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The Owners of 185 Ocean Street Narrabeen
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9 October 2023

Coastal Engineering Advice on 185 Ocean Street Narrabeen

1. INTRODUCTION AND BACKGROUND

It is proposed to undertake alterations and additions to a dwelling, and to construct a new deck, pool and spa, at 185 Ocean Street Narrabeen (hereafter denoted as the 'site'). A Development Application (DA) is to be submitted to Northern Beaches Council for these works. Given the proximity of the site to Collaroy-Narrabeen Beach, a coastal engineering assessment is required by Council, as set out herein.

The report author, Peter Horton [BE (Hons 1) MEngSc MIEAust CPEng NER], is a professional Coastal Engineer with 31 years of coastal engineering experience. He has postgraduate qualifications in coastal engineering, and is a Member of Engineers Australia and Chartered Professional Engineer (CPEng) registered on the National Engineering Register. He 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.

In previous employment, Peter was the main author of the *Coastal Zone Management Plan for Collaroy-Narrabeen Beach and Fishermans Beach* (CZMP) prepared for Warringah Council in 2014, and the *Coastal Erosion Emergency Action Subplan for Beaches in Warringah* prepared for Warringah Council in 2012. He has also prepared DA coastal engineering reports at numerous locations along Collaroy-Narrabeen Beach over the last two decades or so. Peter has inspected the area in the vicinity of the site on numerous occasions in the few decades, including a specific recent inspection of the site on 27 August 2023.

All levels given herein are to Australian Height Datum (AHD). Zero metres AHD is approximately equal to mean sea level at present in the ocean immediately adjacent to the NSW mainland.

2. INFORMATION PROVIDED

Horton Coastal Engineering was provided with 17 drawings (Dwg Nos A101 to 110, 201, 203-A, 203-C, 204, 206, 301, 302) of the proposed development prepared by House Plan Design and Drafting Service, all dated 8 September 2023 and Revision A. A site survey completed by Masri Survey Group (Job No T288, dated 6 August 2023) was also provided.

3. EXISTING SITE DESCRIPTION

Collaroy-Narrabeen Beach is about 3.5km long, extending between Narrabeen Head and Narrabeen Lagoon entrance in the north, to a cliff at Collaroy Rock Baths in the south. The site is located about 30m south of Emerald Street and 80m north of Tourmaline Street. At this location, the beach faces approximately ESE, and is exposed to the dominant south-easterly storm wave climate offshore of Sydney. A vertical aerial view of the site and surrounds is provided in Figure 1, with an oblique aerial view in Figure 2, and a site photograph in Figure 3.

Based on the survey provided, ground levels at the site vary from about 9.3m AHD at the seaward boundary, about 10.7m AHD on the seaward side of the dwelling (which has a ground floor level of about 11.0m AHD), about 10.9m AHD on the landward side of the dwelling, about 10.3m AHD at the landward property boundary, and about 10.1m AHD at the top of kerb at Ocean Street.

