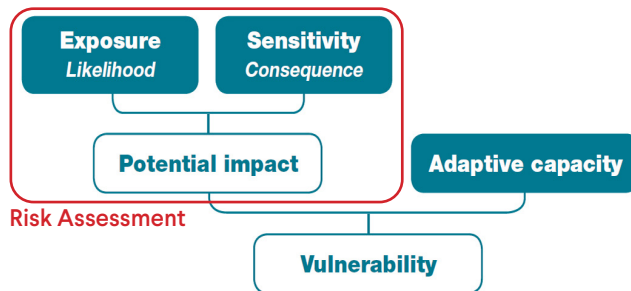


Risk Assessment

Completion of a risk assessment is the first step required to complete a vulnerability analysis.

A risk assessment requires review of the Exposure (Likelihood) and Sensitivity (Consequence) of assets to impacts from Coastal Hazards. The combination of Exposure (Likelihood) and Sensitivity (Consequence) is then used to determine the Potential Impact, or overall Risk to the asset.



(Adapted from Allen Consulting Group 2005)

The Risk Assessment should be completed using the relevant Enterprise Risk Framework for the responsible Authority. This ensures that the outcomes of the assessment are relative to the capacity of that Authority, and that the assessed level of Coastal Hazard Risk is able to be compared to other risks (i.e. risks not associated with coastal hazard impacts) across the organisation. Risk assessments should be completed for both Coastal Erosion and Coastal Inundation Hazards and should consider all relevant planning horizons.

Assessment of Exposure / Likelihood

The assessment of Exposure, or Likelihood as it is more commonly termed, is the assessment of how likely it is that a coastal hazard will impact an asset over a given planning horizon. The assessment of Likelihood is based on the outcomes of the Coastal Hazard Assessment, noting that the level of exposure will change over time.

Following the assessment, each asset will be assigned a Likelihood rating for each planning horizon. The Likelihood rating will typically range between rare and almost certain.

	Rare	Unlikely	Possible	Likely	Almost Certain
Probability	<5%	5% - 10%	10% - 50%	50% - 80%	80% - 100%

Assessment of Sensitivity / Consequence

The assessment of Sensitivity, or Consequence, should be based on a review of the potential impacts of the Coastal Hazard on the asset. The assessment of Consequence should be based on the Consequence scale outlined within the relevant Authority's Risk Enterprise Framework, which will likely include a number of different categories, such as Social, Environmental, Heritage, Economic, etc. The Consequence rating given to each asset should be the most critical (i.e. highest) rating received across each of the different categories.

Similar to the Likelihood assessment, the consequence of Coastal Hazards can change over time.



Assessment of Potential Impact / Risk

The Potential Impact, or level of Risk, is quantified based on the outcomes of the Likelihood and Consequence assessments. A Risk rating matrix is used to determine this overall level or Risk.

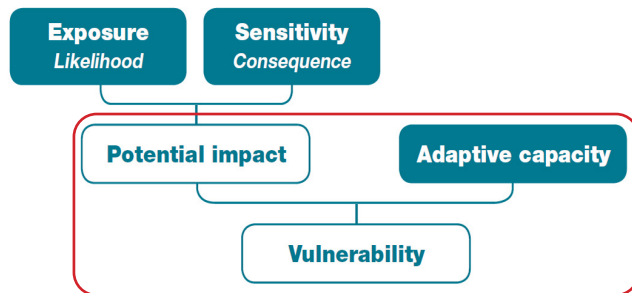
		Consequence				
		Insignificant	Minor	Medium	Major	Catastrophic
Likelihood	Almost Certain	Moderate	Moderate	High	Extreme	Extreme
	Likely	Moderate	Moderate	High	High	Extreme
	Possible	Low	Moderate	Moderate	High	Extreme
	Unlikely	Low	Low	Moderate	Moderate	High
	Rare	Low	Low	Low	Low	Moderate

A Risk Tolerance Scale (from the Authority's Enterprise Risk Framework) can then be used to determine whether the assessed level of Risk for each asset is acceptable, tolerable, or intolerable.

Vulnerability Assessment

A Vulnerability Assessment expands upon the work completed in a Risk Assessment to consider an asset's susceptibility to impacts caused by Coastal Hazards.

The susceptibility of an asset to Coastal Hazards depends upon the Adaptive Capacity of that asset. An asset with high degree of Adaptive Capacity will have a lower overall vulnerability compared to an asset with limited Adaptive Capacity.



(Adapted from Allen Consulting Group 2005)

Vulnerability Assessment

What is Adaptive Capacity?

