Newport Surf Life Saving Club Alterations & Additions DA2021/2173

Review of Coastal Processes & Potential Impacts

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Abbreviations

Abbreviation	Description
AHD	Australian Height Datum
ARI	Average Recurrence Interval
ASEE	amended Statement of Environmental Effects
DA	Development Application
DP	Deposited Plan
LiDAR	Light Detecting and Ranging
PCT	Plant Community Type
PLEP 2014	Pittwater Local Environmental Plan 2014
SLSC	Surf Life Saving Club
TEC	Threatened Ecological Community
ZSA	Zone of Slope Adjustment

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1 Introduction

This document has been prepared by Rhelm on behalf of Northern Beaches Council (hereafter 'Council') to support the Amended Statement of Environmental Effects (ASEE) prepared for the Newport Surf Life Saving Club (SLSC) Alterations and Additions Development Application (DA; DA2021/2173). The key elements of the proposed development discussed in this report include:

- Alterations and additions to the SLSC building as shown in the Architectural Plans prepared by Adriano Pupilli Architects, dated 14 June 2022; and
- Coastal Protection Works Drawings prepared by James Taylor and Associates, dated 24 August 2021.

This *Coastal Summary Report* provides a review of the coastal processes affecting the subject site, which comprises the following lots:

- 394 Barrenjoey Road, Newport (Lot 1 in DP1139445);
- 394 Barrenjoey Road, Newport (Lot 7094 in DP 1059297);
- 394A Barrenjoey Road, Newport (Lot 24 of Section 6 in DP6248); and
- Barrenjoey Road, Newport (Lot 7039 in DP1050730).

It discusses the potential impacts of the proposal on coastal processes / hazards and vice versa.

It summarises the coastal engineering analyses undertaken in support of the DA and responds to the Determination and Statement of Reasons issued by the Sydney North Planning Panel (SNPP) in their refusal of the DA.

The report is structured as follows:

- **Section 2 Methodology** – details the approach to preparing this report and literature reviewed;
- **Section 3 Review of Coastal Processes** – summarises the key coastal processes / hazards affecting the subject site, provides a review of the literature on the impact of seawalls and identifies the potential impacts of the proposal;
- **Section 4 Conclusions** – details the key findings of this review; and
- **Section 5 References** – lists the references used in this report.

2 Methodology

Rhelm undertook a review of the publicly available relevant reports, including those submitted with the DA2021/2173, in order to summarise the key coastal hazards affecting the subject site. The reports reviewed included:

- Worley Parsons (2015) *Pittwater Coastal Hazard Definition and Climate Change Vulnerability Study*;
- Horton Coastal Engineering [HCE] (2018) *Initial Coastal Engineering Advice on Newport SLSC Redevelopment (Draft)*;
- HCE (2020) *Assessment of Options for Redevelopment of Newport SLSC, with Updated Consideration of Risk from Coastal Erosion/Recession*;
- HCE (2021a) *Coastal Engineering and Flooding Advice for Newport SLSC Clubhouse Redevelopment*;
- HCE (2021b) *Coastal Engineering Report and Statement of Environmental Effects for Buried Coastal Protection Works at Newport SLSC*;
- HCE (2022a) *Response to Sydney North Planning Panel on Items Raised in Deferral Letter dated 26 September 2022 in Relation to Newport SLSC (PPSSNH-301 – DA2021/2173)* (including Attachments 1 and 2);
- HCE (2022b) *Second Response to Sydney North Planning Panel on Items Raised in Deferral Letter dated 26 September 2022 in Relation to Newport SLSC (PPSSNH-301 – DA2021/2173)*;
- WRL (2021a) *DRAFT Newport SLSC coastal hazard peer review*; and
- WRL (2021b) *Newport SLSC coastal engineering advice*.

In addition, a literature review was undertaken to provide context for the potential impacts of seawalls on beach access, use and recreational amenity. The following literature was reviewed:

- Pittwater Council (2005) *Pittwater's Ocean Beaches Plan of Management*; and
- MHL-WRL (2021) *Wamberal Terminal Coastal Protection Assessment Stage 2 – Coastal Protection Amenity Assessment*.

The data collation and literature review outcomes were then synthesised to summarise the potential impacts of the proposal, any mitigation measures required (including those recommended in the coastal engineering reports) and respond to Statement of Reasons in the Determination Report prepared by the Sydney North Planning Panel dated 5 October 2022.

3 Review of Coastal Processes

3.1 Overview

Historical context

Newport Beach is located in the Sydney Northern Beaches coastal sediment compartment, which extends from Barrenjoey Head to North Head. Newport Beach faces east and is moderately protected from waves from the south by the presence of Newport Reef (refer **Figure 3-12**), which is a sandstone reef that runs due east of the beach (WorleyParsons, 2015).

Newport Beach and the SLSC have previously been impacted by an intense East Coast Low of May-June 1974. The 25-26 May 1974 storm event co-occurred with spring tides, with a maximum storm surge of 0.59m as measured at Fort Denison, and maximum water level of 1.48m AHD (Kulmar and Nalty, 1997; cited WorleyParsons, 2015). Horton (2021a) summarises historical information on damage associated with the event, which included undermining of the promenade in front of the SLSC building, with a three to four metre erosion scarp. Waves and debris entered the building, causing internal damage to the gear room, power boat shed, and board and ski shed, and a large amount of sand filled the SLSC building. However, there did not appear to be any damage to the building structure. Following the storm, rocks were placed in front of the SLSC to protect the building.

Following the storm, emergency works in the form of rock protection works were placed in front of the SLSC to protect the building. These emergency works remain in place seaward of the SLSC building and are covered in sand most of the time. While the works successfully protected the SLSC from being undermined at the time, Horton (2021a) notes that it does not appear to be an engineered structure. The rocks were placed with no filter layers or underlayers under the primary sandstone armour and it has an overly high toe level. The rocks placed between the larger boulders on the primary outer layer are significantly undersized, and the primary armour units themselves have a diameter of about one metre, which is undersized for the hydraulic stability during a severe coastal storm (Horton, 2021a).

Description of the proposed development

The proposed works are shown in **Figure 3-1**, where:

- The buried secant piles are shown in black and the concrete steps and capping beams in non-stepped areas shown in red;
- The Norfolk Pine tree protection zones are shown in a dashed green line and the structural root zone is shown in a solid green line;
- The seaward extent of the existing rock structure is shown in light blue;
- The present day sone of slope adjustment is shown in yellow; and
- The layout of the SLSC club is shown in dark blue, noting existing and altered portions.

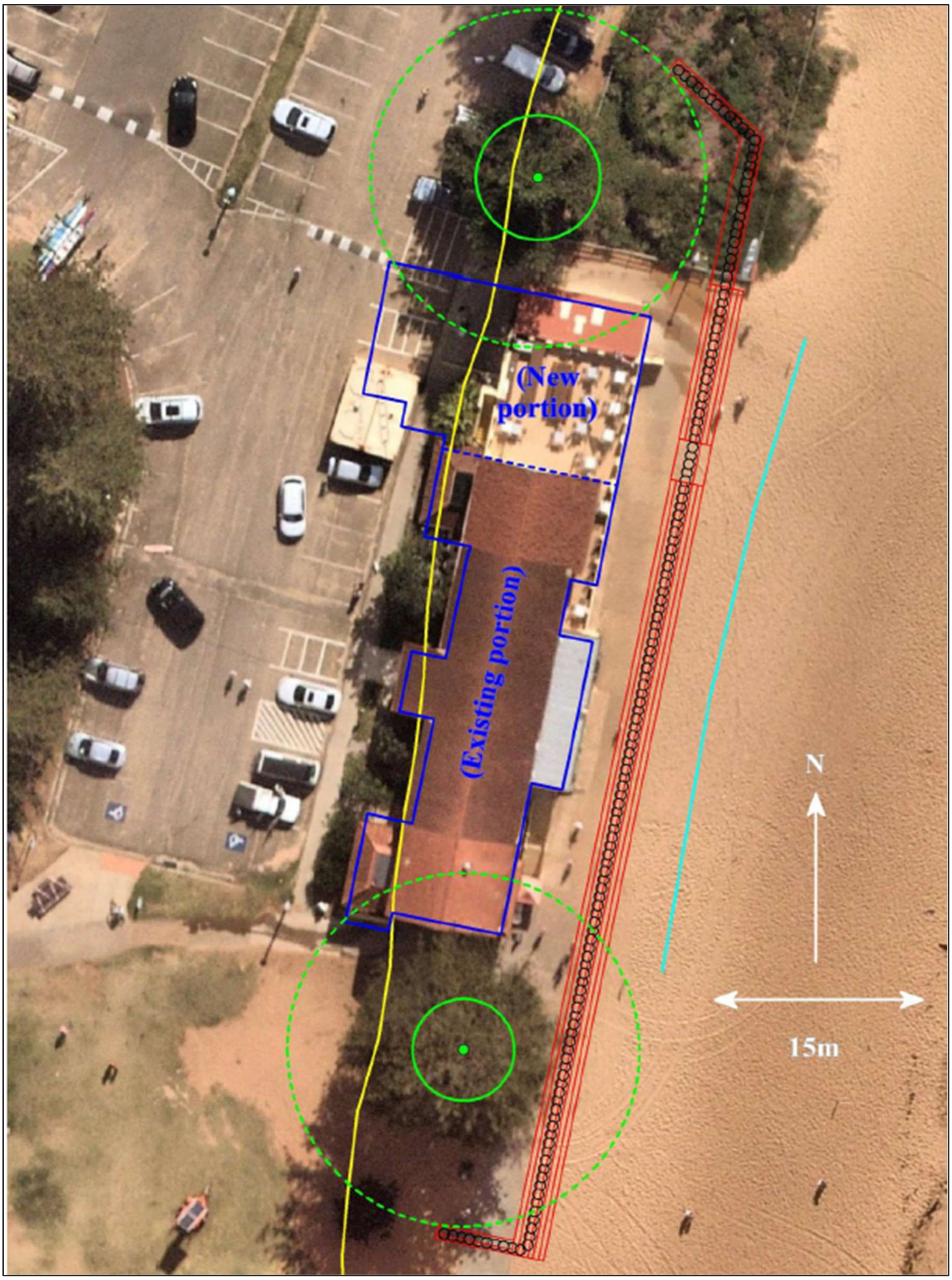


Figure 3-1 Layout of proposed seawall and SLSC building alterations (source: Horton, 2021b)

Design development

The design of the proposal has been developed to a concept level of detail and in accordance with the relevant standards, as is standard engineering practice for DAs. The design of the coastal protection works, the proposed seawall, has been developed in accordance with the relevant design standards and consistent with best practice coastal engineering desktop techniques and approaches to risk management.

