Horton Coastal Engineering
Coastal & Water Consulting

Assessment of Options for Redevelopment of Newport SLSC, with Updated Consideration of Risk from Coastal Erosion/Recession

Prepared by Horton Coastal Engineering Pty Ltd

for Adriano Pupilli Architects

Issue A

17 February 2020

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Document citation:

Horton Coastal Engineering (2020), *Assessment of Options for Redevelopment of Newport SLSC, with Updated Consideration of Risk from Coastal Erosion/Recession*, Issue A, 17 February

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Document Electronic Reference:

rpJ0153-Newport SLSC Redevelopment-Options Assessment-A.docx

EXECUTIVE SUMMARY

It is proposed to undertake alterations and additions at Newport SLSC. The initial concept for the redevelopment of Newport SLSC retained key heritage aspects of the existing building, while providing a new portion to the north. At that time, it was proposed that the retained and new portions would be placed on conventional foundations (that is, not designed with deep piled foundations to provide support to the building if undermined by coastal erosion/recession), and there was no consideration of constructing coastal protection works (a seawall or revetment) to prevent undermining of the building by coastal erosion/recession.

Since the original concept design, Council staff have recognised the potential risks to the SLSC building from coastal erosion/recession, and requested that additional analysis should be undertaken to inform the decision as to whether the redeveloped SLSC should be founded on piles or have seawall/revetment protection (or neither). A number of investigations have been undertaken, namely:

- a geotechnical investigation to assess the degree of protection the existing rock boulders (currently buried under sand, and placed as emergency protection in 1974) may provide in a coastal storm erosion event, and to assess if there may be any inerodible or less erodible materials in the active coastal zone that could reduce the extent of coastal erosion/recession. It was found that the existing rock revetment is inadequate to be relied upon to provide protection to Newport SLSC from coastal erosion, and the active coastal zone would be expected to be fully erodible and sandy;
- review of photogrammetric data for Newport Beach from 1941 to 2018, to assist with understanding long term beach behaviour and in assessing the potential impacts of seawall/revetment options with reference to typical sand levels seaward of the SLSC. A relative long term stability of Newport Beach was found;
- preliminary risk assessment of the level of risk to the proposed SLSC from coastal erosion/recession if no new protection works are constructed and no SLSC piling is undertaken. It was found that the SLSC was clearly at an unacceptably high risk of damage (unless it is constructed on piles or a seawall/revetment is constructed in order to prevent the erosion occurring), assuming that the clubhouse would be considered of Importance Level 2 or 3 as per the Building Code of Australia;
- assessment of the effect of long term recession due to sea level rise on beach levels, and relative impacts of revetment/seawall options over the long term. It was found that with projected long term recession to 2120, the upper portion of the existing boulders would be regularly exposed, a new revetment would be regularly exposed, and a vertical seawall would typically have the upper 2m of wall exposed (unless regular maintenance through beach scraping was undertaken to maintain higher sand levels);
- additional structural engineering advice, particularly on the feasibility of piling the retained and new portions of the redeveloped SLSC; and
- consultation with key stakeholders.

The following options are being considered for the redevelopment of Newport SLSC, and have been assessed herein:

1. current concept, no piles or seawall/revetment
2. current concept, new portion on piles, no seawall/revetment
3. current concept entirely on piles, no seawall/revetment
4. demolish and rebuild on piles, no seawall/revetment
5. current concept, no piles, with rock revetment protection

6. current concept, no piles, with vertical or hybrid seawall protection
7. demolish and rebuild, no piles, with revetment or seawall protection

Council advised that Newport SLSC was to have a structural design life of 50 years (that is, the material components, such as concrete, would be designed for that life), and a coastal engineering design life of 100 years (that is, the building would need to be designed to not be undermined from coastal erosion/recession over a 100 year life, thus requiring piling or a seawall/revetment for a SLSC at the proposed location). It is considered to be conservative to adopt a coastal engineering design life double that of the structural design life, but it can be noted that Council has adopted a structural design life of 50 years in conjunction with a coastal engineering design life of 100 years for other recent SLSC redevelopment Development Applications (DA's) including Long Reef SLSC and Mona Vale SLSC.

Options 1 and 2 must be dismissed, as these options cannot meet Council's design life requirements, nor typical design life and acceptable risk requirements in industry practice. Furthermore, they only allow heritage to remain until damage from coastal processes occurs (actions of the sea would be expected to ultimately destroy the heritage building).

Options 4 and 7 must be dismissed, as these options do not retain heritage, and assuming it was not desired to attempt the long and difficult process of de-listing the heritage item.

This leaves Options 3, 5 and 6 as potentially feasible, and all these options could achieve the outcome that the clubhouse has an acceptably low risk of being damaged by coastal erosion over an acceptably long life. Additional investigations would be required to determine the cost of Option 3 relative to the other options, but it can be noted that Option 6 would be about $570K more expensive than Option 5. However, Option 6 has an advantage over Option 5 in that it has a lower footprint and more chance of consent. The footprint of a seawall (extent on to the beach) as per Option 6 is about 11.5m less than the revetment as per Option 5.

Option 3 does not require the DA to be submitted to the Sydney North Planning Panel unless the Capital Investment Value of the redevelopment is over $5 million (if any part of a DA includes a seawall/revetment, the consent authority is the Sydney North Planning Panel). Option 3 has some disadvantages compared to Options 5 and 6 (in particular, that for Option 3 access to the clubhouse could be partially lost if it was undermined, and a less desirable heritage outcome).

If Options 5, 6 or 7 (ie, constructing a revetment or seawall) were adopted, it is recommended that the seawall/revetment and clubhouse DA's are separated. If the clubhouse and seawall/revetment DA's are separated, acceptable risk considerations would promote the clubhouse DA having a deferred commencement condition that the consent does not operate until the seawall/revetment is constructed or substantially commenced. This would be to prevent the clubhouse being constructed without a seawall/revetment already being in place.

The requirement that the Sydney North Planning Panel is the consent authority for a seawall/revetment DA would not apply if a Coastal Management Program (CMP) had been certified for an area including Newport SLSC. Council would become the consent authority if a CMP had been certified. If a CMP had been certified, and it was recognised therein that seawall/revetment protection of the SLSC was a valid option, the seawall/revetment works would be expected to qualify for a 50% funding contribution from the NSW government.

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1. INTRODUCTION AND BACKGROUND

It is proposed to undertake alterations and additions at Newport SLSC. Horton Coastal Engineering Pty Ltd has been providing coastal engineering advice on the development, and prepared a report "Initial Coastal Engineering Advice on Newport SLSC Redevelopment" dated 14 August 2018, which has been provided as Attachment A.

The initial concept design for the redevelopment of Newport SLSC, which was completed in June 2018, retained key heritage aspects of the existing building, while providing a new portion to the north (note that the proposed north-south footprint of the clubhouse is the same as the existing clubhouse), as illustrated in Figure 1[1]. At that time, it was proposed that the retained and new portions of the redevelopment would be placed on conventional foundations[2] (that is, not designed with deep piled foundations to provide support to the building if undermined by coastal erosion/recession), and there was no consideration of constructing coastal protection works (a seawall or revetment[3]) to prevent undermining of the building by coastal erosion/recession.

Figure 1: June 2018 concept for redevelopment of Newport SLSC, looking from the west, with retained/renovated portion to south and new portion to north

In the Attachment A report, it was noted that although there are some rock boulders (currently buried under sand, and placed as emergency protection in 1974) seaward of the SLSC building, these could not be relied upon to prevent undermining of the SLSC, particularly over the long term (decades). On this basis, it was concluded that it will either have to be accepted that the SLSC may be substantially damaged in a severe coastal storm (to the extent of having to be completely rebuilt), or upgraded protection works would have to be implemented (eg, a rock revetment or vertical concrete wall), or the SLSC would have to be rebuilt on deep foundation piles (and potentially further landward).

On 16 August 2018, a meeting was held with Council staff (Bernard Koon, Adrian Turnbull, Craig Morrison, Donald Gibson and Daniel Milliken), Adriano Pupilli Architects (Adriano Pupilli, Matthew Ryall) and Horton Coastal Engineering (Peter Horton). At that time, Council staff recognised the potential risks to the SLSC building from coastal erosion/recession, and the

[1] It is recognised that the concept design has changed (based on dialogue between Adriano Pupilli Architects and Council's heritage staff) since June 2018, with the new portion of the clubhouse now extending slightly further west and contracting from the south to preserve existing fabric. These changes are not of significance to the report herein.
[2] Conventional foundations include slab-on-ground, strip footings and shallow piers. Some practitioners distinguish "foundations" from "footings", with the latter being the structural element (such as a pier) and the former being the ground material that this structural element bears upon. "Foundations" is used herein to refer to the structural element.
[3] "Revetment" and "seawall" are sometimes used synonymously, but herein a "revetment" is considered to be a sloping rock boulder structure, while a "seawall" is considered to be a vertical or stepped concrete structure.

potential to mitigate these risks through construction of a seawall or revetment (which also retained the heritage structure over the long term), but were reluctant to commit to that pathway without completing a Coastal Management Program (CMP) for Newport Beach first (with a timeline of several years).

There were numerous discussions between Council staff, Adriano Pupilli Architects, a SLSC representative (Rudi Valla) and Horton Coastal Engineering over the subsequent 7 months. On 15 March 2019, a meeting was held with Council staff (Bernard Koon, Adrian Turnbull, Todd Dickinson, Campbell Pfeiffer, Donald Gibson, and Jacqueline Grove), Rudi Valla, Adriano Pupilli Architects (Adriano Pupilli, Matthew Ryall) and Horton Coastal Engineering (Peter Horton), where it was agreed that the redevelopment project could potentially proceed to a Development Application (DA) without a CMP being in place. In subsequent weeks, it was agreed that this DA process, and decisions regarding whether the SLSC should be piled or have seawall/revetment protection (or neither), should be informed by additional analysis, as set out herein. The scope of this additional analysis is outlined in Section 2.

Note that all levels given herein are to Australian Height Datum (AHD). Zero metres AHD is approximately equal to mean sea level at present.

Cost estimates for revetments/seawalls and other items provided herein are indicative, being based on experience from a number of projects at a range of sites and conditions. The estimates are provided for broad guidance only, and are not guaranteed as Horton Coastal Engineering has no control over contractor’s prices, market forces and competitive bids from tenderers. Any construction cost estimate provided may exclude items which should be considered in a cost plan. Examples of such items are design fees, project management fees, authority approval fees, contractor’s risk, preliminaries and project contingencies (eg to account for construction and site conditions, weather conditions, ground conditions and unknown services). If a reliable cost estimate is required, an appropriately qualified Quantity Surveyor should be engaged and market feedback sought.

2. SCOPE OF REPORT HEREIN

To assist with informing decision making as to whether the Newport SLSC redevelopment DA should be as per the original concept (no piling or seawall/revetment), should have piling of the building to mitigate the coastal erosion/recession risk, or should have seawall/revetment protection, a number of investigations have been undertaken, namely:

- a geotechnical investigation (see Section 4) to determine the nature and extent of the buried rock revetment seaward of the SLSC (to assess the degree of protection it may provide in a coastal storm erosion event), and determine subsurface conditions down to about -5m to -7m AHD (to assess if there may be any inerodible or less erodible materials in the active coastal zone that could reduce the extent of coastal erosion/recession);
- review of photogrammetric data for Newport Beach (historical beach profiles) from 1941 to 2018 (see Section 5), to assist with understanding long term beach behaviour and in assessing the potential impacts of seawall/revetment options with reference to typical sand levels seaward of the SLSC;
- preliminary risk assessment of the level of risk to the proposed SLSC from coastal erosion/recession if no new protection works are constructed and no SLSC piling is undertaken (see Section 6), to assist in informing the viability of this as an option;
- assessment of the effect of long term recession due to sea level rise on beach levels, and relative impacts of revetment/seawall options over the long term (see Section 7), to assist in understanding the environmental acceptability of the revetment/seawall options and potential impacts of long term changes in beach levels on exposure of these works and SLSC operations;
- additional structural engineering advice, particularly on the feasibility of piling the retained and new portions of the redeveloped SLSC (see Section 8), to assist in informing the viability of piling as an option; and
- consultation with key stakeholders, namely Council staff, Adriano Pupilli Architects, SLSC representatives and a heritage consultant (see Section 9), to ascertain key issues of concern to these stakeholders and inform option selection.

The options considered in the assessment are listed in Section 3.