Adaptive capacity refers to the ability for an asset to adjust, or be modified, to accommodate impacts from Coastal Hazards. Adaptive Capacity can be through either a natural adaptation or can be through restorative management actions.

The assessment of Adaptive Capacity first requires consideration of a relevant rating scale. The rating scale will generally range from Low Adaptive Capacity for those assets that have little to no ability to absorb

Coastal Hazard impacts (eg. typical buildings), to those that have Very High Adaptive Capacity or where Coastal Hazards will have an Insignificant Impact, such as some beaches and dune systems.

Rating	Description / Frequency
Insignificant Impact; N/A	The impact of the coastal hazard on the asset would have an insignificant impact. This includes where the control or asset would be re-established naturally before further damage would likely occur.
Very High	Very high ability to absorb coastal hazard impacts or where capacity can be restored at relatively low cost. Capacity would be restored naturally over time.
High	Reasonable ability to absorb coastal hazard impacts, with functionality able to be restored. Natural restoration of capacity may occur slowly over time.
Moderate	Small amount of ability to absorb coastal hazard impacts. Restoration of functionality would be difficult, though possible.
Low	Little to no ability to absorb coastal hazard impacts. Functionality would be unable to be restored.

The Adaptive Capacity of an asset can change over time. For example, drainage infrastructure may be able to accommodate impacts from Coastal Inundation up to a point, beyond which the system can no longer function and breaks down.

Vulnerability Analysis

The assessment of asset Vulnerability considers the Adaptive Capacity in conjunction with the assessed level of Risk. A Vulnerability rating matrix is used to determine the overall Vulnerability rating for that asset, similar to the process used for the Risk Assessment.

		Adaptive Capacity				
		Insignificant / N/A	Very High	High	Moderate	Low
Risk Level	Extreme	Low	Moderate	High	Extreme	Extreme
	High	Low	Low	Moderate	High	High
	Moderate	Low	Low	Low	Moderate	Moderate
	Low	Low	Low	Low	Low	Low

Importantly, assets with high Adaptive Capacities will have lower Vulnerability ratings for a given level or Risk.

The final Vulnerability rating for each asset, across each planning horizon, should be assessed against a Vulnerability tolerance scale to determine whether management actions are required.

Vulnerability Level	Action Required	Tolerance
Extreme	Immediate action required to eliminate or reduce the risk to acceptable levels	Intolerable
High	Immediate to short term action required to eliminate or reduce the risk to acceptable levels	Intolerable
Moderate	Reduce the risk or accept the risk provided residual risk level is understood	Tolerable
Low	Accept the risk	Acceptable

Risk Evaluation

Following completion of the Risk and Vulnerability Assessments a review needs to be completed to determine if there are any other factors, or controls, that are already in place to mitigate or manage the risk. This requires consideration of Existing Controls prior to a re-evaluation of the Risks and Vulnerability. The result of this process is an updated assessment that can be used to set priorities for Risk Treatment.



Existing Controls

Existing Controls could include physical controls or planning / management controls.

Some examples of physical controls could include coastal structures (such as groynes, seawalls, headlands, etc), as well as other forms of coastal management such as sand bypassing or nourishment.

Some examples of planning / management controls could include relevant local planning policies or schemes (such as Storm Surge Policies, etc) as well as management strategies such as emergency evacuation management plans, etc.



Rock headland controlling shoreline behaviour

Re-evaluation of Risk

The Existing Controls could have an impact on either the potential extent of Coastal Hazard Impact, assessed through a Coastal Hazard Assessment, or on the Likelihood, Consequence or Adaptive Capacity of an asset.

Following the identification of these Existing Controls, the Risk and Vulnerability Assessment should be reviewed and updated to incorporate any changes that are necessary to appropriately reflect the degree to which the Coastal Hazard impact has been mitigated.

When considering the potential impact of Existing Controls the longevity and/or commitment to ongoing implementation of the control is critical. For example, the presence of an existing coastal structure does not ensure ongoing protection for the surrounding coastline unless the structure has been appropriately

designed and constructed, and there is an ongoing commitment from the relevant Authority to monitor and maintain the structure into the future to ensure that it continues to function as intended.

Priorities for Risk Treatment

Following the re-evaluation of Risk and Vulnerability, the relevant tolerance scales should be used to identify risks that require treatment. This needs to include assessment across all planning horizons to ensure that not only are the assets requiring risk treatment identified, but also the potential timeframes for Risk Treatment. In this way, the priorities for Risk Treatment can be determined, noting that there may be different priorities or timeframes for assets based on Coastal Erosion Risks versus Coastal Inundation Risks.



Erosion impacting coastal houses in Odessa, Ukraine