The analyses reported in HCE (2021b), WRL (2021b) and other coastal engineering reports have enabled quantification of key design parameters for the proposed seawall and enabled identification of the potential impacts of the proposal on coastal processes, the coastal environment, and public safety, access and amenity to satisfy the provisions of the *Coastal Management Act 2016* and *State Environmental Planning Policy (Resilience and Hazards) 2021*. The proposal been developed to a level of detail sufficient to enable the consent authority to be satisfied that the coastal engineering aspects of the proposal have been adequately and appropriately addressed for purposes of a DA.

Following approval of the DA by the consent authority, detailed design development would be undertaken to refine the proposed SLSC alterations and additions and proposed seawall. This is likely to involve both numerical and physical modelling of the proposal to further refine (if required) key design inputs such as wave transformation, wave run-up and overtopping, wave forces and edge effects. As is standard engineering practice, design refinements would be made to mitigate in so far as is reasonable and feasible the potential impacts of coastal hazards on the proposed development (e.g. size and form of the wave return). Similarly, detailed design refinements would consider mitigation of the potential impacts on the coastal environment and public safety, access and beach amenity.

Any residual risk would be managed via the implementation of operational measures recommended in the coastal engineering reports and summarised herein. The operational phase measures to reduce the risk from overtopping hazard would likely include measures similar to those adopted for the Fairy Bower promenade and would include development of a Wave Overtopping Early Warning System to trigger implementation of measures to prevent public access to affected locations adjacent to the SLSC building, thereby reducing the consequences.

The consent authority can be satisfied that the level of risk from coastal hazards/processes has been, and will be, appropriately mitigated for the proposed development.

Key construction activities

The proposed seawall would be located generally landward of the existing rock revetment, as close to the SLSC building as is feasible. Where it meets the required engineering specifications, rock from the existing rock structure would be re-used for purposes of additional armouring of the toe of the proposed seawall. All other rock from the existing structure would be removed during the construction of the new seawall. Where appropriate and feasible from an engineering perspective, some of the rock boulders would be placed at the toe of the proposed seawall for additional protection.

Figure 3-2 shows is an excerpt from the Coastal Protection Works Plans and shows the proposed rock storage area and temporary bund that would be constructed to protect the site from wave activity during construction. The works area would be fenced to prevent access by members of the public for safety reasons.

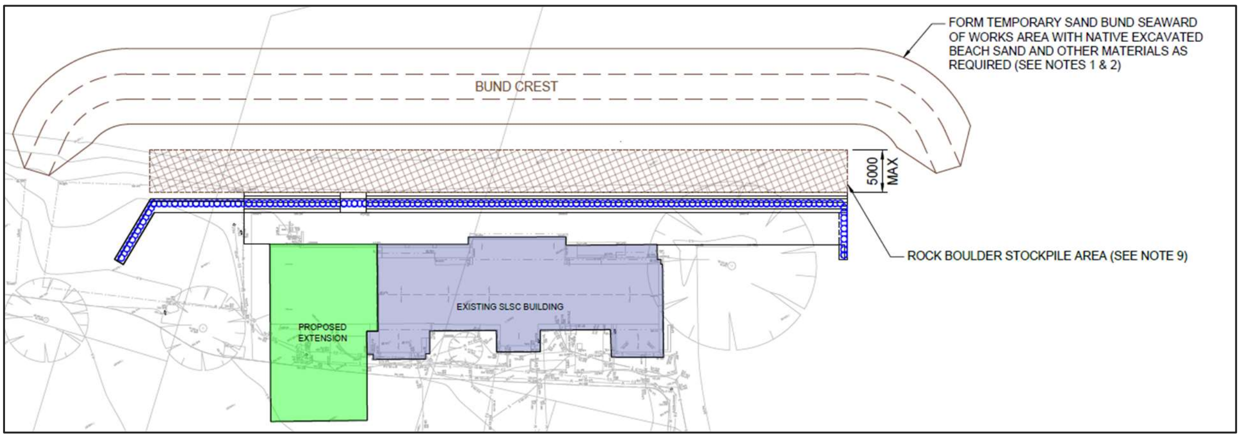


Figure 3-2 Temporary works (source: Coastal Protection Works Plan Drawing No. S05)

The duration of construction of the seawall would be around 8-12 months, including provision for adverse weather impacts on construction scheduling. Where possible, the construction would be programmed to occur over the winter months where beach use by members of the public and members of the SLSC is less intensive. There would be a need for the temporary relocation of SLSC facilities to a precinct within the car park with appropriate beach access for operation of the services and functions of the Club. SLSC activities and operations on the beach could be relocated further northward during construction. Public access to the beach would be maintained and there are several beach accessways available for this purpose. A Public Access and Amenity Plan would be prepared to manage these construction phase impacts.

3.2 Levels for Existing Infrastructure

HCE (2018) provides a summary of available site survey data as follows:

- **SLSC Building Surrounds** - The level of the Newport SLSC building is around 5.4m Australian Height Datum (AHD) at its seaward edge, increasing to around 5.5m AHD at the face of the SLSC;
- **SLSC Building Ground Floor** (existing) is 5.7m AHD;
- **SLSC Building First Floor** (existing) is 9m AHD;
- **Beach Carpark** - Landward of the SLSC, the top kerb of the car park varies from 6.0m AHD in the north to 5.1m AHD in the south, reducing further to 3.5m AHD about 90m south of the SLSC near the beach accessway.

3.3 Current Hazard Extents

Coastal hazards are defined in section 4 (1) of the *Coastal Management Act 2016* as:

a) beach erosion

b) shoreline recession

c) coastal lake or watercourse entrance instability

d) coastal inundation

e) coastal cliff or slope instability

f) tidal inundation

g) erosion and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters.

All of the hazards listed above affect the beach in the vicinity of the SLSC, with the exception of coastal cliff or slope instability and coastal lake or watercourse entrance instability.

The hazard extents presented by HCE (2021a and b) are derived from the analyses undertaken for the *Pittwater Coastal Hazard Definition and Vulnerability Study* (WorleyParsons, 2015). They are reproduced in **Figure 3-3**. The hazard extents presented in the study are generally considered relatively conservative. The hazard lines were derived adopting a 100 year ARI design storm event as the design event and sea level rise projections of 0.3m by 2050 and 0.8m by 2100 relative to the year 2015 (WorleyParsons, 2015). A wave transformation study that that took account of the reefs to the south of Newport Beach. It is noted that, where seawalls are known to exist, the hazard lines were not adjusted and were calculated on the assumption the dune comprises unconsolidated sand (WorleyParsons, 2015). Hence, the hazards lines for Newport Beach do not take into account the presence of the rock revetment put in place in 1974.

Figure 3-4 is a conceptualisation that explains how beach erosion and shoreline recession due to sea level rise are incorporated for purposes of deriving the hazard extents.

Referring to the hazard lines derived for Newport Beach (**Figure 3-3**), the present day hazard lines show that the existing SLSC building, dunes and part of the carpark are located within the wave run-up (*coastal inundation hazard*) and zone of slope adjustment or ZSA (*beach erosion hazard and shoreline recession hazard*). The dune system, carpark and children's playground are all located within the coastal hazard extents in the future planning horizons.

It is noted that, if the proposed seawall were in place, the hazard lines could be re-evaluated and it likely that the wave run-up and ZSA lines for both the present day and future planning horizons would be located further seaward of their current location.