3. OPTIONS CONSIDERED

The following options are being considered for the redevelopment of Newport SLSC, and have been assessed herein:

1. build the entire retained/new SLSC on conventional footings and with no new seawall or revetment as per the current (2018) design, and thus accept that the redeveloped SLSC may be significantly damaged by coastal erosion/recession over its design life;
2. keep the retained SLSC portion on conventional footings, but build the new portion on deep piles, with no new seawall or revetment, and thus accept that the retained portion of the SLSC may be significantly damaged by coastal erosion/recession over its design life (with its damage potentially causing damage to the adjacent new piled portion);
3. build the entire retained/new SLSC on deep piles (which would require temporary bracing of the existing masonry façade over the retained portion), which would reduce the risk of the entire SLSC being damaged if undermined (and thus no new seawall or revetment being required);
4. demolish the entire existing SLSC and rebuild it on deep piles (with re-creation of heritage elements if required), which would reduce the risk of the entire SLSC being damaged if undermined (and thus no new seawall or revetment being required)[4];
5. rebuild the existing rock revetment protection works seaward of the SLSC to current coastal engineering standards, to acceptably reduce the risk to the SLSC development (with the redeveloped SLSC thus constructed on conventional foundations as per the current concept), with an indicative cost for the rock revetment (only) being about $855,000[5];
6. remove the existing rock revetment protection works and construct a lower footprint vertical wall seawall (or hybrid vertical wall with rock toe seawall) seaward of the SLSC, to acceptably reduce the risk to the SLSC development (with the redeveloped SLSC thus constructed on conventional foundations as per the current concept), with an indicative cost for the seawall (only) being about $1,425,000[6]; or
7. as per Option 5 or 6 (ie, constructing a revetment or seawall), with an Option 4 SLSC building design (demolish and rebuild), but on conventional foundations.

These options are assessed in Section 10, after discussion in Section 4 to Section 9 on the various investigations that have been undertaken in recent months to inform option selection. To provide further background on these options:

- with piling (Option 2 for the new portion, and Options 3 and 4 for the entire clubhouse), this reduces the risk of damage to the clubhouse if it is undermined (ie, the clubhouse is supported above the erosion), but it does not prevent the surrounding land from eroding. Therefore, access to the clubhouse could be partially lost after a severe storm for Options 2-4, until sand levels are restored.
- the cost of Option 5 would need to be assessed to determine its cost relative to other options;
- it is the opinion of the author that consent would be more difficult for Option 5 than Option 6, due to the larger footprint of Option 5 (see Section 7);

[4] The extent of piling for this option could potentially be reduced if the clubhouse was also relocated landward. However, this has not been considered as an option herein as it would cause loss of car parking and parkland, and visual and physical connectivity to the water would be diminished (in addition to the impacts of Option 4 on heritage).
[5] Based on a 47m alongshore extent for the clubhouse to be protected, plus an additional 5m extent of the revetment on each side to reduce the risk of outflanking (that is, 57m total length at a cost of $15,000/m).
[6] Based on a 47m alongshore extent for the clubhouse to be protected, plus an additional 5m extent of the seawall on each side to reduce the risk of outflanking (that is, 57m total length at a cost of $25,000/m).

- for Option 6, it would be possible to provide some steps and ramps as part of the seawall to enable public (and SLSC operations) beach access when sand levels lower due to storm erosion. For Option 5, such access at low sand levels would have to be over the rock revetment, which can potentially be unsafe depending on the degree of interlocking of the boulders. For both Option 5 and Option 6 (and Option 7), natural recovery of sand levels could be accelerated by beach scraping (that is, mechanically transferring sand from the intertidal zone to the upper beach near the SLSC, usually with bulldozers or front-end loaders.);
- for the protection works options (Options 5, 6 and 7), it is considered that the impact of the works on the surrounding beach would not be significant, and that no significant built assets would be adversely impacted by the works (except for a potentially greater risk of undermining in the car park to the north due to an additional erosion end effect, which is not considered to be a significant issue). Any protection works at the SLSC would have no impact whatsoever on the houses at the southern end of Newport Beach, which are at least 200m south of the Club.

4. GEOTECHNICAL INVESTIGATION

JK Geotechnics completed borehole drilling, excavation of test pits and Dynamic Cone Penetrometer (DCP) testing near Newport SLSC on 7 August 2019. Preliminary factual results from the investigation are provided in Attachment B.

Boreholes were drilled immediately south and north of the SLSC near its western edge, and on the beach about 15m to 20m seaward of the SLSC. The subsurface was generally found to be sandy down to about:

- -2.5m to -5.1m AHD on the seaward side of the SLSC at BH3 and BH4 (loose to medium dense sand down to -1.2m to -1.7m AHD, then clayey sand or silty sand down to -2.5m to -2.7m AHD, and then medium dense sand at the northern borehole [BH4] down to -5.1m AHD); and
- -0.2m to -2.7m AHD on the landward side of the SLSC at BH1 and BH2 (loose to medium dense sand down to -0.2m to -1.2m AHD, then clayey sand at the northern borehole [BH2] down to -2.7m AHD).

Below the sand:

- stiff to very stiff silty sandy clay was found at BH1 from -0.2m to -3.2m AHD, with clayey sand below this down to -4.7m AHD, then silty sandy clay and clayey sand down to -6.2m AHD, and stiff to very stiff silty clay down to -6.8m AHD;
- very stiff silty clay was found at BH2 from -2.7m to -4.0m AHD, with clayey sand below this down to -6.4m AHD; and
- very stiff silty sandy clay was found at BH3 from -2.5m to -3.9m AHD, with loose sand below this down to -4.9m AHD.

It can thus be concluded that in the active coastal zone (where erosion occurs above about -1m AHD), the natural subsurface seaward of the SLSC would be expected to be fully erodible and sandy, with no constraint on erosion due to stiff clays or bedrock. Discussion on the effect of the existing rock revetment on erosion potential is provided below.

The test pits (TP) and DCP tests revealed that the existing rock revetment may only comprise a single layer of boulders, has many undersized boulders, is poorly interlocked, and has an inadequately high toe level. The potential for only a single layer of boulders being present was evident with various DCP test penetrating without obstruction between the upper layer of boulders (namely DCP5-A, 6-A, 6-B, 6-C, 7-C, 7-D, 7-E, 8-B, and 8-F). This is consistent with Figure 2 in Attachment A, where only a single layer of boulders appears to be present. Undersized boulders (including cobbles) were evident in the test pits, and this is consistent with the undersized material visible in Figure 3 of Attachment A to the left and right of the people. Poor interlocking of the boulders was evident with the many gaps found between the boulders, as per the penetrating DCP tests noted above. The toe of the revetment appeared to be at about 1.8m AHD at TP5, 2m AHD at TP6, 1.8m AHD at TP7, and 1.8m AHD at TP8. An outline of the top surface of the revetment from the test pits, relative to historical beach profiles, is provided in Figure 4.

It can thus be concluded that the existing rock revetment is inadequate to be relied upon to provide protection to Newport SLSC from coastal erosion. An allowance for a 10% reduction in the erosion that would extend landward of the revetment (if it was not present) due to the revetment is considered to be the best estimate, with a plausible range of 5% to 15%.

The borehole investigations of JK Geotechnics also indicated that there would not be any significant obstructions or impediment to piling if Options 2, 3 or 4 were considered.

Note also that JK Geotechnics has completed preliminary acid sulfate soil (ASS) screening for the Newport SLSC site, as provided in Attachment C. They found that actual ASS or potential ASS conditions were not present in the investigation area (to a depth of 12.0m) and are not likely to be disturbed during the proposed development works. Therefore, an ASS management plan was not considered necessary for the proposed development.

5. REVIEW OF PHOTOGRAMMETRIC DATA

The NSW Government has recorded historical beach profiles at Newport Beach, derived from photogrammetric analysis of aerial photography (or directly from LiDAR[7] data collection in recent years) for 13 dates from 1941 to 2018 inclusive. From review of the NSW Beach Profile Database, there is photogrammetric profile at Newport SLSC, with other profiles covering the length of Newport Beach at a 50m alongshore spacing (see Figure 2).
A plot of the historical beach profiles at Newport SLSC (that is, at the red profile in Figure 2) is provided in Figure 3. A zoomed view of the historical profiles is provided in Figure 4, along with the location of the top surface of the existing revetment from the JK Geotechnics test pits.

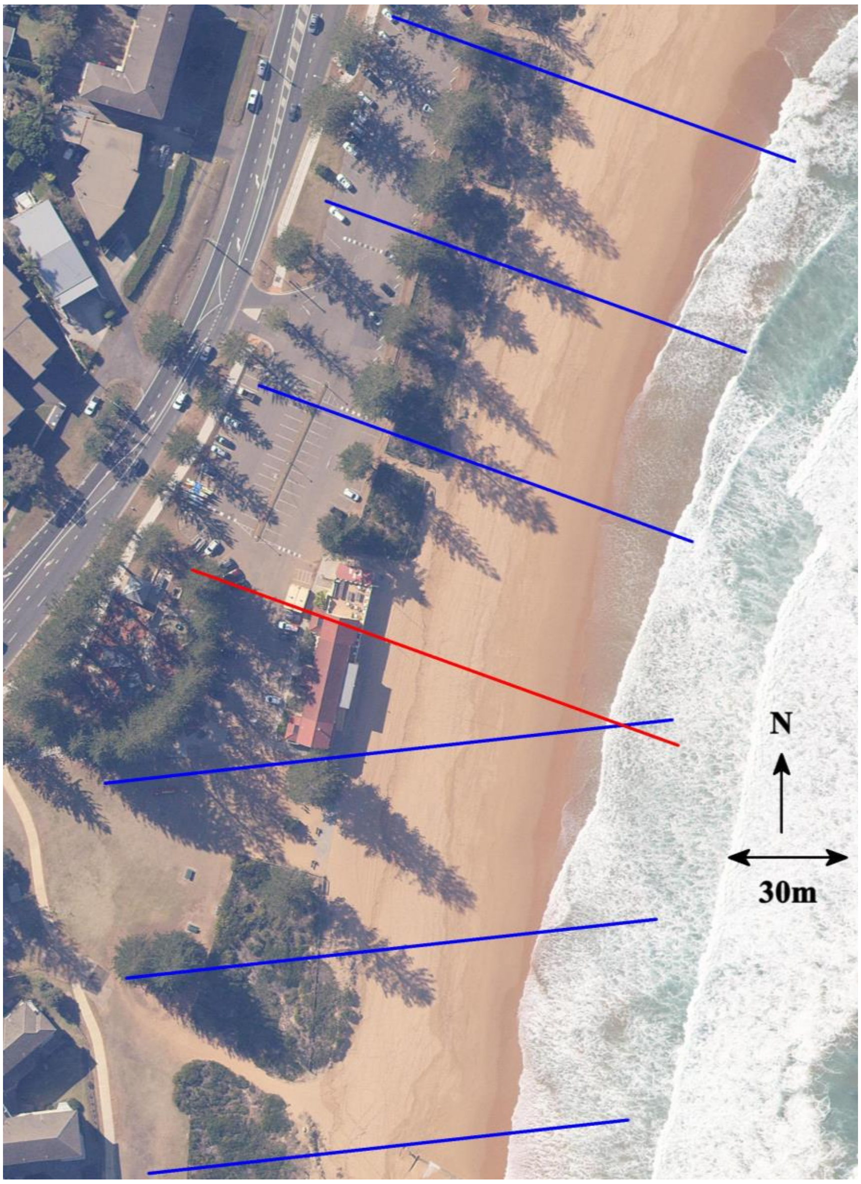

Figure 2: Location of photogrammetric profile at Newport SLSC (red) and other photogrammetric profiles (blue) at Newport Beach (only a selection depicted near the SLSC), with aerial photograph taken on 30 August 2018

[7] LiDAR, which stands for Light Detection and Ranging, uses light in the form of a pulsed laser (typically supported on a flying object such as a plane or drone) to measure distances to the Earth.

