

R1643 Rev 2

December 2023

Hub Property Group

**Frenchman Bay
Coastal Hazard Risk Management & Adaptation
Plan**

marinas

boat harbours

canals

breakwaters

jetties

seawalls

dredging

reclamation

climate change

waves

currents

tides

flood levels

water quality

siltation

erosion

rivers

beaches

estuaries

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1. Introduction

Hub Property Group (HPG) is planning to develop Lot 1 & 2 Frenchman Bay Road (Site) into a high-end tourist destination. The site is located in Frenchman Bay, south-east of Albany, Western Australia. The locality of the site is shown in Figure 1.1.

The City of Albany (City) has designated the site as Special Use Site No. 13 under the provisions of the Local Planning Scheme No. 1. The special use allocation provides for the development of holiday accommodation, caravan park, caretaker's dwellings and a shop. It is identified as a strategic site in the Council's Local Tourism Planning Strategy (Aytou Baesjou Planning, 2021). The City has previously approved a Local Development Plan (LDP) for the site in 2015.

As part of the planning process, there is a requirement to assess the risks to the development from coastal hazards. HPG has therefore engaged M P Rogers & Associates Pty Ltd (MRA) to complete a coastal hazard assessment and Coastal Hazard Risk Management and Adaptation Planning (CHRMAP) for the development.

The requirements and framework for CHRMAP are outlined in the State Planning Policy No. 2.6 - State Coastal Planning Policy (SPP2.6) and more specifically in the CHRMAP Guidelines (WAPC 2019). The CHRMAP for the HPG Frenchman Bay Development has been completed in accordance with those documents and covers the following key items:

- Establishment of the context.
- Coastal hazard assessment (Previously completed (MRA, 2022)).
- Risk analysis and evaluation.
- Risk management and adaptation planning.
- Monitoring and review.

This report outlines the methods, data and outcomes of the CHRMAP assessment.



Figure 1.1 Location of Site

1.1 State Planning Policy 2.6

Within Western Australia, State Planning Policy 2.6: State Coastal Planning Policy (SPP2.6; WAPC 2019) provides guidance for land use and development decision-making within the coastal zone, including the establishment of coastal foreshore reserves to protect, conserve and enhance coastal values. SPP2.6 also provides guidance on the assessment of coastal hazard risks for assets located in close proximity to the coast.

The objectives of SPP2.6 are wide ranging, however a key component of the policy is the identification of appropriate areas for the sustainable use of the coast. This includes use for tourism and commercial purposes, which are relevant to the proposed development. Table 1.1 provides details of how HPG is addressing the stated objectives of SPP2.6.

Table 1.1 Alignment of HPG Development with SPP2.6 Objectives

SPP2.6 Policy Objective		Description of Proposed HPG Development
1	Ensure that development and the location of coastal facilities takes into account coastal processes, landform stability, coastal hazards, climate change and biophysical criteria.	<p>The identification of Coastal Hazards is addressed within Section 3 of this CHRMAP. This section assesses the coastal processes at the proposed development location, within the context of the coastal geomorphology and geology as recommended by SPP2.6.</p> <p>This CHRMAP aims to inform and provide appropriate guidance to key stakeholders with respect to future management of the aforementioned factors.</p>
2	Ensure the identification of appropriate areas for the sustainable use of the coast for housing, tourism, recreation, ocean access, maritime industry, commercial and other activities.	<p>The location of the proposed holiday accommodation will bring more people to this underutilised section of the coast. The site was previously used as a caravan park, but has sat vacant for many years. The City has identified this site as a strategic tourist site and designated it as Special Use Site No. 13 within the Local Planning Scheme. This includes provisions for holiday accommodation and other related facilities. The region has acknowledged a short fall of high-quality tourist accommodation, the proposed development will address this need and take tourism pressure off existing over-crowded areas.</p> <p>The location of the proposed development will enable greater access to the coast to tourists given its proximity. In addition, it will increase patronage to the existing historical whaling station, encouraging engagement with the region's rich maritime history.</p> <p>The existing carpark and beach access to the eastern end of the site will be maintained, with additional beach access planned as part of the proposal.</p> <p>This CHRMAP aims to inform the current and future uses to ensure sustainability with regard to the identified coastal hazards.</p>
3	Provide for public coastal foreshore reserves and access to them on the coast.	<p>The plans for the development include access via existing stairs to public foreshore reserve 21337 which includes a grassed picnic area behind the sandy beach. As mentioned above, the existing public carpark and beach access is to be preserved, with potential for future upgrades to the public amenity in conjunction with government authorities. Carparks for patrons utilising the facility are included within the LDP.</p>
4	Protect, conserve and enhance coastal zone values, particularly in areas of landscape, biodiversity and ecosystem integrity, indigenous and cultural significance.	<p>The HPG design recognises the strong support for retaining public access to the beaches and foreshore reserve as well as preserving the surrounding natural environment for future generations.</p> <p>The design also conserves and enhances engagement with the significant cultural heritage of the area, particularly the historic Norwegian whaling station.</p>

The guidance on the assessment of coastal hazard risk is provided within SPP2.6 in the form of a methodology to assess the potential extent of coastal hazard impacts, as well as for the development of Coastal Hazard Risk Management and Adaptation Planning (CHRMAP). Further details in this regard are also provided in the CHRMAP Guidelines (WAPC 2019).

The key requirement of CHRMAP is to develop a risk based adaptation framework for assets that could be at risk of impact by coastal hazards over the relevant planning timeframe. Importantly, the balance of these risks needs to be considered with reference to the expected lifetime of the relevant assets.

This CHRMAP report has been prepared to provide guidance regarding the risks posed by coastal hazards. Specifically, it covers the following items:

- Establishment of the context.
- Coastal hazard assessment and identification.
- Risk/vulnerability analysis and evaluation.
- Risk management and adaptation planning.
- Implementation planning.
- Monitoring and review.

Details regarding each of these items will be provided in this report.

2. Context

2.1 Purpose

The potential vulnerability of the coastline and the subsequent risk to the community, economy and environment needs to be considered for any coastal development.

SPP2.6 requires that the responsible management authority completes CHRMAP where an existing or proposed development may be at risk from coastal hazards over the planning timeframe. The main purpose of the CHRMAP is to define areas of the coastline which could be vulnerable to coastal hazards and to outline the preferred approach to the monitoring and management of these hazards where required.

CHRMAP can be a powerful planning tool to help provide clarity to existing and future developers, users, managers or custodians of the coastline. This is done by defining levels of risk exposure, management practices and adaptation techniques that the management authority considers acceptable in response to the present and future risks posed by coastal hazards.

Specifically, the purpose of this CHRMAP is as follows.

- Determine the specific extent of coastal hazards in relation to the proposed HPG development.
- Determine the coastal hazard risks associated with the proposed HPG development and how these risks may change over time.
- Establish the basis for present and future risk management and adaptation.
- Provide guidance on appropriate management and adaptation planning for the future, including monitoring.

2.2 Objectives

The key objectives of this CHRMAP are as follows:

- Ensure that HPG and key stakeholders understand the potential likelihood of assets within the proposed development being impacted by coastal hazards over the 100 year planning timeframe.
- Identify vulnerability trigger points and respective timeframes for risk management and adaptation actions.
- Present management and adaptation measures that are informed by, and are acceptable to, HPG and key stakeholders.
- Outline the required coastal adaptation approach in an Implementation Plan that is acceptable to HPG and key stakeholders.
- Incorporate management and adaptation measures into short and long term decision making documentation.

2.3 Scope

The *CHRMAP Guidelines* (WAPC 2019) provide a specific framework for the preparation of a CHRMAP. This is outlined in the flowchart presented in Figure 2.1 which shows the risk management process adapted to coastal planning.

