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Estuarine Risk Management Report for 4 Cabarita Road Avalon Beach

1. INTRODUCTION AND BACKGROUND

At 4 Cabarita Road Avalon Beach, it is proposed to replace an existing boatshed over a similar footprint, along with a slightly raised seawall and landscaping works. A Development Application (DA) is to be submitted to Northern Beaches Council for these works.

As the property is potentially affected by estuarine hazards, it is subject to the *Pittwater 21 Development Control Plan* (DCP)¹, in particular Chapter B3.7 and Chapter D15.18, and the *Estuarine Risk Management Policy for Development in Pittwater* (Estuarine Policy, which is Appendix 7 of Part D of the DCP). The *Coastal Management Act 2016* (in particular Section 27, as modifications to an existing seawall are proposed) and *State Environmental Planning Policy (Coastal Management) 2018* (SEPP Coastal) should also be considered.

Horton Coastal Engineering was engaged to prepare an Estuarine Risk Management Report to meet Council's requirements, as set out herein. The report author is Peter Horton [BE (Hons 1) MEngSc MIEAust CPEng NER]. Peter has postgraduate qualifications in coastal engineering and 27 years of coastal engineering experience, including numerous studies along the Pittwater shoreline and specifically along Cabarita Road. He is a Member of Engineers Australia and Chartered Professional Engineer (CPEng) registered on the National Engineering Register. Peter is also a member of the National Committee on Coastal and Ocean Engineering (NCCOE) and NSW Coastal, Ocean and Port Engineering Panel (COPEP) of Engineers Australia. He has inspected the area in the vicinity of the subject property on several occasions in the last few years, including a specific recent inspection of the property on 30 June 2019.

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

2. INFORMATION PROVIDED

Horton Coastal Engineering was provided with 10 drawings of the proposed development prepared by Corben Architects, namely DA00 and DA02 to DA10, Revision A and dated 9 April 2019. A site survey by C.M.S Surveyors was also provided, Reference 11312detail and dated 12 August 2013.

¹ The DCP version up to Amendment 24 (effective from 20 October 2018) was considered herein.

3. EXISTING SITE DESCRIPTION

A photograph of the subject property taken on 30 June 2019 is provided in Figure 1. The property is located adjacent to the Pittwater waterway on its eastern foreshore, just NE of the tip of Stokes Point, with a broad aerial view depicted in Figure 2. The property is most exposed to a wind-wave fetch from the north (fetch length exceeding 4km), with lesser exposure towards the NNW at Great Mackerel Beach (fetch length of 3.2km) and NW at Currawong Beach (fetch length of 2.6km). Stokes Point is generally considered to be the limit of significant swell wave action for waves propagating from the Pacific Ocean into Pittwater between West Head and Barrenjoey Head.



Figure 1: View of foreshore at subject property, looking SW, with seawall, boatshed and pool evident

Based on the survey, the existing seawall at the property has a crest level of about 1.45m AHD, with adjacent sand levels at the bottom of the wall at about -0.1 to -0.4m AHD. The boatshed has a floor level of about 1.4m AHD. The seawall, pool and boatshed extend about 8m to 9m seaward of the seaward property boundary (a Mean High Water Mark boundary).

Adjacent properties also have vertical seawalls, including 2 Cabarita Road (the only property to the north), and No. 6, 8, 10, 12, 14, 16 and 18 to the south (that is, at least the 7 properties immediately south of the subject property).

Based on the hydrographic chart AUS 215, offshore seabed levels lower to about -5.9m AHD at 30m and 250m offshore, and lower further to about -8.6m AHD between these two locations.

4. PROPOSED DEVELOPMENT

It is proposed to demolish and rebuild the existing boatshed over a similar footprint (extending about 0.5m seaward), with a slightly higher floor level of 1.75m AHD (concrete floor, slab-on-ground, with timber walls). The seawall and adjacent natural ground are to be raised by about 170mm to 1.62m AHD, with the seawall at the same alignment as existing. The raising of the seawall is motivated by the increasing frequency of overtopping of the seawall, as mean sea level has risen over the last century by about 1mm per year on average since 1914 at Fort Denison (Whitehead & Associates, 2014).



Figure 2: Broad aerial view of subject property on 30 August 2018

5. DESIGN LIFE

In the Estuarine Policy, it is noted that a design project life of 100 years should be adopted, unless otherwise justified. A 60-year design life (that is, at 2079) has been adopted for the seawall. This is considered to be a conservative design life for an estuarine seawall with limited adverse consequences if it failed. This is the same design life as adopted in the “Coastal Zone Management Plan [CZMP] for Bilgola Beach (Bilgola) and Basin Beach (Mona Vale)” that was gazetted on 14 July 2017, which is a location where the consequences of coastline hazards being realised are far greater than at the subject property. Although this CZMP does not geographically apply at the subject property, it is the only gazetted CZMP in the former Pittwater Council area, and hence is relevant to consider in the selection of design life.