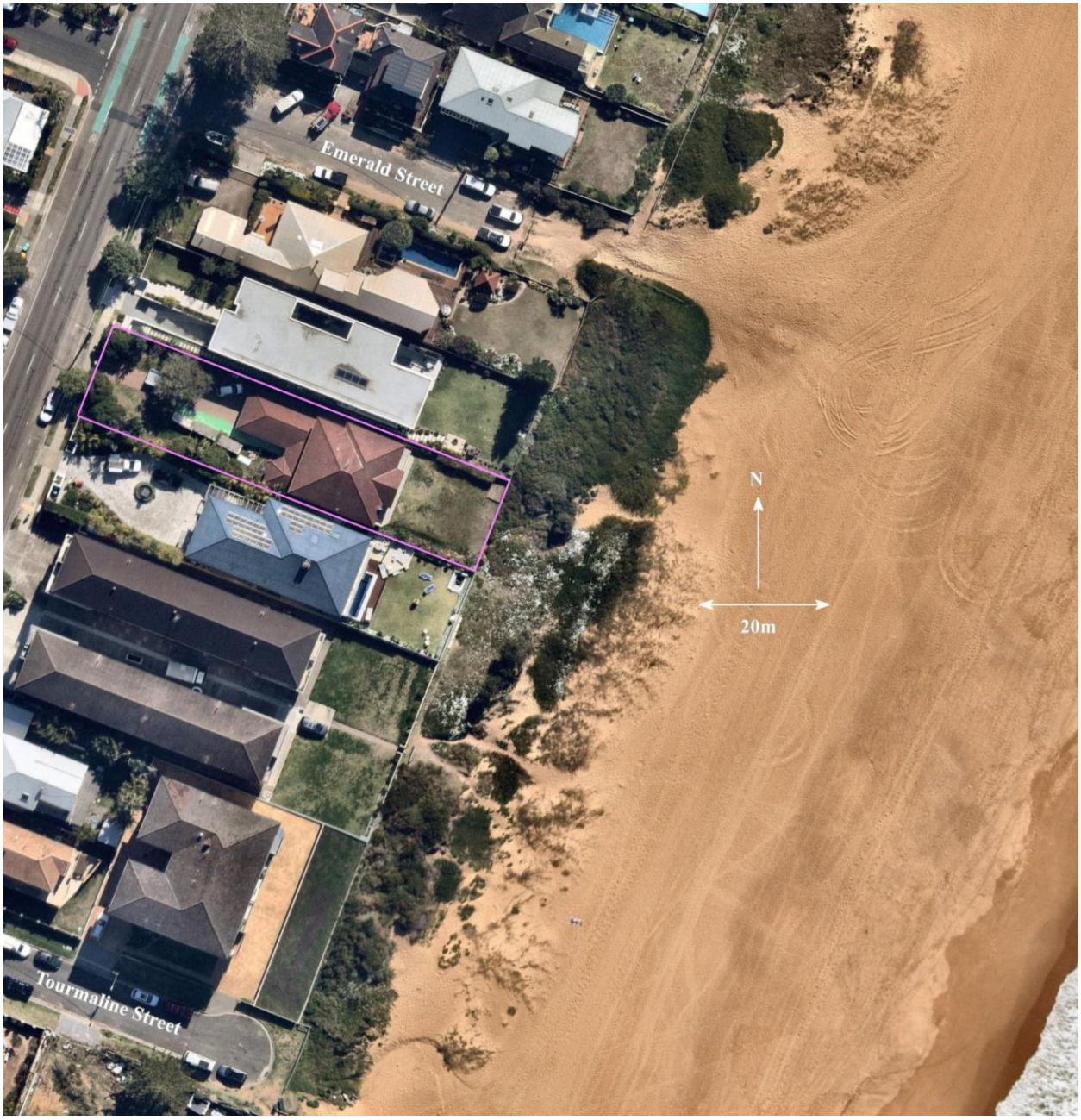


Figure 1: Aerial view of site (surveyed boundary in pink) on 30 August 2023

Figure 2: Oblique aerial view of site (at arrow) on 1 May 2023,facing west

Figure 3: View of site (at arrow) from dune on 27 August 2023, facing WNW

As evident at the site inspection and from review of historical aerial photography, the area immediately seaward of the site is a dune vegetated with grasses, creepers, shrubs and occasional trees, and is typically about 20m to 35m wide cross-shore. Elevations generally reduce seaward of the sand/vegetation interface, with the sandy beach area seaward of the dune having a typical width to the shoreline at mean sea level (based on the NSW Beach Profile Database) of about 50m to 90m, varying with erosion and accretion cycles.

4. PROPOSED DEVELOPMENT

It is proposed to undertake alterations and additions to the dwelling at the site, including extending the dwelling on the landward (western) side on the ground floor and first floor. The ground floor extension is to have a floor level of 11.00m AHD. It is also proposed to construct a new deck, pool and spa seaward (east) of the existing dwelling. The floor level of the deck, and pool coping level, is to be 10.84m AHD.

5. SUBSURFACE CONDITIONS

A geotechnical engineering investigation of the site has been completed by White Geotechnical Group (2023). To the limit of investigation at 2.7m depth, a generally sandy subsurface was encountered.

6. EROSION/RECESSION COASTLINE HAZARDS

Nielsen et al (1992) has delineated various coastline hazard zones, as discussed below and shown in Figure 4, assuming an entirely sandy (erodible) subsurface, which is reasonable based on White Geotechnical Group (2023)[1].