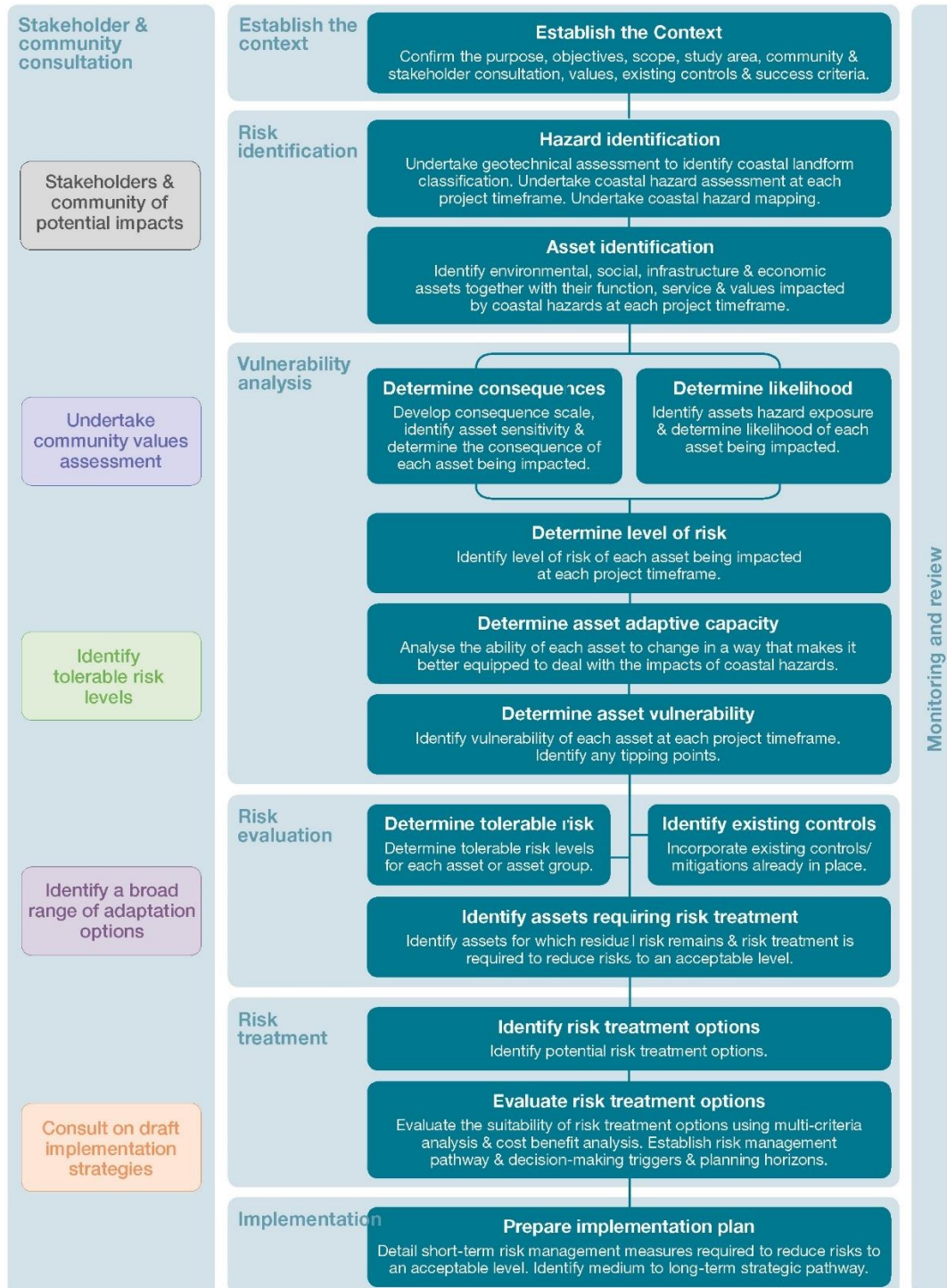


Figure 2.1 Risk Management & Adaptation Process Flow Chart (WAPC 2019)

As presented in the flowchart, the process for the development of a meaningful CHRMAP process requires a number of fundamental inputs. These inputs enable the assessment and analysis of

risk, which should ultimately be informed by input received from key stakeholders, to help shape the subsequent adaptation strategies.

The management of coastal hazard risk associated with the proposed HPG development will be required to present a proposed adaptation plan that is acceptable to the stakeholders. As a result, the approach that has been taken for this plan is to develop a management methodology that allows for flexibility into the future.

The development of the adaptation plan will be informed by the assessment of the coastal erosion and inundation hazards at the site. The identification of the coastal erosion and inundation hazards for the proposed HPG development is discussed within Section 3 of this report.

This CHRMAP will consider the potential risks posed by coastal hazards over a range of horizons covering the 100 year planning timeframe. This planning timeframe is required by SPP2.6 for development on the coast.

Intermediate planning horizons will also be considered to assess how risk profiles may change in the future and to inform the requirement for adaptation strategies. The intermediate planning horizons that will be considered in this CHRMAP are listed below, with present day taken as 2021 (the time when this CHRMAP process was initiated).

- Present day (2021).
- 20 years to 2041.
- 40 years to 2061.
- 60 years to 2081
- 80 years to 2101
- 100 years to 2121.

Based on the results of the risk assessment, risk mitigation strategies will be developed, where required, in order to provide a framework for future management. However, it is important to realise that the risk assessment will be based on the outcomes of the coastal vulnerability assessment, which, by their nature, are justifiably conservative. This is due to the uncertainty around coastal dynamics when predicting impacts over long timeframes. As a result, the framework for future risk management strategies should be considered to be a guide of future requirements.

The actual requirement for implementation of these management actions should ultimately be informed by a coastal monitoring regime. The purpose of this coastal monitoring regime is to identify changes in the shoreline or sea level that could alter, either positively or negatively, the risk exposure of the proposed assets and infrastructure. A recommended coastal monitoring regime is included within the implementation plan, presented within Section 6.2 of this report.

2.4 The Site

This site setting which forms the basis of the CHRMAP has been discussed in detail in the Coastal Hazard Assessment completed by MRA in January 2022. It is advised that the reader view the two documents concurrently.

2.5 Stakeholder Engagement

HPG has been in consultation with the City and other key stakeholders in reviewing a previous LDP put forth by an earlier proponent. This LDP went through a round of public and stakeholder consultation. HPG is currently in discussions with the stakeholders regarding the current LDP and is planning to go through further public and stakeholder consultation once the revised LDP is advertised by the City.

2.6 Key Assets

Key assets within the study area and surrounds have been summarised in Table 2.1 and are shown in Figure 2.2. The risk assessment will focus on these assets to identify their vulnerability and consequently the requirement for risk management. For this type of assessment, it is not considered necessary to break down this list of assets any further into their component parts, as it is the vulnerability of the overall assets that is the important factor.

