<table>
<thead>
<tr>
<th>Options recommended for MCDA scoring</th>
<th>Options recommended to be discarded + rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Status quo</td>
<td>5. Beach face de-watering</td>
</tr>
<tr>
<td>2. Planting</td>
<td><em>Has not been proven to be reliably successful, and success has only been realised on sandy beaches. Not suitable for this coastline.</em></td>
</tr>
<tr>
<td>3. Renourishment (gravel)</td>
<td>8. Wetland or lagoon creation</td>
</tr>
<tr>
<td>4. Inter-tidal renourishment (sand)</td>
<td><em>Insufficient space to create</em></td>
</tr>
<tr>
<td>7. Restore shingle crest</td>
<td><em>No waterways in this location suitable for this option</em></td>
</tr>
<tr>
<td>11. Inundation accommodation</td>
<td>10. Install / enhance inundation protection (stop banks)</td>
</tr>
<tr>
<td>13. Groynes + nourishment</td>
<td><em>Limited space to install</em></td>
</tr>
<tr>
<td>15. Offshore Reef</td>
<td><em>High wave energy environment. Limited benefit. Benefits to sediment retention are not enough to substantially reduce risk</em></td>
</tr>
<tr>
<td>16. Sea wall</td>
<td>17. Retreat the line</td>
</tr>
<tr>
<td>18. Managed Retreat</td>
<td><em>No practical location to move the line of defence to</em></td>
</tr>
</tbody>
</table>
Coastal Unit: Westshore
Option: D1 – Status Quo

Technical Description: Maintain current coastal management approaches – i.e. do nothing new.

<table>
<thead>
<tr>
<th>Options Assessment</th>
<th>Major Benefit</th>
<th>Minor Benefit</th>
<th>Null / Neutral</th>
<th>Negative / adverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inundation Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacent Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Cell Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key Issues / Considerations

Neutral / Factual
Ad hoc approach conducted and funded by a number of entities, often reactive with limited consideration to wider coastal cell.

Positive
Approaches have reduced impacts of erosion and inundation

Negative
Very little in the way of long term planning and adaptive management for climate change.

Some strategies not viable in the medium to long term, as such require new approach

Indication of Longevity
Short term
Coastal Unit: Westshore  
Option: D2 – Planting

**Technical Description:**  
Planting of beach crest areas to improve retention of material, reduce erosion and limit wave overtopping.

**Representative Image**

**Concept Plan**

- Establishing plants on shingle beaches is more problematic than sand dunes
- Species typically larger with bigger root stocks
- Some areas have limited space above Mean High Water Spring (MHWS) tide level to establish vegetation

---

**Options Guide**

<table>
<thead>
<tr>
<th>Options Guide</th>
<th>Major Benefit</th>
<th>Minor Benefit</th>
<th>Null/Neutral</th>
<th>Negative/Adverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inundation Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacent Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Cell Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Implementation Commentary**

Establishing plants can be problematic, however with proper management can be readily implemented. Can be used in conjunction with other options to enhance performance.

**Indication of Longevity**

Short term

---

**Key Issues / Considerations**

**Positive**
- Adds to amenity
- Stabilises beach crest
- Reduces erosion and inundation risk

**Negative**
- Residents value of views could be lost / disrupted when utilising large plants

---

1. Capital and operational cost considerations excluded at this time
2. Pending availability of Social and Cultural Impact assessment work
Coastal Unit: Westshore

Option: D3 – Renourishment – Gravel

Technical Description:
Renourishment of gravel on foreshore area to offset erosion losses, increase beach size and potentially crest height. Larger beach can dissipate more wave energy and reduce/prevent wave overtopping.

Representative Image

Concept Plan

Renourishment volumes, location and frequency to be established during detailed design

Effectiveness largely dependent on the design beach profile and sediment transport rates

Options Guide

<table>
<thead>
<tr>
<th>Options Guide</th>
<th>Major Benefit</th>
<th>Minor Benefit</th>
<th>Null / Neutral</th>
<th>Negative / Adverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inundation Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacent Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Cell Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Implementation Commentary
Generally straightforward to implement, subject to sourcing a suitable, long term supply of material. Westshore renourishment has been a long term programme, good understanding / history using this option

Key Issues / Considerations

Neutral / Factual
- Sediment deficit will change over time as sediment losses increase with climate change

Positive
- Good understanding of how it works - history
- Easier consenting pathway than physical structures
- Performance could be improved with different placement locations

Negative
- May not benefit areas further south depending on area of placement
- Sustainability and suitability of supply an issue
- Regular renourishment works required to maintain beach volumes

Indication of Longevity
Benefits and longevity can be increased by using in conjunction with other options.

