Cost + Loss <b>\$8.4M</b>	Total Pathway Cost
Medium term Additional Hard Protection	Installation of floodgates, pump stations and stopbanks to prevent sea water entering the settlements.	Cost + Loss Ranking 1	\$7.7M
Long term Enhance	Enhance existing inundation protection, and increase community education and emergency management.	Damages Avoided \$0.3M	Takutai KapitaOtal Pathway Cost \$16.2MDanages Avoided Raking1=Danages Moided Raking1=Cotal Pathway Cost \$19.7MStalidings Still Cosed (2130)Danages Avoided Raking1=Danages Moided Raking1=Cotal Pathway Cost Buildings Still Sposed (2130)Danages Avoided Raking1=Danages Moided Raking1=Danages Moided Raking1=Danages Moided Raking1=Danages Moided Raking1=Danages Moided RakingDanages Moided Raking3Mumber of Buildings Still Sposed (2130) AdADanages Moided Raking BADanages Moided Raking BADanages Moided Raking BADanages Moided Raking BADanages Moided Raking BADanages Moided Raking BADanages Moided Raking BADanages Moided Raking BADanages Moided Raking BADanages Moided Raking BADanages Moided Raking BADanages Moided Raking BADanages Moided RakingADanages Moided Raking<



# **Optional Thresholds**

Signals, triggers and thresholds determine when a change to the current management approach is required and means change only happens when, and if, the situation changes.

- Thresholds are situations or scenarios that people don't want to see happen in their community and are to be avoided by implementing further adaptation options. We can avoid reaching adaptation thresholds through signals and triggers.
- Signals are changes that provide an early warning a trigger is approaching, such as monitoring the rate of erosion for a section of the coast.
- Triggers are measures that, when reached, provide ample time to plan for and implement a new pathway or adaptation option so the threshold isn't reached.

The Coastal Advisory Panel has developed an initial set of draft Optional Thresholds to recommend to Council to develop further with communities after Takutai Kāpiti is completed.

There are purposely blanks indicated by 'X' left below as these details will be decided in consultation with each community		CAP wants to know if you think these threshold topics are applicable to the adaptation area								
, after Takutai Kāpiti.		Northern Adaptation Area		Central Adaptation Area		Raumati Adaptation Area		Paekākāriki Adaptation Area		
Optional topic	Possible threshold for each topic	Erosion	Inundation	Erosion	Inundation	Erosion	Inundation	Erosion	Inundation	
Insurance	<ul> <li>X number of dwellings are unable to obtain insurance for coastal hazards.</li> <li>The cost of insurance for a X number of properties exceeds \$X amount per annum making it unaffordable for the community.</li> </ul>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Frequency of coastal flooding	X metres or more of water ponds at specified location/s for a continuous period of more than X number of days.	No	Yes	No	Yes	No	Yes	No	Yes	
Depth of flooding	Water enters X number of dwellings within a specific community X number of times in X number of years.	No	Yes	No	Yes	No	Yes	No	Yes	
Water infrastructure	Drinking water and wastewater infrastructure within X metres of the position of Mean High Water Springs.	Yes	No	Yes	No	Yes	No	Yes	No	
Road access	Access to properties is unavailable for more than X hours, X times in X years.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Telecommunication / power services	Coastal hazards result in telecommunication and/or power outages for more than X hours X times in X years.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Septic tanks	<ul> <li>Septic tank systems are operationally impacted for more than X days per year.</li> <li>Septic tanks are unable to be used X times in X years.</li> </ul>	Yes	Yes	No	No	No	No	Yes	Yes	