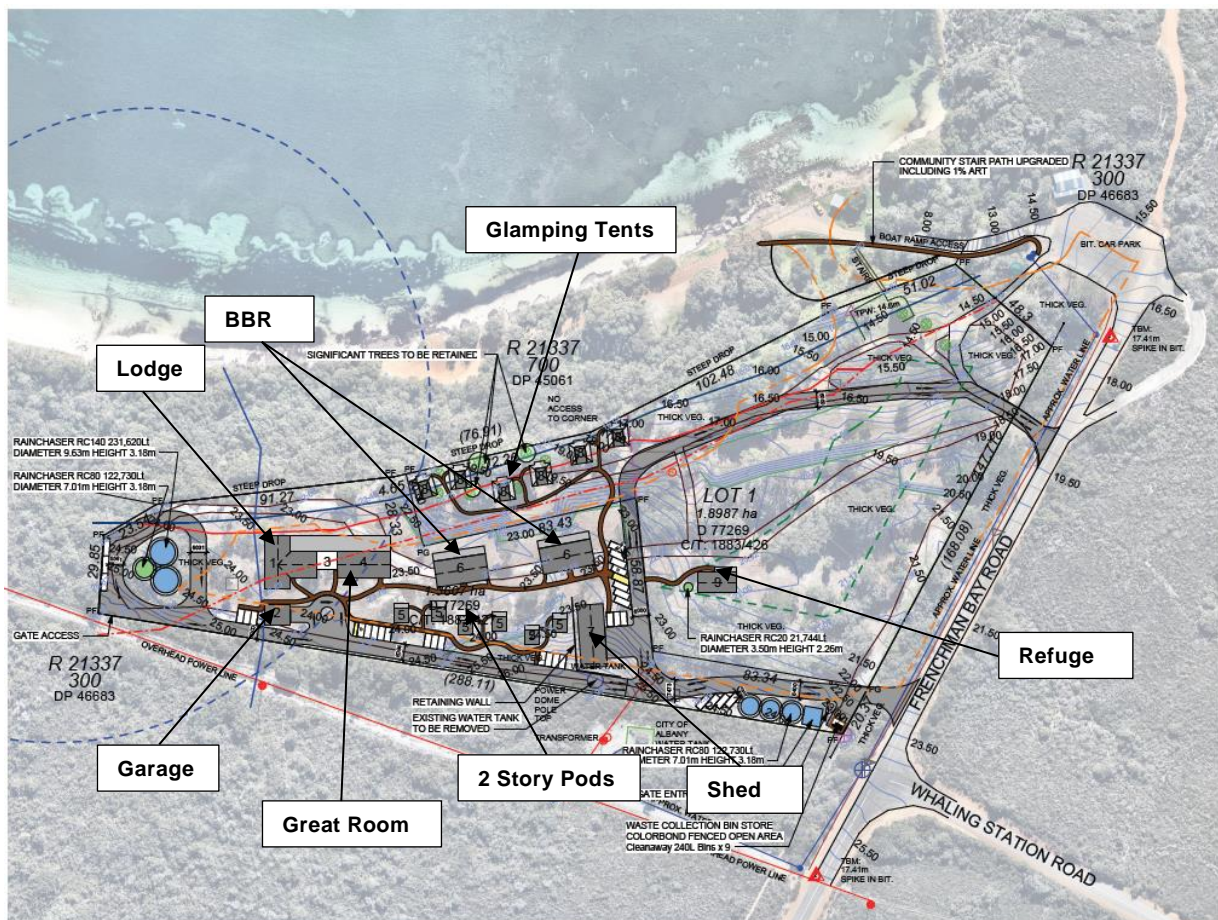


Figure 2.2 Assets within Proposed Holiday Park Development

The excerpt shown in Figure 2.2 is from the full site plan provided by HPG, presented in Appendix A

Table 2.1 Key Assets Identified for Analysis

Type	Key Assets
Social/Economic	Shed
	Great Room
	Lodge
	Garage
	Glamping Tents
	2 Story Pods
	Bespoke Barn Retreat (BBR)
	Refuge

It is noted that the list of assets considered in this report relates solely to the social and economic assets that will be located within the development itself. It is understood that the City of Albany are separately undertaking a CHRMAP process for the public and heritage assets in the area.

2.7 Success Criteria

The success criteria for the CHRMAP will ultimately be as follows:

- Demonstrated understanding by the key stakeholders regarding the likelihood, consequence and subsequent risk of coastal hazards impacting identified assets over each planning horizon.
- Evidence of stakeholder engagement outcomes being incorporated throughout the development of risk management and adaptation measures.
- Acceptance of a risk management and adaptation plan for the 100 year planning timeframe by key stakeholders.
- Evidence of the required changes to existing management controls being implemented.
- Adoption of the Implementation Plan by key stakeholders going forward.

The outcomes of the success criteria listed above are presented in later sections of this report.

3. Coastal Hazard Assessment

The Coastal Hazard Assessment aspect of the CHRMAP process was completed by MRA in January 2022, the reader is referred to MRA, 2022 to view this section of the CHRMAP. Figure 3.1 demonstrates the most important outcome of the Coastal Hazard Assessment. This figure shows the locations of the Coastal Erosion Hazard lines relative to the proposed development locations.

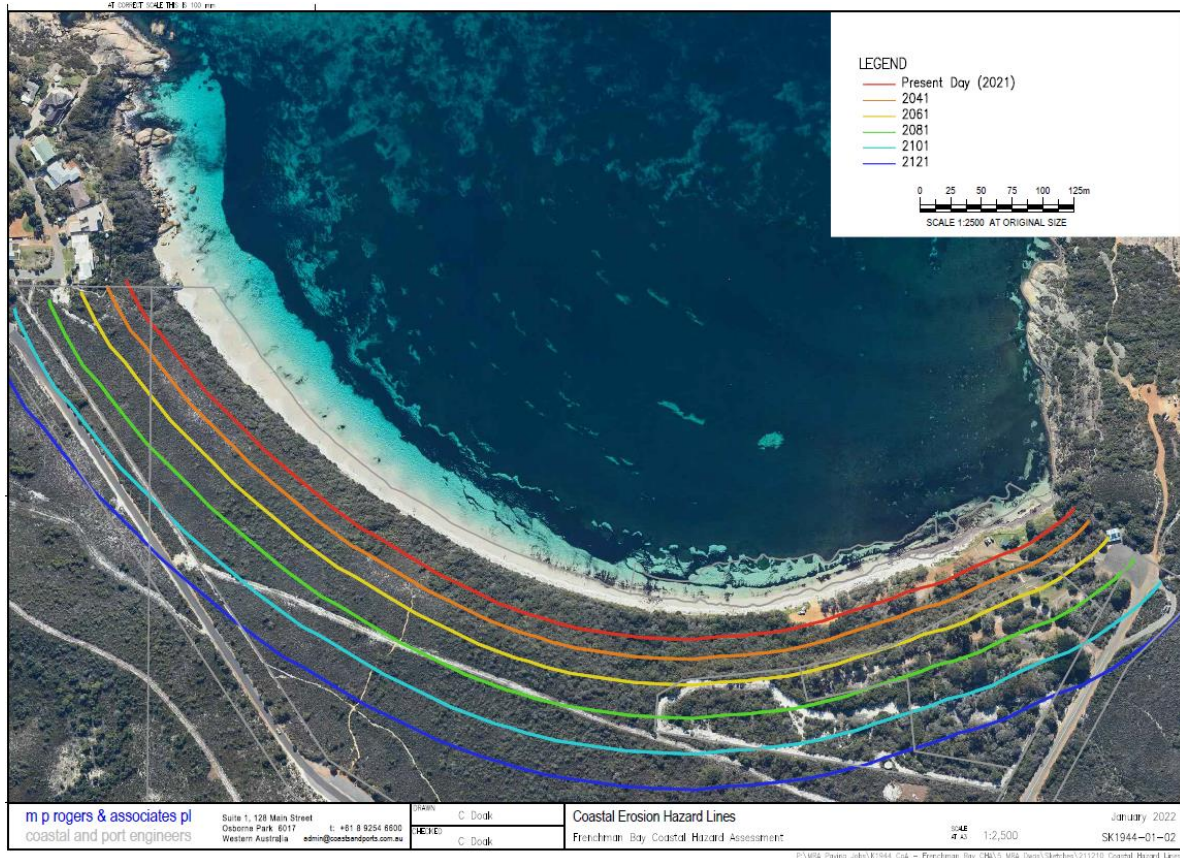


Figure 3.1 Coastal Hazard Map (MRA, 2022)

Inundation hazards were also considered within the Coastal Hazard Assessment; however, given the elevation of the site is above 12 mAHD, inundation will not be an issue.