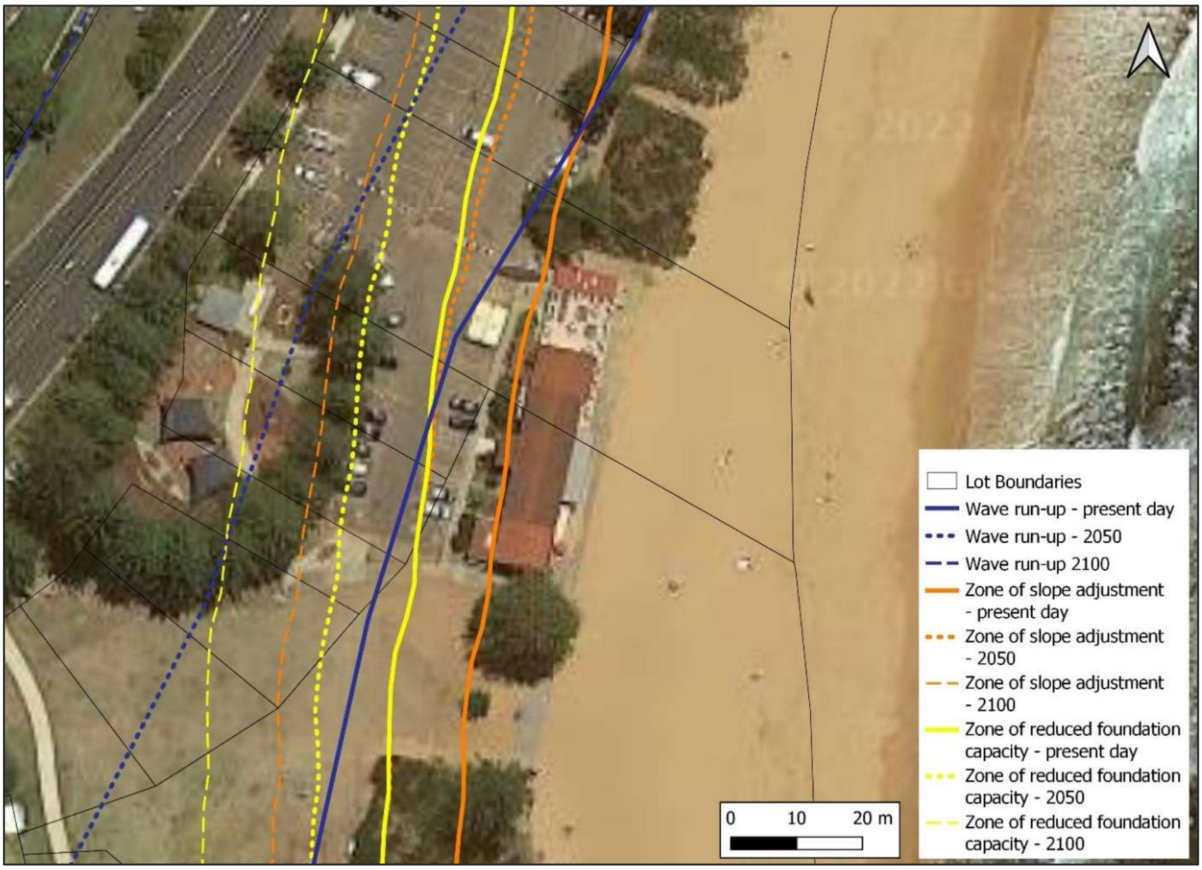


Figure 3-3 Hazard Lines (after: WorleyParsons, 2015), aerial imagery: Google Satellite, 12/3/2018

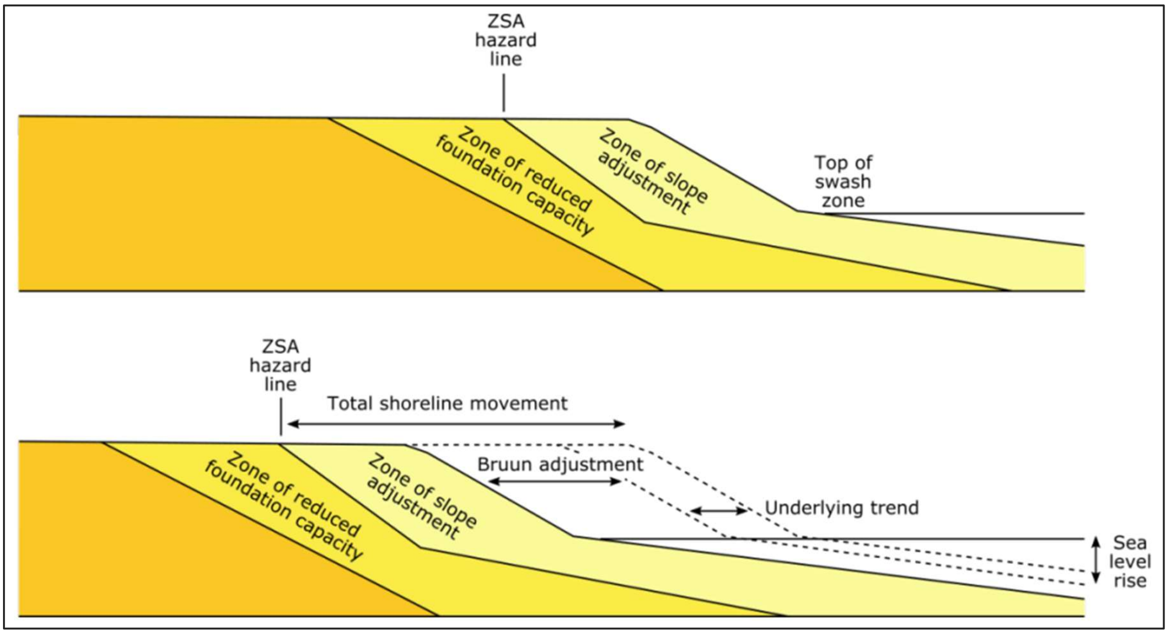


Figure 3-4 Conceptualisation of derivation of beach erosion and shoreline recession hazard lines for the present day (top) and future planning horizon (bottom) (source: BVSC, 2017; modified from Nielsen et al., 1992)

3.4 Coastal Engineering Assessment

This sub-section summarises the analyses undertaken to inform the project coastal engineering and impact assessment.

3.4.1 Adopted Design Parameters and Analytical Methods

The key design parameters adopted for the coastal engineering design and methods of analyses for the quantification of coastal hazards undertaken by HCE and WRL for the DA are summarised in **Table 3-1**.

Table 3-1 Adopted Design Parameters and Analytical Methods

Parameter	Adopted Design Input	Reference
Design life of structure	60 year design life for the seawall	HCE (2021b) and WRL (2021a)
Design Average Recurrence Interval (ARI)	Considered 100, 500, 1000 and 2000 year ARIs	WRL (2021b)
Extreme water levels	100 year ARI design still water level of 1.44m AHD	HCE (2021b)
	As per Table 3 of WRL (2021b) for the full range of design events.	
Extreme offshore wave heights	100 year ARI significant wave height of 8.7m Wave period of 13s Sea level rise as appropriate for planning period	HCE (2021b)
Wave transformation to shore	Assumes waves coming from south to south-east.	HCE (2021a)
	Suggest numerical and/or physical modelling of wave transformation at the detailed design stage to confirm adopted values.	WRL (2021a)
Observed ('baseline') shoreline recession	0m/year - no detectable recession trend based on analysis of available photogrammetric and LiDAR data from 1941-2021, zero sediment loss (excl. that caused by sea level rise)	HCE (2021b) and WRL (2021b)
Sea level rise	0.26m for 2050, 0.44m for 2080	HCE (2021b) and WRL (2021b)
Shoreline recession under sea level rise conditions	7m by 2050, 13.6m by 2080	HCE (2021b)
Design scour level at the seawall	-1 to -2m AHD	HCE (2021b)
	As per Table 6 of WRL (2021b) for the full range of design events, ranging from: • 1.6m to -0.1m AHD for the 100 year and 2000 year ARI storms in the present day; and • 0.5m to -0.7m AHD for the 100 year and 2000 year ARI storms in 2080.	
Wave run-up & overtopping	Estimated using empirical methods and compared to observed debris lines from the 1986 storm.	WRL (2021b)
Wave forces	Numerical modelling with EurOtop and physical modelling recommended for detailed design.	
Seawall end effects	Estimated using empirical methods.	WRL (2021b)

3.4.2 Beach Erosion

For purposes of understanding the variability in beach volume in front of the SLSC, HCE (2020) plotted the available historical beach profile data, reproduced here in **Figure 3-5**. The proposed seawall has been superimposed on the graph for context. The façade of the SLSC building is located at 0m chainage, and the current footpath in front of the building is around 6m wide.

It is apparent that the beach volume and profile fluctuates over time. The 1974 profile captures the highly eroded state of the beach following a series of sequential, major storm events, whereas the 2011 profile shows a more accreted beach. Examining the profiles presented in **Figure 3-5,** the level of the beach immediately in front of the SLSC has ranged from around 5.3m to 5.9m AHD, noting that this level may be limited by the ad hoc rock protection placed in front of the SLSC in 1974.)

The location of the top of the 1974 rock revetment is also shown in **Figure 3-5**, labelled TP5-TP8, dervied from test pits undertaken by JKGeotechnics (2021). The existing rock revetment appears to extend from around 5m to around 12m from the SLSC.