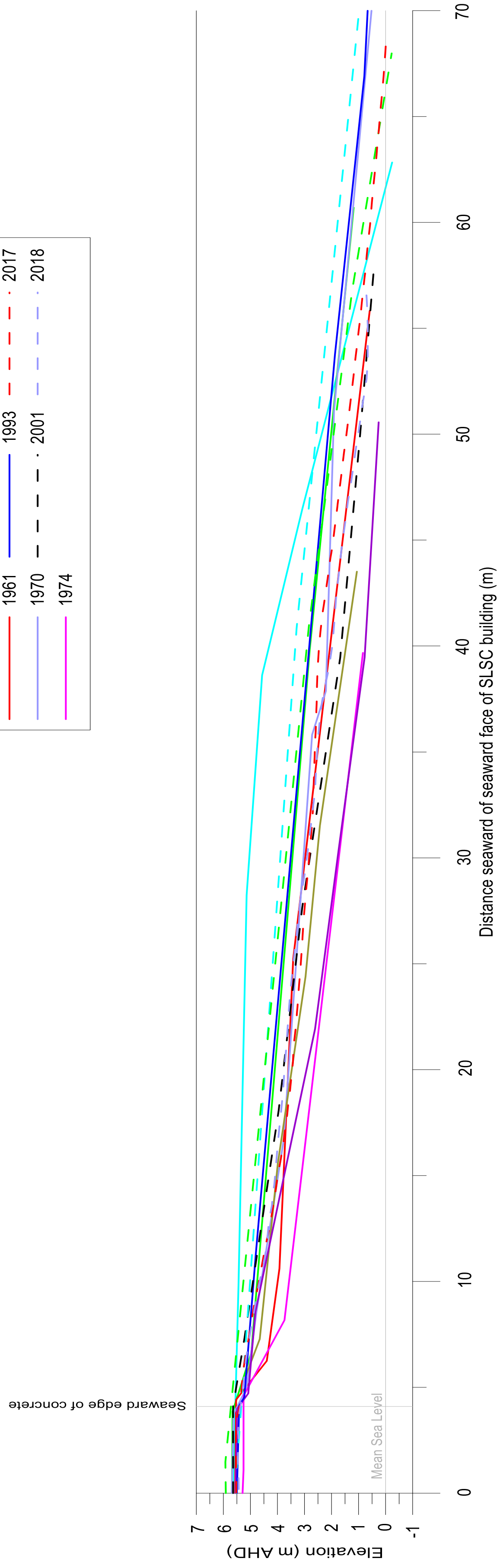

Figure 3: Historical beach profiles at Newport SLSC from 1941 to 2018

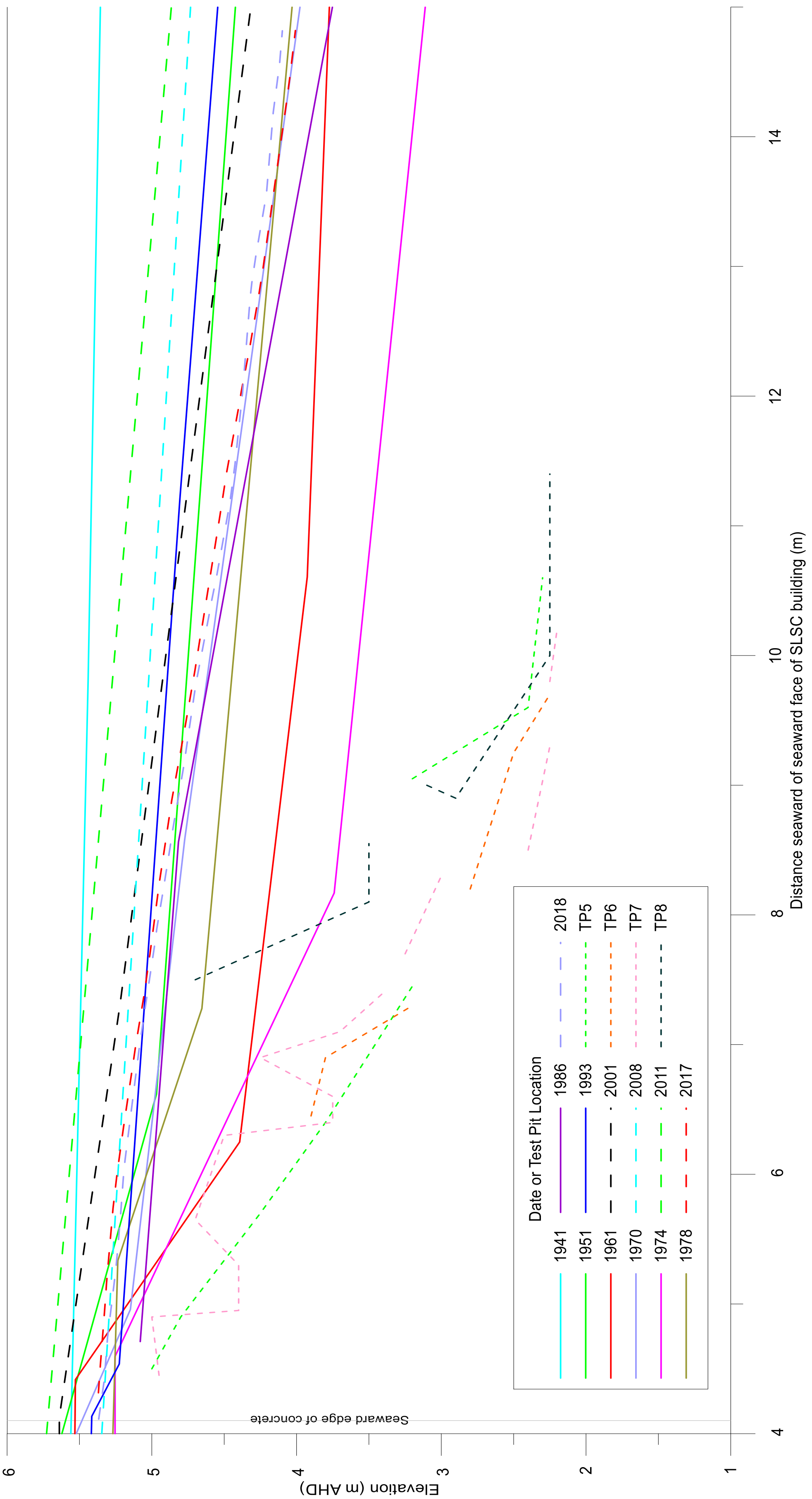

Figure 4: Top surface of revetment from JK Geotechnics test pits, relative to historical beach profiles

It is evident in Figure 3 that the 1974 profile is the most eroded profile recorded at Newport SLSC in the NSW Beach Profile Database. However, this profile was captured about 3 weeks after the 29 May 1974 storm, on 19 June 1974, at which time some beach recovery would have occurred, as well as placement of the rock boulders and likely some mechanical beach scraping to cover the boulders with sand. Other relatively eroded profiles were in 1986 and 1978. The most accreted profiles were in 1941, 2008 and 1993, although note that the 1941 profile is less accurate than the other profile dates and must be used with caution.

In the photogrammetric profiles, the average distance from Newport SLSC to the shoreline at mean sea level is 67m (extrapolating profiles ending above 0m AHD at the same slope as the last two points in the profile).

Plots of the variation in beach volume above 0m AHD seaward of Newport SLSC are provided in Figure 5 (for all photogrammetric dates) and Figure 6 (excluding 1941), along with line of best fit trend lines (dashed). There was a weak recessionary[8] trend including 1941 (of -0.13m^3/m/year), and a stronger accretionary[9] trend excluding 1941 (of +0.39m^3/m/year).

Plots of the variation in various contour positions (these chainages are relative to the landward edge of the red profile in Figure 2) seaward of Newport SLSC are provided as follows, along with line of best fit trend lines (dashed):

- 2m AHD in Figure 7 (for all photogrammetric dates) and Figure 8 (excluding 1941);
- 3m AHD in Figure 9 (for all photogrammetric dates) and Figure 10 (excluding 1941); and
- 4m AHD in Figure 11 (for all photogrammetric dates) and Figure 12 (excluding 1941).

Including 1941, there was a weak recessionary trend or stability for all contour levels (0.0m/year for 2m AHD, -0.04m/year for 3m AHD and -0.06m/year for 4m AHD), and a stronger accretionary trend for all contour levels when excluding 1941 (+0.07m/year for 2m AHD, +0.08m/year for 3m AHD and +0.11m/year for 4m AHD).

It is evident in Figure 4 that the top surface of the revetment generally sits below the 1974 profile (as expected due to beach recovery, discussed above), except at the western edge of TP8. For the profile dates depicted, the last time the revetment would have been significantly exposed may have been in 1978, although long term SLSC members may recall more recent exposure.

[8] A landward movement of the shoreline and the visible beach losing sand volume over the long term.
[9] A seaward movement of the shoreline and the visible beach gaining sand volume over the long term.

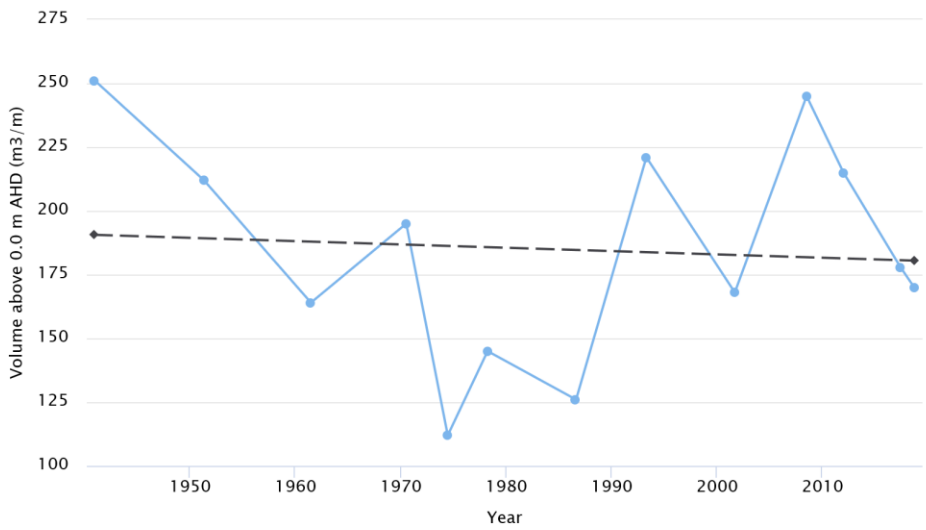

Figure 5: Variation in beach volume above 0m AHD seaward of Newport SLSC for all photogrammetric dates

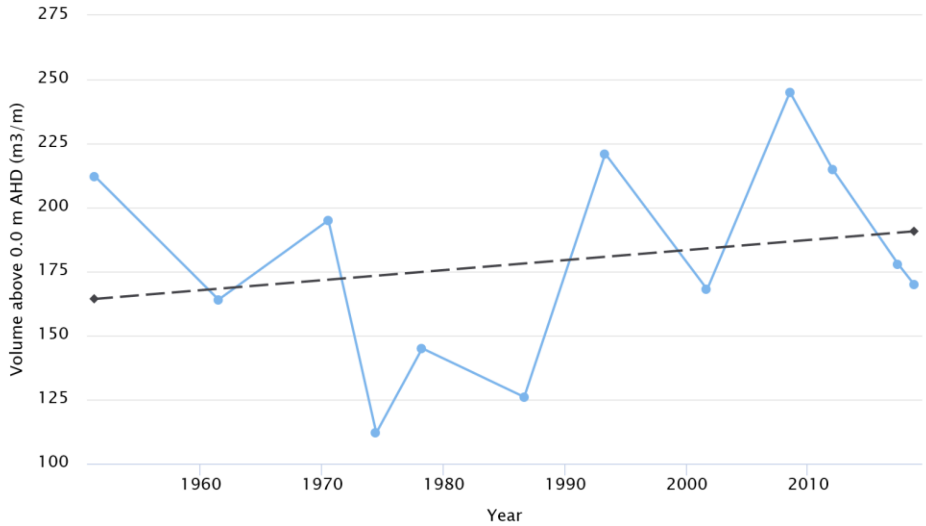

Figure 6: Variation in beach volume above 0m AHD seaward of Newport SLSC for all photogrammetric dates except 1941

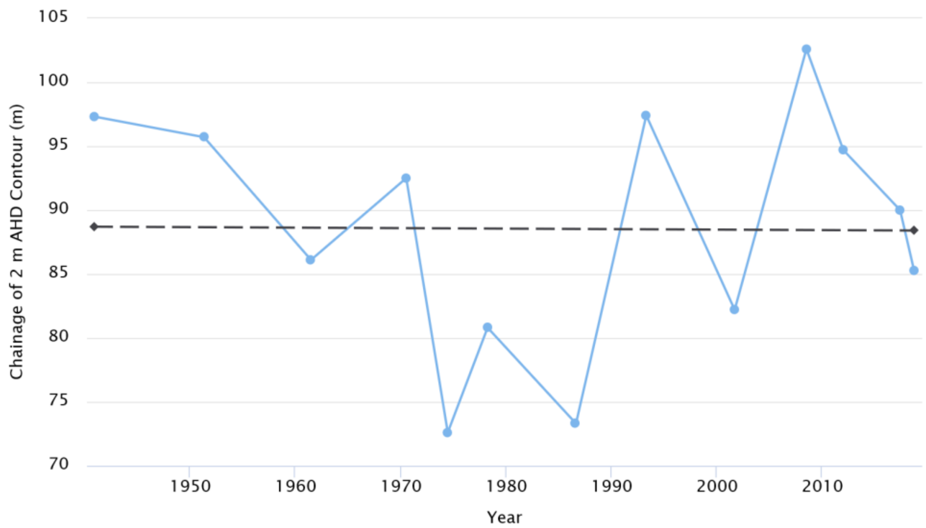

Figure 7: Variation in 2m AHD contour position seaward of Newport SLSC for all photogrammetric dates

