MCDA CRITERIA – EFFECTIVELY MANAGES THE RISKS OF COASTAL EROSION

Management Unit	Pathway	Pathway Description			Effectively Manages the Risks of Coastal Erosion	
		Short term	Medium term	Long term	Score	Notes
Waikanae Unit 5A	1	**Enhance** - Dune and/or wetland resilience, community education and emergency management	**Soft Engineering** - Dune reconstruction	**Soft Engineering** - Beach renourishment	3	• Dune enhancement and reconstruction are both effective measures that are proportionate to the nature and scale of risk over the short-medium term. • If designed and managed properly, is likely to effectively manage impacts under lower SLR scenarios. • Design would be informed by best practise. • Some uncertainty around the effectiveness of renourishment in the long term under higher SLR scenarios, as would require significant sand source input. • Would not exacerbate erosion issues in adjacent areas, southward transport of sediment used for renourishment would have added benefit to Paraparaumu Beach.
	2	**Enhance** - Dune and/or wetland resilience, community education and emergency management AND Soft **Engineering** - Dune reconstruction	**Enhance** - Dune and/or wetland resilience, community education and emergency management AND **Soft Engineering -** Beach renourishment	**Protect - Hard Engineering** - Sea wall	4	• Dune enhancement and reconstruction are both effective measures that are proportionate to the nature and scale of risk over the short-medium term. • Some uncertainty around the effectiveness of renourishment in the medium term under higher SLR scenarios, as would require significant sand source, but combined with planting and dune management could be effective. • Hard engineering would be effective at preventing further retreat of the shoreline in the long term. • Over the long term, hard engineering may exacerbate the erosion hazard directly to the north and south of the wall due to end effects. • Design would be informed by best practise to reduce these effects but there will be environmental impacts and changes to the beach associated with this option over the longer term (i.e. beach narrowing and loss of volume).
	3	**Enhance** - Dune and/or wetland resilience, community education and emergency management AND Soft **Engineering** - Dune reconstruction	**Enhance** - Dune and/or wetland resilience, community education and emergency management AND **Soft Engineering -** Beach renourishment	**Protect - Hard Engineering** - Detached Breakwater	3	• Dune enhancement and reconstruction are both effective measures that are proportionate to the nature and scale of risk over the short term. • Some uncertainty around the effectiveness of renourishment in the medium term under higher SLR scenarios, as would require significant sand source, but combined with planting and dune management could be effective. • Detached breakwater in the nearshore would reduce wave energy approaching the beach and could be effective at reducing erosion risk in Waikanae Beach. • However, the breakwater will likely result in morphological changes to the beach due to reduction in wave energy, and could have some lee-side erosion effects downdrift of the breakwater (e.g. Paraparaumu) as a result of sediment trapping. • The scale and nature of the works required to effectively manage the risk is unlikely to be proportionate to the scale of the hazard. • Design would be informed by best practise.

Waikanae Unit 5A	4	**Enhance** - Dune and/or wetland resilience, community education and emergency management AND Soft **Engineering** - Dune reconstruction	**Protect - Hard Engineering** - Sea wall	**Retreat**	4	• Dune enhancement and reconstruction are both effective measures that are proportionate to the nature and scale of risk over the short term. • A sea wall in the medium term will hold the shoreline seaward of private properties and effectively manage the risks. • Hard engineering would be effective at preventing further retreat of the shoreline in the medium term, but may exacerbate the erosion hazard directly to the north and south of the wall due to end effects. • Design would be informed by best practise to reduce these effects but there will be environmental impacts and changes to the beach associated with this option (i.e. beach narrowing and loss of volume). •Retreat in the long term will remove all risk from the erosion hazard to private property; however, the sea wall in the medium term would have modified the coastal environment, and therefore either continued maintenance of the sea wall would be required, or significant rehabilitation to reform the dunes would be required to re-establish protection.
	5	**Enhance** - Dune and/or wetland resilience, community education and emergency management AND Soft **Engineering** - Dune reconstruction	**Protect - Hard Engineering** - Detached Breakwater	**Retreat**	3	• Dune enhancement and reconstruction are both effective measures that are proportionate to the nature and scale of risk over the short term. • Detached breakwater in the nearshore would reduce wave energy approaching the beach and could be effective at reducing erosion risk in Waikanae Beach. • However, the breakwater will likely result in morphological changes to the beach due to reduction in wave energy, and could have some lee-side erosion effects downdrift of the breakwater (e.g. Paraparaumu) as a result of sediment trapping. • The scale and nature of the works for the detached breakwater to effectively manage the risk is unlikely to be proportionate to the scale of the hazard in the medium term. • Design would be informed by best practise. • Retreat in the long term will remove all risk from the erosion hazard to private property.
	6	**Enhance** - Dune and/or wetland resilience, community education and emergency management AND Soft **Engineering** - Dune reconstruction	**Retreat**	**Retreat**	5	• Effectively manages the risks of coastal erosion over time, and takes actions in the short term to reduce risks over that period and increase the timeframe before retreat would be required. •Enhancement and dune recontouring will be proportionate to the scale of risk in the short term. •There will be no exacerbation of erosion risks on adjacent areas from short term actions in this pathway. • Retreat of beachfront properties would result in total removal of risk to those individuals from erosion, and would be proportionate to the nature and scale of the risk to those impacted.