A 25 year design life (that is, at 2044) has been adopted for the boatshed. This is consistent with *Australian Standard AS 4997 - Guidelines for the Design of Maritime Structures*, in which the recommended design life for a small craft facility is 25 years. Furthermore, in AS 4997 it is noted that generally timber would not be used as the principal structural medium for a facility with a design life greater than 25 years, and at the subject property timber has been proposed as the principal structural medium for the boatshed.

6. ESTUARINE PROCESSES

In Cardno (2015), the 100-year Average Recurrence Interval (ARI) present day water level in the region covering the subject property is reported as 1.50m AHD. This includes the effects of astronomical tide and storm surge (combined level of 1.44m AHD), and local wind setup (0.06m AHD). Wave action can temporarily and periodically increase water levels above this level in a severe storm.

At present at the subject property, Mean High Water is approximately 0.5m AHD and Mean High Water Springs is about 0.6m AHD. The combined astronomical tide and storm surge level for a monthly and bi-annual event is about 1.0m and 1.2m AHD respectively. Corresponding water levels only increase slightly for rarer events, eg 1 year ARI level of 1.24m AHD, 10 year ARI level of 1.34m AHD and 50 year ARI water level of 1.41m AHD (Department of Environment, Climate Change and Water [DECCW] (2010).

In Cardno (2015), sea level rise values of 0.4m at 2050 and 0.9m at 2100 were applied relative to the present, which is not correct as those benchmarks were derived relative to 1990, and historical sea level rise has not been discounted. Appropriate sea level rise values (relative to 2010) with discounting of historical sea level rise would be 0.34m at 2050 and 0.84m at 2100.

For the proposed design life of 60 years (at 2079), it would be possible to interpolate between the 2050 and 2100 benchmarks. However, given the non-linear rate of sea level rise, it is considered to be most appropriate to directly derive sea level rise values from IPCC (2013a, b), which is widely accepted by competent scientific opinion.

Using the same methodology as applied in the acceptable risk assessment in the Bilgola/Basin CZMP referred to in Section 5, with a base year of 2010 as Cardno (2015) water levels were derived at 2010, the sea level rise values presented in Table 1 (at 2079) were determined for various emissions scenarios.

Table 1: Global mean sea level rise (m) from 2010 to 2079 derived from IPCC (2013b)

Emissions Scenario	Exceedance Probability		
	95% exceedance	Median	5% exceedance
SRES A1B	0.28	0.39	0.52
RCP2.6	0.21	0.31	0.42
RCP4.5	0.25	0.36	0.48
RCP6.0	0.25	0.35	0.47
RCP8.5	0.33	0.46	0.61
Average	0.26	0.38	0.50

Taking the median exceedance probability, and average of the 5 emissions scenarios, and adding 15% for local sea level rise variation based on IPCC (2013b), a sea level rise value of 0.43m at 2079 (relative to 2010) was derived. Therefore, the 100 year ARI still water level at 2079 is 1.95m AHD. This means that the seawall would be inundated by still water to a depth of 0.33m in the design event at 2079. Allowing for the 0.43m of sea level rise, the still water level of 1.62m AHD to overtop the seawall would have an approximate 0.08% exceedance probability in 2079 based on Manly Hydraulics Laboratory [MHL] (2014).

Cardno (2015) estimated that the 100 year ARI wave climate in the region covering the subject property was a significant wave height of 0.92m (average of the highest one-third of waves) and mean wave period of 2.4s (or peak spectral wave period of 3.4s assuming a 1.4 multiplier).

Based on stream function wave theory, at the seawall crest (for a design still water level of 1.95m AHD, local depth of 2.25m, and peak spectral wave period of 3.4s) the 100 year ARI wave height of 0.92m would have a crest elevation of 0.59m above the still water level, that is to 2.54m AHD. This level of 2.5m AHD can be adopted as the Estuarine Planning Level (EPL) for the purpose of seawall design for the report herein. It is not appropriate to add 0.3m of freeboard as per Cardno (2015)².

For the boatshed with a 25 year design life, using the same methodology outlined above, a sea level rise value of 0.18m at 2044 (relative to 2010) was derived. Therefore, the 100 year ARI still water level at 2044 is 1.68m AHD, which would not overtop the seawall or reach the boatshed (ignoring wave action). Allowing for the 0.18m of sea level rise, the still water level of 1.68m AHD would have less than a 0.001% exceedance probability in 2044 based on MHL (2014).

Based on stream function wave theory, at the seawall crest seaward of the boatshed (for a design still water level of 1.68m AHD, local depth of 1.98m, and peak spectral wave period of 3.4s) the 100 year ARI wave height of 0.92m would have a crest elevation of 0.61m above the still water level, that is to 2.29m AHD. This wave would overtop the seawall and propagate at shallow depth towards the boatshed, which is proposed to be located about 4.5m landward of the seawall. Based on Cardno (2015) and considering inland attenuation of the wave, the EPL at the boatshed is about 2.2m AHD. That is, about 0.5m depth of inundation could be expected in the boatshed for the design event (again noting that it is not appropriate to add freeboard).