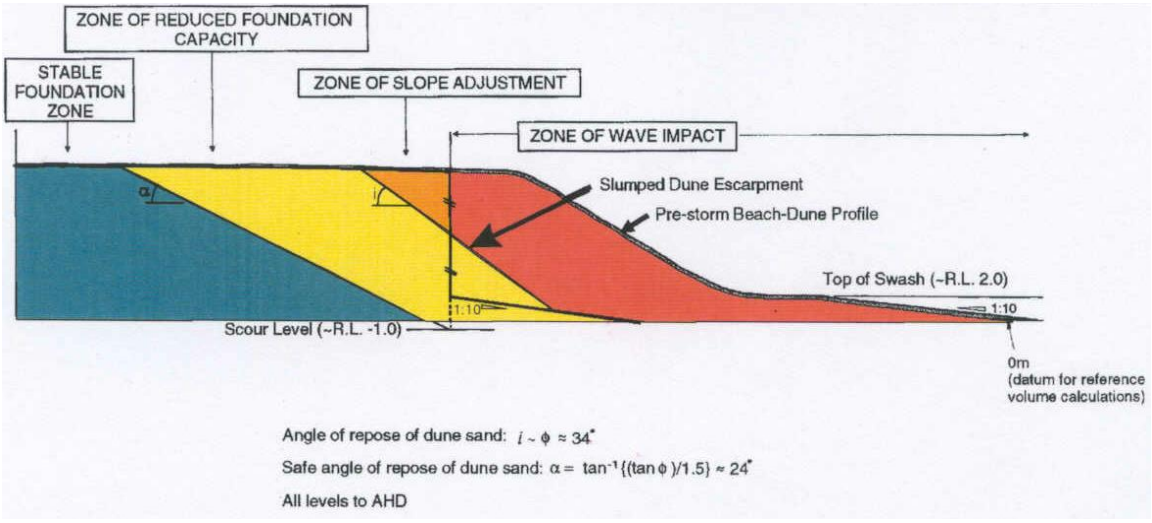


Figure 4: Schematic representation of coastline hazard zones (after Nielsen et al, 1992)

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 (ZSA) 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

[1] A geotechnical investigation extending to greater depths would be required to confirm subsurface conditions down to -1m AHD.

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 the ZRFC (ie landward or below), as the factor of safety within the ZRFC 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.

In Figure 5, various coastline hazard lines are depicted at the site, with an outline of the proposed development also shown in yellow.

Geomarine (1991) devised former adopted Council hazard lines at Collaroy-Narrabeen Beach, with these lines (1991 ZWI, 1991 ZSA and 1991 ZRFC), all defined for an immediate planning period, depicted in Figure 5. Even though they are superseded, the *Warringah Local Environmental Plan 2011* Coastline Hazard Map still depicts these lines. It is evident that the seaward portion of the proposed development (the deck, pool and spa seaward of the existing dwelling) is generally seaward of the 1991 ZRFC, with the landward portion well landward of the 1991 ZRFC.

As part of the CZMP, revised (compared to 1991) coastal hazard lines were delineated at Collaroy-Narrabeen Beach for immediate, 2050 and 2100 planning periods. These CZMP hazard lines (Immediate ZSA, 2050 ZSA and 2100 ZSA) are depicted in Figure 5 (with all 3 lines at the landward edge of the ZSA). It is evident that the seaward portion of the proposed development (seaward of the existing dwelling) is landward of the 2050 ZSA, while the landward portion is generally landward of the 2100 ZSA (except for a small portion of the first floor addition seaward of the 2100 ZSA).

In the CZMP, two lines defining the required minimum setback for new beachfront development at Collaroy-Narrabeen Beach were delineated, including consideration of development on conventional foundations and piled foundations[2]. These lines are depicted in Figure 5 as the “minimum setback for piled development” and “minimum setback for development on conventional foundations”, and were developed based on a 60 year design life, which was justified in the CZMP as being appropriate based on consideration of Australian Standards, tax legislation and community expectations.

It is evident in Figure 5 that the seaward portion of the proposed development straddles the minimum setback for piled development. The landward portion of the proposed development is well landward of the minimum setback for development on conventional foundations.