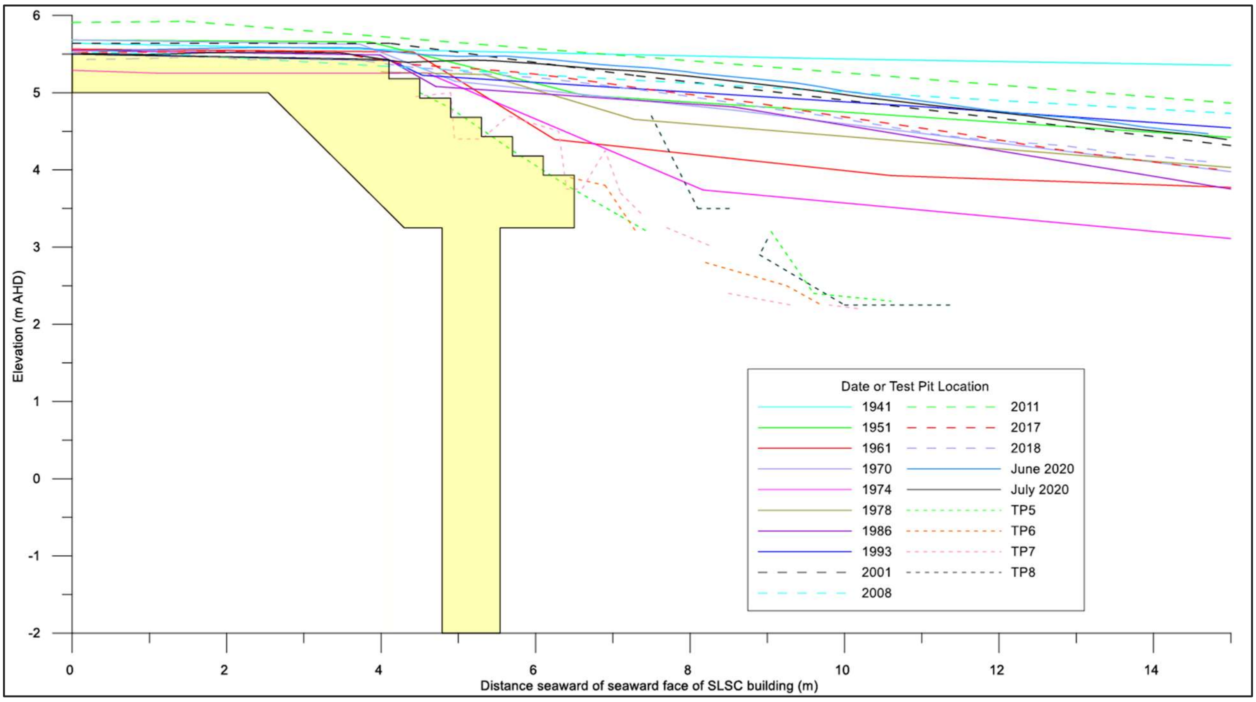


Figure 3-5 Historical beach profile data at Newport SLSC from 1941 to 2020, including top surface of rock boulders placed in 1974, shown relative to proposed seawall (source: HCE, 2020)

WRL (2021b) present the results of SBEACH modelling to predict scour levels at the subject site, both with and without the seawall that forms part of the proposal. 33The modelling was undertaken for the full range of design events to estimate scour levels for the present day and in future planning horizons incorporating sea level rise and shoreline recession.

The estimates are presented in **Figure 3-6**. In the figure, the y-axis corresponds to the façade of the SLSC. The SBEACH modelling estimates scour levels in front of the proposed seawall between -0.5m AHD and -1.0m AHD, which was considered generally consistent with observed historical scour levels during severe storms (WRL, 2021b).

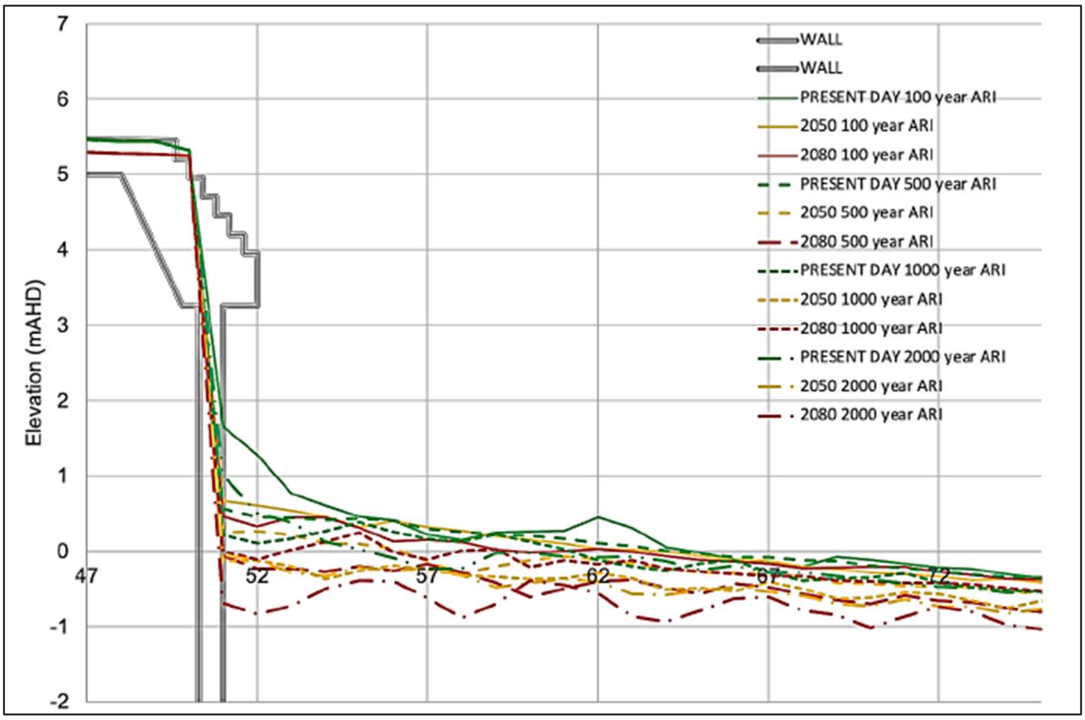


Figure 3-6 Envelope of beach profiles for a range of design storm events storms in SBEACH with the proposed seawall (source: WRL, 2021b)

3.4.3 Wave Run-up and Overtopping

Estimates of wave run-up and overtopping of the proposed seawall were prepared by WRL (2021b) using empirical methods (i.e. desktop calculations). The analyses assumed the crest level of the seawall would be 5.5m AHD and considered two scenarios:

- An average or accreted beach profile; and
- A highly eroded beach profile.

For an average or accreted beach, the wave run-up levels exceed the proposed crest level of 5.5m AHD with potential for overtopping to occur during storm events of 100 year ARI or greater (WRL, 2021b). Using different methods, present day wave run-up levels in a 100 year design event are estimated at 6.11m AHD and 6.71m AHD, with a discharge of around 1.4 to 5.1 L/s/m. In 2080 under climate change conditions, the wave run-up estimates increase to 6.55m AHD to 7.15m AHD, with an overtopping discharge of around 7.3 to 23.4 L/s/m (WRL, 2021b).

When the beach is in an eroded state, the cantilever of the stairs on the proposed seawall effectively acts as a return wall and this will reduce overtopping uprush for lower water levels (WRL, 2021b). Under an eroded state and assuming a vertical seawall with a return wall, the overtopping discharge is estimated for the 100 year storm at 0.38 L/s/m in the present day and 13.31 L/s/m in 2080. For context, discharges of 0.1 L/s/m are considered tolerable for pedestrians and discharges of 1-10 L/s/m are considered tolerable for trained personnel (EurOtop, 2007; cited WRL, 2021b). The tolerable limit for damage to a paved promenade behind a seawall is 200 L/s/m.

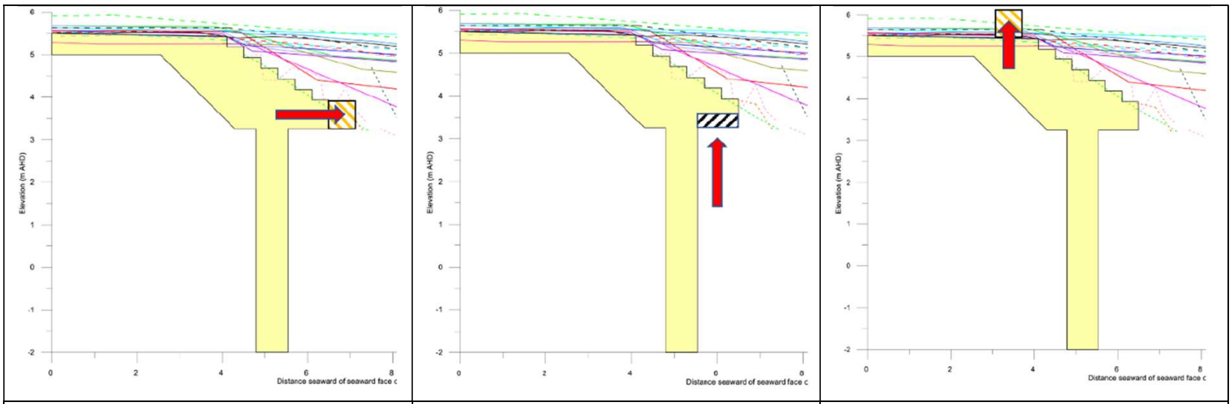
Where the risk from overtopping or wave forces are considered unacceptably high, there are a range of methods to reduce overtopping, as discussed in HCE (2020 and 2021b) and WRL (2021b). Horton Coastal Engineering has proposed several measures to mitigate overtopping risk to members of the public and the SLSC building in the *Coastal Engineering Report* (HCE, 2021b) and the *Coastal Engineering and Flooding Advice* report (HCE, 2021a). These include:

- Installation of staggered solid seating along the promenade to reduce wave forces and inundation depths (as shown in the photo montages);
- Consideration of the stairs during detailed design to act as a wave return, such as by raising the wave return wall or having a wider wave return wall;
- Appropriate structural engineering design of the new elements of the SLSC to withstand the anticipated wave forces;
- Careful consideration of the internal fit out of the ground floor with respect to the design wave run-up level (e.g. location of electrical sockets, wiring and etc.); and
- Operational procedures for implementation during an event (e.g. placement of temporary barriers).

The process which these risk mitigation measures would be investigated and adopted through the detailed design and operational phases of the proposed development are discussed in **Section 3.1**.

Options for the management of overtopping are provided in **Figure 3-7**. The third option at the bottom of **Figure 3-7** is that intended for the construction proposed by HCE (2021b) and shown in the amended plans prepared by Adriano Pupilli Architects (refer Drawing No. 013), reproduced here in **Figure 3-8.**

The effectiveness of a wave return in mitigating wave overtopping as demonstrated by physical modelling for a proposed seawall at Kingscliff is shown in **Figure 3-9**.