² Use of a freeboard is not considered to be necessary. As defined in the Floodplain Development Manual (NSW Government, 2005), freeboard provides a factor of safety to compensate for uncertainties in the estimation of flood levels, such as wave action, localised hydraulic behaviour, and other effects such as climate change. Understanding the purpose of freeboard, it is evident that the estimates of still water levels and wave crest levels given herein generally take account of the components that (by definition) comprise freeboard.

7. RISKS OF DAMAGE TO PROPOSED SEAWALL AND MITIGATION OF THOSE RISKS

The additional height of the seawall will increase its overturning moment, and reduce the factor of safety of the current wall. It is recommended that a check of the revised factor of safety is made as part of detailed structural design, allowing for a design water level of 2.54m AHD over the wall, and allowing for fully saturated soil conditions landward of the wall at the same time as a low estuary water level of -0.5m AHD.

Modifications may need to be made to the wall to achieve an acceptable factor of safety, such as introduction of free draining fill (such as blue metal wrapped in geotextile) landward of the wall (if not already present) and additional drainage outlets (with a geotextile “sock” to prevent soil migration through the outlets) to reduce the potential for groundwater buildup, and addition of anchors.

The condition of the face and base of the existing wall should also be checked, and be made good as required, to ensure there are not gaps through which soil could leak through. The foundation of the wall should also be checked that it is socketed into bedrock or founded below a beach scour level as advised by a coastal engineer, and made good as required.

Given that the seawall may be overtopped by waves at times of severe storms, this may cause erosion of landscaped areas landward of the wall. Reinstatement and repair of these areas may thus be required at times, but this potential damage is not considered to be a concern to overall site stability.

Materials should be selected that are inundation compatible and suitable for the marine environment. Any concrete structures or components should be generally designed in accordance with the requirements of *Australian Standard AS3600 – Concrete Structures* and steel structures or components should be designed to conform with *Australian Standard AS4100 – Steel Structures*. The requirements of *Australian Standard AS4997 - Guidelines for the Design of Maritime Structures* should also be considered.

If the additional height of seawall is to be achieved by adding new stone capping, there is the potential for wave forces to displace the capping in a severe storm. The risk of this occurring can be reduced by having the capping flush with the seaward face of the seawall, having soil landing of the capping to its full height, and having a connection between the capping and seawall. That stated, it is not a significant issue for structural stability if some capping is displaced in a severe storm. Sandstone suitable for the marine environment should be used as advised by a coastal engineer.

If the recommendations within this Section 7 are followed, the risks of damage to the proposed seawall would be suitably mitigated, and it would have an adequately low risk of failure.

8. RISKS OF DAMAGE TO PROPOSED BOATSHED AND MITIGATION OF THOSE RISKS

The main risks of damage to the boatshed from estuarine processes for the design event are as follows:

- wave overtopping propagating into the seaward face of the boatshed, causing damage to the doors and damage to timber elements; and
- inundation of the boatshed floor causing damage to items within the boatshed.

To reduce the risk of damage to the doors they could be designed for wave forces, although designing to resist these loads may be difficult to achieve in practice. Damage may be accepted for this non-habitable structure, as long as the following recommendations are adopted:

- only boating equipment and related items that can withstand periodic inundation should be placed within the boatshed below 2.3m AHD;
- all electrical equipment, wiring, and any other service pipes and connections should be placed above 2.3m AHD, or waterproofed if below the EPL; and
- fuels and other chemicals or potentially toxic materials should be stored above 2.3m AHD or in watertight containers.

It is recommended that the timber used in the boatshed is suitable for the marine environment. Examples of suitable species include tallowwood, white mahogany, grey box, blackbutt, yellow stringybark and turpentine (NSW Maritime, 2005). Timber of Class 1 or 2 natural durability should be used for all marine structures as per *Australian Standard AS4997 - Guidelines for the Design of Maritime Structures*. Timber structures should generally be designed in accordance with the requirements of *Australian Standard AS1720.1 - Timber Structures*.

If the recommendations within this Section 8 are followed, the risks of damage to the proposed boatshed would be suitably mitigated, and it would have an adequately low risk of failure.

9. CONTROLS IN PITTWATER 21 DCP

9.1 Section B3.7

Council requested that Section B3.7 of the Pittwater 21 DCP should be addressed. Section B3.7 applies to dwelling house developments and similar. For a seawall, which is “other development”, it could be argued that Section B3.9 of the DCP applies. That stated, there is no material difference in Section B3.7 and B3.9 for the purpose of the investigation reported herein, so Section B3.7 is referred to herein. Based on Section B3.7 of the DCP (numbering added herein for convenience):

1. All development or activities must be designed and constructed such that they will not increase the level of risk from estuarine processes for any people, assets or infrastructure in surrounding properties; they will not adversely affect estuarine processes; they will not be adversely affected by estuarine processes; and
2. All structural elements below the Estuarine Planning Level shall be constructed from flood compatible materials; and
3. All structures must be designed and constructed so that they will have a low risk of damage and instability due to wave action and tidal inundation; and
4. All electrical equipment, wiring, fuel lines or any other service pipes and connections must be waterproofed to the Estuarine Planning Level; and
5. The storage of toxic or potentially polluting goods, materials or other products, which may be hazardous or pollute the waterway, is not permitted to be stored below the Estuarine Planning Level; and
6. For existing structures, a tolerance of up to minus 100mm may be applied to the Estuarine Planning Level in respect of compliance with these controls.
7. To ensure Council's recommended flood evacuation strategy of 'shelter in place' it will need to be demonstrated that there is safe pedestrian access to a 'safe haven' above the Estuarine Planning Level.