An “acceptable risk for piled development" line is also depicted in Figure 5, indicating the most seaward acceptable development location (for piled development) from a coastal engineering perspective. The proposed development is well landward of the “acceptable risk for piled development” line. The minimum setback for piled development is further landward than the acceptable risk line as it was derived to maintain consistent building alignments, as discussed in the CZMP.

[2] Conventional foundations include slab-on-ground, strip footings and shallow piers, and can be distinguished from deep piled foundations.

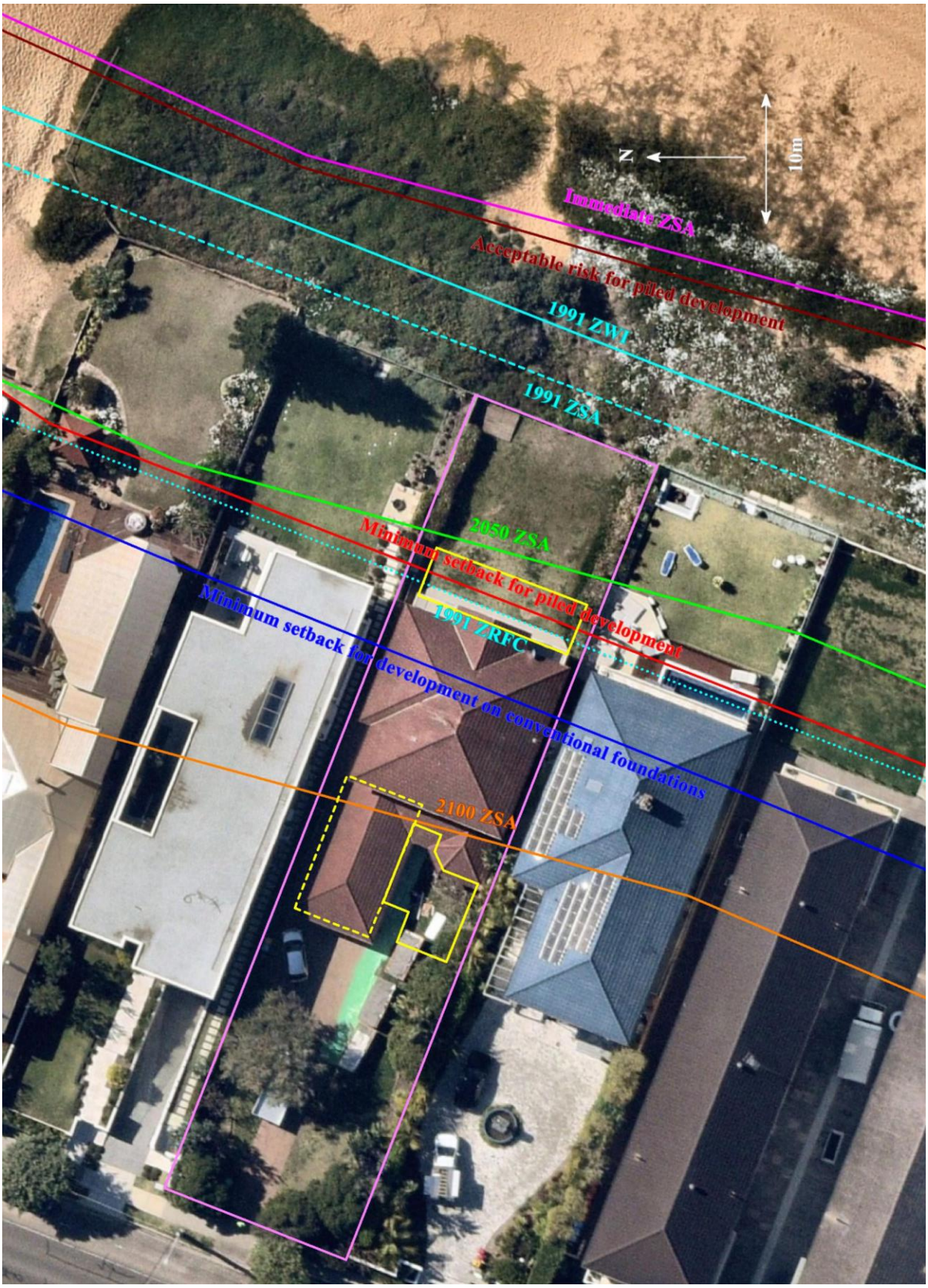


Figure 5: Coastal hazard lines and CZMP setbacks at site, with proposed development outlines in yellow (dashed line shows first floor addition, solid line on seaward side shows deck with pool and spa within this footprint, and solid line on landward side shows ground and first floor addition), and aerial photograph taken on 30 August 2023