Waikanae Unit 5B	1	**Status Quo** AND Community Education and Emergency Management	**Status Quo** AND Community Education and Emergency Management	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	1	• Pathway not designed to address the erosion hazard, and would not effectively manage the erosion risk.
	2	**Status Quo** AND Community Education and Emergency Management	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Additional Hard Protection -** e,g. stopbanks, Culverts and Pump stations	1	• Pathway not designed to address the erosion hazard, and would not effectively manage the erosion risk.
	3	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Accommodate -** Elevate floor levels of buildings and flood proofing buildings and infrastructure	1	• Pathway not designed to address the erosion hazard, and would not effectively manage the erosion risk.
	4	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Accommodate -** Elevate floor levels of buildings and flood proofing buildings and infrastructure	**Retreat**	2	• Pathway not designed to address the erosion hazard, and would not effectively manage the erosion risk. • Only a small number of houses that were retreated for flood hazard would also be impacted by erosion hazard.
	5	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Additional Hard Protection -** e,g. stopbanks, Culverts and Pump stations	**Retreat**	2	• Pathway not designed to address the erosion hazard, and would not effectively manage the erosion risk. • Only a small number of houses that were retreated for flood hazard would also be impacted by erosion hazard.

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Waikanae Estuary Unit 6A and B	1	**Status Quo** AND Community Education and Emergency Management	**Enhance -** Dune and/or wetland resilience, community education and emergency management	**Enhance -** Dune and/or wetland resilience, community education and emergency management	3	• Increasing wetland resilience by planting and management is likely a proportionate response to the scale of hazard within the estuary. • Wetland planting and management likely to help stabilise banks and reduce retreat but could get washed out in large fluvial events. • Avoids the exacerbation of risk in other areas.
	2	**Status Quo** AND Community Education and Emergency Management	**Enhance -** Dune and/or wetland resilience, community education and emergency management	**Protect -** Bank protection	4	• Increasing wetland resilience by planting and management is likely a proportionate response to the scale of hazard. • Wetland planting and management likely to help stabilise banks and reduce retreat of the shoreline. •Hard protection in the long term will be effective at reducing the shoreline retreat around the estuary banks. • Long term action may exacerbate the erosion risks immediately around the ends of the wall (end effects). Will also result in coastal squeeze of the wetland, reducing marshlands plants which act as wave attenuation protection.
	3	**Enhance -** Dune and/or wetland resilience, community education and emergency management	**Enhance -** Dune and/or wetland resilience, community education and emergency management	**Protect -** Bank protection	4	• Increasing wetland resilience by planting and management is likely a proportionate response to the scale of hazard. • Starting the wetland planting earlier will increase the time frame it is effective for. • Wetland planting and management likely to help stabilise banks and reduce retreat of the shoreline. •Hard protection in the long term will be effective at reducing the shoreline retreat around the estuary banks. • Long term action may exacerbate the erosion risks immediately around the ends of the wall (end effects). Additional environmental impacts will include coastal squeeze of the wetland, reducing marshlands plants which act as wave attenuation protection.
	4	**Enhance -** Dune and/or wetland resilience, community education and emergency management	**Protect -** Bank protection	**Protect -** Bank protection	3	• Increasing wetland resilience by planting and management is likely a proportionate response to the scale of hazard. However, medium term bank protection is unlikely to be proportionate to the scale of hazard. • Starting the wetland planting earlier will increase the timeframes it is effective for. • Wetland planting and management likely to help stabilise banks and reduce retreat of the shoreline, however, could get washed out in large fluvial events. •Hard protection in the medium-long term will be effective at reducing the shoreline retreat around the estuary banks. • Bank protection may exacerbate the erosion risks immediately around the ends of the wall (end effects). Additional environmental impacts will include coastal squeeze of the wetland, reducing marshlands plants which act as wave attenuation protection.
	5	**Enhance -** Dune and/or wetland resilience, community education and emergency management	**Retreat -** Retreat recreational infrastructure to make way for wetland migration	**Retreat -** Retreat recreational infrastructure to make way for wetland migration	5	• Increasing wetland resilience by planting and management is likely a proportionate response to the scale of hazard and would increase the timeframe before needing to retreat. • Wetland planting and management likely to help stabilise banks and reduce retreat of the shoreline, but could be washed out in a large fluvial event. • Retreat of assets around the edges will allow for room for the wetland to migrate and continue to provide protection. This will remove risks, and therefore retreat will effectively manage the risks. •This approach is proportionate to the scale of hazard.

