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# Coastal effects assessment guideline for transportation infrastructure

Environment and Urban Design Team

March 2017

Version 004



SH1 - Causeway, Auckland, 2014 (Source: NZ Transport Agency)

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NZ Transport Agency  
Published March 2017

ISBN 978-1-98-851216-7

If you have further queries, call our contact centre on 0800 699 000 or write to us:

NZ Transport Agency  
Private Bag 6995  
Wellington 6141

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## Record of amendment

Amendment number	Description of change	Effective date	Updated by
001	Draft	25 February 2014	David Greig (Jane James, MWH)
002	Draft	2 June 2016	David Greig
003	Final draft for consultation	8 November 2016	Maurice Marquardt
004	Final guide	March 2017	Maurice Marquardt

## FOREWORD

The *Coastal effects assessment guide* was developed in response to the Transport Agency's focus on long-term climate change impacts, such as sea level rise, increased inundation and various environmental effects to ensure resilience of the New Zealand highway network.

Further, regional and district councils are increasingly seeking greater reasoning and justification for design of coastal structures, and are placing greater restrictions in their planning documents controlling development within high risk coastal environments.

The guide describes a coastal environment risk assessment approach intended to inform the planning, design and management of state highway assets in coastal environments. It outlines key questions to be considered based around risks to the assets and their effects on changing coastal dynamics, such as sea level rise and increasing tide or storm impacts.

The guide was developed for project teams involved in the project approval and consenting stages, as well as in the design, construction and management of coastal assets to:

- Identify environmental effects that may influence the maintenance, renewal, new development or management of assets in the coastal environment over the course of the asset's design life.
- Undertake a qualitative risk assessment of environmental effects identified using this guideline.
- Develop measures to address effects on the Transport Agency's assets and/or the environment posed by the coastal environment.

The risk assessment process outlined in this guide summarises and documents key threats to assets and coastal environments, enabling project teams to develop suitable mitigation and management solutions. The guide itself does not provide solutions to mitigate the identified issues.

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# 1. INTRODUCTION

## 1.1 Background

The NZ Transport Agency holds a strong regard towards the natural environment, as demonstrated through our *Environmental and social responsibility policy*. Through this policy the Transport Agency aims to continuously improve performance in the management of environmental impacts, improve its knowledge and understanding of the extent and condition of New Zealand's environment, and identify and comply with all relevant environmental legislation and regulations. This Policy, along with the *State highway environmental plan* and the *Transport Agency statement of intent* are consistent with the requirements of the Land Transport Management Act (2003) and Resource Management Act (1991) as demonstrated in figure 1.

**Figure 1: Relationship of this guide to key Transport Agency policy and strategy documents and guides**



The Transport Agency is committed to ensuring unique coastal processes are effectively considered during the planning and maintenance of assets located in the coastal environment.

## 1.2 Purpose

The purpose of this guideline is to assist those involved in asset management to:

- i. Identify environmental effects that may influence the maintenance, renewal, new development or management of the Transport Agency assets in the coastal environment over the course of an asset's design life.
- ii. Undertake a qualitative risk assessment of environmental effects identified using this guideline.
- iii. Develop measures to address effects on the Transport Agency's assets and/or the environment posed by the coastal locality.

## 2. SCOPE

The scope of this guideline is to provide guidance for considering potential:

- Effects of the coastal environment on the Transport Agency's assets; and
- Environmental effects of the Transport Agency's assets on the coastal environment.

Structural and non-structural assets near or on the coast are subject to dynamic conditions including high energy hydrological changes and chemical reactions that can impact their longevity. Understanding these in current situations and in future scenarios will assist in wise and targeted management of assets.

This guideline provides key questions to inform decision making for on-going management to effectively address coastal effects and contribute to a resilient transportation network over the long term.

The information gained by using this guideline will contribute to, and augment, asset management tools of the Transport Agency to ensure decisions and subsequent actions are documented in one location and auditable. The guideline is aimed at use for all assets in the coastal environment.

## 3. DEFINING COASTAL ENVIRONMENTS

This guideline refers to the 'coastal environment' as defined in a statutory sense to provide a framework for regulatory management and an assessment of potential coastal effects. An explanation of this and related terms is provided in the follow sections and figure 2.

### 1.1 Coastal environment

The 'coastal environment' covers a wide area and is defined by a combination of characteristics, qualities and uses (New Zealand Coastal Policy Statement, 2010). The extent and nature of the 'coastal environment' varies across regions and locations because of the diversity in New Zealand's coastline and landform.

The coastal environment includes all of the 'coastal marine area' (definition provided in next section) and features landward of mean high water springs.

Features that contribute to the 'coastal environment' include physical elements (eg sand dunes, infrastructure and vegetation), dynamic elements (eg coastal processes and hazards such as inundation), character and values (eg landscape and heritage).

### 1.2 Coastal marine area

The coastal marine area (CMA) is specifically defined by section 2 of the Resource Management Act, 1991.

The CMA is defined by both a seaward extent (outer limits of the territorial sea, which is presently 12 nautical miles offshore) and a landward extent (mean high water springs, except where the boundary crosses a river). The CMA includes the foreshore, seabed, coastal water and air space above the water between these two boundaries.

Figure 2: Spatial relationship between the 'coastal environment' and the 'coastal marine area'