4. Risk Analysis

In accordance with WAPC (2019), a risk based approach will be used to assess the hazards and required mitigation and adaptation options for the proposed HPG development. As coastal hazards are the focus of this assessment, it is the likelihood and consequences of these coastal hazards that need to be considered. It is inherent in the development plan that there be no negative social or environmental impacts as a result of the HPG development, with mitigation strategies already highlighted to address these issues.

4.1 Likelihood

Likelihood is defined as the chance of something happening (AS/NZS ISO 31000:2009). WAPC (2019) defines the likelihood as the chance of erosion or storm surge inundation occurring or how often they impact on existing and future assets and values. This requires consideration of the frequency and probability of the event occurring over a given planning timeframe.

The probability of an event occurring is often related to the Average Exceedance Probability (AEP) or the ARI. The use of the AEP to define impacts of coastal hazards over the planning timeframe assumes that events have the same probability of occurring each year. In the case of climate change and sea level rise, which has a large influence on the assessed coastal hazard risk, this is not true. In addition, there is insufficient data available to properly quantify the probability of occurrence. A scale of likelihood has therefore been developed and is presented in Table 4.1.

Table 4.1 Scale of Likelihood

Rating	Description/Frequency
Almost certain	There is a high possibility the event will occur as there is a history of frequent occurrence. 90 – 100% probability of occurring over the timeframe.
Likely	It is likely the event will occur as there is a history of casual occurrence. 60 – 90% probability of occurring over the timeframe.
Possible	The event may occur. 40 – 60% probability of occurring over the timeframe.
Unlikely	There is a low possibility that the event will occur. 10 – 40% probability of occurring over the timeframe.
Rare	It is highly unlikely that the event will occur, except in extreme/exceptional circumstances. 0 – 10% probability of occurring over the timeframe.

The likelihood and consequences of coastal hazards are different for erosion and inundation. As a result, the likelihood and consequence of erosion and inundation should be considered separately. The likelihood of coastal erosion and inundation hazard impact is discussed separately in the following sections.

4.1.1 Coastal Erosion

The likelihood ratings given to the relevant assets are based on the coastal erosion hazard lines presented in Appendix B and the consideration of the probabilities of each of the allowances occurring within the respective planning horizons.

It is important to note that the hazard lines reaching a particular asset at the end of the planning horizon do not necessarily mean that this will occur. This is due to the fact that it requires all of the following to occur.

- The upper estimate of erosion caused by sea level rise.
- Ignoring the existing shoreline movement trend of variability between erosion and accretion and assuming only erosion.
- The severe storm event to be experienced at the end of the planning timeframe (ie when the other allowances have been realised).

Only if all of these occur will the erosion hazard lines be realised. This has been considered in the assessment of likelihood for the relevant assets.

An assessment of the relative likelihood of each of the identified key assets being impacted by coastal erosion hazards has been completed and is presented in Table 4.2. The assessment was completed using the coastal hazard lines presented in Appendix B.

Table 4.2 Assessment of Likelihood of Coastal Erosion Impact

Asset	Present Day	2041	2061	2081	2101	2121
Shed	Rare	Rare	Rare	Rare	Rare	Unlikely
Great Room	Rare	Rare	Rare	Unlikely	Possible	Likely
Lodge	Rare	Rare	Rare	Unlikely	Possible	Likely
Garage	Rare	Rare	Rare	Rare	Unlikely	Possible
Glamping Tents	Rare	Rare	Rare	Unlikely	Possible	Likely
2 Story Pods	Rare	Rare	Rare	Rare	Unlikely	Possible
BBR	Rare	Rare	Rare	Rare	Unlikely	Possible
Refuge	Rare	Rare	Rare	Rare	Rare	Unlikely

The assessment of the likelihood of coastal erosion impact shows that it is rare that coastal erosion will impact the key assets over the 40 year planning timeframe to 2061. However, over the 100 year timeframe to 2121, it is likely that these assets will be impacted by coastal erosion.

4.1.2 Coastal Inundation

Based on the coastal inundation assessment, S4 allowance, outlined in the Coastal Hazard Assessment (refer MRA, 2022), the proposed elevations of the HPG development on Lots 1 & 2 are well above the 500-year ARI inundation water level which is 2.9 mAHD. This level is inclusive of allowance for nearshore wind and wave setup and allowance for the full extent of sea level rise. Review of multiple topographic sources suggest that the absolute lowest level on the site is likely above 12 mAHD. As such, the development is not likely to be impacted by coastal inundation hazards and will not be assessed further in this report.

4.2 Consequence

Consequence is the impact of erosion and storm surge inundation on existing and future assets and the value assigned to that asset (WAPC 2019). Within the context of the vulnerability assessment, consequence is used to consider the sensitivity of an asset to coastal erosion and inundation hazards over the 100 year planning timeframe.

A scale of consequence has been developed which provides a range of impacts and is generally consistent with the Australian Standard Risk Management Principles and Guidelines (ISO 31000:2009) and the Coastal Hazard Risk Management and Adaptation Planning Guidelines (WAPC 2019). The consequence scale is presented in Table 4.3

Table 4.3 Scale of Consequences

Rating	Social	Economic	Environment	Infrastructure	Safety
Catastrophic	Large long term or permanent (~1 yr) loss of services, public access/amenity, employment, wellbeing or culture. No suitable alternative sites exist within the LGA.	Permanent and/or entire loss or damage to property, plant and equipment, finances > \$10 million. Regional economic decline, widespread business failure and impacts on state economy.	Permanent and entire loss of flora, fauna conservation or heritage area (no chance of recovery).	Damage to majority or all of infrastructure (Greater than 75%). Asset with step change sensitivity and no adaptive capacity.	Death or permanent disabilities.
Major	Medium term (~1 month) disruption to services, employment wellbeing, or culture. Very limited suitable alternative sites exist within the LGA.	Permanent and/or large scale loss or damage to property, plant and equipment, finances \$2 - \$10 million. Lasting downturn of local economy with isolated business failures and major impacts in regional economy.	Long-term and/or large scale loss of flora, fauna or heritage area (limited chance of recovery) with local impact.	Damage to significant portion (50% - 75%) or asset with step change sensitivity. Asset with step change sensitivity and some adaptive capacity	Extensive injuries or disabilities.
Moderate	Major short term or minor long-term (~1 week) disruption to services, public access/amenity, employment, wellbeing, or culture. Limited suitable alternative sites exist within the LGA.	Permanent and/or medium scale loss or damage to property, plant and equipment, finances \$100,000 - \$2 million. Significant impacts on local economy and minor impacts on regional economy.	Medium-term and/or medium scale loss of flora, fauna or heritage area (recovery likely) with local impact.	Damage to no more than half of the infrastructure (25% - 50%). Asset with step change sensitivity with adaptive capacity.	Medical treatment.
Minor	Small to medium short-term (~1 day) disruption to services, public access/amenity, employment, wellbeing, or culture. Many suitable alternative sites exist within the LGA.	Permanent and/or small scale loss or damage to property, plant and equipment, finances \$10,000 - \$100,000. Individually significant but isolated impact on local economy.	Short-term and/or small scale loss of flora, fauna or heritage area (strong recovery) with local impact.	Minor damage to infrastructure (10% - 25%).	First aid treatment.
Insignificant	Minimal short-term (~1 hr) inconveniences to services, public access/amenity, employment, wellbeing, or culture. Many suitable alternative sites exist within the LGA.	Permanent and/or small loss or damage to property, plant and equipment, finances < \$10,000. Very minor short-term impacts on local economy.	Negligible to no loss of flora, fauna or heritage area (strong recovery) with local impact.	Little or no damage to infrastructure (Less than 10%).	No injuries or illness.