The proposed deck, pool and spa extend seaward of the minimum setback for piled development. These encroachments are acceptable from a coastal engineering perspective, as long as the structures are founded as described in Section 7. The CZMP minimum setback for piled development was devised on the basis of consistency in the seaward extent of dwellings (ie, the established building line), and was not intended to prevent ground-level structures such as pools and the like. If the encroachments do not adversely affects views (and they are not expected to, given that they are at the ground surface) or other planning matters, they can be accepted.

7. FOUNDATION DESIGN REQUIREMENTS

From a coastal engineering perspective, all parts of the proposed development seaward of the dwelling (deck, pool and spa) should be founded on deep piles. It is required that a minimum depth of piling is adopted based on the distance seaward of the minimum setback for development on conventional foundations (with this distance denoted as *X* herein). That is, pile depths would need to be devised based on ignoring the upper *Z* metres of soil, where *Z* is equal to *X*tan(33) based on an angle of repose (Φ) for sand of 33°. Therefore, for example, the upper 3.2m of soil should be ignored in defining the depth of piles at the landward edge of the deck (which is located about 4.9m seaward of the minimum setback for development on conventional foundations)[3], and the upper 5.8m of soil should be ignored in defining the depth of piles at the seaward edge of the deck (which is located about 9.0m seaward of the minimum setback for development on conventional foundations). Note that the maximum *Z* value does not need to extend below -1m AHD.

As part of detailed design, the structural engineer should allow for sand slumping forces in the seaward direction and wave forces in the landward direction on the piles, as advised by a coastal engineer.

Based on geotechnical and structural engineering advice as part of detailed design, it may be necessary to increase pile depths beyond the depths necessary to meet the above requirements, to achieve uniform ground conditions to minimise the risk of differential settlement.

From a coastal engineering perspective, all parts of the proposed development on the landward side of the existing dwelling may be founded on conventional foundations. That is, on the landward of the existing dwelling, there are no particular foundation requirements from a coastal engineering perspective and foundation design can be undertaken based on conventional structural and geotechnical engineering considerations.

8. COASTAL INUNDATION COASTLINE HAZARDS

In Geomarine (1991) and the CZMP, a present day wave runup level of 8m AHD was adopted at Collaroy-Narrabeen Beach in the vicinity of the site (which can be taken as a 100 year ARI wave runup level exceeded by 2% of waves). Taking sea level rise into account and making simplistic assumptions, this level would increase to about 8.4m AHD at 2083, using the median sea level rise value adopted in the CZMP for a 60 year life at that time.

[3] That is, the piles would need to extend a sufficient distance below this 3.2m depth (a sufficient distance below about 7.5m AHD, given that there is a ground level of 10.7m AHD) at this location.

Therefore, with ground levels exceeding 10m AHD, oceanic inundation is not expected to be a significant risk at the site for a severe coastal storm over a design life exceeding 60 years. That is, there are no oceanic inundation controls required at the site.

9. CONSENT MATTERS

9.1 *Warringah Local Environmental Plan 2011*

Based on Clause 6.5(3) of *Warringah Local Environmental Plan 2011* (LEP), "development consent must not be granted unless the consent authority is satisfied that the development:

(a) will not significantly adversely affect coastal hazards, and
(b) will not result in significant detrimental increases in coastal risks to other development or properties, and
(c) will not significantly alter coastal hazards to the detriment of the environment, and
(d) incorporates appropriate measures to manage risk to life from coastal risks, and
(e) avoids or minimises exposure to coastal hazards, and
(f) makes provision for relocation, modification or removal of the development to adapt to coastal hazards and NSW sea level rise planning benchmarks".

Based on Clause 6.5(4), "development consent must not be granted unless the consent authority is satisfied that the foundations of the development have been designed to be constructed having regard to coastal risk".