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Otaihanga Unit 7B	1	**Status Quo** AND Community Education and Emergency Management	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Additional Hard Protection** (e.g. stopbanks, culverts and pump stations)	1	•There is no erosion hazard in the Otaihanga area, and this pathway was not developed to manage the erosion hazard. All pathways in this management unit are scored 1 to reflect this and be relative to one another.
	2	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Accommodate -** Elevate floor levels of buildings and flood proofing buildings and infrastructure	1	•There is no erosion hazard in the Otaihanga area, and this pathway was not developed to manage the erosion hazard. All pathways in this management unit are scored 1 to reflect this and be relative to one another.
	3	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Accommodate -** Elevate floor levels of buildings and flood proofing buildings and infrastructure	**Retreat**	1	•There is no erosion hazard in the Otaihanga area, and this pathway was not developed to manage the erosion hazard. All pathways in this management unit are scored 1 to reflect this and be relative to one another.
	4	**Additional Hard Protection** (e.g. stopbanks, culverts and pump stations)	**Enhance** - Enhance new inundation protection, dune and/or wetland resilience, and community education and emergency management	**Retreat**	1	•There is no erosion hazard in the Otaihanga area, and this pathway was not developed to manage the erosion hazard. All pathways in this management unit are scored 1 to reflect this and be relative to one another.
	5	**Enhance** - Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Additional Hard Protection** (e.g. stopbanks, culverts and pump stations)	**Additional Hard Protection** (e.g. stopbanks, culverts and pump stations)	1	•There is no erosion hazard in the Otaihanga area, and this pathway was not developed to manage the erosion hazard. All pathways in this management unit are scored 1 to reflect this and be relative to one another.

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Paraparaumu Unit 8A	1	**Enhance -** Dune and/or wetland resilience, community education and emergency management	**Protect - Soft Engineering** - Dune Reconstruction	**Protect - Soft Engineering** - Beach Renourishment	3	• Dune enhancement and reconstruction are both effective measure that are proportionate to the nature and scale of risk over the short-medium term for most of Paraparaumu Beach. • If designed and managed properly, is likely to effectively manage impacts under lower SLR scenarios. • Design would be informed by best practise. • Beach renourishment likely to be effective around the shoreline north of Tikotu Stream in the wave shadow of Kapiti Island. • Pathway will not effectively manage the risks to the built environment south of the Tikotu Stream where some service assets are already at risk. Beach renourishment has been trialled at this end of the shoreline before and was not successful.
	2	**Enhance -** Dune and/or wetland resilience, community education and emergency management AND **Protect - Soft Engineering** - Dune reconstruction	**Enhance -** Dune and/or wetland resilience, community education and emergency management AND **Protect - Soft Engineering** - Beach Renourishment	**Protect - Hard Engineering -** Sea wall	4	• Dune enhancement and reconstruction are both effective measures that are proportionate to the nature and scale of risk over the short-medium term. • Some uncertainty around the effectiveness of renourishment in the medium term under higher SLR scenarios, as would require significant sand source, but combined with planting and dune management could be effective. • Hard engineering would be effective at preventing further retreat of the shoreline in the long term, especially at the southern end of Marine Parade and at the northern end of Manly Street. • Over the long term, hard engineering may exacerbate the erosion hazard directly to the north and south of the wall due to end effects. • Design would be informed by best practise to reduce these effects but there will be environmental impacts and changes to the beach associated with this option over the longer term (i.e. beach narrowing and loss of volume).
	3	**Enhance -** Dune and/or wetland resilience, community education and emergency management AND **Protect - Soft Engineering** - Dune reconstruction	**Enhance -** Dune and/or wetland resilience, community education and emergency management AND **Protect - Soft Engineering** - Beach Renourishment	**Protect - Hard Engineering -** Detached Breakwater	3	• Dune enhancement and reconstruction are both effective measures that are proportionate to the nature and scale of risk over the short-medium term. • Some uncertainty around the effectiveness of renourishment in the medium term under higher SLR scenarios, as would require significant sand source, but combined with planting and dune management could be effective. It has been trialled once at the southern end of marine parade and was not successful. • Detached breakwater in the nearshore would reduce wave energy approaching the beach, and could be effective at reducing erosion risk in Paraparaumu Beach. • However, the breakwater will likely result in morphological changes to the beach due to reduction in wave energy, and could have some lee-side erosion effects downdrift of the breakwater (e.g. Raumati) as a result of sediment trapping, where the erosion hazard is already high. • The scale and nature of the works required to effectively manage the risk is unlikely to be proportionate to the scale of the hazard. • Design would be informed by best practise.