The assessed consequences of coastal erosion for each of the planning horizons are outlined in Table 4.4. As shown in the table, the consequences of erosion vary for some key assets over different timeframes due to the potential effects of increased erosion.

Table 4.4 Assessment of Consequence of Coastal Erosion Impact

Asset	Present Day	2041	2061	2081	2101	2121
Shed	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Minor
Great Room	Insignificant	Insignificant	Insignificant	Moderate	Major	Major
Lodge	Insignificant	Insignificant	Insignificant	Moderate	Major	Major
Garage	Insignificant	Insignificant	Insignificant	Insignificant	Minor	Minor
Glamping Tents	Insignificant	Insignificant	Insignificant	Minor	Moderate	Moderate
2 Story Pods	Insignificant	Insignificant	Insignificant	Insignificant	Moderate	Major
BBR	Insignificant	Insignificant	Insignificant	Insignificant	Moderate	Major
Refuge	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Moderate

Erosion is deemed to have a low consequence if the asset is landward of the coastal hazard line for the assessed planning horizon, since the extent of impact to the social, economic and environmental criteria is based on the extent of the potential erosion.

The key assets are situated landward of the coastal erosion hazard lines up to 2061 and were therefore assessed to have an insignificant level of consequence to coastal erosion. Beyond 2061 through to 2121, some assets were evaluated to have a moderate to major consequence of coastal erosion, in line with the assessed scale of consequence in Table 4.3.

5. Risk Evaluation

5.1 Risk Evaluation Matrix

The risk rating is assessed through a matrix of “likelihood” vs “consequence”. A risk matrix defining the levels of risk has therefore been developed. This risk matrix is generally consistent with WAPC (2019) and the principles of AS 5334 (Standards Australia 2013) and is presented in Table 5.1.

Table 5.1 Risk Matrix

RISK LEVELS		CONSEQUENCE				
		Insignificant	Minor	Moderate	Major	Catastrophic
LIKELIHOOD	Almost Certain	Low	Medium	High	Extreme	Extreme
	Likely	Low	Medium	Medium	High	Extreme
	Possible	Low	Low	Medium	High	Extreme
	Unlikely	Low	Low	Medium	Medium	High
	Rare	Low	Low	Low	Medium	Medium

A risk tolerance scale assists in determining which risks are acceptable, tolerable and unacceptable. The risk tolerance scale used for the assessment is presented in Table 5.2. The risk tolerance scale shows that the extreme and high risks need to be managed.

Table 5.2 Risk Tolerance Scale

Risk 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 risk to acceptable levels	Intolerable
Medium	Reduce the risk or accept the risk provided residual risk level is understood	Tolerable
Low	Accept the risk	Acceptable

5.2 Risk Assessment

The risk assessment for the study area will be completed in accordance with the recommendations of AS5334 (2013), which requires a detailed risk analysis to include a vulnerability analysis to thoroughly examine how coastal hazards and climate change may affect the assets. This includes consideration of the adaptive capacity and vulnerability of the relevant assets.

Table 5.3 presents the assessed coastal erosion risk levels for each of the identified key assets potentially at risk over the 100 year planning timeframe.

Table 5.3 Assessment of Risk of Coastal Erosion Impact

Asset	Present Day	2041	2061	2081	2101	2121
Shed	Low	Low	Low	Low	Low	Low
Great Room	Low	Low	Low	Medium	High	High
Lodge	Low	Low	Low	Medium	High	High
Garage	Low	Low	Low	Low	Low	Low
Glamping Tents	Low	Low	Low	Low	Medium	Medium
2 Story Pods	Low	Low	Low	Low	Medium	High
BBR	Low	Low	Low	Low	Medium	High
Refuge	Low	Low	Low	Low	Low	Medium

The results of the risk assessment show that the key assets are at low risk from coastal erosion hazards during the 40 year planning timeframe to 2061. Beyond this timeframe through to 2121, the assets have an increased level of risk from coastal erosion, from medium to high risk and would therefore require action to mitigate the risk.

5.3 Vulnerability

As per the recommendations of AS 5334 *Climate change adaptation for settlements and infrastructure*, a detailed risk analysis should include a vulnerability analysis to thoroughly examine how coastal hazards and climate change may affect the assets. This includes consideration of the adaptive capacity and vulnerability of the assets previously assessed for coastal hazard risk.

The vulnerability of the identified assets as part of the proposed HPG development are related to the risk from coastal hazards, as well as their sensitivity to the impacts caused by these hazards and their ability to respond to them (termed adaptive capacity). This is demonstrated in the *CHRMAP Guidelines* (WAPC 2019) by the following Figure 5.1.

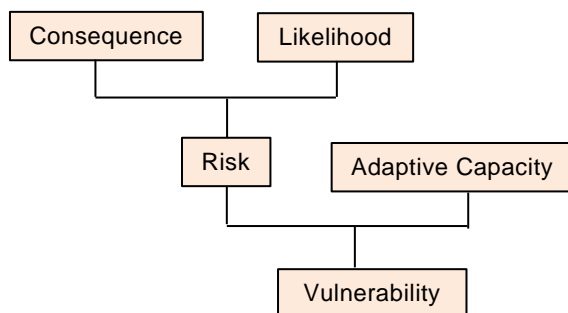


Figure 5.1 Vulnerability Assessment Flowchart (WAPC 2019)

5.3.1 Adaptive Capacity

Adaptive capacity is defined in AS5334 as the ability to respond to climate change to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

This should be considered in conjunction with any changes to the current risk factors over time which may influence an assets future adaptive capacity. A scale of adaptive capacity has been developed for this assessment and is presented in Table 5.4.

Table 5.4 Adaptive Capacity Ratings

Adaptive Capacity Rating	Description
Low	<p>Little or no adaptive capacity. Asset cannot respond to coastal hazard impact and functionality cannot be restored.</p> <p>For example, roads, carparks or buildings that once impacted will require significant modifications to restore functionality.</p>
Moderate	<p>Small amount of adaptive capacity. Asset can partially adapt to coastal hazard impact and functionality can be somewhat restored through repair or redesign.</p> <p>For example, parks or undeveloped lots that once impacted can be modified to restore partial functionality.</p>
High	<p>Decent adaptive capacity. Asset can adapt to coastal hazard impact and functionality can be restored. Additional adaption measures should be considered.</p> <p>For example, portable homes / dongas, prefabricated modular units such as stairs, floating jetties.</p>
Very High	<p>Good adaptive capacity. Asset can respond to coastal hazard impact and functionality can be restored.</p> <p>For example, drink fountains, furniture or shelters that once impacted can be modified relatively easily to restore original functionality.</p>

The adaptive capacity for the majority of the assets has been deemed to be low, as they are buildings that would require significant modifications to restore functionality. This is with the exception of the Glamping tents which have a high adaptive capacity, due to these structures being portable and that they can simply be adjusted and moved to adapt to coastal hazards.

5.3.2 Vulnerability

To determine the vulnerability of the key assets as part of the HPG development, the following matrix was developed for this assessment. Essentially, the vulnerability of each identified asset increases or decreases where the asset has a low or high adaptive capacity respectively.

Table 5.5 Vulnerability Matrix

VULNERABILITY LEVELS		ADAPTIVE CAPACITY			
		Very High	High	Moderate	Low
RISK LEVEL	Extreme	Medium	High	Extreme	Extreme
	High	Low	Medium	High	High
	Medium	Low	Low	Medium	Medium
	Low	Low	Low	Low	Low

A vulnerability tolerance scale is important to define the level at which adaptive capacity is deemed acceptable, tolerable or intolerable/unacceptable. The following tolerance scale has been adopted for this assessment.