With regard to Item 1, the proposed boatshed is to be constructed over a similar footprint as the existing boatshed, and with the floor level raised about 0.35m, reducing its risk of damage from inundation. The boatshed would not change estuarine processes nor increase the level of risk in surrounding areas, which is intrinsically low anyhow. The increase in height of the proposed seawall would not be expected to significantly change or impact on estuarine processes nor surrounding properties, except to reduce the overtopping into the subject property in severe storms. If the recommendations in Section 7 and Section 8 are followed, the risks of the proposed seawall and boatshed respectively being adversely affected by estuarine processes would be suitably mitigated.

With regard to Item 2, it has been recommended in Section 7 and Section 8 that materials should be selected that are inundation compatible and suitable for the marine environment.

With regard to Item 3, if the recommendations in Section 7 and Section 8 are followed in design and construction, then the seawall and boatshed respectively would have a low risk of damage and instability due to wave action and tidal inundation.

With regard to Item 4 and Item 5, it was noted in Section 8 that this should apply to the proposed boatshed, with these items not applicable to the proposed seawall.

Item 6 has not been applied to the boatshed for design purposes. Either way, the floor of the boatshed will be below the EPL.

With regard to Item 7, this is not applicable to a non-habitable boatshed and seawall. It can be noted that occupants are not at significant risk of injury on the site for the design event, and can shelter-in-place in the dwelling without any need for evacuation. It is further noted that the largest component of elevated water level is astronomical tide, which is entirely predictable and independent of the storm event, so early warning is available. The inundation peak would also only have a duration of around 2 hours (at high tide).

Based on Section B3.7 of the DCP, “developments that propose mitigation works that modify the wave action or tidal inundation behaviour within the development site including the filling of land, the construction of retaining structures and the construction of wave protection walls may be permitted on a merit basis subject to demonstration through an Estuarine Risk Management Report that:

- (a) The wave action or tidal inundation mitigation works do not have an adverse impact on any surrounding property or estuarine processes up to the Estuarine Planning Level; and
- (b) The wave action or tidal inundation mitigation works result in the protection of the existing and the proposed development from inundation up to the Estuarine Planning Level; and
- (c) The wave action or tidal inundation mitigation works do not have an adverse impact on the environment (this includes but is not limited to the altering of natural flow paths and the clearing of vegetation)”.

The above applies, as a raised seawall with filling landward is proposed.

With regard to Item (a), as noted in regard to Item 1 above, the proposed works would not impact on surrounding properties or estuarine processes.

With regard to Item (b), raising the seawall is necessary to provide adequate protection to the foreshore land from wave overtopping over the long term, to take account of historical rise and future projected rise in mean sea level. The seawall itself would have low risk of damage and instability due to wave action and tidal inundation as noted in regard to Item 3 above.

With regard to Item (c), the proposed works would not alter natural flow paths, and would be marginally filling an area that is already filled and established with lawn.

In Section B3.7 of the DCP it is stated that “consideration may be given on a merit basis to a floor level of a boat shed at a level lower than the Estuarine Planning Level where it can be demonstrated through an Estuarine Risk Management Report that the boat shed is structurally designed to withstand periodic wave action and tidal inundation up to the Estuarine Planning Level”. If the recommendations in Section 8 are followed, this would be achieved.

9.2 Section D15.18

As a raised seawall is proposed, Section D15.18 of the Pittwater 21 DCP applies to these works. The DCP is impractical to apply literally along the Pittwater foreshore where seawalls, particularly vertical walls, are prevalent. In D15.18 of the DCP, it is stated that “seawalls shall not be permitted”, with a variation that “Council may consider the construction of seawalls where there is potential for erosion from coastal processes and protection of property is necessary”.

In response, it can be noted that seawalls are permissible with consent based on NSW legislation, namely Clause 19 of *State Environmental Planning Policy (Coastal Management) 2018*, that prevails over D15.18. At the subject property, there is an existing vertical seawall, with vertical seawalls at all surrounding properties as noted in Section 3. If there was not a seawall, the foreshore would be subject to erosion, undermining the boatshed, pool and access to the dwelling, and ultimately impacting on slope stability. A seawall is thus necessary to maintain the existing foreshore infrastructure, along with being an existing use.