Short-term
**Coastal Unit: Westshore**

**Option: D4 – Renourishment – Sand**

**Technical Description:** Renourishment of finer sand to intertidal area

**Representative Image**

<table>
<thead>
<tr>
<th>Options Guide</th>
<th>Major Benefit</th>
<th>Minor Benefit</th>
<th>Null/Neutral</th>
<th>Negative/Adverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inundation Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacent Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Cell Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Implementation Commentary**

Difficulty sourcing large volumes of suitable material – dredging material sourced from the Port of Napier shipping channel is most viable source, however material placement is problematic – inshore dumping can have significant adverse effects on marine life and recreational / customary activities (e.g. diving, spearfishing, gathering kai moana)

**Key Issues / Considerations**

**Neutral / factual**

- Sediment deficit (i.e. losses to erosion / abrasion) is approx. 30k m³/annum in the north, 60k m³/annum in the south

**Positive**

- Increased amenity (potential)
- Easier consenting pathway than physical structures

**Negative**

- Sand washed away quicker than it can be placed e.g. reliance on ongoing actions
- May not benefit areas to south
- Is there a suitable, long term and sustainable source?
- Deficit is approx. 30k / annum (abrasion losses) – less losses than southern cell – limited recycling option (e.g. sourcing from Esk River mouth and moving south) here given movement of gravel is less predictable

**Indication of Longevity**

- Short term
Coastal Unit: Westshore  
Option: D6 – Beach-scraping

Technical Description: Redistribution of available sediments to maximise beach crest width and standard of protection.

Representative Image

Concept Plan

Realignment of beach crest planform to provide consistent standard of protection

Formation of wider and higher beach crest using available beach sediment

Options Guide

<table>
<thead>
<tr>
<th>Options Guide</th>
<th>Major Benefit</th>
<th>Minor Benefit</th>
<th>Null/Neutral</th>
<th>Negative/Adverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inundation Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacent Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Cell Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Implementation Commentary

Generally straightforward to implement, requires no additional materials or structures.

Key Issues / Considerations

Neutral / Factual

Neutral / Factual

- Option only requires surveys, planning and the use of plant machinery

Positive

- Relatively quick to undertake
- Provides increased protection against inundation

Negative

- On mixed sand and gravel beaches potential problems mixing fine sediments with coarser gravels in the beach crest
- Only viable when sufficient beach material available
- Does not address the overriding erosion issue
- Would require regular work to maintain the beach crest

Indication of Longevity

Short term

---

1 Capital and operational cost considerations excluded at this time
2 Pending availability of Social and Cultural Impact assessment work
Coastal Unit: Westshore

Option: D7 – Restore Shingle Crest

Technical Description: Raising dune level at low elevations to reduce inundation risk

Representative Image

Concept Plan

Natural lower undulation or access point

Area raised to match standard of adjacent beach and reduce inundation risk

Options Guide

<table>
<thead>
<tr>
<th>Options Guide</th>
<th>Major Benefit</th>
<th>Minor Benefit</th>
<th>Null/Neutral</th>
<th>Negative/Adverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inundation Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacent Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Cell Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Implementation Commentary
Quick and easy to implement in areas where there is a noticeable difference in topographic elevation at the rear of the beach.

Key Issues / Considerations

Positive
- Increases inundation protection at weak points
- Easy to implement
- Can be done quickly and effective immediately
- Unlikely to require much maintenance

Negative
- May impede beach access
- Views from properties may be affected
- Does not mitigate against erosion

Indication of Longevity
Short to medium term

---

1 Capital and operational cost considerations excluded at this time
2 Pending availability of Social and Cultural Impact assessment work
Coastal Unit: Westshore
Option: D1 – Inundation accommodation

Technical Description: Implementation of policy to improve flood resilience of current and future properties

Representative Image

Options Guide

<table>
<thead>
<tr>
<th>Options Guide</th>
<th>Major Benefit</th>
<th>Minor Benefit</th>
<th>Null/Neutral</th>
<th>Negative/Adverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inundation Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacent Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Cell Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key Issues / Considerations

Positive
- Reduces risk of internal flooding
- Reduces damage/loss in the event of flooding
- If flooded properties can be refurbished more quickly and at a lower cost

Negative
- Does not reduce the erosion risk
- Reduces effects of inundation, does not prevent them
- Only practical if flooding events are fairly infrequent
- Problem of funding for current properties and unlikely to be a mandatory requirement

Implementation Commentary
In addition to the above concepts external modifications such as removable flood barriers for doorways, shutters for windows and covers for external vents can help reduce the risk.