With regard to Clauses 6.5(3)(a), (b) and (c), 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 (or the environment), as it would be founded with structural integrity on piles (assuming that the requirements in Section 7 are followed) well above the level of wave action for an acceptably rare storm and acceptably long design life, or founded landward of the CZMP minimum setback for development on conventional foundations. The proposed development would have a suitably low risk of being affected by erosion/recession coastal hazards if the foundation design requirements in Section 7 are followed, and Clauses 6.5(3)(d) and (e) and 6.5(4) would therefore be satisfied.

With regard to Clause 6.5(3)(f), the proposed development has been designed to not be damaged by coastline hazards for an acceptably rare storm and acceptably long design life, rather than relocated or removed. This is consistent with the CZMP.

9.2 *Warringah Development Control Plan 2011*

Part E9 of the *Warringah Development Control Plan 2011* (DCP)[4] has discussion on "Coastline Hazard". Based on the DCP, the risk of damage from coastal processes is to be reduced through having appropriate setbacks and foundations. If foundation design is carried out consistent with Section 7, the proposed development would be appropriately founded. The proposed setbacks are consistent with the CZMP from a coastal engineering perspective, and the development extending seaward of the minimum setback for piled development is acceptable if this is satisfactory in terms of view loss and other planning considerations.

Furthermore, based on Part E9 of the DCP, the applicant must demonstrate compliance with the *Northern Beaches Coastal Erosion Policy*, the CZMP and the *Collaroy-Narrabeen Protection*

[4] Amendment 21 of the DCP was reviewed, which commenced on 1 June 2022.

Works Design Specifications. As no protection works are proposed, neither the *Northern Beaches Coastal Erosion Policy* (except as noted below) nor *Collaroy-Narrabeen Protection Works Design Specifications* are generally applicable for the subject DA. As noted above, the proposed setbacks are consistent with the CZMP from a coastal engineering perspective.

If founded as described in Section 7, the proposed development would have an acceptably low risk of being damaged by coastal erosion/recession.

With regard to the *Northern Beaches Coastal Erosion Policy*, as noted above this is mostly focussed on the construction of coastal protection works. However, it can be noted that:

- as per 2(b), the risk of damage to the proposed development from coastal processes is acceptably low; and
- as per 2(d), the proposed development would not adversely impact on adjoining properties or coastal processes.

Therefore, the proposed development complies with the *Northern Beaches Coastal Erosion Policy,* where relevant.

Also, based on the DCP, development must be constructed with a suitable floor level or in a manner that minimises the risk of coastal inundation for severe coastal storms occurring over the next 50 years. This is the case for the proposed development, as discussed in Section 8.

9.3 *State Environmental Planning Policy (Resilience And Hazards) 2021*

9.3.1 Preamble

Based on *State Environmental Planning Policy (Resilience and Hazards) 2021*[5] (SEPP Resilience) and its associated mapping, the site is the site is within a "coastal environment area" (see Section 9.3.2) and "coastal use area" (see Section 9.3.3).

9.3.2 Clause 2.10

Based on Clause 2.10(1) of SEPP Resilience, "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".

[5] Encompassing the former *State Environmental Planning Policy (Coastal Management) 2018*.

With regard to (a), the proposed works are in a developed residential area, and would not be expected to adversely affect the biophysical and hydrological (surface and groundwater) environments. Based on review of stormwater drainage drawings prepared by Metric, a piped drainage system with a minimum 2,000L rainwater tank is proposed, discharging to Ocean Street as per conventional stormwater management practice and BASIX, and consistent with existing drainage arrangements. The proposed development would not be a source of pollution as long as appropriate construction environmental controls are applied.

Assuming that there is no native vegetation or fauna and their habitats at the site that would be impacted by the works, the proposed works would not be expected to adversely affect the ecological environment.

With regard to (b), the proposed development would not be expected to adversely affect coastal environmental values or natural coastal processes over its design life, as it is at an acceptably low risk if damage from erosion/recession and inundation for an acceptably rare storm and over the acceptably long design life.

With regard to (c), the proposed development would 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 necessarily definitively considered herein. That stated, there are no undeveloped headlands nor rock platforms in proximity to the proposed development, no marine vegetation in the area to be developed, and no known native vegetation of significance at the site. No significant impacts on marine fauna and flora would be expected as a result of the proposed development, as the development would not be expected to interact with subaqueous areas over the design life except in rare storms.