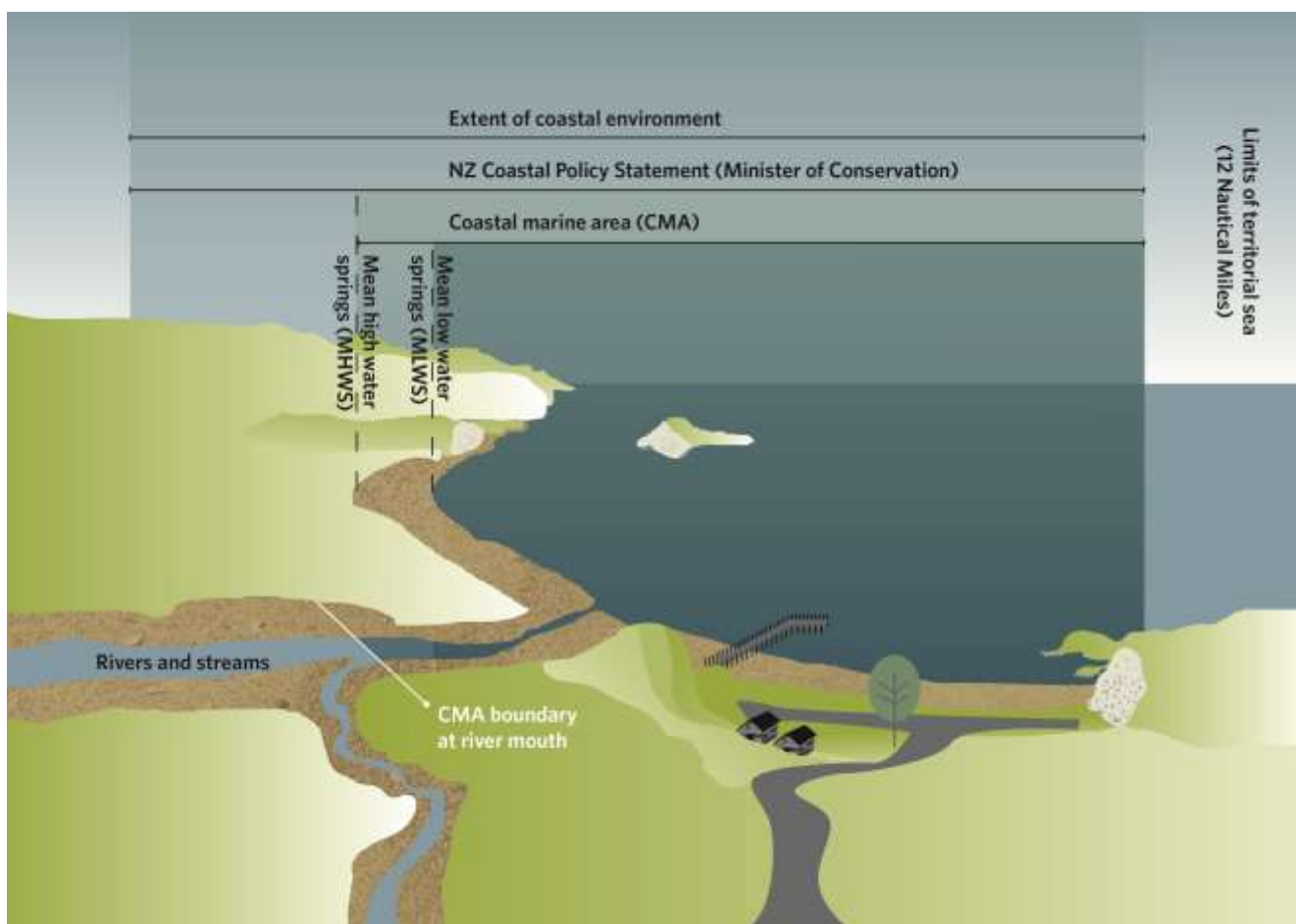


Image source: NZ Transport Agency



## 4. EFFECTS IN THE COASTAL ENVIRONMENT

The Transport Agency's assets, and the activities that these assets support, have the potential to have an effect on the coastal environment and to be affected by it also.

The nature and scale of these effects will often differ between locations because the characteristic of the 'coastal environment' also differs between locations. Examples of the typical environmental effects associated with the Transport Agency's assets in the coastal environment are summarised in table 1 and described in more detail in appendix A.

**Table 1: Examples of typical environmental effects in the coastal environment**

Effects on the Transport Agency's assets in coastal environment	Effects of the Transport Agency's assets on the coastal environment
Inundation by flow or tide reducing use availability (road/culverts/bridges) and asset degradation.	Wave deflection to neighbouring areas or changes in water flow causing erosion and inundation.
Saturation and erosion of abutment/footings soils leading to structural failure (including from wave action).	Increased deposition/erosion in channels around culverts and bridges reducing hydraulic capacity.
Chemical degradation of surfaces (paint/steel/wood) leading to more frequent maintenance or replacement.	Habitat (and biodiversity) modification as a result of deposition/erosion, changes in chemical characteristics and water movement.
Instability and loss of formed areas associated with asset (landscaping, walls, etc).	Environmental quality effects (eg water, beaches, mud flats, mangrove communities).
Structural stress/degradation of engineering assets.	



**SH1 near Wellington, 2013. (Source: NZ Transport Agency)**

## 5. STRUCTURE OF THIS GUIDELINE

The guideline is structured around four steps that are illustrated in figure 3.

Step 1 helps to determine if you need to use this guideline, steps 2–3 take the user through an information gathering and risk assessment process and step 4 provides a reporting format for information collected.

Figure 3: Structure of the coastal effects assessment guideline



## 6. USING THIS GUIDELINE

This guideline is intended to be used by those involved in asset design, planning, maintenance and renewal to inform risk management assessments and responsible investment decisions for resilient infrastructure in the coastal environment.

Guideline users are encouraged to work systematically through the guideline (steps 1–3) and record key information generated from investigations on the *Coastal effects screen* (step 4).

**Note:** the screen format should be considered flexible to allow for individual project’s needs, yet still gather key information.

The *Coastal effects screen* is designed as a summary document to highlight key coastal environmental issues that may influence the maintenance, renewal, new development or on-going management of the Transport Agency’s assets within the coastal environment. The *Screen* is a ‘repository’ for the key information generated during the step 2 assessment and step 3 risk analysis processes outlined in this guideline and can be used to demonstrate consideration of coastal effects in asset planning processes.

### Step 1: Are you working in the coastal environment?

#### CHECKLIST 1: Coastal environment

##### Objective

Determine whether asset(s) or activities may be in the ‘coastal environment’.

##### Checklist

Is the asset, group of assets or activity:

- Located in or near the coastal marine area (between mean high water spring and in the water – including foreshore, seabed, coastal water and air space above the water)?
- Located in an area that has coastal features, processes, character or values described in a regional or district plan?
- Located in or near a stream, river or estuary that may be influenced by coastal processes?
- Located in an area where it may cause an effect on the coastal environment (physical, process, value)?

##### Tools and references

Resources that can assist you in answering the above questions include:

- The Transport Agency’s spatial mapping tool and asset databases – identify assets and their physical location.
- Regional asset management plan and contract databases – identify any specific requirements for asset management.
- CSVue.
- Regional plan (coastal).
- District plan.

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## Outcome and actions

If you answered YES to any of the checklist questions, the asset(s) or activity(ies) are likely to be in the coastal environment.

- **ACTION 1** – Use this guideline to help you assess coastal effects.
- **ACTION 2** – Complete the *Coastal effects screen* as you undertake the assessment of coastal effects.
- **ACTION 3** – Attach a map and/or photos of the assets and location to the completed *Coastal effects screen*.

If you answered NO to all of the checklist questions, it is unlikely that the asset(s) are being affected by, or having an effect on, the coastal environment. You may wish to contact a Planning Advisor to confirm this position, prior to proceeding with works planning.

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Auckland, Feb 2014. (Source: Peter Mitchell, Auckland Motorway Alliance)

## Step 2: Understanding coastal influences

### CHECKLIST 2: Describing the asset(s)

#### Objective

Develop a broad understanding of the asset(s), associated structures/components and function.