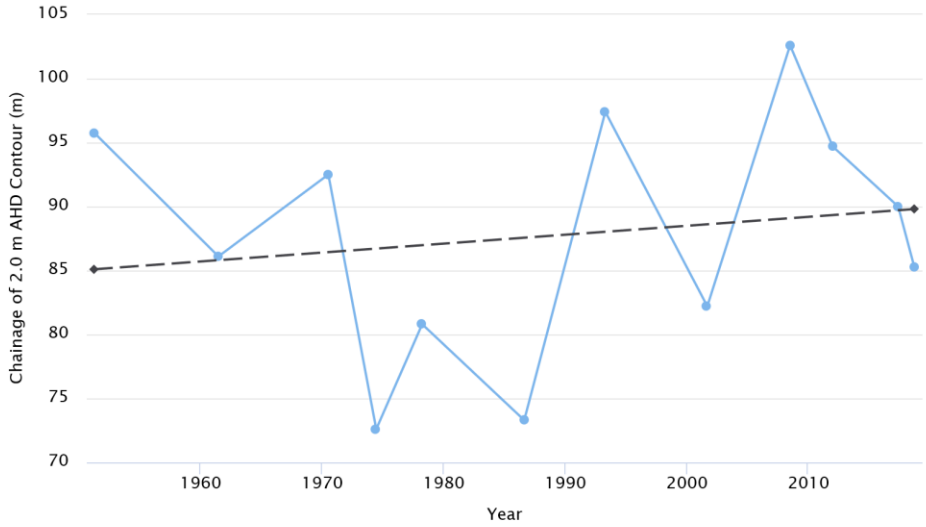

Figure 8: Variation in 2m AHD contour position seaward of Newport SLSC for all photogrammetric dates except 1941

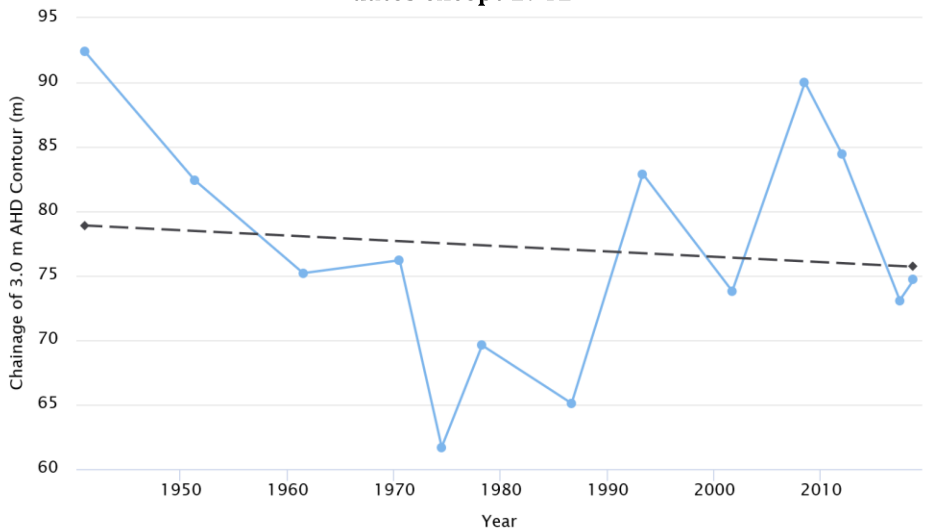

Figure 9: Variation in 3m AHD contour position seaward of Newport SLSC for all photogrammetric dates

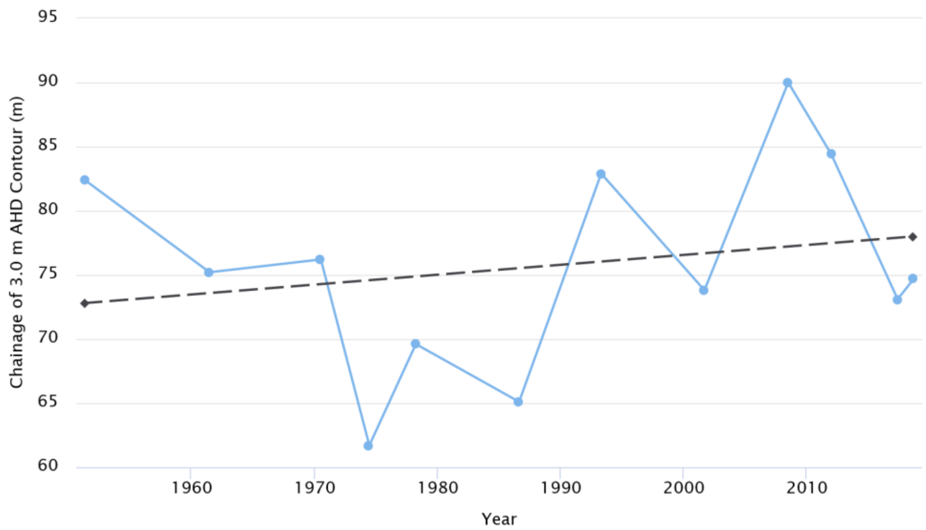

Figure 10: Variation in 3m AHD contour position seaward of Newport SLSC for all photogrammetric dates except 1941

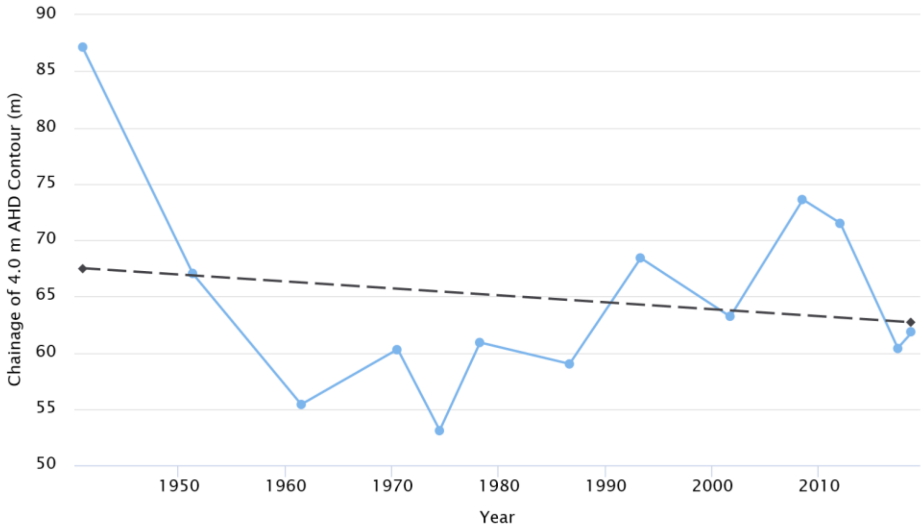

Figure 11: Variation in 4m AHD contour position seaward of Newport SLSC for all photogrammetric dates

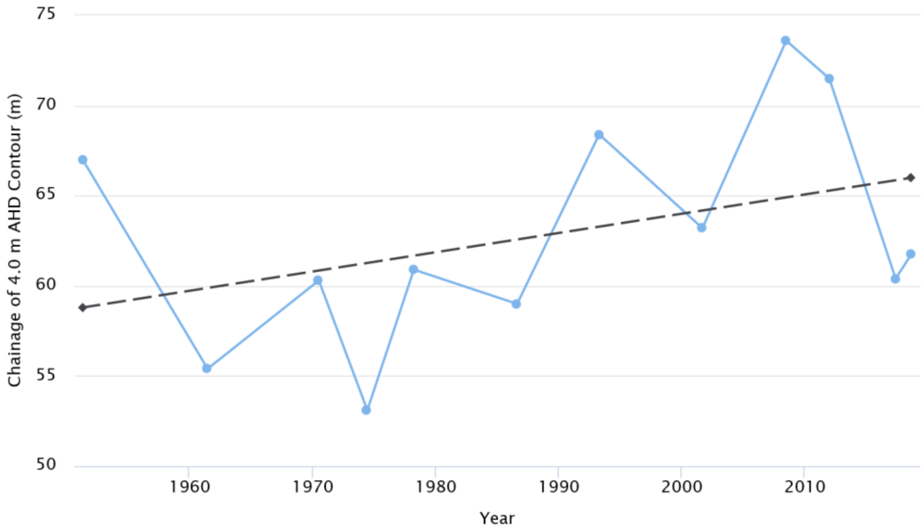

Figure 12: Variation in 4m AHD contour position seaward of Newport SLSC for all photogrammetric dates except 1941

Overall, the plots of the variation in beach volume and contour position in Figure 5 to Figure 12 show the relative long term stability of Newport Beach, without an obvious recessionary or accretionary trend (it is recognised that only one profile has been depicted herein, but the same lack of trend is evident by analysing all profiles).

6. PRELIMINARY COASTAL EROSION/RECESSION RISK ASSESSMENT

6.1 Generic Explanation of Hazard Zones

Nielsen et al (1992) has delineated various coastline hazard zones as discussed below and depicted in Figure 13, assuming an entirely sandy (erodible) subsurface above -1m AHD.

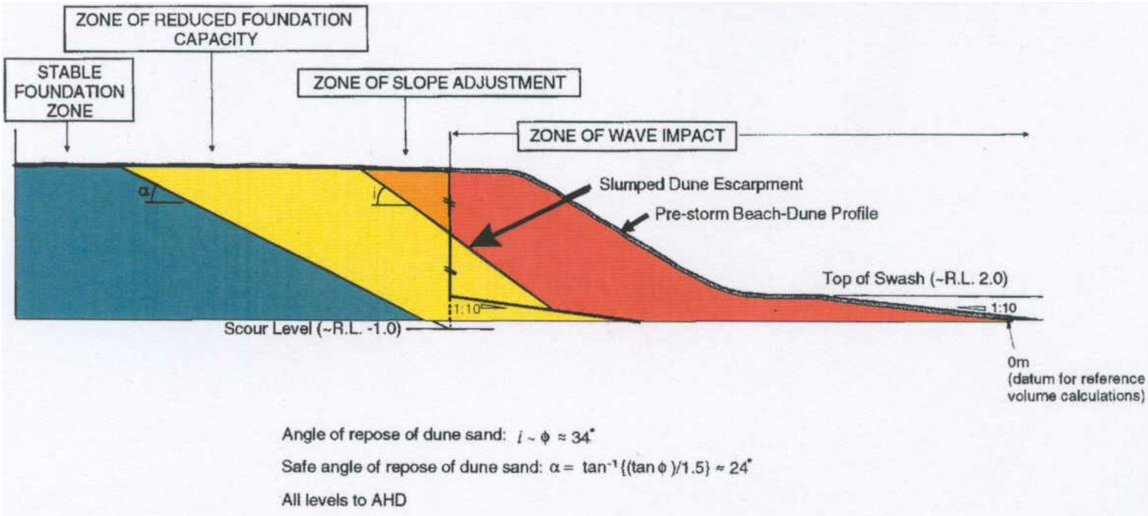

Figure 13: Schematic representation of coastline hazard zones (after Nielsen et al, 1992)

The *Zone of Wave Impact* (ZWI) delineates an area where any structure or its foundations would suffer direct wave attack during a severe coastal storm. It is that part of the beach which is seaward of the beach erosion escarpment.

A *Zone of Slope Adjustment* is delineated to encompass that portion of the seaward face of the beach that would slump to the natural angle of repose of the beach sand following removal by wave erosion of the design storm demand. It represents the steepest stable beach profile under the conditions specified.

A *Zone of Reduced Foundation Capacity* (ZRFC) for building foundations is delineated to take account of the reduced bearing capacity of the sand adjacent to the storm erosion escarpment. Nielsen et al (1992) recommended that structural loads should only be transmitted to soil foundations outside of this zone (ie landward or below), as the factor of safety within the zone is less than 1.5 during extreme scour conditions at the face of the escarpment. In general (without the protection of a terminal structure such as a seawall), dwellings/structures not piled and located within the ZRFC would be considered to have an inadequate factor of safety.

6.2 Previous Coastal Hazard Definition

Based on the draft "Coastline Hazard Definition and Climate Change Vulnerability Study" prepared for Pittwater Council and dated 3 July 2012 (denoted as the "Hazard Study" herein), coastline hazard lines in the vicinity of Newport SLSC for Immediate, 2050 and 2100 planning periods are as depicted in Figure 14, for lines at the landward edge of the ZSA (solid lines) and ZRFC (dashed lines). The Immediate Wave Runup line (predicted extent of wave runup in a severe storm at present) is also depicted.