Indication of Longevity
Short to medium term

---

1. Capital and operational cost considerations excluded at this time
2. Pending availability of Social and Cultural Impact assessment work
Coastal Unit: Westshore

Technical Description: Interrupts wave action and limits the movement of sediment (gravels and sand) along the coast through longshore drift, thereby reducing localised losses to erosion. Nourishment is used to supply sand / gravel to the area protected by the groynes.

Representative Image

Concept Plan

Options Guide

<table>
<thead>
<tr>
<th>Options Guide</th>
<th>Major Benefit</th>
<th>Minor Benefit</th>
<th>Null / Neutral</th>
<th>Negative / Adverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inundation Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacent Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Cell Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key Issues / Considerations

Neutral / Factual
- Nourishment required in addition to groyne construction
- Can be constructed from rock, concrete or armour units

Positive
- Lower ongoing maintenance costs than nourishment on its own (but higher capital/upfront costs)
- Structures provide greater certainty in terms of standard of protection
- Maintains beach for amenity use

Negative
- Reduces supply of sediment northwards
- Access along the beach may be affected
- Ongoing beach maintenance

Implementation Commentary
Can be complex to consent and may create amenity issues, however is a tried and tested method of addressing erosion losses, including local examples
Construction material used dependant on local availability of rock and a cost estimates of alternatives.
Maintenance of structures should be fairly limited however additional beach nourishment may be required during the scheme life

Indication of Longevity
Consideration may be given to groyne length and crest elevation in order to be able to create a larger beach (crest height and width) in future years, to combat sea level rise and increasing risk, extending scheme life.

Short to medium term

* Capital and operational cost considerations excluded at this time

\(^{2}\) Pending availability of Social and Cultural Impact assessment work
## Coastal Unit: Westshore

### Option: D14 – Breakwater

**Technical Description:** Shore parallel offshore breakwater (crest above MHWS). Structures break waves, promote the build up of sediment in the lee of the structure and reduce longshore drift.

### Representative Image

- **Sea Palling, Norfolk (UK)**
- **Holly Beach, Louisiana (US)**

### Concept Plan

- Location, size, spacing and number of structures indicative only
- Parameters to be defined in the detailed design stage
- Material used will depend on the availability of locally sourced rock and the relative cost of alternatives (e.g. concrete units)

#### Options Guide

<table>
<thead>
<tr>
<th>Erosion Mitigation</th>
<th>Minor Benefit</th>
<th>Null/Neutral</th>
<th>Negative/Adverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inundation Mitigation</td>
<td>Minor Benefit</td>
<td>Null/Neutral</td>
<td>Negative/Adverse</td>
</tr>
<tr>
<td>Adjacent Impacts</td>
<td>Minor Benefit</td>
<td>Null/Neutral</td>
<td>Negative/Adverse</td>
</tr>
<tr>
<td>Overall Cell Impacts</td>
<td>Minor Benefit</td>
<td>Null/Neutral</td>
<td>Negative/Adverse</td>
</tr>
</tbody>
</table>

#### Implementation Commentary

Length of structures, spacing and crest height all act to determine the natural shape of beach that will form and whether the beach will eventually join up with the structure (tombolo) or accrete part way towards it (salient).

Can be constructed from rock, geotextile bags filled with sand or concrete armour units.

#### Key Issues / Considerations

<table>
<thead>
<tr>
<th>Neutral/Factual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore bathymetry and wave climate dictates feasibility of option both in terms of size of structures and potential formation/evolution of beach</td>
</tr>
<tr>
<td>Option would also require beach nourishment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecologically beneficial (fish habitat)</td>
</tr>
<tr>
<td>Reduces longshore drift and erosion losses</td>
</tr>
<tr>
<td>Increased width of beach and amenity area</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can cause increased erosion to adjacent coastline</td>
</tr>
<tr>
<td>Consenting can be problematic</td>
</tr>
<tr>
<td>Navigational hazard</td>
</tr>
<tr>
<td>Large volumes of replenishment may be initially required to form the crenular beaches</td>
</tr>
</tbody>
</table>

#### Indication of Longevity

Medium term

---

1. Capital and operational cost considerations excluded at this time
2. Pending availability of Social and Cultural Impact assessment work
Coastal Unit: Westshore  
Option: D15 – Offshore Reef

Technical Description: Shore parallel offshore reef (crest below MHWS). Structures break waves, promote the build up of sediment in the lee of the structure and reduce longshore drift.