		Erosion	Inundation	Erosion	Inundation	Erosion	Inundation	Erosion	Inundation
Foreshore access	It is no longer possible to walk along the foreshore of X beach during X tide.	Yes	No	Yes	No	Yes	No	Yes	No
Beach access	<ul> <li>Safe public access at specified location/s is damaged X times over X years.</li> <li>Safe public access to launch boats at specified location/s] is damaged X times over X years.</li> </ul>	Yes Yes	No No	Yes Yes	No Yes	Yes Yes	No No	Yes No	No No
Seawall	The seawall requires significant maintenance and reinforcement exceeding \$X, X times, in X years.	No	No	No	No	Yes	No	Yes	No
Dune volume	The dunes at X beach are less than X metres in width, or height, or Xm <sup>3</sup> in volume.	Yes	Yes	Yes	Yes	No	No	No	No
Significant event	<ul> <li>Any serious injuries and/or fatalities that occur as a result of a coastal erosion or coastal inundation event.</li> <li>A coastal storm significantly compromises the effectiveness of the existing inundation (or erosion) protection structures.</li> </ul>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cost of public maintenance	<ul> <li>The overall cost of the current publically funded management approach exceeds \$X per year.</li> <li>A targeted rate of more than \$X per year is required to fund the ongoing publically funded maintenance of current management approach.</li> </ul>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cost of private maintenance	The cost to maintain or replace privately owned seawalls exceeds what X number of property owners are prepared to pay.	No	No	No	No	Yes	No	Yes	No
Recovery time between events	<ul> <li>X community is required to respond to X significant coastal storms within X number of years.</li> <li>Emergency works costing over \$X are required at X frequency to repair protection structures at X location.</li> </ul>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Shore bird habitats	The habitat of X species is reduced.	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Mahinga kai	Shellfish are no longer able to be gathered from X location.	Yes	Yes	Yes	Yes	Yes	No	Yes	No

# Takutai Kāpiti.



#### What is the MCDA process?

Multiple Criteria Decision Analysis (MCDA) is a decision-making process used to aide in assessing the pathways and options that came about during the Dynamic Adaptive Planning Pathways (DAPP) process.

The adaptation options differ in how they benefit different criteria. An option that may be beneficial in one criterion may be detrimental for another criterion, so the MCDA tool helps by providing a way to form the list of options in order of preference, from most preferred to least preferred.

#### What are the steps in the process?

- 1. **Decision Criteria:** Develop a set of criteria to score potential adaptation options.
- 2. Weighting: Assign weights for each of the criterion to reflect their relative importance to the adaptation area.
- 3. Weighted Scoring: Combine the weights and scores for each pathway to derive an overall value.

### Step 1: Decision Criteria

## What are the different decision criteria used to score each adaption pathway option?

- **Community, social and economic wellbeing values:** How the pathway options will impact the community and social cohesion.
- **Ecology:** How the pathway options will impact the habitat for indigenous or other species in the area.
- Landscape: How the pathway options will impact the natural character and landscape of the area.
- **Public access and recreation:** How the pathway options will impact the public's ability to access the coast and carry out recreational activities in the area.
- **Te ao Māori values:** How the pathway options will impact the relationship of Māori and their culture and traditions, along with maintaining access and enabling the carrying out of customary activities.
- Effectively manages the risks of coastal erosion: How effectively the pathway options will manage this risk of erosion. (Technical criterion)
- **Effectively manages the risks of coastal inundation:** How effectively the pathway options will manage this risk of inundation. (Technical criterion).
- **Regulatory consenting and policy risk:** How viable each pathway option is in consideration to consenting and policy processes. (Technical criterion).

#### Step 2: Weighting

#### Some of these criteria seem more important than others.

#### Are they all considered equal or weighted differently? Who decides?

Certain criteria are weighted as more important than others, so the scores given to each pathway on those criteria will be boosted as being more favourable.

Before the scoring process for each pathway begins, CAP decides on the weighting of each criterion to reflect its importance in comparison to the others specific to the adaptation area in focus. The weighting is reflective of which criterion the CAP, given feedback from the community, consider either 'critical', 'important', or 'merely relevant' in deciding which actions are put forward as a recommendation for implementation to Council.

The criteria are all weighted by CAP on a scale from 1 to 3 (1 = Important, 2 = Very important, and 3 = Critical), and help reflect that while all the criteria are important to consider they may not always be equally important.

#### Step 3: Scoring Pathways

#### How does the scoring work?

During the MCDA scoring process each pathway is given a scoring between 1 and 5 for each management unit within the adaptation area. The higher the score the better the option is. But the pathways are not just given one overall score, they are scored against how beneficial each pathway is for each of the decision criterion.

The scores that have been given to each pathway are then adjusted according to the weighting assigned to each criterion as done in Step 2 of the MCDA process.

### How does CAP know which pathways are best for each of these criterion?

CAP is supported by the Technical Advisory Group (TAG) which include a group of subject matter experts in each of these areas who advise CAP on how each of the criteria will be negatively or positively impacted by the pathways. TAG provided pre-scoring commentary for CAP to consider.