The criteria to consider in D15.18 are listed below:

- i. where possible, maintain the curvature of the existing shoreline;
- ii. incorporate low profile walls, battered or stepped back from the foreshore wherever practicable, with a maximum recommended height of 1 metre above mean high water mark. (1.5 metres AHD);
- iii. constructed of or faced in rectangular shaped sandstone, being either dressed or rough-cut in order to promote a uniform treatment along the foreshore. Alternative building materials, such as reconstructed sandstone concrete blocks or similar, which reflect a sandstone character shall also be suitable, particularly where greater structural strength may be required. Materials such as timber, concrete (including nylon mattress structures) gabions or other materials not in keeping with the character of the area shall not be permitted. Concrete/nylon mattress structures may be suitable for public drainage and associated bank stabilisation works where it can be demonstrated that such structures will not detract from the visual amenity of the locality.
- iv. only clean fill is to be used behind sea walls.
- v. where practicable, sandy beach areas should be incorporated in front of seawalls.
- vi. be designed so that the existing footprint is maintained (i.e. does not encroach any further into the intertidal zone) and the seawall is sloped back towards the property. There must be no additional reclamation of water land (requires a permit from the

- Department of Primary Industries) or replacement of the existing wall with a vertical seawall;
- vii. that there is no mortaring of the seawall and a geotextile fabric is used behind the seawall to prevent loss of sediment through the seawall;
 - viii. should be rock rip rap, boulders or similar complex structures, and where possible incorporate further vertical and horizontal complexity.
 - ix. maximise the incorporation of native riparian and estuarine vegetation;
 - x. create low sloping seawalls and/or incorporate changes of slope; and
 - xi. it is recommended that proponents consult with both the Coasts & Estuaries section of the Office of Environment and Heritage, and with the Aquatic Habitat Protection unit of the Department of Primary Industries.
 - xii. compliance with Environmentally Friendly Seawalls - A Guide to Improving the Environmental Value of Seawalls and Seawall-lined Foreshores in Estuaries (Sydney Metropolitan Catchment Management Authority 2009).

For Item (i), the raised seawall alignment matches the existing seawall alignment, which follows the shoreline alignment.

For Item (ii), the seawall is proposed to be raised to account for increased overtopping as mean sea level has risen over the last century and is projected to continue to rise. If sea level rises by x, increasing the wall crest level by x maintains the same height of wall relative to the waterline. The proposed crest level of 1.62m AHD is only 120mm above the 1.5m AHD stipulated in (ii), which is much less than the projected sea level rise over the design life.

For Item (iii), the raised wall would be consistent in appearance with the existing wall.

For Item (iv), use of clean imported fill is expected, and could be a condition of consent. As noted in Section 7, a drainage layer is required landward of the wall.

For Item (v), no modification to the existing sandy beach offshore of the seawall is proposed.

For Item (vi), the raised seawall is on the same alignment as existing. The existing seawall is vertical, and it is appropriate to maintain this profile, with the existing wall being retained and existing infrastructure located landward.

For Item (vii), recommendations on use of geotextile fabric have been provided in Section 7. There is no mortar between the concrete blocks forming the wall at present. As noted in Section 7, it may be necessary to infill any gaps in the concrete through which soil could leak through, so a restriction on the use of mortar is not considered to be appropriate.

For Item (viii), as outlined above a vertical wall is being maintained at this site, and a sloping boulder type wall is not appropriate. Complexity could be added by fitting 'flowerpot' type units on to the face of the wall around mean sea level, but this is beyond the scope and has not been proposed for this seawall raising project.

For Item (ix), the position and profile of the seawall does not allow estuarine vegetation to be incorporated. It is not strictly forming a riparian zone as it is not adjacent to a river.

For Item (x), see Item (vi).

For Item (xi), this is not necessary for a minor seawall raising well above the intertidal area, that would not affect aquatic vegetation.

For Item (xii), see Item (viii).

10. ESTUARINE RISK MANAGEMENT POLICY FOR DEVELOPMENT IN PITTWATER

The requirements of the *Estuarine Risk Management Policy for Development in Pittwater* (Estuarine Policy) have been met herein by consideration of:

- estuarine processes and the Estuarine Planning Level in Section 6;
- risks of damage to the proposed seawall and mitigation of those risks in Section 7;
- risks of damage to the proposed boatshed and mitigation of those risks in Section 8; and
- the controls in B3.7 of the Pittwater 21 DCP in Section 9.1.

Furthermore, although the current Estuarine Policy does not have a form that is required to be filled in, Council has in the past requested that a form provided in a former Estuarine Policy be filled in, as provided at the end of the document herein.

11. CLAUSE 7.8 OF PITTWATER LOCAL ENVIRONMENTAL PLAN 2014

11.1 Clause 7.8(1)

Based on Clause 7.8(1) of *Pittwater Local Environmental Plan 2014*, the “objectives of this clause are as follows:

- (a) to ensure that development in the foreshore area will not impact on natural foreshore processes or affect the significance and amenity of the area,
- (b) to ensure continuous public access along the foreshore area and to the waterway”.

The proposed seawall and boatshed will not significantly impact on natural foreshore processes, and will not affect public access as the raised seawall is on the same alignment as existing and in an area where public access is already constrained by numerous jetties projecting into the waterway and limited dry foreshore (that is not used for public access).