Extend projection of return wall	Raise level of return wall	Add return wall on crest

Figure 3-7 Options for reducing wave overtopping (after: WRL, 2021b)

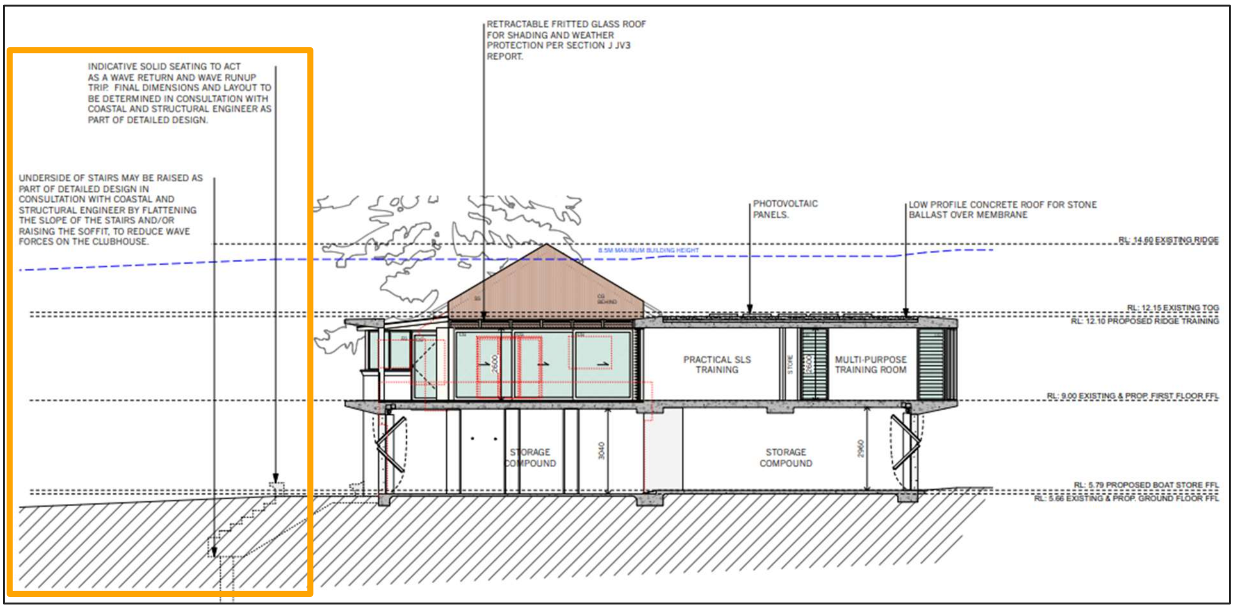


Figure 3-8 Proposed wave return wall and other potential design measures to mitigate wave overtopping hazard, refer text and images outlined in orange (source: design plans prepared by Adriano Pupilli Architects, dated 14/6/2022, refer Drawing No. 013)


Stepped concrete seawall – 6mAHD crest with wave return wall during 10 year ARI event, present day

Stepped concrete seawall – 5.45m AHD crest with no wave return wall during 500 year ARI event, present day

Figure 3-9 Physical modelling of wave overtopping of a stepped seawall with and without a wave return wall (source: Modra et al., 2016)

Further, it is noted that the majority of the ground floor areas that would be subject to wave overtopping and wave forces are non-habitable storage areas. Given they are not habitable areas and noting the possibility of securing these areas and making sure no people are present at the time of an event, it is considered that the consequences of wave overtopping for members of the public and public property could be appropriately managed with standard risk mitigation measures (i.e. similar to those adopted for properties in flood prone areas subject to overfloor flooding), as detailed in **Section 3.1**.

As reported in HCE (2021a) the Newport SLSC has previously been impacted by beach erosion and wave run-up and overtopping during a severe coastal storm in May 1974. The proposed seawall would mitigate the erosion risk to the SLSC building and by incorporating a wave return structure, reduce the impact of wave run-up and overtopping during a storm, thereby reducing the existing level of impact of coastal storms on the heritage building. The process by which the detailed design and operational phase of the proposed development would manage the risk of coastal hazards to members of the public is detailed in **Section 3.1** of this report.

3.4.4 Shoreline Recession and End Effects

Measured historical long term shoreline recession rates reported in the *Coastline Hazard Definition and Climate Change Vulnerability Study* (WorleyParsons, 2015) are -0.15m/year and +0.37m/year for the north and south of Newport Beach, respectively. Based on this finding, Horton (2021b) and WRL (2021b) assumed no background trend of shoreline recession at the site (i.e. without sea level rise, the shoreline would not recede).

However, shoreline recession is projected to occur under projected sea level rise. Projected long term recession of Newport Beach due to sea level rise alone was calculated by WorleyParsons (2015) at 11.7m and 28.9m relative to an increase in mean sea level of 0.3m and 0.8m respectively. Horton (2021b) applied the Bruun Rule to derive projected long term recession for the design life of the proposed seawall (2080), adopting a projected sea level rise of 0.44m, estimated at 13.6m.

If the historical profiles are translated shoreward to account for this projected shoreline recession, they can be mapped in relation to the proposed seawall to consider the potential impacts of the proposal on beach amenity. Horton (2021b) prepared a figure, reproduced here as **Figure 3-10**, to show that the proposed seawall is expected to remain largely buried even under future shoreline recession due to sea level rise at the end of the design life. The steps could provide beach access most of the time and it is expected that, even with projected long term recession due to sea level rise, that the average beach width at the end of the design life would be roughly 50-60m (HCE, 2021b).

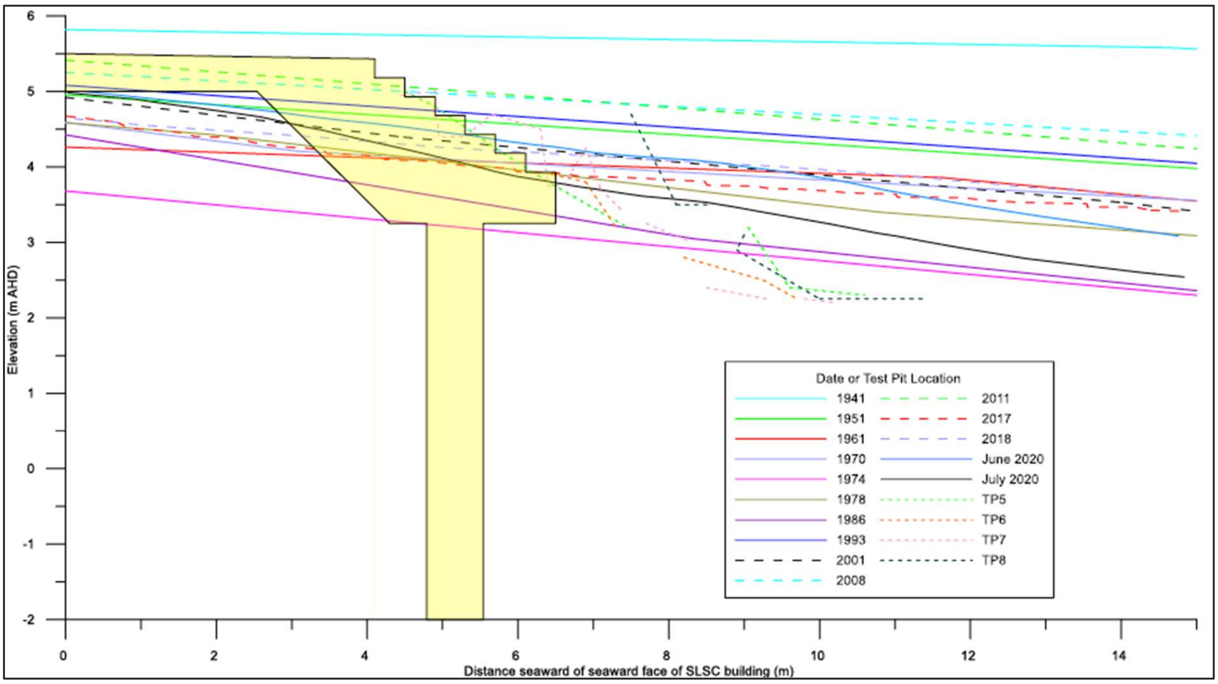


Figure 3-10 Historical shoreline profiles and proposed seawall as per Figure 3-3, with profiles translated shoreward to account for long term recession due to sea level rise over the design life (source: HCE, 2021b)

It is noted, however, that the proposed seawall would prevent shoreline recession under sea level rise conditions, although there is potential for end effects to occur, whereby the land immediately adjacent to the ends of the seawall is subject to increased erosion due to the presence of a coastal protection structure.

WRL (2021b) provided a desktop estimate of seawall end effects for the 100 year ARI design storm for the three planning horizons and assuming a seawall crest length of 85m. They found no significant seawall end effect in the present day up to the 100 year ARI event as there is sufficient sand buffer in front of the seawall. However, in future an end effect may occur due to the reduction of beach volume in front of the seawall due to sea level rise (WRL, 2021b).

The impact of the estimated end effects on the erosion hazard lines is shown in **Figure 3-11**. It may be possible to reduce these end effects by reducing the overall length of the seawall crest (WRL, 2021b).