The technical criteria are scored by TAG, and mana whenua score the te ao Māori values criterion, and CAP score the remaining criteria. The CAP can choose different scores based on the technical advice, their own knowledge, and local understanding. The CAP also reflects on the community's values and objectives for each adaptation area when scoring the pathways.

## Where is the economic assessment criteria?

There is no cost-based decision criteria included in the MCDA assessment. This allows for the non-monetary elements of different short-listed potential pathways to be assessed separately without financial bias, prior to a separate economic analysis being undertaken of the short-listed pathway. This two-step process is considered important as it ensures that potential pathways can be thoroughly tested in terms of the coastal hazard management objectives without cost factors dominating the MCDA evaluation.



Takutai Kāpiti. D ynamic A daptive P lanning P athway

#### What is the DAPP approach?

The Dynamic Adaptive Planning Pathway approach (DAPP) is recommended by the Ministry for Environment as this approach aims to aid in development of plans that can adapt in situations of uncertainty. Using this approach will allow for a coastal adaptation plan that can adapt to the future changes that may be seen in the Kāpiti Coast District through the impacts of climate change. The DAPP approach can allow for future change and advancements without committing to investments that may be difficult and costly to adjust if the effects of climate change end up being different than those that have been projected for the future.

DAPP is like a roadmap that shows several different ways for getting to where we want to be in the future. You can start planning where you want to go now, but you still have the ability to change routes for getting there, or even your whole direction, as conditions change (or don't change as expected).

For Takutai Kāpiti, the development of our roadmap will include short-term, medium-term, and long-term options that will be tailored for each area in the Kāpiti district. Climate change is likely to have different implications for each of these areas, along with there being a difference in the protections already in place for them, so it is important to focus on each area separately to plan the best possible options for their unique needs.

#### Why is it beneficial for us to use the DAPP approach?

The DAPP approach is beneficial because although we have science to project the future impacts of climate change, there is no way of knowing precisely what will happen. Impacts in 50 or even 100-years time could change. We know that there will be an impact, but we have no way of precisely predicting the future. Trying to plan in advance for something that has possible unknown implications is tricky but still important. The DAPP approach allows for flexibility and adaptability to future conditions we cannot see yet.

#### Why does each pathway have several steps?

DAPP includes several pathways with multiple stages that are planned to be enacted at certain points in the future if and when the climate situation changes. We have no way of knowing for certain what impacts future sea level rise and climate change will have on our district, so having several steps along these pathways allows for flexibility and adaptability to the new set of circumstances in the short, medium and long-term.

#### At what points in the process is the community consulted for feedback?

Throughout the process, CAP will engage both independently and in facilitated environments to gauge community feedback on the development of the preferred pathways. The CAP acts as the conduit and community voice for input into the Coastal Hazards Adaptation Recommendation Report to Council. The specific points in the process where the community is consulted for their feedback are through the CAP community engagement workshops that happened at the beginning of the process for each adaptation area, and after CAP have decided on their draft pathway options but before they submit their Recommendation Report to Council.

#### What are our options?

The different steps in the pathways are adaptation 'options'. Options is the broader term that groups the different types of actions. Each step in the pathway has options and actions. For example, a pathway could include an 'Enhance' option, a 'Protect' option, and then a 'Protect' option. The timeframes for progressing these three options would depend on when "signals" of change (agreed with you) occur in real-time ("the trigger"), at a level that requires action ("the threshold"). The "Avoid" option is included in all pathways through land-use planning. Our umbrella options with an example of one of the actions that may be considered under each are:



live with the hazard" Example action:

Raising minimum floor levels of existing buildings and we do it better"

Example action: Raising minimum floor levels of existing buildings

places we know will be at risk in the future" Example action: Reduce intensification or development in at-risk areas

the hazard"

Example action: Building sea walls

Example action: Land swaps

#### How is the preferred pathway decided for each area?

The Multiple Criteria Decision Analysis (MCDA) decision tool is being used for the Takutai Kāpiti project to assist the Coastal Advisory Panel (CAP) in identifying which options are best suited for the area. This tool involves scoring each pathway option against eight criteria.

#### When do you move to the next steps in the pathway?

Adaptation planning relies on signals, triggers, and thresholds to determine when a change to the current management approach is required. The most critical element to this working is that, they are not time bound steps and, we work with you to agree on the signals of change; triggers for action; and thresholds for action that we set.