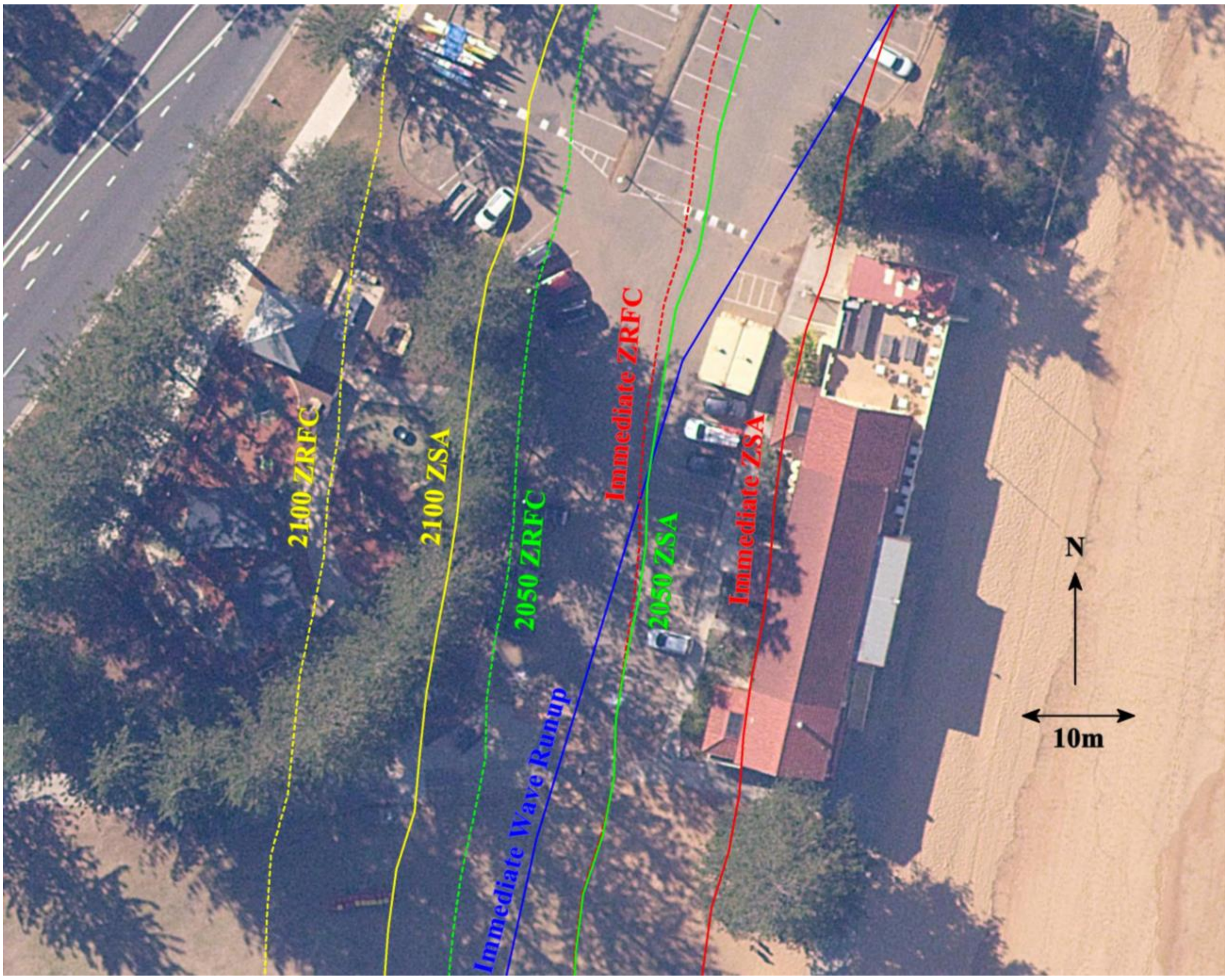

Figure 14: Coastline hazard lines in vicinity of subject property from Hazard Study (aerial photograph taken on 30 August 2018)

The Hazard Study is the latest formal hazard definition for Newport Beach. It is recognised that the hazard definition in this study was conservative, and it was not completed in a probabilistic framework (that is, no probabilities were associated with the hazard lines), but the position of the hazard lines well landward of the SLSC is indicative of the significant risk of undermining of the SLSC from coastal erosion/recession at present and even more so over the long term. A coastal erosion "acceptable risk" line for the immediate planning period is depicted in Section 6.6.

The position of the Immediate Wave Runup line well landward of the SLSC is consistent with damage to the SLSC from wave runup and overtopping that has occurred in the past, eg in 1974. The ground floor of the existing and proposed SLSC is vulnerable to wave runup and oceanic inundation damage, with this risk increasing with sea level rise over the long term. The current concept for the redevelopment of Newport SLSC has included consideration of reducing this inundation risk, eg by locating the more robust non-habitable spaces that could be tolerant of inundation in the most at-risk areas.

6.3 Design Life

Council advised that Newport SLSC was to have a structural design life of 50 years (that is, the material components, such as concrete, would be designed for that life), and a coastal engineering design life of 100 years (that is, the building would need to be designed to not be undermined from coastal erosion/recession over a 100 year life[10]).

As discussed in Horton et al (2014) and Horton and Britton (2015), a 60 year design life is considered to be appropriate in relation to residential beachfront development (that relies on the protection works for protection against erosion/recession over the design life) as it is consistent with Australian Standards applying to the development landward of the protection works, the cost of new residential development is amortised for tax purposes over 40 years based on Subdivision 43-25 of the *Income Tax Assessment Act* 1997, and a design life of at least 50 years would be considered to be reasonable for permanent structures used by people. A 60 year planning period was adopted in the *Coastal Zone Management Plan for Bilgola Beach (Bilgola) and Basin Beach (Mona Vale)* (CZMP), which was certified by the Minister for the Environment on 30 June 2016 and gazetted on 14 July 2017. Although this CZMP does not geographically apply at Newport SLSC, it is the only gazetted CZMP in the former Pittwater Council area, and hence is relevant to consider in the selection of design life at a similar open coast beach.

A structural design life of 50 years, as adopted by Council, is generally consistent with the above where relevant (noting that there are different requirements for a non-habitable SLSC compared to a habitable residential dwelling).

It is considered to be conservative to adopt a coastal engineering design life double that of the structural design life, but it can be noted that Council has adopted a structural design life of 50 years in conjunction with a coastal engineering design life of 100 years for other recent SLSC redevelopment DA's including Long Reef SLSC and Mona Vale SLSC. Gordon et al (2019) considered that for foundation design of coastal assets, the design life of the foundations may be longer than above-ground the structure, which is somewhat consistent with Council's approach here.

The assessment of long term recession due to sea level rise outlined in Section 7 is thus undertaken for a 100 year planning period (as stipulated by Council).

6.4 Definition of Acceptable Risk

6.4.1 Necessity for Consideration of Acceptable Risk

It is important to establish the level of risk that is acceptable to adopt for the redevelopment of Newport SLSC. In 2013, the author (with assistance of other peer reviewers) developed a methodology to define the appropriate setback for new beachfront development on the basis of 'acceptable risk' to property, as described in Horton et al (2014) and Horton and Britton (2015). The framework of the adopted risk assessment methodology came from Australian Geomechanics Society (AGS) procedures for landslide risk management (AGS 2007a, b), modified to be appropriate for 'sandy beach' coastline hazards.

The AGS procedures are an established, recognised and peer reviewed methodology for defining landslide risk for development assessment. They were developed over a period of more than a decade via a Working Group of experts, were subject to peer review and discussion through a Landslides Taskforce with 23 members, and have been widely applied in

[10] This could be achieved by building the SLSC landward of a 100 year planning period hazard line, or building the SLSC on piles designed to support the structure in a severe storm occurring at the end of 100 years, or building a seawall/revetment seaward of the SLSC.

geotechnical engineering practice since 2000. Therefore, they are suitable basis for the 'acceptable risk' methodology.

Part of the motivation for development of the methodology by the author was to avoid the two inappropriate extremes that can sometimes be applied in development control setbacks, namely:

- the over-optimistic denial of risk scenario where virtually no controls are applied on development, and climate change related sea level rise is a myth to be ignored; or
- the over-conservative doomsday scenario where every coastline hazard parameter selected is upper bound, which can sterilise development that is highly unlikely to be at significant risk within its design life.

A consent authority as the regulator has the responsibility of defining the level of risk that is acceptable. Developers and landowners should not be allowed to decide on the level of risk they are willing to take in their investment decisions as they may not be the ones to bear the outcomes of their decisions. A regulator such as a local Council has a duty of care to make decisions that will not adversely impact on future owners and on future costs to the broader community and environment.

Without a risk assessment approach, a consent authority may end up making philosophical decisions on beachfront development that unnecessarily sterilise development, or political decisions to appease landowners that may lead to development being approved which would have an unacceptable risk of damage.

Although originally developed to define beachfront setbacks, the acceptable risk methodology can also be used to define the acceptable probability of damage to Newport SLSC over a particular design life, thus governing whether redevelopment at its current position could occur on conventional foundations (as per Option 1) or whether piling or seawall protection was required to reduce the risk of undermining to an acceptably low level.

6.4.2 Risk to Life

Only risk to property is evaluated herein. Risk to life related to redevelopment of Newport SLSC was considered to be acceptably low (no matter what Option is selected) as:

- coastal storms (large waves and elevated water levels) are generally foreseeable at least 24 hours in advance, with warnings issued by the Bureau of Meteorology;
- a large component of elevated water levels is astronomical tide, which can be accurately predicted decades into the future;
- erosion would generally be expected to be greatest for a few hours near the peak of the tide;
- the progress of erosion on a beach is visible and perceptible, and would not generally be expected to proceed undetected to damage development;
- it is highly unlikely that someone would be occupying the SLSC and would be unaware (or would not have been made aware) that the clubhouse was at imminent threat of damage;
- the State Emergency Service (SES), if mobilised, has powers to warn and evacuate occupants if required (as does NSW Police); and
- Council could request the SES taking on a Combat Agency role if an actual emergency was occurring and it had not already been mobilised.

These factors mean that the clubhouse would have a low probability of occupancy and/or loss of life during an actual storm event that could threaten the development, and hence have a low risk to life, which would satisfy the acceptance criteria given in AGS (2007a).

6.4.3 Acceptable Property Risk Level for Newport SLSC

Risk is defined as the product of likelihood and consequences. A risk matrix is presented in AGS (2007a, b), as shown in Figure 15. For example, if the consequences of a particular "unlikely" event were "minor", then the risk would be considered "low".

Likelihood	Consequence				
	Catastrophic	Major	Medium	Minor	Insignificant
Almost Certain	Very High	Very High	Very High	High	Medium
Likely	Very High	Very High	High	Medium	Low
Possible	Very High	High	Medium	Medium	Very Low
Unlikely	High	Medium	Low	Low	Very Low
Rare	Medium	Low	Low	Very Low	Very Low
Barely Credible	Low	Very Low	Very Low	Very Low	Very Low

Figure 15: AGS (2007a, b) risk matrix

AGS (2007a, b) defined "acceptable risk" as follows:

> "A risk for which, for the purposes of life or work, we are prepared to accept as it is with no regard to its management. Society does not generally consider expenditure in further reducing such risks justifiable".

A key aspect of the AGS (2007a, b) approach is that they defined the acceptable level of risk for new development as being "low" risk (or lesser, that is "very low") as per the matrix in Figure 15. This was based on review of the limited literature available, extensive discussion amongst the AGS Working Group, and consideration of the annualised cost of damage to property. AGS (2007a, b) concluded that "Low Risk to Property is an appropriate recommendation for acceptable risk to the regulator for [buildings] which are of Importance Level 2 (as defined in the BCA [Building Code of Australia][11])". Note that AGS (2007a, b) considered that the acceptable risk level was "low" for structures of both:

- Importance Level 2 (such as low-rise residential construction and buildings and facilities below the limits set for Importance Level 3); and
- Importance Level 3 (such as buildings and facilities where more than 300 people can congregate in one area, schools of greater than 250 people, health care facilities with a capacity of 50 or more residents, power generating facilities, water treatment and waste water treatment facilities)[12].

[11] In Section B1.2 of the *National Construction Code 2019 Guide to BCA Volume One*, the important level descriptors are provided.
[12] For structures of Importance Level 1 (such as farm buildings and sheds, isolated minor storage facilities, and minor temporary facilities), the designated acceptable risk level was "medium". For structures of Importance Level 4 (such as buildings and facilities designated as essential facilities or with special post-disaster functions, medical emergency or surgery facilities, emergency service facilities such as fire, rescue, police etc.), the designated acceptable risk level was "very low".

Newport SLSC would be considered to be of Importance Level 2 or 3, so “low” risk can be considered acceptable for the redevelopment of Newport SLSC.

The former Pittwater Council had a *Risk Management Policy for Coastal Public Buildings and Assets in Pittwater*, in which it was recognised that:

> “…existing council owned buildings in the coastal zone of Pittwater, in particular surf life saving club buildings may, in part, be located seaward of the immediate hazard line. These buildings will be affected, sooner or later, by coastal hazards exacerbated by climate change including, shoreline recession, coastal erosion and oceanic inundation, yet most will remain viable and serviceable in the short to medium term future”.

However, this policy does not apply to the Newport SLSC redevelopment, with an expected construction cost over $2 million (ignoring seawall/revetment protection or piling), as the policy only applies where the total estimated value of the work is less than $500,000 (indexed)[13].

6.4.4 Consequences

AGS (2007a, b) used 5 consequence descriptors. These descriptors were related to the percentage of damage caused to a property due to a landslide event, relative to the market value of the property (land plus structures), as listed in Table 1.

Table 1: Consequence descriptors from AGS (2007a, b)

Descriptor	Approximate cost of damage	Description
Catastrophic	> 100%	Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequence damage.
Major	40% to 100%	Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequence damage.
Medium	10% to 40%	Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequence damage
Minor	1% to 10%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works
Insignificant	< 1%	Little damage

For the investigation reported herein, it was considered that an appropriate consequence descriptor to adopt would be “minor”, applying for a scenario of storm erosion leading to a slumped erosion escarpment immediately seaward of the clubhouse on conventional foundations. Although a structure immediately landward of a slumped escarpment may not be damaged at all, in recognition of the structure being in a Zone of Reduced Foundation Capacity

[13] Based on consumer price index rates at https://www.ato.gov.au/Rates/Consumer-price-index/, the indexing from November 2013 (when the policy was last updated) to the end of December 2019 is a multiple of 116.2 ÷ 104.8, equals 1.11. Thus $500,000 can be indexed to a present value of about $554,000.