#### Checklist

Use the prompts below to develop an understanding of the asset(s):

- Where is the asset(s) located?
- What are the main structural components (eg bridge, retaining wall, pavement, etc)?
- What materials and coatings are the asset(s) and its components made of?
- Are there any unusual characteristics (physical features, operations, maintenance issues)?
- How does the asset, and its components, interface with the coastal environment (eg is the asset: in/out water, near stream/river/estuary, impacting on natural water flow, exposed to waves, high or low energy aquatic environment, etc)?
- Are there any records of observed or known effects of the asset(s) on the coastal environment (eg shoreline erosion, bank slumping, sediment build up, vegetation establishment, etc)?
- What is the function and strategic value of the asset (ie what functions does the asset support – traffic movement, cyclists, overland flow, etc)?
- How important is the asset(s) in highway function, particularly with regards to route security?

#### Tools and references

Resources that can assist you in understanding the above asset information include:

- Asset databases (e.g. RAMM, contract database, bridge database).
- Maintenance records.
- CSVue.

#### Outcome and actions

Broad understanding of asset function and key features that may be influenced, or have an influence on, the coastal environment.

- **ACTION 1** – Ensure asset information is recorded in relevant databases.
- **ACTION 2** – Summarise key asset information on the *Coastal effects screen* (including a location map, photos, etc).

### CHECKLIST 3: Describing the environment

#### Objective

Develop a broad understanding of the characteristics of the environment (natural, social, cultural, economic) within which the asset(s) are located.

#### Checklist

Use the prompts below to develop an understanding of the surrounding environment:

- Visit the site to identify, validate and record key environmental features.
- Identify the key ecological features in the location (physical features, natural processes).
- Identify the key landscape, character and amenity features in the location.
- Identify any significant archaeological, heritage, Maori/Iwi or other cultural features in the location.
- Determine whether there are any known recreational (eg swimming) or economic (eg marine farming) interests near the location.
- Identify any known coastal hazards at or near the location.
- Determine how future climate (eg sea level rise, storminess, rainfall, temperature, etc) might influence the integrity, durability, function and maintenance of the asset(s).

#### Tools and references

Resources and organisations that can assist you in understanding the environmental context include:

- The Transport Agency spatial tools.
- Regional and district plan maps.
- Archaeological databases.
- The New Zealand Coastal Policy Statement.
- Department of Conservation.
- Heritage New Zealand.
- Iwi representatives.

#### Outcome and actions

Broad understanding of the characteristics of the environment (natural, social, cultural, economic) within which the asset(s) are located.

- **ACTION 1** – Ensure environmental information is recorded in relevant databases.
- **ACTION 2** – Summarise key environmental information on the *Coastal effects screen*.

**CHECKLIST 4: Describing the legal context****Objective**

Identify legislation, planning instruments and authorisations relevant to the location and function of the asset(s) and identified surrounding features.

**Checklist**

Use the prompts below to help identify whether proposed works will require approvals under the RMA or other legislation:

- Does the asset have existing resource consents?
- Will work associated with an asset with existing resource consent comply with the conditions of consent?
- Is the asset subject to a designation?
- Will the work be in accordance with the *purpose* of the designation?
- Is the work fully located within the designation footprint?
- Are there designation conditions to be complied with?
- What plans (regional coastal plan, other regional plans, district plan) apply?
- Are the works classified as a permitted activity under the relevant plan/s?
- Will the works comply with the permitted activity standards/rules/conditions?
- Are the works classified as controlled/restricted discretionary/discretionary/non-complying activities?
- Will the work require resource consent?
- Will the work affect, or be in proximity to, an identified archaeological site?
- Will the work require an authorisation under the Heritage New Zealand Pouhere Taonga Act 2014 to disturb or destroy an archaeological site?
- Are the works within an area subject to a protected customary right?

**Tools and references**

Resources that can assist you in identifying legal requirements include:

- Regional coastal plans – hazard maps, outstanding coastal landscape and character features.
- District plans – coastal hazard maps, designation schedules and designation notations on planning maps, archaeological site notations on planning maps.
- CSVue – for checking existing consents held by the Transport Agency.
- NZ Archaeological Association Archaeological Site Recording Scheme  
<http://nzaa.eaglegis.co.nz/NZAAPublic/>
- Ministry of Justice: <http://www.justice.govt.nz/treaty-settlements/office-of-treaty-settlements/marine-and-coastal-area-takutai-moana/about-the-legislation/frequently-asked-questions>
- Ministry for the Environment: <http://www.mfe.govt.nz/publications/rma/everyday/>

## CHECKLIST 4 (cont') : Describing the legal context

### Outcome and actions

Understanding of the legal framework and specific requirements of consents and other authorisations relevant to the location, surrounding features, the physical asset(s) and their function.

- **ACTION 1** – Ensure legal information is recorded in relevant databases.
- **ACTION 2** – Summarise key legal requirements on the *Coastal effects screen*.



SH16 Causeway Te Atatu to Pt Chevalier, Auckland, Jan 2011: (Source: Peter Mitchell, Auckland Motorway Alliance)

## CHECKLIST 5: Identifying effects of the coastal environment on the Transport Agency's assets

### Objective

Identify actual and potential effects that the coastal environment may have on the Transport Agency's asset(s) and their function over the assets lifetime (eg 50+ years).



## Checklist

Use the prompts below to determine if and how coastal environmental factors may have an effect on the physical integrity, durability, maintenance requirements and function of the asset(s) now and over the lifetime of the asset:

- Nature and scale of exposure to salt (underwater, sea spray, wind)?
- Nature and scale of exposure to wind or windborne debris (eg sand)?
- Nature and scale of exposure to waves, tidal movements, water currents or debris transported by water (eg asset collapse, scour, undermining structures, etc)?
- Temporary or permanent inundation/flooding resulting from heavy rainfall, storm surge, king tides?
- Nature and scale of exposure to coastal erosion including shoreline (and stream) movement, sand/substrate movement and deposition?
- Nature and scale of exposure to landslips or landslides?
- Presence of coastal vegetation (natural and planted)?
- How might climate change projections exacerbate or alleviate these coastal environmental effects (eg sea level rise, increasing storminess, changing intensity/frequency or rainfall, changing temperatures, number and duration of hot/cold days etc)?

You will need to draw on information about the asset and its surrounding environment to determine actual and potential effects over the long term.

## Tools and references

Resources that can assist you in identifying coastal effects on the Transport Agency assets include:

- Ministry for the Environment [Guides for local government – Preparing for climate change](#) (2008), [Preparing for coastal change](#) (2009).
- NIWA coastal hazard mapping materials and resources. [www.niwa.co.nz](http://www.niwa.co.nz)
- The Transport Agency's [State highway environmental and social responsibility environmental plan](#).
- The Transport Agency's [Environment and social responsibility \(ESR\) screen](#).
- The Transport Agency's [Z19 State highway environmental and social responsibility \(ESR\) standard](#).
- The Transport Agency's Highways Information Portal [assessment and design guidance](#).

## Outcome and actions

Identification of key coastal environmental factors and actual/potential effects these may have on the Transport Agency asset(s) and their function over the assets lifetime.

- **ACTION 1** – Ensure information on environmental effects is recorded in relevant databases.
- **ACTION 2** – Summarise key environmental effects on the *Coastal effects screen*.