With regard to (e), the proposed development would not impact on public open space and access to and along the foreshore, being entirely within private property.

With regard to (f), a search of the Heritage NSW "Aboriginal Heritage Information Management System" (AHIMS) was undertaken on 9 October 2023. This resulted in no Aboriginal sites nor Aboriginal places being recorded or declared within at least 200m of the site.

With regard to (g), the proposed development is entirely on private property and would not be expected to interact with the surf zone over its design life except in rare storms when surfing would not be possible, so would not impact on use of the public surf zone.

Based on Clause 2.10(2) of SEPP Resilience, "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 2.10(1).

9.3.3 Clause 2.11

Based on Clause 2.11(1) of SEPP Resilience, "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 development would not impact on foreshore or beach access, as discussed previously.

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

With regard to (a)(iv), there are no particular Aboriginal sites nor Aboriginal places within 200m of the proposed development, as noted in Section 9.3.2.

With regard to (a)(v), the nearest environmental heritage items listed in Schedule 5 of the LEP are the group of Washington Palms (*Washingtonia robusta*) near Narrabeen Lagoon between Lagoon Street and Ocean Street, and the stone wall on Ocean Street between Malcolm Street and the Ocean Street bridge, which are at least 190m from the site. The proposed development would not be expected to impact on these or more distant heritage items.

With regard to (b), the proposed development has been designed and sited to avoid any potential adverse impacts referred to in Clause 2.11(1).

9.3.4 Clause 2.12

Based on Clause 2.12 of SEPP Resilience, "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 noted in Section 9.1, the proposed development would not give rise to any increased coastal hazard on that land or adjacent land, as it would be founded with structural integrity on piles

well above the level of wave action for an acceptably rare storm and acceptably long design life, or founded landward of the CZMP minimum setback for development on conventional foundations.

9.3.5 Clause 2.13

Based on Clause 2.13 of SEPP Resilience, "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".

The CZMP operates as a certified coastal management program, and consistency with the CZMP has been discussed in Section 6.

9.3.6 Synthesis

The proposed development satisfies the requirements of *State Environmental Planning Policy (Resilience and Hazards) 2021* for the matters considered herein.

10. CONCLUSIONS

It is proposed to undertake alterations and additions to a dwelling, and to construct a new deck, pool and spa, at 185 Ocean Street Narrabeen. The proposed development would be at an acceptably low risk of damage from erosion/recession coastline hazards over the next 60 years if founded as described in Section 7. If so, the proposed development would be consistent with the coastal engineering requirements listed in Clause 6.5 of *Warringah Local Environmental Plan 2011,* Part E9 of the *Warringah Development Control Plan*, *State Environmental Planning Policy (Resilience and Hazards) 2021*, the CZMP, and the *Northern Beaches Coastal Erosion Policy*.

Oceanic inundation is not expected to be a significant risk at the site for a severe coastal storm over a design life exceeding 60 years. That is, there are no inundation controls required at the site.

The proposed deck, pool and spa extend seaward of the minimum setback for piled development. These encroachments are acceptable from a coastal engineering perspective, as long as the structures are founded as described in Section 7. This setback was devised on the basis of consistency in the seaward extent of dwellings, and was not intended to prevent ground-level structures such as pools and the like. If the encroachments do not adversely affects views (and they are not expected to, given that they are at the ground surface) or other planning matters, they can be accepted.

11. REFERENCES

Geomarine (1991), "Narrabeen-Collaroy Fishermans Beach, Criteria for the Siting and Design of Foundations for Residential Development", *Geomarine Report No. 69021R02*, in association with Coffey Partners International, for Warringah Shire Council, February

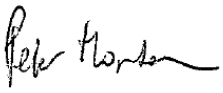
Nielsen, AF; Lord, DB and HG Poulos (1992), "Dune Stability Considerations for Building Foundations", *Australian Civil Engineering Transactions*, Institution of Engineers Australia, Volume CE34, No. 2, June, pp. 167-173

White Geotechnical Group (2023), *Geotechnical Investigation: Additions and Alterations and New Pool at 185 Ocean Street, Narrabeen*, 11 September, J5096

12. 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