- Signals are the things we are monitoring to determine when change is needed. For example, we can monitor the rate of erosion to determine how the coast is responding to sea level rise.
- Triggers are the point when we need to change the management option. The triggers need to consider management approaches and timeframes to implement these. In some cases, these may be reached 10 years prior to a threshold being reached. A trigger might be when erosion reaches a certain distance from the nearest dwelling.
- Thresholds are the point where the level of risk or damage is no longer acceptable under the current management option. These need to be set by the community or asset owner. For example, you might be okay with ankle deep water around your dwelling once a year, but you're not happy with water ponding around your dwelling all winter. We therefore need to plan to adapt before this happens.

Part of CAP's work will be identifying "optional thresholds" for further community discussion. Detailed triggers, signals and thresholds will be agreed with each community after the Coastal Advisory Panel provides their Recommendation Report to Council.

## Takutai Kāpiti.

The CAP proposes recommending the following approach to managing coastal hazards in the District Plan:

- Use of a risk-based approach similar to that adopted by Porirua City Council and Wellington City Council in their recent District Plan reviews.
- Coastal hazards planning rules and provisions will constrain subdivision, use and development according to levels of risk.
- Risk areas will be mapped based on the best available information including relevant national and regional direction (NZCPS & RPS) and the most up to date IPCC information and relevant national guidance.

Note: The mapping, planning provisions and rules will be developed by Council district planners after Takutai Kāpiti in partnership with mana whenua and consultation with the community. Do you agree with the CAP's proposed approach to managing coastal hazards in the District Plan?

Please give your feedback on one of the cards provided.

Independent Coastal Advisory Panel wants your feedback

## Soft Engineering Erosion Protection Options

Soft engineering for erosion protection involves:

- Moving around the sand that is already on the beach to build up the beach profile to provide a greater level of protection; or
- Bringing in additional sand to help build up the beach profile volume and provide a greater level of protection.

There are various methods that you could use to achieve effective outcomes, and ways to minimise the effects that these mechanisms could have on important values of the coastal environment. These methods would require various degrees of resource consenting depending on what was proposed, and this process would require any adverse effects to be avoided or minimised to obtain the best outcome for the environment. Below are some examples of how soft engineering could be done on the Kāpiti Coast:

### Ways to effectively move sediment around



## Soft Engineering Erosion Protection Options



### Ways to bring sediment into the beach system

Foreshore Renourishment

Renourishment

(to the back of the beach)

Renourishment could be undertaken by bringing in additional sand and adding it to the back of the beach to build bulk and height to provide protection in storms. Providing dry sand to the back of the shore will enhance and speed up dune growth following storm events or erosion episodes. It is best applied on narrow dune systems that are in net erosional states in episodic storms, and where there is available space for the dune to retreat landward. This approach is key for when placement of material on the front of the dune or foreshore is not sustainable.

Material can be placed onto the foreshore/lower beach environment rather than directly onto the dune. This is used to limit disturbance of the dune planting, with the aim that a steeper, higher upper beach will reduce run-up length and prevent it reaching the dune toe (and therefore reducing erosion potential). This method is used on recreational beaches to increase usable beach width, but can have a limited lifetime as material will quickly

> move alongshore and across shore if the system is out of balance with plan shape and beach slope.

Nearshore Renourishment

## Hard Engineering Erosion Protection Options

There are various types of 'hard engineering' erosion protection options that could be implemented on the Kāpiti Coast. Generally, they are designed to do one of the following:

- 'Hold the line' use an engineered structure to keep the shoreline in its current or some desired new
  position. There are many variations of structure design and materials that can be used to achieve this,
  and to provide for different values (i.e. recreation and access, ecological values).
- 'Long-shore sediment trapping' use an engineered structure to trap sediment being naturally transported alongshore to build up the beach therefore providing shoreline protection by the increased beach width of trapped sediment (e.g. groynes).
- 'Reduce wave attack' place an engineered structure in the nearshore to break up wave energy which promotes the retention of sediment on the beach behind the structure (e.g. detached breakwater).