## CHECKLIST 6: Identifying effects of the Transport Agency's assets on the coastal environment

### Objective

Identify actual and potential effects that the Transport Agency's asset(s), and the activities they support, may have on the coastal environment over the assets lifetime (eg 50+ years).

### Checklist

Use the prompts below to determine if and how the asset(s) physical structure, maintenance activities or its function may have an effect on the coastal environment over the lifetime of the asset(s):

- May result in changes to water flow (eg volume velocity, depth, direction)?
- May result in changes to coastal erosion processes including scour, beach erosion, deposition?
- May result in the discharge of contaminants to air, land or water (eg surface runoff, cleaning by-products, etc)?
- May result in the accumulation of contaminants in the coastal environment over time (eg marine sediments, water, shellfish, etc)?
- May result in the modification or destruction of habitat (above or below water) and/or disruptions to wildlife needs (eg food, access, migration)?
- May result in changes to ecological composition in terrestrial or marine systems?
- May create barriers to fish passage?
- May generate light pollution?
- May have an effect on natural landscape features, visual quality, amenity value and/or access?
- May have an effect on vegetation (aquatic/terrestrial, natural/planted)?
- Describe the nature and scale of potential effects on the environment that have been identified.

You will need to draw on information about the asset and its surrounding environment to determine actual and potential effects over the long term.

### Tools and references

Resources that can assist you in identifying coastal effects include:

- The Transport Agency's environmental guidelines.
- Regional coastal plan and district plan.

### Outcome and actions

Identification of actual and potential effects that the Transport Agency asset(s) and the activities they support may have on the coastal environment over the assets lifetime (e.g. 50+ years).

- **ACTION 1** – Ensure information on environmental effects is recorded in relevant databases.
- **ACTION 2** – Summarise key environmental effects on the *Coastal effects screen*.

## Step 3: Assessing the risk of coastal effects

### Step 3.1 Introduction

Understanding the level of risk associated with each identified coastal environmental effect is important for determining a response that will appropriately match effort and commitment to the scale of risk.

In simple terms, the level of risk can be determined by a simple equation:

$$\text{Risk level} = \text{likelihood} \times \text{consequence}$$

For both likelihood and consequence, a number of factors need to be taken into account. These assessments are combined to determine the overall level of risk of the effect.

### Step 3.2 Scope of this risk assessment process

This risk assessment process will assist users to qualitatively determine the level of risk associated with coastal effects identified as a result of using these guidelines. This process is relevant to both coastal effects on the Transport Agency assets and effects of the Transport Agency assets on the coastal environment.

The method outlined below is a simplified process aligned with the Transport Agency's *Minimum standard Z/44 - risk management*. Outputs of the process outlined below are intended to integrate smoothly with risk management approaches established as part of other activities undertaken by or on behalf of the Transport Agency.

### Step 3.3 Recording risk assessment outcomes

The *Coastal effects screen* (template in appendix B) provides a table for recording coastal effects and outputs of the risk assessment process.

### Step 3.4 Qualitative risk assessment methodology

Outlined below is a step-by-step process to guide you through a simple risk assessment for coastal effects that have been identified as a result of using this guideline. Key steps are:

- A. Describe specific coastal effects (including effects on the asset and effects of the asset).
- B. Determine the likelihood of each effect.
- C. Determine the consequence of each effect.
- D. Determine the risk level of each effect.

## A. Description of coastal effects

Coastal effects must be clearly described to ensure the statement can be effectively considered against the likelihood and consequence criteria.

- **ACTION 1** – Review and refine the description of coastal effects identified in steps 2.4 and 2.5 of this guideline and recorded on the *Coastal effects screen*.

**Example: Inserting description in the *Coastal effects screen***

Step	Category	Description of Coastal Effects	Risk Assessment (Guideline Step 3)		
			Likelihood <i>Unlikely, Likely, Very Likely</i>	Consequence <i>Low, Medium, High</i>	Risk Level <i>Low, Moderate, High</i>
2.4	COASTAL ENVIRONMENTAL EFFECTS ON INFRASTRUCTURE	Retaining wall adjacent to coastal highway periodically subject to storm surge events			
	<i>What coastal environmental effects may have an impact on Transport Agency asset(s) over the asset lifetime (incl. sudden events and long term impacts)?</i>				
	<i>How will these effects impact on the physical integrity, durability, maintenance requirements and function of the asset(s) over the asset lifetime</i>				



**SH1 Esmonde Road to Northcote, Auckland. Jan 2011. (Source: Peter Mitchell, Auckland Motorway Alliance)**

**B. Likelihood effects will occur**

Likelihood, also referred to as probability, is assigned a category based on a number of factors including asset type, asset location, environmental sensitivity and timeframe under consideration.

- **ACTION 2** – For each of the coastal environmental effects that have been identified and recorded on the *Coastal effects screen*, assign a likelihood rating using table 2.

**Table 2: Likelihood criteria**

Likelihood		
<i>For an identified coastal environmental effect, what is the likelihood the effect will occur?</i>		
Unlikely	Likely	Very Likely
Coastal effect could occur in next 70–100 years; or may only occur in exceptional circumstances.	Coastal effect should occur at some time in the next 30–70 years.	Coastal effect expected to happen in the next 0–30 years; or will probably occur in most circumstances.

- **ACTION 3** – Enter the likelihood ratings on the *Coastal effects screen*.

**Example: Inserting likelihood rating in the *Coastal effects screen***

Step	Category	Description of Coastal Effects	Risk Assessment (Guideline Step 3)		
			Likelihood <i>Unlikely, Likely, Very Likely</i>	Consequence <i>Low, Medium, High</i>	Risk Level <i>Low, Moderate, High</i>
2.4	COASTAL ENVIRONMENTAL EFFECTS ON INFRASTRUCTURE	Retaining wall adjacent to coastal highway periodically subject to storm surge events	Likely		
	<i>What coastal environmental effects may have an impact on Transport Agency asset(s) over the asset lifetime (incl. sudden events and long term impacts)?</i>				
	<i>How will these effects impact on the physical integrity, durability, maintenance requirements and function of the asset(s) over the asset lifetime</i>				

## C. Consequence of effects

Consequence, or the impacts of an effect, is assigned a category based on evaluation across a number of key factors.

- **ACTION 4** – For each of the identified coastal environmental effects that have been identified and recorded on the *Coastal effects screen*, assign a consequence rating using the table 3.