Paraparaumu Unit 8A	4	**Enhance -** Dune and/or wetland resilience, community education and emergency management AND **Protect - Soft Engineering** - Dune reconstruction	**Protect - Hard Engineering -** Sea wall	**Retreat**	4	• Dune enhancement and reconstruction are both effective measures that are proportionate to the nature and scale of risk over the short-medium term. • A sea wall in the medium term will hold the shoreline seaward of private properties and effectively manage the risks. • Hard engineering would be effective at preventing further retreat of the shoreline in the medium term, but may exacerbate the erosion hazard directly to the north and south of the wall due to end effects. • Design would be informed by best practise to reduce these effects but there will be environmental impacts and changes to the beach associated with this option (i.e. beach narrowing and loss of volume). •Retreat in the long term will remove all risk from the erosion hazard to private property; however the sea wall in the medium term would have modified the coastal environment, and therefore either continued maintenance of the sea wall would be required, or significant rehabilitation to reform the dunes would be required to re-establish protection.
	5	**Protect - Hard Engineering -** Sea wall	**Protect - Hard Engineering -** Sea wall	**Retreat**	3	• Sea wall will effectively manage the erosion risks over the short-medium term. Retreat will remove the risks over the long term. • Sea wall in the short to medium term is only proportionate to the scale of the risks at the southern end of the adaption area. Along the rest of the adaptation area shoreline, a seawall is not proportionate to the scale of the hazard. • There would likely be an exacerbation of the erosion risks at the ends of the walls (end effects) and other environmental impacts such as beach narrowing in front of the wall.
	6	**Enhance -** Dune and/or wetland resilience, community education and emergency management AND **Protect - Soft Engineering** - Dune reconstruction	**Retreat**	**Retreat**	4	• Effectively manages the risks of coastal erosion over time, and takes actions in the short term to reduce risks over that period and increase the timeframe before retreat would be required. •Enhancement and dune recontouring will be proportionate to the scale of risk in the short term. •There will be no exacerbation of erosion risks on adjacent areas from short term actions in this pathway. • Retreat of beachfront properties would result in total removal of risk to those individuals from erosion. It would be proportionate to the nature and scale of the risk to those impacted to retreat. • Enhance and dune reconstruction is unlikely to be effective at managing the erosion risks at the southern end of Marine Parade where erosion risk is already high in the short term.

Paraparaumu Unit 8B	1	**Status Quo** AND Community Education and Emergency Management	**Status Quo** AND Community Education and Emergency Management	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	1	• Pathway not designed to address the erosion hazard, and would not effectively manage the erosion risk.
	2	**Status Quo** AND Community Education and Emergency Management	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Additional Hard Protection** (e.g. stopbanks, culverts and pump stations)	1	• Pathway not designed to address the erosion hazard, and would not effectively manage the erosion risk.
	3	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Accommodate -** Elevate floor levels of buildings and flood proofing buildings and infrastructure	1	• Pathway not designed to address the erosion hazard, and would not effectively manage the erosion risk.
	4	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Accommodate -** Elevate floor levels of buildings and flood proofing buildings and infrastructure	**Retreat**	2	• Pathway not designed to address the erosion hazard, and would not effectively manage the erosion risk. • Only a small number of houses that were retreated for flood hazard would also be impacted by erosion hazard.
	5	**Enhance -** Enhance existing inundation protection, dune and/or wetland resilience, and community education and emergency management	**Additional Hard Protection** (e.g. stopbanks, culverts and pump stations)	**Retreat**	2	• Pathway not designed to address the erosion hazard, and would not effectively manage the erosion risk. • Only a small number of houses that were retreated for flood hazard would also be impacted by erosion hazard.