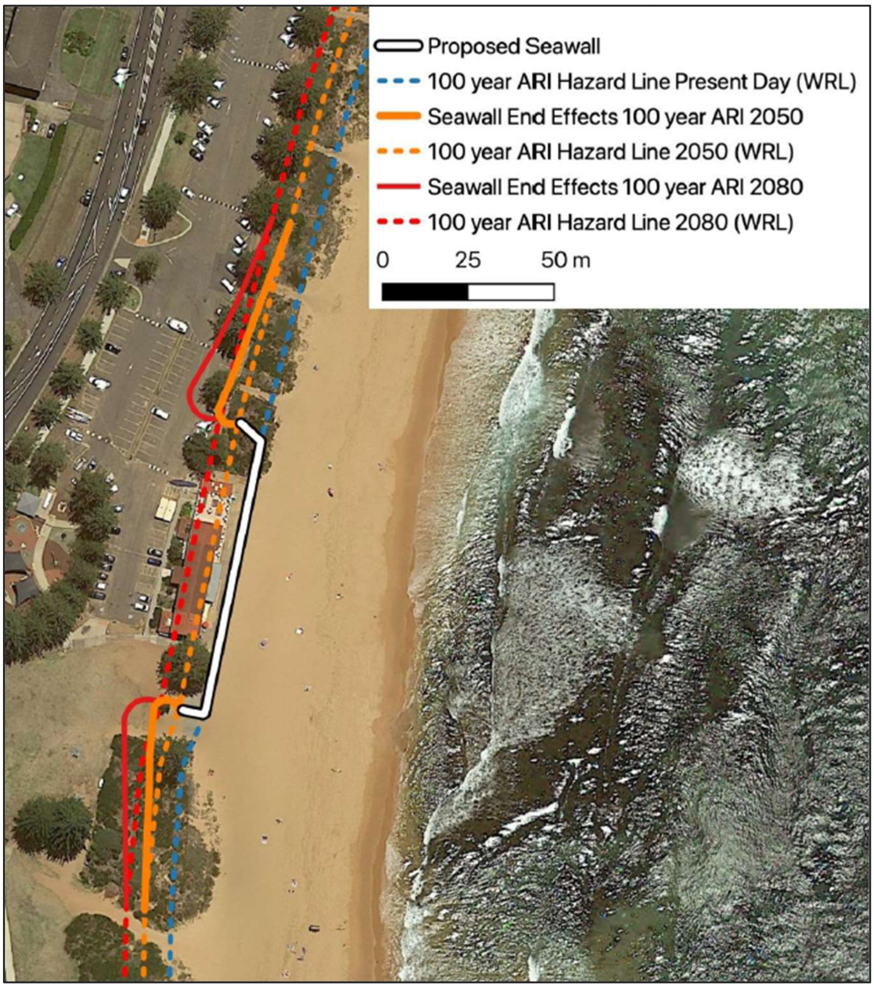


Figure 3-11 Theoretical seawall end effect for 100 year ARI conditions (source: WRL, 2021b)

3.5 Potential Impacts of the Proposal

This section provides a discussion on the potential impacts of the proposal on coastal values, with reference to the publicly available published literature.

3.5.1 Public Open Space and Public Access To and Along the Beach

Construction phase impacts on public access

There are currently over ten publicly accessible beach accessways spaced along the length of Newport Beach (**Figure 3-12**). As discussed in **Section 3.1**, the works area for the seawall construction would be fenced off for safety reasons. This would preclude public access from the car park via the two or three of the accessway adjacent to the SLSC; however, there are a number of alternative accessways that could be used. It may also preclude public access along the shoreline under high tide conditions or following an erosion event. Alternative pedestrian access would be provided via the car park at these times. This impact on alongshore access would be similar to that observed following an erosion event under existing conditions.

The SLSC would operate out of a temporary facility during the works to the building. During the works to construct the seawall, the SLSC operations could be moved northwards along the beach. The specific location to which the operations would be relocated would be determined based on conditions at the time. As is apparent in **Figure 3-12**, there is ample room on the beach for relocation of SLSC operations.

Construction phase impacts would be managed in accordance with a Public Access and Amenity Plan.

Figure 3-12 Public accessways to Newport Beach

Beach width during the operational phase

The subject site is located within the Coastal Use coastal management area under the *State Environmental Planning Policy (Resilience and Hazards) 2021.*

One of the key concerns typically raised by beach users in relation to seawalls is the potential for seawall construction to result in net loss of beach width. The width (and volume) of the beach is a key factor governing access along the beach and for a range of different recreational activities. The literature review on beach amenity width presented in MHL-WRL (2021) identified the following important themes:

- Generally, people prefer wider beaches compared to narrow beaches, but not too wide;
- Sufficient beach width is desirable for purposes of walking along the shoreline or sitting or lying on the beach without getting wet or coming into contact with waves;

- Sufficient beach width is also important for sporting or other recreational activities. In the case of Newport Beach, this would include surf life saving activities;
- There is a seasonal aspect to beach amenity width, with smaller numbers of beach users in winter. At these times a lesser beach width may be acceptable, provided there is provision for alongshore access, whether along the beach or an adjacent path;
- Beach safety and the potential exposure of structures can also be an issue when the beach is in an eroded state. This is an issue at the subject site due to the presence of the rocks placed in front of the Newport SLSC following the 1974 storms; and
- The ability of a beach to resist erosion events (and therefore maintain a suitable level of amenity) is better correlated to beach volume.

Of particular interest is an analysis of the impact of different coastal protection options on beach width undertaken for the *Wamberal Terminal Coastal Protection Assessment* by MHL-WRL (2021). For that study the authors adopted a minimum dry beach width of 5m between the seawall and the wave run-up limit, a width that would provide for some storm erosion but without being too wide for beach users, noting that the beach would be far wider than this during most tide and wave conditions. In the base case, and adopting the 2% wave run-up level, the existing beach had a width less than 5m around 1.4% of the 10 year period analysed, or on average 5.1 days per year. When the analysis was re-run for the vertical and tiered vertical seawall options with a more landward alignment, the amount of time the beach width failed to meet the required minimum of 5m decreased to 0.2% and 1.1% of the 10 year period (or 0.7 and 4 days respectively) (MHL-WRL, 2021). In this case the presence of the seawall is predicted to have a net neutral or even a small positive impact on beach amenity width. There would be fewer occasions where the beach would be less than 5m width.

The proposal for Newport Beach SLSC incorporates a vertical seawall with steps, which would be similar to the vertical and tiered vertical seawall options discussed above. It is reasonable to assume a similar level of impact on beach amenity width would occur at Newport Beach. Hence it is considered likely that the impact of the proposal on beach amenity width would be minor. Further, the provision of a high amenity seawall that incorporates seating and stairs would be an improvement over the existing condition and would provide improved access to an eroded beach over the existing condition.

Another key consideration raised in the *Coastal Protection Amenity Assessment* report (MHL-WRL, 2021) is that the interaction of seawalls with coastal processes (and therefore the level of impact on the beach) is highly dependent on their position within the active profile. A schematic of the active profile is provided in **Figure 3-13**.

Where a seawall is located further landward within the active zone of the beach profile it locks away a smaller amount of the total beach volume and is less frequently exposed to wave activity. The more seaward the structure is located, the larger the volume of sand locked up by the seawall and the more frequent the exposure to waves. Hence, a seawall will have a lower level of impact on beach access and amenity the further landward it is located within the active beach zone.

Where a seawall is located further landward within the active zone of the beach profile it locks away a smaller amount of the total beach volume and is less frequently exposed to wave activity. The more seaward the structure is located, the larger the volume of sand locked up by the seawall and the more frequent the exposure to waves. Hence, a seawall will have a lower level of impact on beach access and amenity the further landward it is located within the active beach zone.

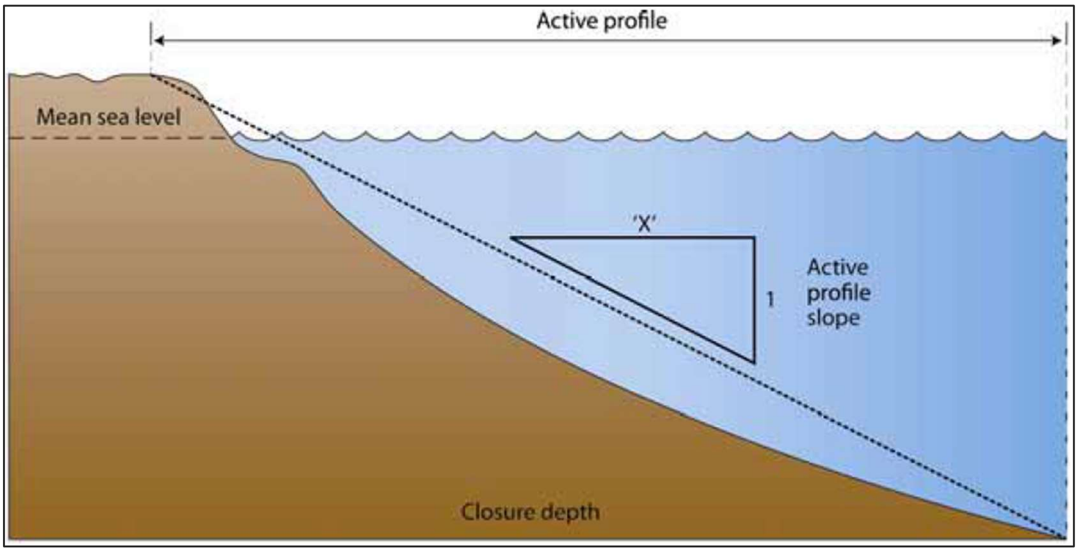


Figure 3-13 Idealised schematic of the active profile (source: DECCW, 2010)

HCE (2020) reports the results of an analysis of the average width of Newport Beach as measured from the SLSC to the shoreline at Mean Sea Level (0m AHD) is 67m. However, a review of aerial imagery of Newport Beach sourced from Nearmap shows that the width of the beach is highly variable and generally recovers relatively quickly following even a large storm event, noting that additional corrections for tide can be made. The images provided in

Tt is noted that the dunes are located seaward of the zone of slope adjustment hazard lines (refer **Figure 3-3**) and would be impacted by coastal storm events even if the seawall were not there. While the vegetation stabilises the dune and minimises the risk of erosion during a storm, there is a risk that over time the integrity of these dune systems would be impacted and some areas of the dune would be lost, noting landward migration won't be possible due to the presence of built infrastructure. Similarly, parts of the adjacent public open space and beach accessways also fall within the 100 year ARI hazard lines and would also be impacted, irrespective of the presence of the proposed seawall.

show the rate of beach recovery following a major East Coast Low storm event over 4-6 June 2016.