11.2 Clause 7.8(2)

Based on Clause 7.8(2) of *Pittwater Local Environmental Plan 2014*, “development consent must not be granted for development on land in the foreshore area except for the following purposes:

- (a) the extension, alteration or rebuilding of an existing building wholly or partly in the foreshore area, if the levels, depth or other exceptional features of the site make it appropriate to do so,
- (b) boat sheds, sea retaining walls, wharves, slipways, jetties, waterway access stairs, swimming pools, fences, cycleways, walking trails, picnic facilities or other recreation facilities (outdoors)”.

The proposed seawall and boatshed, which are within the foreshore area, satisfy Clause 7.8(2)(b).

11.3 Clause 7.8(3)

Based on Clause 7.8(3) of *Pittwater Local Environmental Plan 2014*, “development consent must not be granted under this clause unless the consent authority is satisfied that:

- (a) the development will contribute to achieving the objectives for the zone in which the land is located, and
- (b) the appearance of any proposed structure, from both the waterway and adjacent foreshore areas, will be compatible with the surrounding area, and
- (c) the development will not cause environmental harm such as:
 - i) pollution or siltation of the waterway, or
 - ii) an adverse effect on surrounding uses, marine habitat, wetland areas, fauna and flora habitats, or
 - iii) an adverse effect on drainage patterns, or
 - iv) the removal or disturbance of remnant riparian vegetation, and
- (d) the development will not cause congestion or generate conflict between people using open space areas or the waterway, and
- (e) opportunities to provide continuous public access along the foreshore and to the waterway will not be compromised, and
- (f) any historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance of the land on which the development is to be carried out and of surrounding land will be maintained, and
- (g) in the case of development for the alteration or rebuilding of an existing building wholly or partly in the foreshore area, the alteration or rebuilding will not have an adverse impact on the amenity or aesthetic appearance of the foreshore, and
- (h) sea level rise, coastal erosion and recession, or change of flooding patterns as a result of climate change, have been considered”.

For Item (a), the objectives were listed above (in Section 11.1, in relation to Clause 7.8(1)), where it was noted that the proposed seawall and boatshed satisfied these objectives, and hence Item (a) is satisfied.

For Item (b), the proposed seawall and boatshed would match the appearance and levels of the existing/adjacent seawalls and boatsheds respectively. The new boatshed is a renovation of an existing boatshed over a similar footprint and slightly higher floor level.

For Item (c), if properly designed and constructed (including the use of appropriate construction environmental controls), the proposed seawall and boatshed would not cause any significant pollution or siltation of the waterway, nor adversely impact on adjacent areas. No remnant riparian vegetation is to be removed as part of the proposed works.

For Item (d), the proposed works would not affect public use of the foreshore and would not cause any conflict with waterway uses.

For Item (e), the proposed works would not affect public access along the foreshore area.

For Item (f), there is no known historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance of the land on which the development is to be carried out.

For Item (g), see Item (b).

For Item (h), sea level rise was considered in Section 6. Issues relating to scour/erosion would be overcome by ensuring that the existing seawall was founded on bedrock or below estimated scour levels, as outlined in Section 7.

11.4 Clause 7.8(4)

Based on Clause 7.8(4) of *Pittwater Local Environmental Plan 2014*, “in deciding whether to grant consent for development in the foreshore area, the consent authority must consider whether and to what extent the development would encourage the following:

- (a) continuous public access to and along the foreshore through or adjacent to the proposed development,
- (b) public access to link with existing or proposed open space,
- (c) public access to be secured by appropriate covenants, agreements or other instruments registered on the title to land,
- (d) public access to be located above mean high water mark,
- (e) the reinforcing of the foreshore character and respect for existing environmental conditions”.

As stated above, the proposed works would not affect public access along the foreshore.

12. STATE ENVIRONMENTAL PLANNING POLICY (COASTAL MANAGEMENT) 2018

12.1 Preamble

Based on *State Environmental Planning Policy (Coastal Management) 2018* (SEPP Coastal) and its associated mapping, the subject property is within a “coastal environment area” (see Section 12.2) and “coastal use area” (see Section 12.3).

Based on Clause 19(1) of SEPP Coastal, the proposed seawall (coastal protection works) is permissible with consent at the subject property.

12.2 Clause 13

Based on Clause 13(1) of SEPP Coastal, “development consent must not be granted to development on land that is within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following:

- (a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,
- (b) coastal environmental values and natural coastal processes,
- (c) the water quality of the marine estate (within the meaning of the *Marine Estate Management Act 2014*), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1,
- (d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,
- (e) existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,
- (f) Aboriginal cultural heritage, practices and places,
- (g) the use of the surf zone”.

With regard to (a), the proposed works are in a developed residential area, with the boatshed a renovation of an existing boatshed and the seawall modification only a raising of an existing seawall. The works would not be expected to adversely affect the biophysical, hydrological (surface and groundwater) and ecological environments. The proposed works would not be a source of pollution as long as appropriate construction environmental controls are applied.

With regard to (b), the proposed works would not be expected to adversely affect estuarine processes in Pittwater.