**Table 3: Consequence criteria**

	Consequence		
	<i>For an identified coastal environmental effect, what is the consequence that may result from the effect?</i>		
	Low	Medium	High
Legal compliance	Compliant or potential compliance breach managed at the local level.	Potential compliance breach with legal rebuke/abatement notices/restrictions.	Potential for prosecution.
Stakeholders and relationships	Potential for disruption to stakeholder relationship slowing site specific activity.	Potential for disruption to stakeholder relationship slowing regional activity.	Potential for disruption to stakeholder relationship slowing nationally strategic activity.
Reputation of the Transport Agency	Potential for negative regional media coverage and/or negative feedback from Minister.	Potential for negative national media coverage or Ministerial/Parliamentary questions or 3 <sup>rd</sup> party investigation.	Potential for negative international and national media coverage or intervention by the Minister required.
Environment	Potential effects to environment take 0–6 months to restore.	Potential effects to environment take 6–12 months to restore.	Potential effects to environment take more than one year to restore.
Health and safety	Potential for recoverable injuries manageable with in-situ care.	Potential for recoverable injuries requiring professional medical treatment or temporary impacts on public health.	Potential for fatalities or multiple injuries leading to permanent disability or recoverable injuries requiring hospitalisation or long term impacts on public health.
Route security	Potential loss of route availability for a regional distributor or connector highway.	Potential loss of route availability for a regional strategic highway.	Potential loss of route availability for a national strategic highway.
Asset damage	Can be fixed within 2 days.	Can be fixed within 5 days.	Repair takes longer than 5 days.
Project or programme delivery	Potential for programme failure resulting in a minor delay to delivery.	Potential for programme failure resulting in a moderate delay to delivery.	Potential for programme failure resulting in significant delay to delivery.

- **ACTION 5** – Enter the consequence ratings on the *Coastal effects screen*.

**Example: Inserting consequence rating in the *Coastal effects screen***

Step	Category	Description of Coastal Effects	Risk Assessment (Guideline Step 3)		
			Likelihood <i>Unlikely, Likely, Very Likely</i>	Consequence <i>Low, Medium, High</i>	Risk Level <i>Low, Moderate, High</i>
2.4	COASTAL ENVIRONMENTAL EFFECTS ON INFRASTRUCTURE	Retaining wall adjacent to coastal highway periodically subject to storm surge events	Likely	Medium	
	<i>What coastal environmental effects may have an impact on Transport Agency asset(s) over the asset lifetime (incl. sudden events and long term impacts)?</i>				
	<i>How will these effects impact on the physical integrity, durability, maintenance requirements and function of the asset(s) over the asset lifetime</i>				

**C. Risk level of effects**

The risk level for an identified coastal environmental effect is determined by combining the likelihood and consequence ratings using a pre-developed matrix.

- **ACTION 6** – For each of the identified coastal environmental effects that have been identified and recorded on the *Coastal effects screen*, determine the risk level using the table 4.

**Table 4: Risk level matrix**

		CONSEQUENCE		
		Low	Medium	High
LIKELIHOOD	Unlikely	Low	Moderate	High
	Likely	Low	Moderate	High
	Very likely	Moderate	High	High

- **ACTION 7** – Enter the risk level on the *Coastal effects screen*.

### Example: Entering risk level in the coastal effects screen

Step	Category	Description of Coastal Effects	Risk Assessment (Guideline Step 3)		
			Likelihood <i>Unlikely, Likely, Very Likely</i>	Consequence <i>Low, Medium, High</i>	Risk Level <i>Low, Moderate, High</i>
2.4	COASTAL ENVIRONMENTAL EFFECTS ON INFRASTRUCTURE	Retaining wall adjacent to coastal highway periodically subject to storm surge events	Likely	Medium	Moderate
	<i>What coastal environmental effects may have an impact on Transport Agency asset(s) over the asset lifetime (incl. sudden events and long term impacts)?</i>				
	<i>How will these effects impact on the physical integrity, durability, maintenance requirements and function of the asset(s) over the asset lifetime</i>				

## Step 4: Coastal effects screen

The *Coastal effects screen* is designed as a summary document to highlight key coastal environmental issues that may influence the maintenance, renewal, new development or on-going management of the Transport Agency's assets within the coastal environment.

The *Coastal effects screen* is a repository for the key information generated during the step 2 assessment and step 3 risk analysis processes outlined in this guideline and can be used to demonstrate consideration of coastal effects in asset planning processes.

The *Coastal effects screen* forms part of the asset planning processes and attached to asset management plans. The Screen is intended to support applications for proposed works to demonstrate consideration of coastal effects and integration of mitigation measures in proposed works plans.

A template for the *Coastal effects screen* is provided in appendix B of this guideline.



## 7. CASE STUDIES

To assist users to understand how this guideline can be used to add value to asset planning processes, a case study of the Petone to Ngauranga Cycle Way project has been included in appendix C.

This example intends to give an insight into the nature and scale of information that can be identified and recorded as part of an effective assessment of coastal effects for highways infrastructure.








SH6, Nelson, 2015. (Source: NZ Transport Agency)



## 8. REFERENCES




- Auckland Council (2013) *The proposed Auckland unitary plan, notified 30 September 2013*.
- Department of Conservation (2010) *New Zealand Coastal Policy Statement*.
- Ministry of Transport (2003) *Land Transport Management Act*.
- NZ Transport Agency (2013) *Minimum standard Z/44 – risk management, version 3*.
- NZ Transport Agency (2014) *Statement of intent 2014-2018*.
- New Zealand Legislation (1991) *Resource Management Act*.
- NZ Transport Agency (2008) *Environmental plan, version 2*.




# APPENDIX A: EXAMPLES OF POTENTIAL COASTAL EFFECTS

	Location or circumstance likely	Effect of CMA or coastal environment on asset or activity	Effect of asset or activity on CMA or coastal environment
<p>Bridge</p> 	<p>Crossing streams or estuaries near river mouths that are located in the CMA or coastal environment (eg Orewa, Waiwera)</p> <p>Crossing harbours in the CMA (eg Tauranga, Auckland Harbour Bridge)</p>	<p>Salt water corrosion</p> <p>Structural damage from wave/wind energy</p> <p>Bridge scour due to coastal processes such as waves, tides and storm surges</p>	<p>Heavy metal and oil pollution from surface run-off and windborne dust</p> <p>Damage to marine habitat</p> <p>Adverse effects on coastal ecology</p> <p>Modification of natural water flow pattern</p>
<p>On / Off ramps</p> 	<p>Crossing CMA (eg Waterview) or coastal environment (eg Wellington)</p>	<p>Inundation from storm surges and sea water level rise</p> <p>Damage by shoreline erosion</p>	<p>Heavy metal and oil pollution from surface run-off and windborne dust</p> <p>Adverse effects on coastal ecology</p>
<p>Causeways (definition: linear reclamation with holes for water to flow)</p> 	<p>Crossing the CMA (harbours or estuaries)</p>	<p>Inundation from storm surges and sea water level rise</p> <p>Structural damage from wave energy</p>	<p>Heavy metal and oil pollution from surface run-off and windborne dust</p> <p>Adverse effects on coastal ecology</p> <p>Modification of natural water flow pattern (eg change in flow velocity and depth)</p>