(Nielsen et al, 1992) and hence having a lower factor of safety, it was considered that there was the potential for some damage.

6.4.5 Likelihood

To achieve a "low" risk (Section 6.4.3), with a "minor" consequence (Section 6.4.4), based on Figure 15 it is necessary to have a likelihood of "unlikely" or rarer. The indicative probability for an "unlikely" event from AGS (2007a, b) is an annual exceedance probability (AEP) of 0.01%.

6.5 Coastal Hazard Parameters for Risk Assessment

6.5.1 Beach Erosion

During storms, large waves, elevated water levels and strong winds can cause severe erosion to sandy beaches. Storm demand represents the volume of sand removed from a beach (defined herein as the volume lost above 0m AHD) in a severe storm or series of closely spaced storms.

Based on measurements at NSW beaches, Gordon (1987) derived relationships between storm demand and Average Recurrence Interval (ARI), at both "high demand" (at rip heads) and "low demand" (away from rip heads) areas. He estimated that the storm demand above 0m AHD was about 220m^3/m for the 100 year ARI event, for exposed NSW beaches at rip heads, and described a relationship between storm demand and the logarithm of ARI that was linear.

In the Hazard Study, a 100 year ARI storm demand of 235m^3/m was adopted for Newport Beach, although analysis of the 1974 storm indicated maximum estimated erosion volumes of about 200m^3/m in the vicinity of the SLSC. Wave transformation modelling was also undertaken as part of the Hazard Study, thus accounting for the reefs to the south of Newport Beach provide some protection from southerly swell, but this does not provide any support for a further reduction in erosion volumes. A 100 year ARI storm demand of 200m^3/m was thus adopted herein, with the same form of relationship as Gordon (1987).

Assuming a 15% reduction in this storm demand due to the existing boulders (the upper limit from Section 4), the 100 year ARI storm demand reduces to 170m^3/m.

6.5.2 Base Profile

An average beach-full (that is, relatively accreted) profile should be selected as the base profile for hazard definition, as design storm demands can only be realised at accreted profiles. The 2011 date would be suitable in this regard (3rd most accreted in volume, and 2nd most accreted in contour position at 3m and 4m AHD, excluding 1941).

6.6 Immediate Planning Period Acceptable Risk Line

For the immediate planning period, for an AEP of 0.01% (to achieve "low" risk, see Section 6.4.5) and including the 15% reduction in storm demand due to the existing boulders, the corresponding storm demand for this event is 312m^3/m (based on the methodology outlined in Section 6.5.1). Applying this storm demand to the 2011 base profile (Section 6.5.2), the position of the landward edge of the ZSA (see Section 6.1) is landward of the SLSC, as depicted in Figure 16. This is the acceptable risk line for the immediate planning period. That is, the redeveloped SLSC (given that it has the same seaward extent as existing) is at an unacceptably high risk for the immediate planning period, unless it is constructed on piles or a seawall/revetment is constructed in order to prevent the erosion occurring[14].

Figure 16: Position of coastal erosion acceptable risk line for immediate planning period at Newport SLSC

It is also possible to determine acceptable risk lines for other planning periods, but this was beyond the scope of the high-level risk assessment undertaken for the study reported herein. That stated, if at unacceptable risk for the immediate planning period, Newport SLSC is clearly inherently at unacceptable risk, and assessment of longer planning periods would not change that outcome.

Due to cumulative probabilities, a seemingly unlikely 1% AEP event (which has a 1% chance of occurring in any year) has a 40% and 63% chance of occurring at least once over 50 years and 100 years respectively. However, also assumes that the climate is 'stationary', ie randomly varying but not trending. This is not the case with climate change, with a 0.1% AEP storm erosion event today becoming more like a 10% AEP event in 100 years (two orders of magnitude more likely) from long term recession due to sea level rise (see Section 7.1.3). Over a 100 year life, it is virtually certain that the SLSC building would be undermined at least once due to coastal erosion/recession (unless a seawall/revetment prevented that erosion/recession).

[14] Note that the acceptable risk line in Figure 16 is considered to be unconservative (eg estimated with the upper limit reduction in erosion for the existing boulders and lower estimate of storm demand), so this conclusion is considered to be robust. If the Hazard Study storm demand was used in conjunction with the lower limit reduction in erosion for the existing boulders, the 0.01% AEP line in Figure 16 would be approximately 0.11% AEP (that is, an order of magnitude more likely).

7. EFFECT OF LONG TERM RECESSION DUE TO SEA LEVEL RISE ON BEACH LEVELS, AND RELATIVE IMPACTS OF REVETMENT/SEAWALL OPTIONS OVER THE LONG TERM

7.1 Long Term Coastal Hazard Parameters

7.1.1 Long Term Recession due to Net Sediment Loss

The photogrammetric data analysis outlined in Section 5 indicated no clear recession or accretion trend, and thus a zero long term recession rate due to net sediment loss would be reasonable in the study area.

7.1.2 Sea Level Rise

Sea level rise values can be derived in a probabilistic manner from Intergovernmental Panel on Climate Change [IPCC] (2013), which is widely accepted by competent scientific opinion.

With a base year of 2011, as per Section 6.5.2, the sea level rise values presented in Table 2 (at 2120) were determined for various emissions scenarios, assuming that the projected rate of rise from 2090 to 2100 continued to 2120.

Table 2: Global mean sea level rise (m) from 2011 to 2120 derived from IPCC (2013)

Emissions Scenario	Exceedance Probability		
	95% exceedance	Median	5% exceedance
SRES A1B	0.51	0.72	0.97
RCP2.6	0.29	0.48	0.70
RCP4.5	0.41	0.61	0.84
RCP6.0	0.45	0.67	0.88
RCP8.5	0.66	0.94	1.26
Average	0.46	0.68	0.93

It is also relevant to consider regional sea level rise variation, that is how the study area sea level rise may vary from the global mean. From Figure 13.21(a) of IPCC (2013), although the resolution is coarse, it can be estimated that sea level rise in NSW is projected to be 10-20% larger than the global mean at 2081-2100 (compared to 1986-2005). Assuming these increases also apply at 2120, applying a 15% increase, and assuming an average of the 5 emissions scenarios listed in Table 2, the median sea level rise at 2120 can be estimated as 0.78m (with a 95% to 5% range of 0.53m to 1.07m).

7.1.3 Long Term Recession Due to Sea Level Rise

Bruun (1962) proposed a methodology to estimate shoreline recession due to sea level rise, the so-called Bruun Rule. It can be described by the equation (Morang and Parson, 2002):

$$R = \frac{S \times B}{h + d_c} \qquad (1)$$

where R is the recession (m), S is the long-term sea level rise (m), h is the dune height above the initial mean sea level (m), d_c is the depth of closure of the profile relative to the initial mean sea level (m), and B is the cross-shore width of the active beach profile, that is the cross-shore distance from the initial dune height to the depth of closure (m). Equation 5 is a mathematical expression that the recession due to sea level rise is equal to the sea level rise multiplied by the average inverse slope of the active beach profile, with the variables as illustrated in Figure 17.

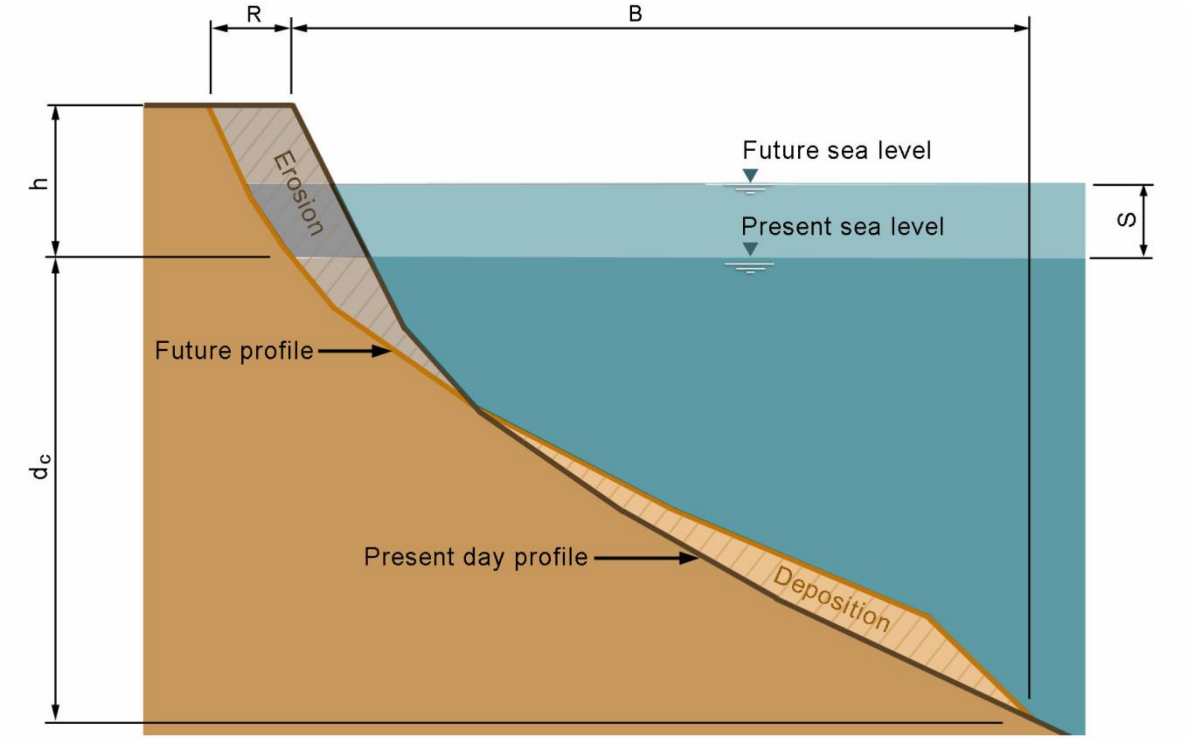

Figure 17: Illustration of variables in the Bruun Rule

There are a number of methods available to estimate the depth of closure, including techniques based on wave (and sediment) characteristics, sedimentological data, and field measurements. Hallermeier (1981, 1983) defined two closure depths, namely "inner" (closer to shore) and "outer" (further from shore) closure depths. The "inner" closure depth is considered to be appropriate to use herein. From Hallermeier (1981), the "inner" closure depth is approximately 12m relative to AHD at Newport Beach, with the average inverse slope of the active beach profile corresponding to this depth equal to 31.

Therefore, for the median sea level rise of 0.78m at 2120 (see Section 7.1.2), long term recession can be estimated as 24.2m (with a 95% to 5% range of 16.4m to 33.2m).

7.2 Impact of Long Term Recession Due to Sea Level Rise

An illustration of the historical profiles as per Figure 4, with 24.2m recession applied (as a 24.2m landward translation of the profiles and a 0.78m raising of the profiles for sea level rise) is provided in Figure 18. Outlines of the top surface of a typical revetment (as per Option 5, with a crest level at the current promenade level, and allowing for a 3m wide crest) and seaward face of typical seawall (as per Option 6, with a crest level at the current promenade level, and allowing for a 1m projection seaward of the promenade) are also provided.