Table 5.6 Vulnerability Tolerance Scale

Vulnerability Level	Further Action Required	Vulnerability Tolerance
Extreme	Asset has minimal capacity to cope with the impacts of coastal hazards without additional action. Adaptation needs to be considered as a priority.	Unacceptable / Intolerable
High	Asset has limited ability to cope with the impacts of coastal hazards. Adaptation should be considered to reduce vulnerability to acceptable levels.	Tolerable, if as low as possible
Medium	Asset has some ability to cope with the impacts of coastal hazards. Actions should be considered to reduce vulnerability as low as reasonably practical (ALARP).	Tolerable / Acceptable
Low	Assets has high resilience and is able to cope with the impacts of coastal hazards without additional action.	Acceptable

The vulnerability tolerance scale shows that assets with **High** and **Extreme** vulnerability need to be managed to reduce vulnerability levels to **Medium** or **Low**. Despite being considered acceptable, assets with **Medium** or **Low** vulnerabilities should also be considered and adaptation measures should be implemented to reduce vulnerability levels as low as reasonably practical (ALARP). This is discussed in Section 6 of this CHRMAP.

The vulnerabilities of each of the identified assets have been calculated and are shown in Table 5.7. The assets identified as having **High** and **Extreme** vulnerability from coastal erosion impact require management over the 100 year planning timeframe.

Table 5.7 Assessment of Vulnerability of Coastal Erosion Impact

Asset	Present Day	2041	2061	2081	2101	2121
Shed	Low	Low	Low	Low	Low	Low
Great Room	Low	Low	Low	Medium	High	High
Lodge	Low	Low	Low	Medium	High	High
Garage	Low	Low	Low	Low	Low	Low
Glamping Tents	Low	Low	Low	Low	Low	Low
2 Story Pods	Low	Low	Low	Low	Medium	High
BBR	Low	Low	Low	Low	Medium	High
Refuge	Low	Low	Low	Low	Low	Medium

The results of the risk and vulnerability assessments show that the key assets have a tolerable (low) level of vulnerability to coastal erosion hazards over the 40 year planning timeframe through to 2061. Beyond the 40 year and into the 100 year planning timeframe to 2121, some assets are identified as having a High vulnerability to coastal erosion hazards. These high vulnerability assets (i.e. the Lodge and Great Room) require additional adaptation measures to be implemented into the management plan to reduce the vulnerability levels as low as reasonably practical. These measures will be discussed in the following section of the report.

6. Risk Adaptation & Mitigation Strategies

6.1 Available Risk Mitigation Strategies

Risk adaptation and mitigation strategies are required for HPG to address the coastal hazard risks and asset vulnerabilities identified in Section 5. SPP2.6 outlines a hierarchy of risk adaptation and mitigation options, where options that allow for a wide range of future strategies are considered more favourably. This hierarchy of options is reproduced in Figure 6.1.



Figure 6.1 Risk Management & Adaptation Hierarchy

These four broad option categories are generally outlined below.

- Avoid – avoid new development within the area impacted by coastal hazards.
- Retreat – the relocation or removal of assets within an area identified as likely to be subject to intolerable risk of damage from coastal hazards.
- Accommodation – measures which suitably address the identified risks.
- Protect – used to preserve the foreshore reserve, public access and public safety, property and infrastructure.

The assessment of these options is generally done in a progressive manner, moving through the various options until an appropriate mitigation strategy is found. Adaptation options can vary depending on the type of asset, and often a range of complementary strategies may be required to mitigate coastal hazard risks.

6.2 Proposed Management Strategy

Being a tourist development that will have a finite timeframe until the facilities need to be replaced, the requirement for a coastal risk mitigation strategy for the proposed HPG retreat development is informed by the design life of the infrastructure. The vision for the development is to provide luxury tourist accommodation with glamping, chalets and a lodge. It will also provide a number of highly adaptable glamping tents as well as relevant tourist facilities. The design of the retreat will therefore be sensitive to the natural environment with the intention of being as visually unobtrusive as possible from both the beach and surrounding land areas.

The glamping tents are the closest asset to the ocean and most likely to be first affected. The highly adaptable nature of these glamping tents means that they can be moved with limited work required, reducing the impact of the proposed adaptation method on the overall operation of the retreat.

Being a luxury retreat and given the coastal nature of the infrastructure, it is envisaged that the design life of the structures will be limited to around 40 years. Therefore, the proposed coastal management strategy should be focused on a 40 year planning horizon when considering the initial construction of the retreat.

For the initial construction of the retreat the intention is to **avoid** risks associated with coastal hazards. As a result, the built form of the Retreat will be located landward of the coastal erosion hazard line for the 40 year planning horizon. Similarly, the finished floor levels of the retreat will be located well above 2.9 mAHD, avoiding risks associated with coastal inundation. This avoidance of the coastal hazard risk over the 40 year planning horizon means that there will be an almost insignificant chance of the development being impacted by erosion over this period. Further, it would be expected that, given the conservatism that is inherent in the assessment of the coastal hazard risk, development in this location would probably be unaffected by coastal hazards for a period longer than 40 years.

Given the approach outlined above, the site plan for the retreat has been prepared and is shown in Figure 6.2. This figure also shows the location of the coastal erosion hazard lines for the various planning horizons. As shown, all of the built form is located behind the 2061 erosion hazard line, therefore avoiding the risk of coastal erosion hazards over the design life of the structures. Nevertheless, whilst the proposed management strategy avoids the risk for the coming 40 years, SPP2.6 requires the development of an adaptation strategy that extends to a 100 year planning horizon. In this regard, further management actions are required.

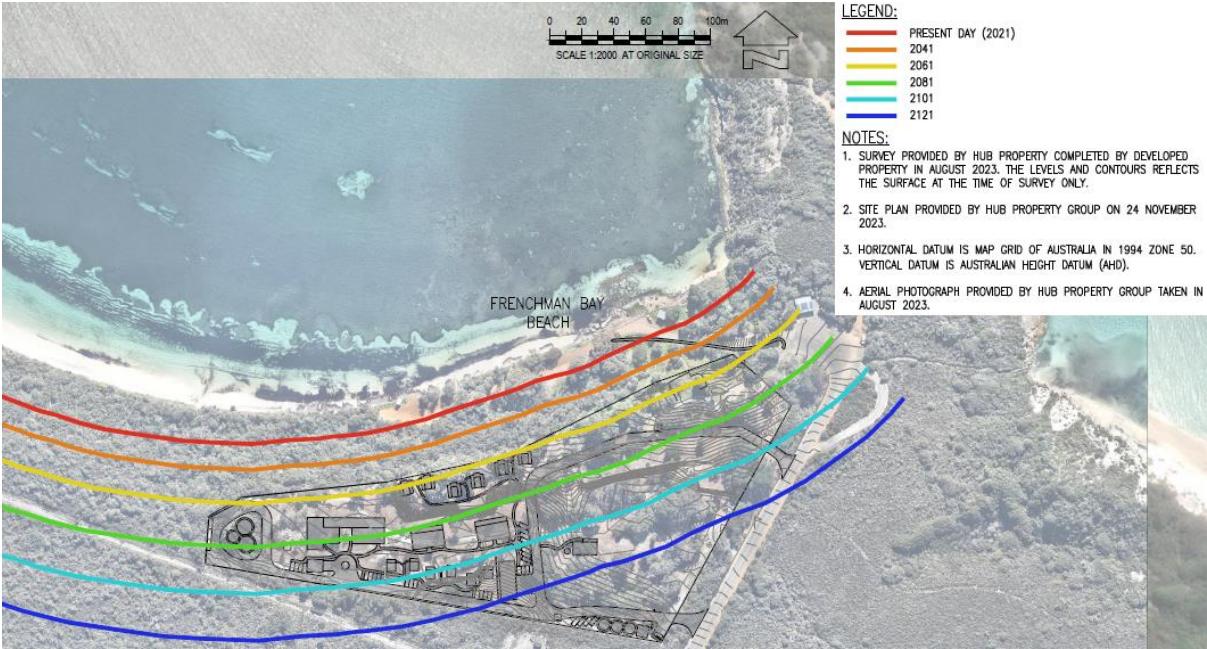


Figure 6.2 Retreat Site Plan & Erosion Hazard Lines

The long term adaptation strategy is **managed retreat**. This managed retreat shall be initiated by a coastal monitoring regime which revolves around a **trigger point**. It is recommended the trigger point be located a distance from the seaward boundary of each asset that is equal to the S1