	Location or circumstance likely	Effect of CMA or coastal environment on asset or activity	Effect of asset or activity on CMA or coastal environment
<p>Retaining walls</p> 	<p>Protect the road from landslides, rockfalls, etc (structure to retain soil between different elevations)</p>	<p>Structural damage from wave energy</p> <p>Salt water corrosion</p>	<p>Impede fish movement</p> <p>Loss of natural landscape</p> <p>Adverse effects on visual quality and amenity value</p>
<p>Sea walls</p> 	<p>Protect the road from falling into the sea or sea eroding the road</p>	<p>Structural damage from wave energy</p> <p>Salt water corrosion</p>	<p>Damage/loss of marine habitat</p> <p>Adverse effects on coastal ecology</p> <p>Inhabit the interaction between coastal marine and terrestrial systems</p> <p>Impede the exchange of sediment between land and sea</p> <p>Loss of natural landscape</p>
<p>Gabions, rip-rap, groynes</p>	<p>Groynes – located in water to dissipate energy</p> <p>Rip-rap – assemblage of rocks to</p>	<p>Structural damage from wave energy</p>	<p>Inhabit the interaction between coastal marine and terrestrial systems</p>




	Location or circumstance likely	Effect of CMA or coastal environment on asset or activity	Effect of asset or activity on CMA or coastal environment
	<p>absorb/deflect energy and slow water flow to reduce potential for erosion around structures                      Gabions – cage/box filled with rocks/sand/soil to protect against erosion</p>	<p>Salt water corrosion</p>	<p>Damage/loss of marine habitat                       Adverse effects on coastal ecology</p>
<p>Noise walls</p> 	<p>Wall to protect sensitive activities (human, environment)</p>	<p>Salt water corrosion                       Structural damage from wave/wind energy</p>	<p>Loss of natural landscape                       Adverse effects on visual quality and amenity value</p>
<p>Fences</p>	<p>Keep people off the highway                      To provide a screen (eg amenity)                      Safety</p>	<p>Salt water corrosion                       Damage by shoreline erosion</p>	<p>Loss of natural landscape                       Adverse effects on visual quality and amenity value</p>


	Location or circumstance likely	Effect of CMA or coastal environment on asset or activity	Effect of asset or activity on CMA or coastal environment
<p>Barriers</p> 	In the CMA or coastal environment to protect road users	Damage by shoreline erosion	<p>Loss of natural landscape</p> <p>Adverse effects on visual quality and amenity value</p>
<p>Pavements and surfacing</p> 	In the CMA and coastal environment	<p>Salt water corrosion</p> <p>Damage by shoreline erosion</p> <p>Inundation from storm surges and sea water level rise</p> <p>Seaspray</p>	<p>Heavy metal and oil pollution from surface run-off and windborne dust</p> <p>Adverse effects on coastal ecology and habitat</p>
<p>Tunnels</p> 	In the coastal environment (eg cut into rock, eg Kaikoura)	Inundation from storm surges and sea water level rise	<p>Heavy metal and oil pollution from surface run-off and windborne dust</p> <p>Damage/loss of coastal flora and fauna</p>

	Location or circumstance likely	Effect of CMA or coastal environment on asset or activity	Effect of asset or activity on CMA or coastal environment
<p>Signage</p> 	In the CMA and the coastal environment (eg bridge signs)	<p>Salt water corrosion</p> <p>Structure damage from wave/wind energy</p> <p>Damage by shoreline erosion</p>	<p>Loss of natural landscape</p> <p>Adverse effects on visual quality and amenity value</p>
<p>Lighting</p> 	In the CMA and the coastal environment (eg bridge)	<p>Salt water corrosion</p> <p>Structure damage from wave/wind energy</p> <p>Damage by shoreline erosion</p>	Light pollution – some marine life are vulnerable to light (eg turtles)
<p>Pavement markings</p> 		Salt water corrosion	Adverse effects on coastal ecology due to contaminant discharges (eg dye chemicals)



Location or circumstance likely	Effect of CMA or coastal environment on asset or activity	Effect of asset or activity on CMA or coastal environment
<p>Vegetation</p> 	<p>Unable to adapt to harsh coastal environment</p>	<p>Impact on native habitat when Introduced species outcompete native plants</p>
<p>Traffic signals (on/off ramps, traffic lights)</p> 	<p>Salt water corrosion</p> <p>Structure damage from wave/wind energy</p>	<p>Loss of natural landscape</p> <p>Adverse effects on visual quality and amenity value</p>
<p>Intelligent transportation system assets (cameras, phones, variable message signs)</p> 	<p>In the CMA and the coastal environment (eg. causeways gantry signs)</p> <p>Salt water corrosion</p> <p>Structure damage from wave/wind energy</p>	<p>Loss of natural landscape</p> <p>Adverse effects on visual quality and amenity value</p>

Location or circumstance likely	Effect of CMA or coastal environment on asset or activity	Effect of asset or activity on CMA or coastal environment
<p>Building and associated facilities</p> 	<p>Salt water corrosion</p> <p>Structure damage from wave/wind energy</p>	<p>Loss of natural landscape</p> <p>Adverse effects on visual quality and amenity value</p>
<p>Stormwater collection, conveyance and disposal devices</p> 	<p>Loss of effectiveness in managing flooding due to oceanic back flooding (caused by sea level rise and storm surge)</p> <p>Salt water corrosion</p> <p>Structure damage from wave/wind energy</p>	<p>Heavy metal and oil pollution from surface run-off and windborne dust</p> <p>Local scour in the vicinity of the outfall device</p> <p>May enhance beach erosion</p>
<p>Stormwater management (treatment) devices</p> 	<p>Structure damage from wave/wind energy</p> <p>Loss of effectiveness due to oceanic back flooding (caused by sea level rise and storm surge)</p>	

Location or circumstance likely	Effect of CMA or coastal environment on asset or activity	Effect of asset or activity on CMA or coastal environment
<p>Culverts</p> 	<p>Salt water corrosion</p> <p>Structure damage from wave/wind energy</p> <p>Flooding caused by sea level rise and storm surge</p>	<p>Modification of natural water flow pattern (eg change in flow velocity and depth)</p> <p>Local scour and erosion</p> <p>Restrict fish passage eg due to high water velocity</p>

# **APPENDIX B: COASTAL EFFECTS SCREEN TEMPLATE**

## COASTAL EFFECTS SCREEN,

**Screen purpose:** Summarise coastal environmental effects that may influence the maintenance, renewal, new development or on-going management of the Transport Agency's assets within the coastal environment.

Detail outcomes of a simple qualitative risk assessment of key coastal effects and resulting asset management responses to inform asset planning decisions.

**Screen use:** To be completed as part of asset planning processes and attached to asset management plans (demonstrate consideration of coastal effects and integration of mitigation measures in proposed works).