The proposed seawall would extend up to 5m from the façade of the SLSC building and be located in the landward portion of the active beach zone. For context, in the first post-storm image in

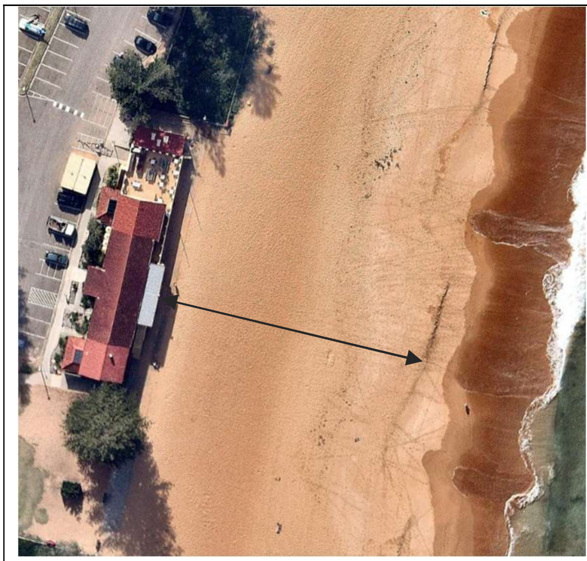
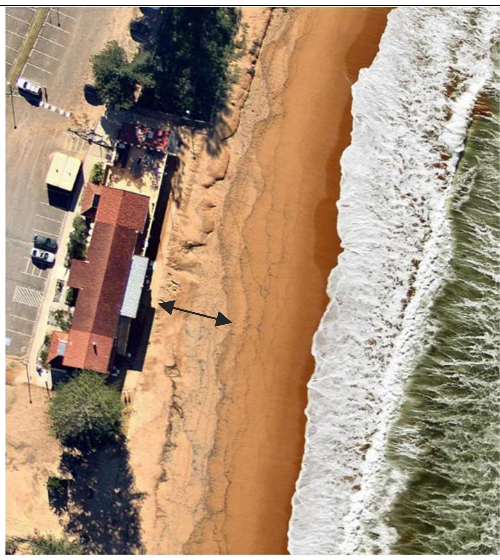
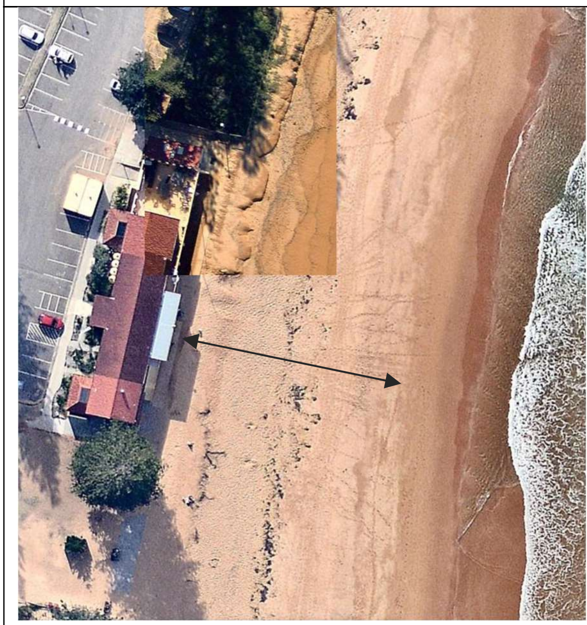
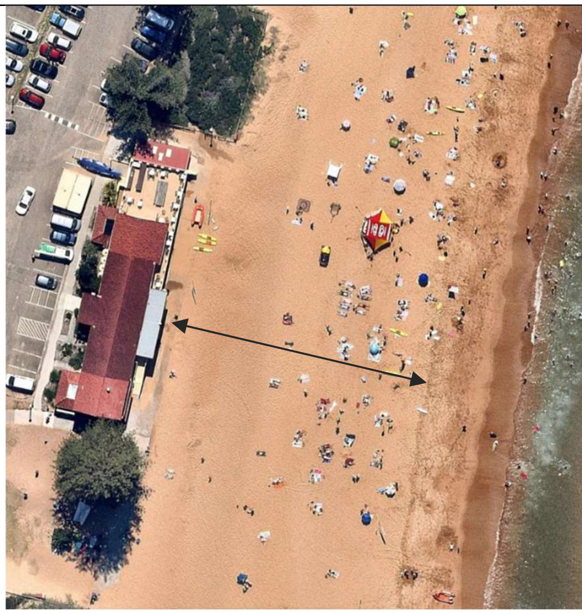
Tt is noted that the dunes are located seaward of the zone of slope adjustment hazard lines (refer **Figure 3-3**) and would be impacted by coastal storm events even if the seawall were not there. While the vegetation stabilises the dune and minimises the risk of erosion during a storm, there is a risk that over time the integrity of these dune systems would be impacted and some areas of the dune would be lost, noting landward migration won't be possible due to the presence of built infrastructure. Similarly, parts of the adjacent public open space and beach accessways also fall within the 100 year ARI hazard lines and would also be impacted, irrespective of the presence of the proposed seawall.

, the toe of the dune is around 6-7m from the façade and slightly seaward of the dune fencing. The authors of the *Coastal Protection Amenity Assessment* report prepared for Wamberal Beach (MHL-WRL, 2021) note that the available literature suggests that when the seawall is located in the landward portion of the active beach area, scour in front of the seawall is typically temporary, occurring only during large storms. With the return to mild wave conditions, the beach in front of the seawall recovers naturally, such that the seawall is fronted by sandy beach. This was demonstrated in a study of ten years of data for several beaches with seawalls in the Northern Beaches Local Government Area (but excluding Newport Beach) - despite the exposure of the rock protection located on Collaroy-Narrabeen Beach following storm activity, the beach consistently recovered to pre-storm width (greater than 20m) at a rate of 0.07 to 0.14 m/day (Phillips, 2018; cited MHL-WRL, 2021).

The bulk of the recovery in beach width and volume occurs in the first months after the storm event and continues gradually thereafter, albeit at a slower rate (provided there are no further erosion events). Given the position of the proposed seawall in the landward portion of the active beach zone, it is expected that the rate of recovery following a storm event would be similar following construction of the proposed seawall. It is expected that the structure would be buried most of the time, and if sufficient recovery has not occurred within six months of the event, Council would accelerate beach recovery by reinstating the affected land (HCE, 2020). A condition of consent has been proposed in Table 7-2 of the ASEE to give effect to this commitment.

It is understood that the rocks placed on the beach in 1974 occasionally become slightly exposed or lie just below the surface of the sand, presenting a hazard to beach users. Further, as they are significantly undersized, they are also at risk of mobilisation during a severe storm. The removal and/or re-use of the existing rock structure from the beach would mitigate this risk to beach users and the environment.

Table 3-2 Beach recovery after the July 2016 storm (source: Nearmap) – note: not corrected for tide/waves

	
Pre-Storm - 6 May 2016 – Length of line 48m.	Post-storm - 8 June 2016 – length of line 12.8m.
	
4 July 2016 – length of line 38m.	2 October 2016 – length of line 43.5m.

'End effects' impacts on adjacent public open space and dune system

Another potential issue associated with seawalls is flanking erosion (or 'end effects'). End effects arise when the seawall is located in the active beach zone and erosion occurs at either end of the seawall to compensate for the sand locked behind the seawall. As discussed in **Section 3.4.4**, analyses undertaken by WRL (2021b) indicate that end effects are not likely to be an issue in the present day. Over time, however, sea level rise and shoreline recession would result in the seawall being located further into the active beach zone. It is therefore reasonable to assume that the proposed seawall may at some time in future gradually start to cause flanking erosion and the analyses in **Section 3.4.4** indicate this is likely to be the case. If this were to occur following a storm event, it would negatively impact the dune systems to the north and south, and the public reserve to the south of the SLSC. Ideally the seawall would be located further landward to minimise this impact, however this is not possible due to the location of the SLSC building. As discussed in **Section 3.1**,the detailed design of the seawall would consider seawall returns that minimise end effects. Adopting also the proposed condition of consent relating to reinstatement of areas affected if natural beach recovery is not sufficient, the potential impacts can be appropriately managed such they do not adversely affect beach access or amenity, or the coastal environment.

Tt is noted that the dunes are located seaward of the zone of slope adjustment hazard lines (refer **Figure 3-3**) and would be impacted by coastal storm events even if the seawall were not there. While the vegetation stabilises the dune and minimises the risk of erosion during a storm, there is a risk that over time the integrity of these dune systems would be impacted and some areas of the dune would be lost, noting landward migration won't be possible due to the presence of built infrastructure. Similarly, parts of the adjacent public open space and beach accessways also fall within the 100 year ARI hazard lines and would also be impacted, irrespective of the presence of the proposed seawall.

3.5.2 Use of the Surf Zone

The impacts of seawalls on surfing amenity was considered by the authors of the *Coastal Protection Amenity Assessment* report prepared for Wamberal Beach (MHL-WRL, 2021), who developed a list of all known seawalls located on the open coast of south-east Queensland and NSW, along with some international examples. Of the 91 surfing beaches comprising the list of beaches with seawalls, only six are known to experience reduced beach amenity due to narrow beach width for alongshore access and use of the beach for surf life saving. Of the beaches considered, there were no known reports of seawall impacts on surfing amenity, with the exception of some locations where narrow beach widths and wave activity makes getting into and out of the water challenging from time to time.