With regard to (c), the proposed works will not adversely impact on water quality as long as appropriate construction environmental controls are applied.

With regard to (d), this is not a coastal engineering matter so is not definitively considered herein. That stated, there are no undeveloped headlands or rock platforms in proximity to the proposed development, and no marine vegetation in the area to be developed.

With regard to (e), the proposed works would not impact on public open space and access to and along the foreshore.

With regard to (f), based on a search of the Office of Environment and Heritage “Aboriginal Heritage Information Management System” (AHIMS) on 31 July 2019, there are no particular Aboriginal sites or Aboriginal Places recorded or declared within 200m of the subject property.

With regard to (g), there is no significant or practical surf zone offshore of the subject property, so this is not applicable. That stated, the proposed works would not be expected to alter wave and water level processes seaward of the property.

Based on Clause 13(2) of SEPP Coastal, “development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:

- (a) the development is designed, sited and will be managed to avoid an adverse impact referred to in subclause (1), or
- (b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or
- (c) if that impact cannot be minimised—the development will be managed to mitigate that impact”.

The proposed development has been designed and sited to avoid the adverse impacts referred to in Clause 13(1).

12.3 Clause 14

Based on Clause 14(1) of SEPP Coastal, “development consent must not be granted to development on land that is within the coastal use area unless the consent authority:

- (a) has considered whether the proposed development is likely to cause an adverse impact on the following:
 - (i) existing, safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,
 - (ii) overshadowing, wind funnelling and the loss of views from public places to foreshores,
 - (iii) the visual amenity and scenic qualities of the coast, including coastal headlands,

- (iv) Aboriginal cultural heritage, practices and places,
- (v) cultural and built environment heritage, and
- (b) is satisfied that:
 - (i) the development is designed, sited and will be managed to avoid an adverse impact referred to in paragraph (a), or
 - (ii) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or
 - (iii) if that impact cannot be minimised—the development will be managed to mitigate that impact, and
- (c) has taken into account the surrounding coastal and built environment, and the bulk, scale and size of the proposed development”.

With regard to (a)(i), the proposed works would not impact on foreshore access, as discussed previously.

With regard to (a)(ii), (a)(iii), (a)(v) and (c), these are not coastal engineering matters so are not considered herein.

With regard to (a)(iv), there are no particular Aboriginal sites or Aboriginal Places recorded or declared within 200m of the subject property, as noted in Section 12.2.

With regard to (b), the proposed development has been designed and sited to avoid any potential adverse impacts referred to in Clause 14(1).

12.4 Clause 15

Based on Clause 15 of SEPP Coastal, “development consent must not be granted to development on land within the coastal zone unless the consent authority is satisfied that the proposed development is not likely to cause increased risk of coastal hazards on that land or other land”. As discussed in Section 9.1, the proposed development is unlikely to have a significant impact on coastal hazards or increase the risk of coastal hazards in relation to any other land.

12.5 Clause 16

Based on Clause 16 of SEPP Coastal, “development consent must not be granted to development on land within the coastal zone unless the consent authority has taken into consideration the relevant provisions of any certified coastal management program that applies to the land”. No certified coastal management program applies at the subject property.

13. COASTAL MANAGEMENT ACT 2016

Based on Section 27 of the *Coastal Management Act 2016*, “development consent must not be granted under the *Environmental Planning and Assessment Act 1979* to development for the purpose of coastal protection works, unless the consent authority is satisfied that:

- (a) the works will not, over the life of the works:
 - (i) unreasonably limit or be likely to unreasonably limit public access to or the use of a beach or headland, or
 - (ii) pose or be likely to pose a threat to public safety, and
- (b) satisfactory arrangements have been made (by conditions imposed on the consent) for the following for the life of the works:

- (i) the restoration of a beach, or land adjacent to the beach, if any increased erosion of the beach or adjacent land is caused by the presence of the works,
- (ii) the maintenance of the works”.

For Section 27(a), the works will not ever unreasonably limit public access to or the use of a beach or headland, as they are not changing the current foreshore extent, and the area seaward of the property is not an area used by the public. The works have been designed to have an acceptably low risk of damage, and therefore pose an acceptably low threat to public safety. Given the location of the works in an area that is not used by the public, there can be confidence that the works would never be a threat to public safety, even if they failed.

For Section 27(b), the beach area seaward of the proposed works would not ever be affected by the proposed works. It is therefore not relevant to be applying a requirement for beach restoration at the subject property. Given the relatively low value of the proposed works and low consequence of any damage to the works, and the fact that the seawall is an existing use, it is considered to be unnecessary to be applying a maintenance condition as per Section 27(b)(ii) in this case.

14. CONCLUSIONS

At 4 Cabarita Road Avalon Beach, it is proposed to replace an existing boatshed over a similar footprint, along with a slightly raised seawall and landscaping works. If the recommendations in Section 7 and Section 8 are followed, the risks of the proposed seawall and boatshed respectively being adversely affected by estuarine processes would be suitably mitigated.