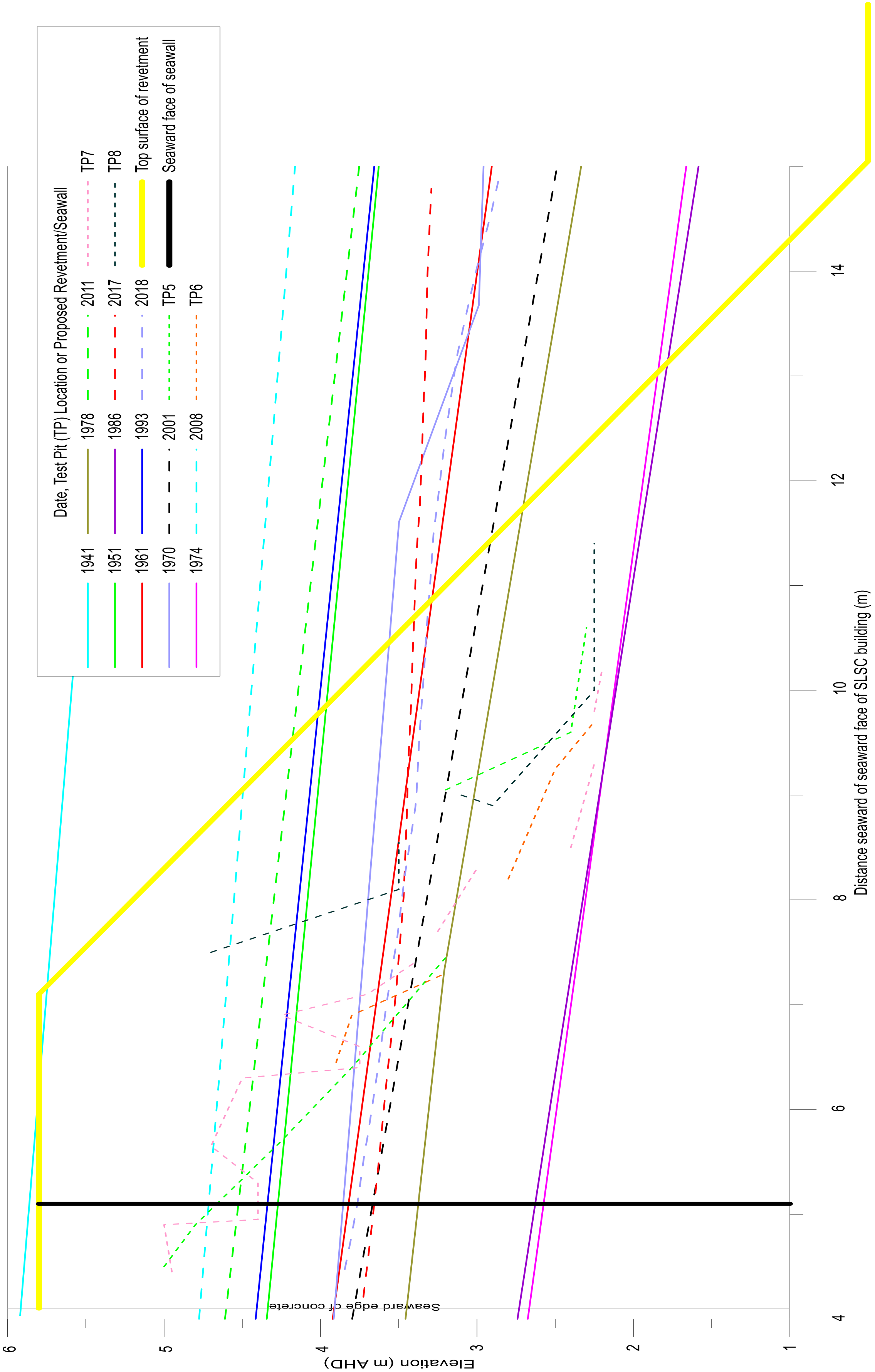

Figure 18: Receded profiles at 2120 in relation to existing boulders and potential revetment and seawall footprints

It is evident that with projected long term recession to 2120, the upper portion of the existing boulders (which only extend up to about 5m AHD) would be regularly exposed (12 of the 13 profiles reveal at least some exposure, 8 of the 13 profiles reveal at least 1m of exposure vertically, and 11 of the 13 profiles reveal at least 2m of exposure vertically), assuming that the historical profiles are representative of typical beach behaviour.

With projected long term recession to 2120, a revetment as per Option 5 would be regularly exposed (all 13 profiles reveal at least some exposure, 9 of the 13 profiles reveal at least 1m of exposure vertically, and 9 of the 13 profiles reveal at least 2m of exposure vertically). The revetment would extend about 5.5m seaward of the current seaward boulder extent.

It may be possible to develop a technical argument that the impacts of a revetment on coastal processes would be acceptably low or insignificant, given that most of the revetment footprint would be buried under sand for most of the time. However, the draconian requirements of the *Coastal Management Act 2016* may make the Sydney North Planning Panel loathe to approve a revetment which exceeds the current boulder footprint and extends further on to public land.

With projected long term recession to 2120, a seawall as per Option 6 would be expected to typically have the upper 2m of wall exposed. The footprint of the seawall (extent on to the beach) is about 11.5m less than the revetment.

It is recognised that assessing impacts at 2120 is conservative, and for environmental impact assessment purposes it may be more appropriate to assess for a 50 year planning period (to 2070). However, 2120 is consistent with the 100 year coastal engineering life stipulated by Council.

Regular maintenance through beach scraping may make it possible to maintain higher sand levels than depicted in Figure 18, in an attempt to keep the revetment covered or to maintain sand levels adjacent to the seawall crest to facilitate access. However, Figure 18 shows that this may be an extensive and ongoing operation given the magnitude of lowering in natural beach levels over the long term.

8. STRUCTURAL ENGINEERING ADVICE

Structural engineering advice on the options listed in Section 3 has been obtained from Partridge, as provided in Attachment D. They noted that:

- for Option 1, the foundations of the new portion could match the performance of the foundations of the retained building, to reduce the potential for cracks to occur due to differential settlement (ignoring the potential for coastal erosion to undermine the building);
- for Option 2, there would be additional cost (compared to Option 1) for the piling, as well as for a thicker ground floor slab and two layers of steel reinforcement in the new portion. They also noted that differential settlement between the retained and new portions could be in the order of 10-20mm, and damage to the retained portion from undermining could damage the new portion. To reduce the risk of this occurring, the two portions of the building could be structurally isolated (with an isolated slab on piles for the new portion, expansion joints in the walls between the two portions of the building allowing for vertical movement, maintaining two independent roof frames, and designing roof drainage at the junction between the two roof portions to allow for the vertical movement in the structure). It was considered that this option did not provide sufficient benefit to justify the additional expense;
- for Option 3, both the existing and new portions of the building would have similar foundations, lowering the potential for cracks occurring due to differential settlement. The existing masonry façade would need to be temporarily braced to ensure its stability prior to demolition of the existing internal structure, and would need to be re-supported on the new ground floor slab which would be suspended over piers. Rebuilding the internal portions of the existing building increases the scope and therefore costs compared to Option 2;
- for Option 4, this would ensure that the risk of damage from coastal erosion will be minimised, and produces an entirely new structure compliant with current relevant Australian Standards, with a design life of 50 years to suit the minimum requirements of the National Construction Code, and no concerns regarding interaction between existing and new elements. This would be more costly than Option 1 and 2, but may be similar in cost (and time to construct) to Option 3 depending on the cost of temporary support of the existing façade compared with the cost of constructing a new external façade; and
- Options 5 and 6 would have the least impact on the existing structure[15].

[15] Partridge incorrectly described Option 7 in Attachment D as having a seawall/revetment and piling (Option 7 does not have piling). They noted that this provides a level of protection above and beyond a typical approach for minimising the risk of structural damage as the result of coastal erosion.

9. CONSULTATION WITH KEY STAKEHOLDERS

9.1 Preamble

Consultation has been undertaken with key stakeholders, namely Council staff, Adriano Pupilli Architects, SLSC representatives and an external heritage consultant, to ascertain key issues of concern to these stakeholders and inform option selection. Key points raised in discussion with these stakeholders are outlined below. Comments are generally summarised and paraphrased, and are thus not necessarily reproduced verbatim.

Where a comment is considered to be questionable, a footnote is provided in response.

9.2 Council – Building Assets

Campbell Pfeiffer (Executive Manager Property) and Donald Gibson (Manager, Building Assets - Planning, Design & Delivery) were contacted, and made the following comments:

- Council is generally risk averse, so Options 1 and 2 are not suitable if Council is to progress with the addition to the building;
- Option 5 was the preferred solution, as it is $570,000 cheaper than Option 6, with similar benefits in protecting the asset; and
- it is recognised that Options 3, 4 and 7 may be unacceptable from a heritage viewpoint.

9.3 Council – Heritage

Janine Formica (Heritage Planner) and Brendan Gavin (Principal Planner) were contacted. Janine made the following comments:

- Newport SLSC is listed as a heritage item in Schedule 5 of *Pittwater Local Environmental Plan 2014*. As such, Council has an obligation to ensure that this heritage is recognised, protected and that any change to the building respects its identified heritage significance;
- Options 4 and 7, which involve complete demolition of the clubhouse, are unacceptable from a heritage point of view, even if certain heritage elements are re-created;
- Options 1-2 are preferred as they retain the existing clubhouse and provide a new portion to meet current day demands[16];
- Option 3 has the potential to also deliver this outcome, although it would result in complete removal of all internal fabric, retaining only the external shell of the heritage building. Option 3 is thus acceptable but not preferred;
- Options 5 and 6 have additional cost and possible flow on effects to other parts of the beach[17], and the risk to the clubhouse from coastal erosion/recession is an accepted risk and one which has been part of the history of this building for the last 87 years[18], but could be supported;

[16] Options 5 and 6 also achieve this.
[17] Potential end effects are not considered to be significant, as discussed in Section 3.
[18] A counter to this argument is that the risk of clubhouse damage over the long term is significant (see Section 6.6, with the acceptable risk line well landward of the clubhouse), with the next 87 years expected to entail increasing risk over time from recession due to sea level rise. Furthermore, building industry standards would generally not support accepting such a significant risk (the risk should not be accepted now, even if it has in the past), and the design life standard Council has applied to its other SLSC developments would not allow Options 1 or 2 to be accepted.

9.4 Council – Coastal

Craig Morrison (Senior Environment Officer – Coast) was contacted, and made the following comments from the perspective of managing the coastal processes at the site and providing a space that is both functional for the SLSC as well as the broader Northern Beaches community over its design life:

- the importance of retaining the heritage aspects of the existing structure as well as balancing the potential costs of the various design options is recognised, but these aspects have not been considered in the comments below;
- the SLSC should be resilient to the impacts of coastal hazards for the nominated design life, while limiting impacts to the adjoining beach environment., with a preference to facilitate options such as piling (that is, Options 3 and 4) to enhance resilience to coastal hazards over coastal protection works;
- the redevelopment should provide a functional space that enables the SLSC to undertake its activities allowing for changing beach conditions and sea levels over its design life;
- Options 5 and 6 are acceptable if they are assessed to have a limited impact on the adjoining land and public access[19];
- Options 1 and 2 are not ideal, but the potential impact to public safety during a storm event could be managed through an Emergency Action Plan for the building. If either of these options were implemented council would need to document the decision process around their selection and be clear it understands and accepts the residual risk.

Paul Hardie (Principal Officer - Coast & Estuary) was also contacted in the earlier stages of the project and advised that it would be difficult to support a development proposal costing at least $1 million that significantly increases the value of an asset at risk without any measures to remove or reduce risk (as per Option 1).

9.5 Council – Parks and Reserves

Jeremy Smith (Manager, Park Assets - Planning, Design & Delivery) was contacted, and made the following comments:

- the challenge is balancing the needs of a growing club that has a higher expected level of service than years past, the considerable heritage value of the structure; and the need to adapt to increased frequency of coastal hazards, while ensuring the amenity of the beach is protected;
- Option 1 cannot be considered due to the value of the asset;
- Option 5 is not supported if the rock revetment footprint increases in a seaward direction (which it would for this option), unless it can be done in a way that does not affect beach amenity (the SLSC is there because there is a beach)[20];
- Option 6 could be supported if it would not significantly impact on the beach environment;
- Option 3 is preferred, followed by Option 4;

[19] It is considered that both options could be assessed to have an acceptable impact on these matters, although Option 5 (revetment) may not be seen to satisfy the public access test by a consent authority.
[20] See Section 7 for discussion on the effect of an increased footprint rock revetment on coastal processes.

9.6 Adriano Pupilli Architects

Adriano Pupilli made the following comments:

- Option 3 is undesirable as it destroys significant heritage fabric in the building and can be seen as facadism[21]. Retaining facades and replacing the internals of the existing SLSC is considered to be of a type of heritage conservation that has fallen out of favour since it was used prolifically in the 1980's and 1990's. Since then, a heritage conservation policy has been established, called *The Burra Charter 2013*. Article 15.3 of that Charter notes that "demolition of significant fabric of a place is generally not acceptable", while Article 15.2 mentions that where changes to significant heritage fabric are necessary, they should be reversible;
- Option 4 is undesirable as re-creation of heritage elements would likely be deemed as imitation, and not in keeping with current practice of heritage conservation. Re-creation of significant fabric is viewed as not being authentic and detracting from the cultural significance of the place. Article 20 of *The Burra Charter 2013* discusses "reconstruction" and where this approach may be deemed acceptable, namely "reconstruction is appropriate only where a place is incomplete through damage or alteration, and only where there is sufficient evidence to reproduce an earlier state of the fabric. In some cases, reconstruction may also be appropriate as part of a use or practice that retains the cultural significance of the place"[22];
- Option 6 seems the most feasible as it has low footprint protection works with the potential to incorporate amenity and enhanced access, with the ability to retain and preserve the existing heritage fabric of the clubhouse without invasive retro-fitting of piled foundations. However, the cost of this solution will need consideration.