Representative Image

Concept Plan

Options Guide

<table>
<thead>
<tr>
<th>Erosion Mitigation</th>
<th>Major Benefit</th>
<th>Minor Benefit</th>
<th>Null/Neutral</th>
<th>Negative/Adverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inundation Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacent Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Cell Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Implementation Commentary
Length of structures, spacing and crest height all act to determine the natural shape of beach that will form and whether the beach will eventually join up with the structure (tombolo) or accrete part way towards it (salient).
Can be constructed from rock, geotextile bags filled with sand or concrete armour units.

Key Issues / Considerations¹ ²

Neutral/Factual
› Offshore bathymetry can dictate feasibility of option both in terms of size of structures and potential formation/evolution of beach
› Option would also require beach nourishment

Positive
› Ecologically beneficial (fish habitat)
› Reduces longshore drift and erosion losses

Negative
› Can cause increased rips / currents leading to public safety issues and potentially increased inundation (unintended consequences)
› Constructability
› Consenting
› Can add surfing feature – but may also ruin surf breaks
› Navigational hazard

Indication of Longevity
Medium

¹ Capital and operational cost considerations excluded at this time
² Pending availability of Social and Cultural Impact assessment work
Coastal Unit: Westshore

Option: D16 – Sea Wall

Technical Description: A large structure of rocks and/or concrete that absorbs/reflects wave energy and provides a physical barrier to erosion. Crest height of structure designed to limit overtopping and prevent inundation.

Representative Image

Concept Plan

Options Guide

<table>
<thead>
<tr>
<th>Options Guide</th>
<th>Major Benefit</th>
<th>Minor Benefit</th>
<th>Null/Neutral</th>
<th>Negative/Adverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inundation Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacent Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Cell Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Implementation Commentary
Complex to consent and expensive to construct, however relatively straightforward to design given extensive experience available on similar structures both along this coast and elsewhere.

Key Issues / Considerations

Neutral / Factual
- Vertical seawalls can be used in combination with groynes, renourishment and/or rock revetments

Positive
- Effective at reducing erosion risk behind the defence and holding the line
- Can be designed to prevent inundation and accommodate medium term sea level rise

Negative
- End effects of structure would need managing
- Vertical walls can exacerbate beach erosion due to reflected wave energy
- Height to address overtopping in the mid to long term is significant – impacts on amenity / views
- Community values – beach and access lost
- Can build expectations of safety and inadvertently encourage more investment and development within hazard zones

Indication of Longevity
Medium to long term

1 Capital and operational cost considerations excluded at this time
2 Pending availability of Social and Cultural Impact assessment work
Coastal Unit: Westshore

Option: D18 – Managed Retreat

Technical Description: A strategic relocation of assets and people away from areas at risk, enabling restoration of those areas to their natural state.

Representative Image

Concept Plan

- Property and infrastructure relocated out of the hazard zone
- Equivalent sections made available for construction in order that the size of the community is maintained
- Coastal strip reverted to natural state, with restrictions on building/development, to provide an amenity benefit for public use
- Timing of relocation to be based on current risk and residual life of property

Options Guide

<table>
<thead>
<tr>
<th>Erosion Mitigation</th>
<th>Major Benefit</th>
<th>Minor Benefit</th>
<th>Null/Neutral</th>
<th>Negative/Adverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inundation Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacent Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Cell Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Implementation Commentary

Implementation can be complex.

Where risk is considered untenable, consider preventing rebuilding or significant investment/enhancement in defined areas through plan provisions (District or Regional Plan).

Key Issues / Considerations* ¹

Neutral / factual
- Early planning
- Proactive Council policies
- Issue of fairness – who pays / who benefits

Positive
- Provides complete and long lasting risk reduction

Negative
- Risks influencing the property market / values
- May be different financial / implementation models that could be more workable
- Residual infrastructure issues – safety / ecological / amenity issues
- Social impacts / uncertainty for residents

Indication of Longevity

Likely the ultimate result at some time in the future as sea levels continue to rise. Key questions to consider are when managed retreat should be implemented, where, how, and how to respond to coastal hazards risks in the interim.

Long term

* Capital and operational cost considerations excluded at this time

¹ Pending availability of Social and Cultural Impact assessment work