Based on that review, it is considered that the proposed seawall at Newport Beach SLSC will not adversely impact on the use of the surf zone.

3.5.3 Coastal Environmental Values

The subject site is located in the Coastal environmental area coastal management area under the *State Environmental Planning Policy (Resilience and Hazards) 2021.* It has been largely cleared of native vegetation and has been developed as landscaped public open space. The Sydney Metro Area V3.1 2016 E-VIS 4489 vegetation mapping indicates the adjacent due vegetation is PCT 772 Coast Banksia – Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion. There are no Threatened Ecological Communities associated with this PCT. A small area of dune vegetation would be removed for the construction of the proposed seawall (HCE, 2021b). The dune and dune vegetation would be reinstated following the completion of the works.

No aquatic vegetation would be removed for the proposal. There would be no direct impacts to the marine environment.

The dominant natural habitat at the site is the sandy beach and adjacent coastal waters**3.4.2**. These coastal habitats are subject to high rates of natural variation and significant changes to habitats can occur over short and long timeframes in relation to cycles of erosion and accretion, wave activity and coastal storms. As discussed above in **Sections 3.4.2** and **3.4.3**, these naturally occurring coastal processes are not expected to be significantly modified by the proposal.

In the longer term, there is potential for the proposal to impact the dune system to the north and south of the seawall due to edge effects (refer **Figure 3-11**). Should the dunes be impacted during a coastal storm due to edge effects from the proposed seawall, they would be reinstated in accordance with the proposed condition of consent detailed in Table 7-2 of the ASEE. It is noted that these dunes are located within the future zone of slope adjustment mapped by WorleyParsons (2015; refer **Figure 3-3**) and would likely be subject to impact from coastal processes in future irrespective of the proposed seawall.

In addition, the proposed seawall extends further to the south to provide protection for the Norfolk Pine located south of the SLSC building, which would otherwise be vulnerable to undermining due to coastal erosion.

3.5.4 Overshadowing, Wind Funnelling and Views

Overshadowing

The existing SLSC building is located west of the beach, with any additional overshadowing of the foreshore limited to the afternoon. The additional overshadowing is attributable the First Floor Lounge and Terrace, which extends higher than the existing uncovered outdoor first floor terrace in this location.

The application is accompanied by Shadow Diagrams by Adriano Pupilli Architects that compare the current level of overshadowing to that resulting from the proposed development during midwinter, when the extent of overshadowing is at its greatest. In consideration of the size of the beach and the available sandy foreshore, the extent of additional overshadowing arising from the proposed development is considered to be reasonably described as minor.

The proposed seawall would be buried for the majority of the time and will not result in unreasonable overshadowing of the beach.

Wind Funnelling

The proposed development is generally maintained within the existing footprint of the building, with the proposed additions limited to the north-western corner. The proposed additions are unlikely to result in any changes to existing conditions with regard to wind funnelling.

Views

The application is accompanied by Visual Impact Analysis Report by Don Fox Planning which confirms that the proposed development will not result in any adverse impacts upon views to/from the beach. It is noted that any potential impact upon views was also considered by Council and the SNPP in the determination of DA2021/2173, and no concerns were raised in this regard.

3.5.5 Visual Amenity and Scenic Qualities

The site is not located within Scenic Protection Area under the provisions of Pittwater Local Environment Plan 2014 (PLEP 2014). Nonetheless, the existing building is visible from multiple vantage points within the immediate vicinity of the site and is visually prominent as seen from the adjoining beachfront and reserve.

The proposed design solution carefully balances the composition of the building to ensure that the new additions do not dominate the existing building and that the heritage significance of the existing building is retained and preserved. As stated in the accompanying Statement of Heritage Impact by Heritage21 (2022b), the proposed extension employs modern, clearly identifiable materials and a muted colour palette that is sympathetic to the heritage item and presents a sympathetic and compatible integration of new and heritage fabric.

The visual impact of the proposed development was also considered in the Visual Impact Analysis Report by Don Fox Planning that accompanies the application, which confirms that the proposed development will not result in any adverse visual impacts upon the surrounding natural environment.

The views from within the building are identified as being of exceptional significance in the accompanying *Conservation Management Plan* by Heritage21 (2022a). The proposed additions have been designed to celebrate these views, enhancing the visual amenity experienced by people within the building.

The proposed seawall is to be buried beneath the sand most of the time and will not be readily visible from the foreshore.

However, the seawall may become exposed in extreme erosion events and would remain visible until the sand in front of the building is replenished. As discussed in **Section 3.5.1**, the beach recovery is relatively rapid, and the seawall would not remain fully exposed for long. The application is supported by photomontages demonstrating the visibility of the seawall at different degrees of exposure.

The wall has been designed to present as a series of steps in the foreground of the existing building and will not result in any unreasonable or adverse impacts upon the visual amenity of the foreshore.

3.5.6 Aboriginal Cultural Heritage

A search of the Aboriginal Heritage Information Management System conducted on 18 November did not identify any listed sites of Aboriginal cultural heritage significance within the subject site or nearby. The site has been subject to a high degree of historic disturbance due to coastal processes (e.g. the depth of scour from the 1974 storm) and for the construction of existing built infrastructure (i.e. the SLSC, walkways, rock protection works). While there remains the potential to encounter previously unidentified archaeological material, it is unlikely.

It is acknowledged, however, that the site is likely to hold significance to the Gai-Mariagal people, the Traditional Custodians of the land on which the proposal is located. Newport Beach would have provided access to resources such as fish and shellfish in the beach and adjacent rock platforms, as well as coastal plants collected for food or for medicinal reasons.

Given the extensive historical modification of the site, and the fact that the proposal alters an existing building (rather than adding a new building), and also that the seawall would be buried most of the time, it is considered that the proposal would not contribute materially to the current level of impact on any Aboriginal cultural heritage values or significance associated with the site. An Unexpected Finds Protocol would be implemented during construction to ensure appropriate management response, should any suspected archaeological material or relics be uncovered during the works.

3.5.7 Cultural and Built Environmental Heritage

The site has a long history of use by the local community for recreation and enjoyment of the coastal environment. Popular activities include swimming, surfing, sunbaking, walking, exercising and generally enjoying the scenic quality of the coastal environment. The use of the area for these activities is an important contributor to the cultural heritage values of the subject site.

The existing SLSC clubhouse was built in 1933. The Newport SLSC building is identified as an item of local heritage significance, as shown on the Heritage Map of PLEP 2014 and as listed in Schedule 5 of PLEP 2014. The proposed works are located within the curtilage of this heritage site. The *Newport SLSC Conservation Management Plan* (Heritage21, 2022a) states that '*The Newport Surf Life Saving Club established in 1911 has historical, associative, social and aesthetic significance for the Newport Community….The item…indicates social and associative value as its plays a vital role in the development of Newport as a hub for tourism and leisure activities*.' The proposal would provide for the sustainable ongoing use of the SLSC by adapting the requirements of the building to the contemporary needs of the SLSC, including the increased membership and need for specialist equipment. As highlighted in **Sections 3.4.2 and 3.4.4**, the clubhouse is currently vulnerable to beach erosion and the seawall would protect the heritage listed clubhouse, thereby extending its life and providing for the ongoing sustainable use of the building.

The Norfolk Pines that are located to the north and south of the SLSC building, and to the west around the playground also contribute to the cultural heritage of the site. It is noted that the seawall has been designed to protect one of the Norfolk Pines that would otherwise be at risk from undermining due to shoreline erosion over time.

4 Conclusions

Management of risk from coastal hazards

Based on the coastal engineering and investigations undertaken to date, it is considered that the risk to the proposal from coastal hazards can be appropriately managed.

In the operational phase, the residual risk from coastal hazards to members of the public and users of the Newport SLSC can be appropriately managed through adoption of operational and maintenance procedures and practices.

The impacts of the proposal on coastal processes would be minor in the short term, increasing slightly over time due to the impacts of climate change. However, mitigation measures have been proposed to appropriately manage the identified impacts.

Benefits of the proposed development

The key benefits of the proposal relate to the improved amenity and functionality of the SLSC building, which is a public asset of great significance to the community. In addition to the role of the SLSC in providing training and surf life saving services, the SLSC building is also used for other public purposes, with rooms available for hire. It acts as a hub and fosters community cohesion in the local neighbourhood. Another benefit is the preservation and protection from coastal hazards of the heritage significant features of the SLSC while at the same time providing for the sustainable use of the SLSC building and heritage surf culture of the site.

The alternative to proceeding with the proposed development is to 'do nothing' or 'do minimum' (I.e. undertake the SLSC alterations and additions without constructing the seawall). Neither of these options are in the public interest as they would result in the potential loss or damage of a significant community asset and associated essential services following a severe storm event. Further, it is noted that the existing level of risk to members of the public from coastal hazards (e.g. wave overtopping) and associated impacts on beach amenity and access would continue.

Not only is the existing rock structure insufficient to mitigate risks to public safety and assets from coastal hazards, but there is also a potential public safety and environmental risk associated with dislodgement of rocks from the existing structure during a storm and/or exposure of rocks following an erosion event. Should a severe storm damage the existing structure, the adverse impacts to the environment and beach users would be material and would be costly to rectify.

Concluding remarks

On the whole, it is considered that the benefits of the proposed development outweigh the impacts and that the risk from coastal hazards can be appropriately managed through a combination of design and operational and maintenance measures. The consent authority can be satisfied that the proposed development is in the public interest and is supported by the majority of the participants in the community engagement undertaken for the proposal.

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