allowance plus 5m factor of safety. Explicitly, when the shoreline retreat reaches a point 33m from each asset the managed retreat shall be initiated. This is expected to take place sometime beyond the initial 40 year planning horizon and likely after the built forms need replacing. This replacement of the built form will provide a convenient and pre-emptive opportunity for a **managed retreat** of the infrastructure. Under this scenario the replacement infrastructure should be relocated to an area that is deemed to be safe for the ensuing planning horizon based on the results of an updated coastal hazard assessment completed at that time. The design of the new layout for the retreat will therefore need to respond to the results of that coastal hazard assessment.

Similarly, as the behaviour of any coastline can be complex and subject to change, ongoing monitoring of the coastline should be completed in perpetuity. Details of the proposed monitoring are provided in Table 6.1.

Table 6.1 Proposed Coastal Monitoring

Type of Monitoring	Description	Requirement / Frequency
Visual Inspections	Visual inspection and monitoring of the beach to identify any significant changes in the shoreline. Changes would be evident through the erosion of the beach and presence of an erosion scarp with or without the loss of vegetation.	Ongoing as part of the operation of the Retreat. The character of the beach will be constantly monitored as part of the operation of the retreat.
Shoreline Mapping	Ortho-rectified aerial photographs will be purchased and the coastal vegetation line mapped to track the movement of the shoreline. This method will help to ascertain if there is any creep in shoreline position that is not being picked up through the visual inspections.	Every 5 years or when the visual inspections suggest a significant change in the beach/shoreline.
Survey Cross Sections	Survey of the beach and foreshore along four profiles fronting the retreat site. The profiles would seek to capture the foreshore out to a water depth of approximately 5 m. These surveys would help to determine the extent of the change in the shoreline profile that is occurring.	This level of survey would only be required if the eroded shoreline came within a horizontal distance of approximately 43 m of the retreat site (the S1 allowance plus 15m). If this were to occur then the survey cross sections should be completed every 1 to 2 years depending on the recommendations of a coastal engineer at that time.

This monitoring should be used to identify if the shoreline erodes to the extent that a trigger position is reached where the risk of coastal hazards becomes too great. If this were to occur, then the at-risk infrastructure should be removed and relocated to an area that is considered safe based on the results of a coastal hazard assessment at that time. For this shoreline the trigger value should be the S1 allowance plus 5 m as a factor of safety as noted above. Therefore, if the shoreline (denoted by the coastal vegetation line or toe of an erosion scarp where present) recedes to the point that it comes within 33 m of the seaward boundary of a retreat asset, then the

managed retreat of the infrastructure that is at risk should commence. It is noted this is likely to be experienced by the glamping tents first.

It is noted that all of the requirements outlined above are the full responsibility of the landowner, with the landowner ultimately responsible for all costs and any other requirements to enable the coastal adaptation strategy to be completed. Whilst this is acknowledged and accepted by the current land owner, it is important that this requirement is conveyed to any prospective future landowners. As a result, it is recommended that a notification be placed on the titles of Lots 1 & 2 Frenchman Bay Road advising that the subject land is at risk from coastal hazards and is subject to management in accordance with this coastal management strategy.

For clarity, a summary of the proposed coastal management strategy has been prepared and is presented in Figure 6.3.

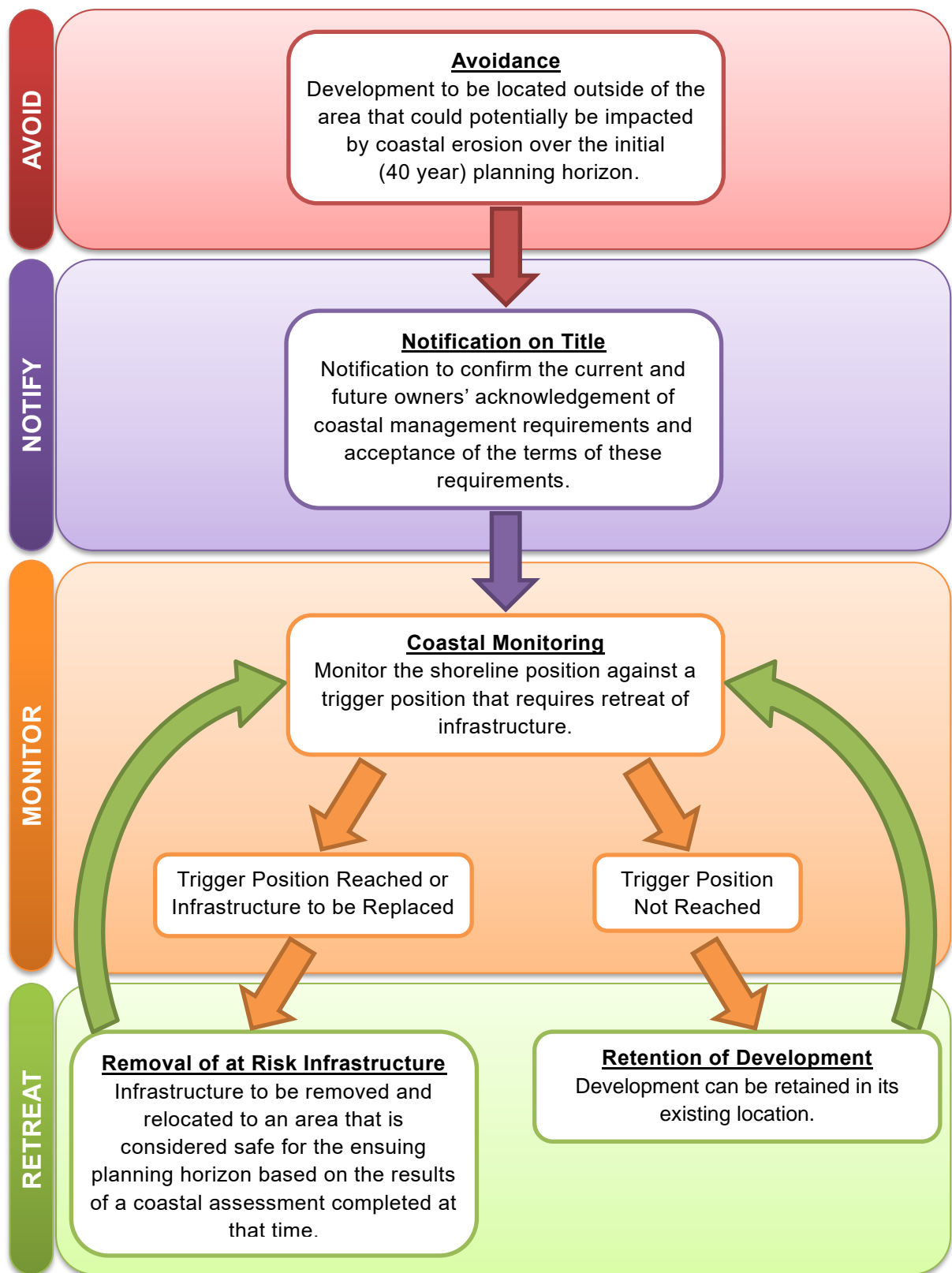


Figure 6.3 Summary of Coastal Management Strategy

7. Conclusions

This CHRMAP has been completed to provide guidance on required adaptation and management actions associated with the proposed HPG development. The coastal hazard assessment completed previously and referred to in Section 3 as well as this CHRMAP report have been completed in line with the recommendations of SPP2.6 and WAPC (2019).