Step	Category	Questions/prompts	Information relevant for decision making
2.1	ASSET(S)	<p>What asset(s) are being considered?</p> <p>Where is asset(s) located in relation to the coastal environment (eg in water, 50m above MHWS)? Attach map and/or photos.</p> <p>Note any unusual characteristics or known issues about the asset(s) design, operation or location.</p> <p>Note asset(s) role in providing route security.</p> <p>Attach maps and images to illustrate asset and location.</p>	
2.2	ENVIRONMENT	<p>What are the key natural, social, cultural and economic features in the surrounding environment?</p> <p>Are there any coastal hazards in/around the locality?</p> <p>Are any climate change factors likely to modify the environment over time? If so, what and how?</p>	
2.3	LEGAL CONTEXT	<p>Does the asset(s) have resource consent? If so, detail key requirements for coastal effects.</p> <p>Is the asset(s) subject to a designation? If so, detail key requirements for coastal effects.</p> <p>Will the works require resource consent?</p> <p>Will the works be in proximity of an archaeological site or other protected site or location?</p>	

## COASTAL EFFECTS SCREEN, cont'

Step	Category	Description of coastal effects	Risk assessment (guideline step 3)			Risk mitigation /comments
			Likelihood <i>Unlikely, likely, very likely</i>	Consequence <i>Low, medium, high</i>	Risk level <i>Low, moderate, high</i>	
2.4	COASTAL ENVIRONMENTAL EFFECTS ON INFRASTRUCTURE					Are there any design or operation modifications that can be applied to adequately manage medium and high risks?
		What coastal environmental effects may have an impact on the Transport Agency's asset(s) over the asset lifetime (incl. sudden events and long term impacts)?				
		How will these effects impact on the physical integrity, durability, maintenance requirements and function of the asset(s) over the asset's lifetime?				
2.5	EFFECTS OF INFRASTRUCTURE ON COASTAL ENVIRONMENT					
		What are the key environmental effects that the Transport Agency's asset(s) may have on the coastal environment (incl. immediate and long term impacts)?				

\*\* Insert additional rows for steps 2.4 and 2.5 as required.

## **APPENDIX C: CASE STUDY**

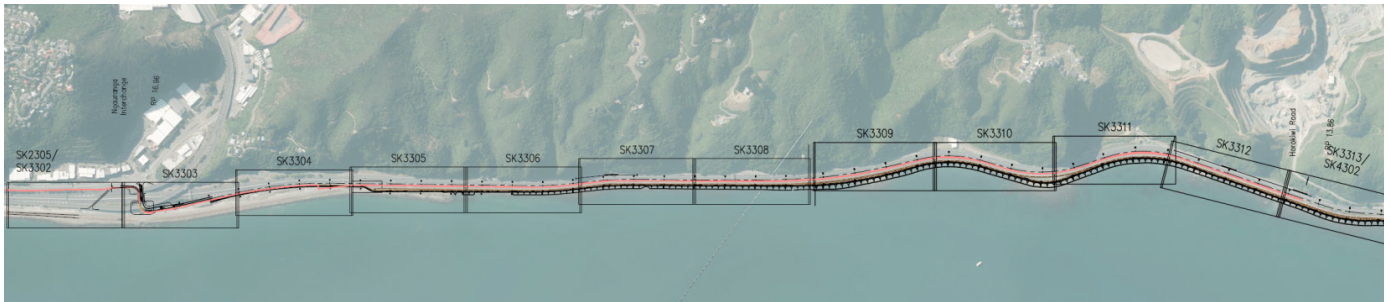




# Ngauranga to Petone shared path case study

COASTAL EFFECTS ASSESSMENT GUIDE

September 2016



The Petone to Ngauranga project will provide 4.2km of safe walking and cycling infrastructure along the coastal section of the Wellington Harbour, linking Wellington and the Hutt Valley. The project will act as a catalyst to increase walking and cycling facilities along a total length of 10.5km. The project will also improve transport resilience along this critical transport corridor.

The project is located along a busy section of State Highway 2 (SH2) linking Wellington City with the Hutt Valley. The transport corridor includes two north bound lanes and two south bound lanes on SH2. Adjacent to the state highway on the seaside are two railway tracks from the Hutt Valley line. The corridor runs along coast line and is partially located on reclaimed land.

An existing cycleway is running partially on the shoulder of the southbound lane of SH2 and along a separated path between the railway line and SH2. Over the recent years there has been increasing public pressure to improve the track, which can only be used by southbound cyclist and is deemed to be unsafe by many cyclists.

Currently at the detailed business case stage (July 2015), the project is evaluating two alternative design options for a pathway allowing both walking and cycling.

- The preferred option is to construct a 3m shared pathway on the seaside of the railway line adjacent to SH2 between Ngauranga and Petone. This will require the reclamation of a 5m platform along the coastline.
- The alternative option is to construct a pedestrian pathway between the existing rail and road corridors. This will include enhancing the existing pathway and constructing a new section to separate the pathway from the highway along the whole corridor. This option does not involve any new reclamation, but requires some improvements of the existing sea wall.



The existing cycle lane and walkway

## Coastal effects assessment

The case study examines the application of a guide to assess the coastal effects on the preferred option as outlined above.

The guide puts in place several considerations needed to understand the resilience of the preferred option. The guide allows decision making to be recorded and provide evidence that predicted effects associated with the proposed option meet the engineering needs and statutory approval requirements.

## Resilience

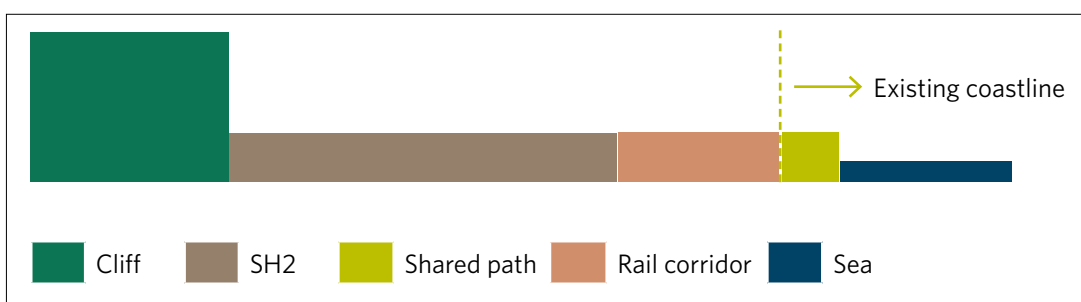
Resilience is considered the ultimate objective in the context of hazard mitigation.

Treasury defines resilience as: The concept of resilience is wider than natural disasters and covers the capacity of public, private and civic sectors to withstand disruption, absorb disturbance, act effectively in a crisis, adapt to changing conditions, including climate change, and grow over time.

Wellington is known for its wild weather and has its fair share of natural hazards, including recent storm and rain events and earthquakes. In a number of these events the Wellington to Petone transport corridor has been impacted leading to closure of rail and vehicle transport.

Widening the transport corridor by creating a platform through reclamations has the potential to improve the resilience of the corridor to withstand environmental hazards such as storm surges and sea level rises, and to improve access to the railway line for maintenance and repair.