These methods would all require various degrees of resource consenting, and this process would ensure any adverse effects would be avoided or minimised to obtain the best outcome for the environment. Below are some examples of hard engineering options that could be explored on the Kāpiti Coast:

### Groynes

A groyne is a structure built perpendicular to the shoreline out into the sea that is used to trap sediment being transported by longshore drift. Groynes can be built out of rock, timber, concrete, or

put of rock, timber, concrete, or geotextile materials.



Groynes will trap sediment travelling alongshore, which can result in a build up of the beach the 'upstream' side of the structure, but erosion in the lee of the structure. Therefore, in order to be effective, typically there needs to be multiple groynes constructed to reduce the effects of erosion on the lee side.

### **Detached Breakwaters**

Detached breakwaters are structures that are parallel to the shoreline either in the nearshore or further offshore. They aim to alter the wave conditions to reduce wave energy reaching the beach and encourage the buildup of sediment in the beach and nearshore. When these are effective, they can alter the morphology and beach form. They can also enhance ecological habitat.



There are many different designs of breakwaters, which can have their own advantages. Variations in breakwater design can include:

- Use of material (e.g. rock, geotextiles, or concrete).
- Location of the structure in the nearshore, or offshore.
- Fully submerged, exposed at low tide, or fully exposed.
- Longshore continuity of the structure (e.g. one continuous structure vs lots of small structures).

Nearshore, exposed

Offshore, submerged

STRICT COUNC

## Hard Engineering Erosion Protection Options

### Seawalls

Seawalls are the most common structures used to 'hold the line', being a solid barrier along the shoreline which can prevent the passing of water and sediment between the land and the sea. The design of a seawall can vary depending on the environment it is being placed in, the desired location, and cobenefits trying to be achieved (e.g. reduction in coastal flooding, increased ecological values, access, and recreation).

Some examples of different types of seawalls that could be explored for the Kapiti Coast include:

#### Sloping Rock Revetment Large rocks are placed at a designed slope to

create the necessary crest height and mass to prevent individual rocks from shifting and exposing the shoreline to erosion and to reducing the risk of overtopping.

### Vertical Timber Wall

Vertical wall constructured from timber. It could be considered a more natural looking alternative to



considered a more natural looking alternative to a concrete wall, however, is likely to have the same negative impacts of beach lowering from wave reflection

and a shorter design life than concrete.

### Vertical Concrete Wall

Vertical wall constructed of concrete at a designed crest level to prevent overtopping. This

occupies a smaller footprint than the rock revetment but can have negative
 impacts on increasing beach lowering in front of the structure

due to wave reflection.

### Interlocking Concrete Wall

Interlocking concrete structure: a mid-way between a vertical structure and sloping revetment.



New designs and technology can allow for this to be a small footprint, and potential opportunities to provide for other values desirable

to the community (e.g. ecological value by incorporation of rock pools into the design).

### Setback Seawall

Constructing a new seawall setback from the current shoreline to allow for some space between the built

Erodes

over

time

and natural environment for a period of time. In most cases, this could require the retreat of beach front property or infrastructure to allow for the

> natural erosion of the shoreline back to a new position.

### Bank Protection -Gabion Baskets

Gabion baskets are wired baskets filled with cobbles. They can be effective at providing bank stabilisation

> in low energy environments , - such as estuaries.

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# **'Accommodate'** Options

'Accommodate' options are about allowing people to stay in place and live with the hazard while reducing the impacts and dangers of the hazard on people and infrastructure, or making it easy to temporarily or permanently move when the hazard occurs. Accommodate options typically deal with the flood hazard, and accommodating the water when it temporarily or permanently floods the land. Accommodate options are not as effective for erosion hazards, as erosion typically results in a permanent loss of land. The following summarises the potential 'Accommodate' options that could be explored on the Kāpiti Coast:

### **Raising Buildings and Floor Levels**

Some buildings can be raised above the flood level to reduce damage to the structure, contents, and the danger to people. This could be done using stilts, piles, or raised building platforms, and could allow water to flow around or under the house.

While this will mean that individual homes can stay dry, there still may be some issues with accessing the property or nearby services if roads are not also raised. Depending on how high a building needs to be raised, access to the building could require stairs which may be undesirable to some.



Buildings can be flood-proofed either using sealant or barriers to prevent water from entering the inside of a building. Efforts can also be made to change the use of bottom floors of buildings to reduce the consequences of them being flooded (e.g. raising electrical wiring and sockets, tiled floors). Similar to raising houses, there may still be issues with people being able to access nearby services required during event as roads may still flood and prevent access.