Lots 1 & 2 Frenchman Bay Road have long been earmarked for the development of a tourist retreat site. The current owner of Lots 1 & 2 proposes to develop luxury holiday accommodation in the form of a retreat on the site. The vision for the retreat is to provide luxury tourist accommodation that is sensitive to the natural environment and local aesthetics.

An assessment of the potential future areas of impact caused by the action of coastal hazards was completed in accordance with the requirements of SPP2.6. The results of this assessment show that the shoreline fronting the site could be vulnerable to change caused by a combination of severe storm erosion and sea level rise. In this regard, it is prudent to consider the potential future shoreline changes and the possible impacts on the retreat site in the context of future coastal adaptation and management requirements. It is noted however that an assessment of the historical movement of the shoreline fronting the site shows that the beach has experienced very little gross movement over the last half a century with the exception of the erosion adjacent to, and likely caused by, the redundant historical seawall. This demonstrates the apparent stability of the shoreline and highlights that the results of the coastal hazard assessment are likely to be conservative for this location.

The completion of the coastal hazard risk assessment for the proposed HPG development has shown that there is a risk of coastal hazard impact over the 100 year planning timeframe. However, these risks are limited to erosion impacts and are tolerable during the 40 year planning timeframe. The serviceable design lifetime of the built form structures within the proposed development are within this planning timeframe. As such the short term (40 year plan) is to avoid the potential coastal hazards. The long term (100 year plan) is a managed retreat, which shall be initiated by erosion beyond the trigger point as mentioned in section 6 of this report.

A coastal management and adaptation strategy was presented within this report that outlines the proposed future management strategy. This strategy is based on an avoidance of risk over the design life of the built form structures, followed by a managed retreat of the structures triggered by erosion of the shoreline, or at such time as the structures need to be replaced. The requirements of this coastal management and adaptation strategy are understood and accepted by the land owner. Furthermore, for the avoidance of doubt, it is noted that all costs associated with the requirements of this strategy will be borne by the landowner. To make any future prospective owners of this site aware of this requirement, it is suggested that a notification also be included on the title for the Lots.

Given the proposed management strategy, the proposed HPG development should appropriately respond to risks posed by coastal hazards in the short, medium and long term.

8. References

- Ayton Baesjou Planning 2021. *Proposed Modifications to Frenchman Bay Local Development Plan: Lots 1 & 2 Frenchman Bay Road*. Albany.
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- MRA 2015. *Scarborough Beach Pool CHRMAP*, R698 Rev 0. Prepared for Christou, Perth.
- MRA 2017. *Scarborough Redevelopment CHRMAP*, R708 Rev 5. Prepared for Metropolitan Redevelopment Authority, Perth.
- MRA 2017. *Vancouver Beach Resort CHRMAP*, R835 Rev 1. Prepared for Dr Cherry Martin, Perth.
- MRA 2018. *South West Storm Selection*, R1004 Rev 0. Prepared for the Department of Transport, Perth.
- MRA 2020. *Surfing WA HQ CHRMAP*, R1390 Rev 0. Prepared for Surfing WA, Perth.
- MRA 2022. *Frenchman Bay Coastal Hazard Assessment*, R1630 Rev 0. Prepared for the City of Albany, Perth.
- WAPC, 2013. *Statement of Planning Policy No. 2.6 – State Coastal Planning Policy*. Western Australian State Government, Perth.
- WAPC 2019. *Coastal Hazard Risk Management and Adaptation Planning Guidelines*. Government of Western Australia, Perth.

9. Appendices

Appendix A Stage One Site Plan (HPG)

Appendix B Coastal Erosion Hazard Lines – SK1961-01D

Appendix A Stage One Site Plan (HPG)

BUILDING TYPES	FOOT PRINT	NO. OF UNITS
1. LODGE	300m ²	1
2. GARAGE	80m ²	1
3. ALFRESCO	80m ²	1
4. GREAT ROOM	200m ²	1
5. 2 STORY PODS	30m ²	6
6. BBR	200m ²	2
7. SHED	200m ²	1
8. GLAMPING TENTS	26m ² / Roof 68m ²	6
9. REFUGE	120m ²	1

NO. OF PEOPLE 48
 NO. OF BEDS 24
 NO. OF PARKING BAYS 34

Note Parking:
 90° Parking bay dimensions w 2600 x L 5400
 60° Parking bay dimensions w 2600 x L 6000
 45° Parking bay dimensions w 2600 x L 6000
 Parallel Parking bay dimensions w 2400 x L 6600

- BUILDINGS
- DECK
- WATER TANKS No. 2x RC140 3xRC80 TOTAL 831,430Lt
- FIRE WATER TANKS No. 1x RC80 1xRC20 TOTAL 144,474Lt
- WALK PATHS
- ROADS
- Vancouver springs setback
- Vancouver springs 100m area
- 2061 Coastal Erosion hazard line
- 75m Horizontal setback datum
- Single story development setback
- Lot Boundary realignment
- Refuge area
- BAL 29 Contour



STAGE ONE SITE PLAN
 1 : 1000

Rev	Description	Date

CODE	SUITABILITY DESCRIPTION

STATUS	PURPOSE OF ISSUE

PROJECT
 1823 FRENCHMAN BAY ROAD,
 FRENCHMANS BAY

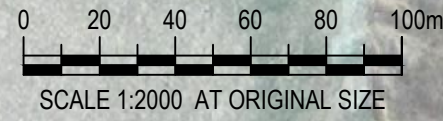
TITLE
 DEVELOPMENT SITE PLAN STAGE
 1

CLIENT
 HUB PROPERTY GROUP

DRAWN BY TYSON HARRIS	CHECKED BY PAUL KING	DATE 24.11.2023
SCALE (@ A1) 1 : 1000		PROJECT NUMBER Project Number
DRAWING NUMBER A100		REV DA Submission

Appendix B Coastal Erosion Hazard Lines – SK1961-01D

AT CORRECT SCALE THIS IS 100 mm



LEGEND:

- PRESENT DAY (2021)
- 2041
- 2061
- 2081
- 2101
- 2121

NOTES:

1. SURVEY PROVIDED BY HUB PROPERTY COMPLETED BY DEVELOPED PROPERTY IN AUGUST 2023. THE LEVELS AND CONTOURS REFLECTS THE SURFACE AT THE TIME OF SURVEY ONLY.
2. SITE PLAN PROVIDED BY HUB PROPERTY GROUP ON 24 NOVEMBER 2023.
3. HORIZONTAL DATUM IS MAP GRID OF AUSTRALIA IN 1994 ZONE 50. VERTICAL DATUM IS AUSTRALIAN HEIGHT DATUM (AHD).
4. AERIAL PHOTOGRAPH PROVIDED BY HUB PROPERTY GROUP TAKEN IN AUGUST 2023.

FRENCHMAN BAY BEACH

FRENCHMAN BAY ROAD

WHALING STATION ROAD

AT CORRECT SCALE THIS IS 100 mm

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