9.7 SLSC Representatives

SLSC representatives, namely Rudi Valla (on the Club Building Committee), in consultation with the Club President (Glen Borg) and Deputy President (Rob Emerson), made the following comments:

- there is a commitment to move the DA forward from Council staff, Councillors, and the local State member (Rob Stokes);
- the Club wanted to appropriately address the identified coastal risks while seeking approval for the DA in the shortest possible timeframe;
- the Club is not in favour of any options which involve the complete or partial demolition of the existing Clubhouse building beyond that identified on the current plans (ie, they are not in favour of Options 4 or 7), as the current plans have been endorsed by the Club's Executive Committee, and they are concerned that these options would create adverse reactions from sections of the Club's internal membership, a large proportion of the local community, and Council's heritage staff (so as to delay and potentially halt the DA process);
- the Club favours Option 5 (expressing surprise that it would have a more difficult consent pathway than Option 6, and essentially not accepting that view), which deals

[21] "Facadism" is superficial retention of heritage aspects of a building without consideration of the broader social and cultural significance of the building.
[22] It is possible that this could also be used as an argument to support Option 4, in that reconstruction prevents damage to the heritage occurring through coastal erosion, but a counter to that is that Options 5 and 6 could also achieve that outcome without reconstruction.

with the ongoing risk of some storm damage to the clubhouse potentially occurring in the next 50 to 100 years, and is cheaper than Option 6;

- the Club would be willing to support Option 6 if there was little or no change to the current beach access and concourse arrangement. Any proposal to have above ground barriers in front of the Clubhouse which restrict or prevent direct beach access would significantly impact the Club's day to day and essential lifesaving operations which would not be supported by the Club[23];
- Options 5 (and 6) may allow the clubhouse redevelopment and revetment/seawall to be undertaken as separate projects under separate budgets, maximising flexibility of delivery of these works and facilitating staging of the works[24];
- the Club is aware that in a major storm event, beach profiles may be significantly altered and that access to the beach may be restricted or impinged for a period of time. The Club would prefer to deal with such one-off events on a case by case basis and accepts that temporary access measures may need to be implemented at the time for such events. The Club would prefer to have to manage one off disruptive events every 50 or so years[25] rather than relying on mitigation measures which compromise the Club's day to day operations and beach safety activities; and
- the Club does not favour Option 3 as there was concern that the piling works could impact on the structural integrity of the existing clubhouse structure[26].

9.8 Heritage Consultant

Paul Rappoport, a heritage consultant from Heritage 21, made the following comments:

- given the heritage listing of the clubhouse, the options that retain heritage (Options 1, 2, 5 or 6) should be adopted while this is the case;
- however, Option 3, given that there would be conservation of facades, could also be accepted from a heritage perspective;
- although Option 4 was undesirable from a heritage perspective, if there is overwhelming evidence that the existing building is in imminent danger of being destroyed naturally by sea waves, then in anticipation of this eventuality, an application to the NSW government to de-list the building as a heritage item could be made to allow this option to proceed. However, this would be a long (many years) and difficult process, and may not succeed.

[23] No restriction or prevention of beach access is envisaged with Option 6. For example, integrating a ramped "apron" or steps below concourse level into the seawall would enhance access after a coastal erosion event but otherwise remain buried by sand.
[24] As discussed in Section 9, it is considered that if Options 5 or 6 (or 7) are adopted, the seawall/revetment and clubhouse DA's should be separated. However, in terms of staging, it may be necessary to prevent the clubhouse being constructed without a seawall/revetment already being in place.
[25] This is considered to be a significant underestimate of the average recurrence interval of disruptive storm events, given the lowering of sand levels projected with sea level rise (see Section 7.2) which in itself would impact on beach access around the clubhouse without ongoing beach scraping.
[26] This has not been raised as a concern by the structural engineer.

10. ASSESSMENT OF OPTIONS

In Section 3, seven options were listed that have been considered for the redevelopment of Newport SLSC. These options are assessed in Table 3.

Table 3: Assessment of options for redevelopment of Newport SLSC

Option	Advantages	Disadvantages
1 (current concept, no piles or seawall/revetment)	• no building re-design required • preferred by Council's heritage staff and heritage consultant	• clubhouse has an unacceptably high risk of being damaged by coastal erosion over an unacceptably short life • cannot meet Council's design life requirements • heritage cannot be retained in long term due to risk of undermining from coastal erosion • not supported by Council's building assets staff • not preferred by Council's coastal staff • not supported by Council's parks and reserves staff
2 (current concept, new portion on piles, no seawall/revetment)	• preferred by Council's heritage staff and heritage consultant	• existing portion of clubhouse has an unacceptably high risk of being damaged by coastal erosion over an unacceptably short life • cannot meet Council's design life requirements • heritage cannot be retained in long term due to risk of undermining from coastal erosion • not supported by Council's building assets staff • not preferred by Council's coastal staff • new portion is at significant risk of damage when existing portion is undermined • access to new portion could be partially lost if undermined • does not provide sufficient benefit to justify the additional expense compared to Option 1
3 (current concept entirely on piles, no seawall/revetment)	• clubhouse has an acceptably low risk of being damaged by coastal erosion over an acceptably long life • acceptable to Council's heritage staff and the heritage consultant • preferable to Council's coastal and parks and reserves staff	• access to clubhouse could be partially lost if undermined • not preferred by Council's heritage staff • undesirable to Adriano Pupilli Architects as it destroys significant heritage fabric • more expensive than Options 1 and 2

Option	Advantages	Disadvantages
4 (demolish and rebuild on piles, no seawall/revetment)	• clubhouse has an acceptably low risk of being damaged by coastal erosion over an acceptably long life • allows complete flexibility on design to suit current and future Club and community purposes • preferable to Council's coastal and parks and reserves staff (ignoring heritage)	• unacceptable to Council's heritage staff • undesirable to Adriano Pupilli Architects as it is not in keeping with current practice of heritage conservation • likely to be unacceptable to the local community and Club's internal membership • undesirable to heritage consultant • would require de-listing the SLSC as a heritage item, which could take many years and not be successful • access to clubhouse could be partially lost if undermined • more expensive than Options 1 and 2
5 (current concept, no piles, with rock revetment protection)	• clubhouse has an acceptably low risk of being damaged by coastal erosion over an acceptably long life • about $570K cheaper than Option 6 • preferred by Council's building assets staff • acceptable to Council's heritage staff • preferred by Council's heritage consultant • acceptable to Council's coastal and parks and reserves staff if impacts are acceptable • preferred by Club • protects clubhouse and land around clubhouse	• it may be difficult to obtain consent from the Sydney North Planning Panel due to the increased footprint of a rock revetment on public land
6 (current concept, no piles, with vertical or hybrid seawall protection)	• clubhouse has an acceptably low risk of being damaged by coastal erosion over an acceptably long life • can incorporate amenity in seawall (eg bleachers for sitting) if desired • can incorporate steps and ramps in seawall to enable beach access over a wider range of sand levels • acceptable to Council's heritage staff • preferred by Council's heritage consultant	• about $570K more expensive than Option 5

Option	Advantages	Disadvantages
	• acceptable to Council's coastal and parks and reserves staff if impacts are acceptable • preferred by Adriano Pupilli Architects (subject to cost) • could be supported by Club if beach access maintained • protects clubhouse and land around clubhouse • has lower footprint than Option 5 and more chance of consent	
7 (demolish and rebuild, no piles, with revetment or seawall protection)	• clubhouse has an acceptably low risk of being damaged by coastal erosion over an acceptably long life • preferable to Council's coastal staff (ignoring heritage)	• unacceptable to Council's heritage staff • likely to be unacceptable to the local community and Club's internal membership • undesirable to heritage consultant • would require de-listing the SLSC as a heritage item, which could take many years and not be successful

For all options (except Option 5), unless proposed to be removed, existing boulders could remain and potentially be scattered over the beach in a severe storm.

Options 1 and 2 must be dismissed, as these options cannot meet Council's design life requirements, nor typical design life and acceptable risk requirements in industry practice. Furthermore, they only allow heritage to remain until damage from coastal processes occurs (actions of the sea would be expected to ultimately destroy the heritage building).

Options 4 and 7 must be dismissed, as these options do not retain heritage, and assuming it was not desired to attempt the long and difficult process of de-listing the heritage item.

This leaves Options 3, 5 and 6 as potentially feasible, and all these options could achieve the outcome that the clubhouse has an acceptably low risk of being damaged by coastal erosion over an acceptably long life. Additional investigations would be required to determine the cost of Option 3 relative to the other options, but it can be noted that Option 6 would be about $570K more expensive than Option 5. However, Option 6 has an advantage over Option 5 in that it has a lower footprint and more chance of consent.

Option 3 does not require the DA to be submitted to the Sydney North Planning Panel, unless the Capital Investment Value of the redevelopment is over $5 million (see discussion below). Option 3 has a number of disadvantages compared to Options 5 and 6 (in particular, that access to the clubhouse with Option 3 could be partially lost if it was undermined, and a less desirable heritage outcome for Option 3).

If Options 5, 6 or 7 (ie, constructing a revetment or seawall) were adopted, it would need to be decided whether the revetment/seawall component is made a separate DA to the SLSC clubhouse DA, or they were combined. The consent authority for a clubhouse DA is Council's Local Planning Panel, unless the Capital Investment Value (CIV) of the redevelopment is over

$5 million[27]. However, for a seawall/revetment DA (and also if combined with the clubhouse DA)[28], the consent authority is the Sydney North Planning Panel. Both the Local Planning Panel and Sydney North Planning Panel are independent from Council, and the likelihood of the consent with either panel is not considered to be an issue. However, given that a seawall/revetment DA may have particular consent conditions such as a time limited consent which would be undesirable to lump in with the clubhouse consent, it is recommended that the seawall/revetment and clubhouse DA's are separated if it is decided proceed with a seawall/revetment option. This is also the recommendation of Daniel Milliken, Principal Planner at Council.

If the clubhouse and seawall/revetment DA's are separated, the question would then be whether the clubhouse DA has a deferred commencement condition that the consent does not operate until the seawall/revetment is constructed or substantially commenced. This would be to prevent the clubhouse being constructed without a seawall/revetment already being in place. Acceptable risk considerations would promote that outcome.

The requirement that the Sydney North Planning Panel is the consent authority for a seawall/revetment DA would not apply if a Coastal Management Program (CMP) had been certified for the Newport SLSC area or a wider area (such as Newport Beach) incorporating Newport SLSC. Council would become the consent authority if a CMP had been certified. If a CMP had been certified, and it was recognised therein that seawall/revetment protection of the SLSC was a valid option, the seawall/revetment works would be expected to qualify for a 50% funding contribution from the NSW government.

[27] Refer to Schedule 7 of *State Environmental Planning Policy (State and Regional Development) 2011*, regarding what is regionally significant development. From Clause 3, regionally significant development is "Council related development over $5 million - development that has a CIV of more than $5 million if: (a) a council for the area in which the development is to be carried out is the applicant for development consent, or (b) the council is the owner of any land on which the development is to be carried out, or (c) the development is to be carried out by the council, or (d) the council is a party to any agreement or arrangement relating to the development (other than any agreement or arrangement entered into under the Act or for the purposes of the payment of contributions by a person other than the council)". Recent DA's for Mona Vale SLSC and Long Reef SLSC had/have the Sydney North Planning Panel as the consent authority as their CIV's exceeded $5 million.
[28] That is, if any part of a DA includes a seawall/revetment, the consent authority is the Sydney North Planning Panel.

11. CONCLUSIONS

The following options are being considered for the redevelopment of Newport SLSC, and have been assessed herein:

1. current concept, no piles or seawall/revetment
2. current concept, new portion on piles, no seawall/revetment
3. current concept entirely on piles, no seawall/revetment
4. demolish and rebuild on piles, no seawall/revetment
5. current concept, no piles, with rock revetment protection
6. current concept, no piles, with vertical or hybrid seawall protection
7. demolish and rebuild, no piles, with revetment or seawall protection

Options 1 and 2 must be dismissed, as these options cannot meet Council's design life requirements, nor acceptable risk requirements. Furthermore, they only allow heritage to remain until damage from coastal processes occurs.

Options 4 and 7 must be dismissed, as these options do not retain heritage, and assuming it was not desired to attempt the long and difficult process of de-listing the heritage item.

This leaves Options 3, 5 and 6 as potentially feasible, and all these options could achieve the outcome that the clubhouse has an acceptably low risk of being damaged by coastal erosion over an acceptably long life. Additional investigations would be required to determine the cost of Option 3 relative to the other options, but it can be noted that Option 6 would be about $570K more expensive than Option 5. However, Option 6 has an advantage over Option 5 in that it has a lower footprint and more chance of consent. The footprint of a seawall (extent on to the beach) as per Option 6 is about 11.5m less than the revetment as per Option 5.

Option 3 does not require the DA to be submitted to the Sydney North Planning Panel unless the Capital Investment Value of the redevelopment is over $5 million (if any part of a DA includes a seawall/revetment, the consent authority is the Sydney North Planning Panel). Option 3 has a number of disadvantages compared to Options 5 and 6 (in particular, that access to the clubhouse with Option 3 could be partially lost if it was undermined, and a less desirable heritage outcome for Option 3).

If Options 5, 6 or 7 (ie, constructing a revetment or seawall) were adopted, it is recommended that the seawall/revetment and clubhouse DA's are separated, so that potential time limited consent conditions for a seawall/revetment are not applied to the clubhouse consent.

The requirement that the Sydney North Planning Panel is the consent authority for a seawall/revetment DA would not apply if a Coastal Management Program (CMP) had been certified for an area including Newport SLSC. Council would become the consent authority if a CMP had been certified. If a CMP had been certified, and it was recognised therein that seawall/revetment protection of the SLSC was a valid option, the seawall/revetment works would be expected to qualify for a 50% funding contribution from the NSW government.

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