### **Relocatable Houses**

Buildings can be designed in a way to be easily relocated before the risk to flooding or erosion becomes intolerable. This option could primarily be applied to new builds. Existing buildings could be relocated, however, differences in structures and foundations could make it logistically difficult and result in high costs.



## Hard Engineering Ka Inundation Protection Options

Hard engineering for coastal flood protection is generally built infrastructure that is intended to either:

- Prevent water from reaching land where it is not wanted; or
- Enable water to get back to the sea when flooding occurs.

Hard engineering options typically are undertaken to provide protection to a wider area than property level protection. Below summarises potential hard engineering flood protection options that could be explored for the Kāpiti Coast:

### Non-return valves on stormwater

Non-return valves can be installed on the end of stormwater pipes. They allow for stormwater to drain out of the pipe, but prevent water from the sea travelling up the pipe and exacerbating the flood hazard on land. They also reduce beach sediment entering the pipes therefore reducing the risk of blockages. There are various types of non-return valves, the following being two common examples.



### Stopbanks and Earth Bunds

Stopbanks are engineered structures, usually made from earth material, that are placed parallel to a coastline or river system to prevent flooding from the sea or river during storms. The crest height of the stopbanks would be informed through a design level for a specified flood event, which could include both coastal and river sources of flooding. These structures can also provide for other values such as recreation, as stopbanks are often also used as walking/cycling pathways.



### **Pumpstations**

Stormwater pump stations help protect areas by pumping to sea large volumes of ponded flood water from low lying areas where natural runoff is low.



### Storm Surge Barriers and Flood Gates

Storm surge barriers are structures that are 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. Storm surge barriers are typically large structures built across large water bodies.



Flood gates act in a similar way. They are adjustable gates used to prevent storm surges entering existing waterways and can be applied to smaller waterways and inlets.

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# 'Enhancement' Options

Enhancement options are approaches to improving the existing environment, infrastructure, and community understanding on coastal hazards to increase the resilience to future hazards.



### Enhancement of Existing Stormwater Infrastructure

Increase the resilience of existing stormwater infrastructure to be more resilient. This could include incorporating sea level rise and higher intensity events into the design of existing stormwater management infrastructure when it is being upgraded, such as stormwater pipes and stopbanks.

### Enhancement of Existing Erosion Protection

Add elevation to the top of the wall to prevent overtopping Adding material to existing structures (e.g. sea walls) to increase resilience. This could include adding height to the top of the structure, as well as material to the toe to reduce toe scour and resulting failure.

Stopbank

Add material to the toe to reduce scour and undermining

RICT COUNCIL

## **'Enhancement'** Options

### **Environmental Monitoring**

Monitoring of the environmental responses to sea level rise (SLR) will be critical to understand changes in signals, triggers, and thresholds. Monitoring of the physical changes we see on our coast may be a combination of regular data capture - e.g. using drones, surveying, state of environment monitoring; as well as citizen science monitoring – eg relying on community members to keep records of changes they see and impacts of large events. Monitoring and data collection will play an important role in updating future models to have more certainty around future projections of shoreline and flood responses to SLR.

### Community Education and Emergency Management

- Increasing community understanding and awareness of present and future coastal hazards
- Update emergency management to take account for the new information we have about how hazards may change in the future with SLR and climate change.
- Educate the community on how we can better prepare for significant events and changing hazards on our coast.



## **Retreat Options**

Managed retreat involves proactively moving people, assets, and activities away from the hazard. This can occur progressively as the risk to individual properties becomes intolerable or could involve moving part of a community together. The land that has been retreated from is then restored to its natural state or used to (re)establish coastal protection works.

How managed retreat could be undertaken in Kāpiti is yet to be explored given it is not anticipated to be required in the short-term. Prior to managed retreat being required, or desirable, in Kāpiti it is anticipated that there will be some central government guidance on implementing managed retreat and more examples of proactive managed retreat in New Zealand that Kāpiti can learn from.

Some potential options for retreat that have been explored elsewhere in New Zealand:

- Buyouts Full or partial compensation is provided to property owners to relocate to another space.
- Leasebacks Government (local or central) purchases land and leases it back to existing owners.
- Land swaps Alternative land is made available and property owners are offered the ability to swap their existing hazard-prone land for a new section.