### Cross-section of the transport corridor indicating the 5m platform



5m reclamation (harbourside) with a new 3m wide shared path provided on the eastern side of the railway, existing shared path used as service lane.

## Main environmental effects

The coastal effects assessment has been applied in a workshop involving the Transport Agency project manager and Environment and Urban Design team, as well as a resilience expert from AECOM and an ecologist from Boffa Miskell. The environmental impacts were assessed following the coastal assessment guide assigning specific risk categories to the individual impacts areas.

Both AECOM and Boffa Miskell had also prepared preliminary assessment reports on resilience and ecological impacts along the coastal section of the project guiding the coastal effects assessment.

The environmental impacts of the reclamation and sea wall construction identified as having a high risk are:

- effects on bird life occupation and behaviour during construction work
- ecological changes in intertidal and sub-tidal environments, including loss of habitat
- moderate degradation of water quality (turbidity) through sediment discharge (earthworks) and sea floor disturbance.

The following specific environmental effects on the reclamation and sea wall have been identified as the proposed platform:

- Predicted increase in sea levels, storm surges and tidal effects).
- Wind effects, especially in combination of marine conditions (storm surge and tidal effects).
- Earthquakes and landslips/washouts that could dislocate the transport corridor.

Overall, impacts from natural environment on the Transport Agency asset have higher risk levels associated with them than impacts from Transport Agency structure on the natural environment.

From the assessment the coastal effects that ranked high have now been considered in terms of mitigation processes that can be applied. This strengthens arguments for construction processes and mitigation options needed in design and consent processes.

## Main projects objectives and risks

The main objectives for this project are:

- to provide safe walking and cycling infrastructure linking Wellington and Hutt Valley
- to improve transport resilience through providing a walking and cycling facility and enhance maintenance and repair access on the railway line.

The main project risks are:

- Impact from storm surges and climate change on the reclamation (new and existing), the sea wall and ultimately the transport corridor.
- Consenting delays and extra costs for a construction of a wider platform from the proposed reclamation.
- Project engineering costs.

CATEGORY	DESCRIPTION OF COASTAL EFFECTS	RISK ASSESSMENT			RISK MITIGATION/ COMMENT
		LIKELIHOOD	CONSEQUENCE	RISK LEVEL	
NEGATIVE ENVIRONMENTAL IMPACTS ON TRANSPORT AGENCY ASSET	Marine conditions (cumulative assessment of wave run-up/ set-up, sea level rise, storm surge, tidal effects, datum adjustment and wind effects from storms)	Likely	High	High	Mitigate by designing platform at RL 4.3, 0.5m above current RL of 4.4. This RL 4.9 is for a 1:100 return period. The current 4.4 already had some protection built into it.
	Inland flooding	Likely	Medium	Moderate	Risk may be increased if occurring in combination with adverse marine conditions (assessment is not based on proper modelling of inland flooding).
	Salt water erosion	Likely	Low	Low	
	Wind effects (including climate change impacts)	Very likely	Medium	High	Design mitigation through innovation, eg where we place structures and embed them into ground, lighting poles that fail safe etc
	Earthquake	Very likely	High	High	Design up to the appropriate design code. Widening the corridor will also increase response time to impacts on rail corridor improving resilience of the transport corridor and ability to respond quickly.
	Landslip	Likely	High	High	Widening the corridor will reduce the consequences and impacts from landslip/coastal erosion on the rail corridor.

CATEGORY	DESCRIPTION OF COASTAL EFFECTS	RISK ASSESSMENT			RISK MITIGATION/ COMMENT
		LIKELIHOOD	CONSEQUENCE	RISK LEVEL	
NEGATIVE IMPACTS OF TRANSPORT AGENCY ASSET ON COASTAL AND MARINE ENVIRONMENT	Ecological impacts on birdlife	Likely	High	High	Mitigate impacts by avoiding construction work during breeding season and through provision of replacing habitats.
	Ecological impacts on terrestrial vegetation	Very likely	Low	Low	There is potential to replace and enhance terrestrial vegetation as result of this project. Noting aesthetic value of terrestrial vegetation.
	Ecological impacts on inter-tidal and sub-tidal environment (consider loss of seabed)	Likely	High	High	Mitigate by offsetting permanent loss of habitat elsewhere in the Wellington harbour and planting coastal fringe vegetation.
	Replacement of water volume (through reclamation)	Likely	Low	Low	Potentially mitigate by removing unneeded reclamation elsewhere in the Wellington harbour.
	Modification of natural water flows	Unlikely	Low	Low	
	Exacerbate coastal erosion in adjoining areas	Unlikely	Low	Low	Mitigate by integrating design into existing coast.
	Physical disturbance of seabed and water quality during construction	Very likely	Low	Moderate	Temporary disturbance so low risk.
	Light pollution	Unlikely	Low	Low	Mitigate by designing lighting in a way that reduces light spill (dark sky approved lighting). Low ecological risk.
	Impact on wave run-up and set-up	Very likely	Low	Low	
POSITIVE IMPACTS OF TRANSPORT AGENCY ASSET ON COASTAL AND MARINE ENVIRONMENT	Improvement to ecological environment (flora)	Very likely	High (positive)	High (positive)	Opportunities to enhance coastal (terrestrial) flora. Marine environment may be improved through treatment of run-off.
	Positive effects on visual amenity (*social effects)	Very likely	High (positive)	High (positive)	
	Minimising coastal erosion on reclaimed coast	Unlikely	Low	Low	No significant coastal erosion at the moment (reclamation unlikely to negatively impact on erosion). Sea wall will be designed to improve withstanding
	Remediating potential existing hazardous substances from coastal and marine environment? (tbc)	Unlikely	Low	Low	Potential hazardous material may be locked in through reclamation and sea wall.

CATEGORY	DESCRIPTION OF COASTAL EFFECTS	RISK ASSESSMENT			RISK MITIGATION/ COMMENT
		LIKELIHOOD	CONSEQUENCE	RISK LEVEL	
CONSENTING IMPACTS	Reclamation platform	Very likely	High	High	
	Discharge of sediment during construction	Very likely	High	High	Hydro dynamic modelling mitigation
	Noise during construction	Very likely	Low	Low	Temporary disturbance.
	More varied coastline	Very likely	High	High	Opportunities to vary coastline if costs allow.

### Lessons learnt

- Impacts from climate change are potentially significant (including cumulative) and need consideration in the project design.
- A larger platform will provide more protection and higher levels of resilience.
- No changes to the current transport corridor and seawall will leave the transport corridor under significant risk of future disruption, limiting resilience.
- The project team identified that the proposal can have a significant positive impacts on the ecological environment (flora), visual amenity, and social aspects of enhanced access.



#### CONTACT DETAILS

For further information on the Transport Agency's resource efficiency objectives or if you have a great example to share please visit the resource efficiency space on HIP or contact [environment@nzta.govt.nz](mailto:environment@nzta.govt.nz)