The proposed boatshed and seawall (as relevant) satisfy the requirements of Sections B3.7 and D15.18 of the Pittwater 21 DCP, the *Estuarine Risk Management Policy for Development in Pittwater*, Clause 7.8 of *Pittwater Local Environmental Plan 2014*, *State Environmental Planning Policy (Coastal Management) 2018*, and Section 27 of the *Coastal Management Act 2016*, as outlined herein.

15. REFERENCES

Cardno (2015), *Pittwater Estuary Mapping of Sea Level Rise Impacts*, LJ2882/R2658v7, Revised Draft, for Pittwater Council, February

Department of Environment, Climate Change and Water [DECCW] (2010), *Coastal Risk Management Guide: Incorporating sea level rise benchmarks in coastal risk assessments*, DECCW 2010/760, August, ISBN 978 1 74232 922 2

Intergovernmental Panel on Climate Change (2013a), “Summary for Policymakers”, in: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, [Stocker, TF; Qin, D; Plattner, G-K; Tignor, M; Allen, SK; Boschung, J; Nauels, A; Xia, Y; Bex, V and PM Midgley (editors)], Cambridge University Press, Cambridge, United Kingdom and New York, New York, USA

Intergovernmental Panel on Climate Change (2013b), *Climate Change 2013, The Physical Science Basis, Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Final Draft, 30 September

Manly Hydraulics Laboratory [MHL] (2014), “OEHS NSW Water Level Distribution Analysis”, *Report MHL 2100*, March, prepared for NSW Office of Environment and Heritage

NSW Government (2005), *Floodplain Development Manual, the management of flood liable land*, Department of Infrastructure, Planning and Natural Resources, DIPNR 05_020, ISBN 0 7347 5476 0, April

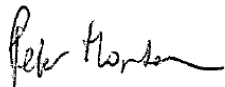
NSW Maritime (2005), *Engineering Standards & Guidelines for Maritime Structures*, First Edition, March

Whitehead & Associates (2014), *South Coast Regional Sea-level Rise Planning and Policy Response Framework*, Version 04, Final, 20 October, for Eurobodalla Shire Council and Shoalhaven City Council

16. SALUTATION

If you have any further queries, please do not hesitate to contact Peter Horton via email at peter@hortoncoastal.com.au or via mobile on 0407 012 538.

Yours faithfully
HORTON COASTAL ENGINEERING PTY LTD



Peter Horton
Director and Principal Coastal Engineer

This report has been prepared by Horton Coastal Engineering Pty Ltd on behalf of and for the exclusive use of Shane Gluskie and Corben Architects (the client), and is subject to and issued in accordance with an agreement between the client and Horton Coastal Engineering Pty Ltd. Horton Coastal Engineering Pty Ltd accepts no liability or responsibility whatsoever for the report in respect of any use of or reliance upon it by any third party. Copying this report without the permission of the client or Horton Coastal Engineering Pty Ltd is not permitted.

Estuarine Risk Management Policy for Pittwater Form No. 1 is provided overleaf

FORM NO. 1

To be submitted with Estuarine Risk Management Report

Development Application for Shane Gluskie and Corben Architects

Name of Applicant

Address of site 4 Cabarita Road Avalon Beach

Declaration made by a Coastal Engineer as part of an Estuarine Risk Management Report

I, Peter Horton on behalf of Horton Coastal Engineering Pty Ltd
(Insert Name) (Trading or Company Name)

on this the 14th August 2019 (date)

certify that I am a Coastal Engineer as defined by the Estuarine Risk Management Policy for Development in Pittwater and I am authorised by the above organisation/company to issue this document and to certify that the organisation/company has a current professional indemnity policy of at least \$2 million.

Please mark appropriate box

- ☒ I have prepared the detailed Estuarine Risk Management Report referenced below in accordance with the Estuarine Risk Management Policy for Development in Pittwater
- ☐ I am willing to technically verify that the detailed Estuarine Risk Management Report referenced below has been prepared in accordance with the Estuarine Risk Management Policy for Development in Pittwater
- ☐ I have examined the site and the proposed development/alteration in detail and, as detailed in my report, am of the opinion that the Development Application only involves Minor Development/Alterations or is sited such that a detailed Estuarine Risk Management Report is not required.

Estuarine Risk Management Report Details:

Report Title:

Estuarine Risk Management Report for 4 Cabarita Road Avalon Beach

Report Date:

14 August 2019

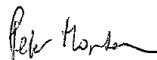
Author: Horton Coastal Engineering Pty Ltd

Documentation which relate to or are relied upon in report preparation:

See Section 2 and Section 15 of report

I am aware that the above Estuarine Risk Management Report, prepared for the above mentioned site is to be submitted in support of a Development Application for this site and will be relied on by Northern Beaches Council as the basis for ensuring that the estuarine risk management aspects of the proposed development have been adequately addressed to achieve an acceptable risk management level for the life of the structure, taken as at least 100 years unless otherwise stated and justified in the Report and that all reasonable and practical measures have been identified to remove foreseeable risk.

Signature



Name

Peter Horton

Chartered Professional Status

MIEAust CPEng

Membership No.

452980