J5096C
9th April, 2025

185 Ocean Street, Narrabeen

Geotechnical Comments for Section 4.55 Plans

We have reviewed the existing geotechnical report, the original plans, and the 10 amended plans by house plan drafting, drawings numbered A102 to 109, A204, and A206. All revision C. All dated 08/04/2025.

The changes are as follows:

- Relocate the proposed pool closer to the N common boundary.
- Reduce the depth of the pool excavation from ~1.8m to ~1.4m.
- Internal and external alterations to the house layout.

The changes are considered minor from a geotechnical perspective. The changes do not alter the recommendations or the risk assessment in the original report carried out by this firm numbered J5096 and dated the 9th October, 2023.

White Geotechnical Group Pty Ltd.

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GEOTECHNICAL INVESTIGATION:

Additions and Alterations and New Pool at **185 Ocean Street, Narrabeen**

1. Proposed Development

1.1 Extend the existing house on the W side, including the addition of a balcony.

1.2 Install a new pool flush with the E side of the house by excavating to a maximum depth of ~2.0m.

1.3 Other external additions and alterations.

1.4 Details of the proposed development are shown on 17 drawings prepared by house plan drafting, drawings numbered A101 to 105, A106-, A107 to 110, A201, A203-A, A203-C, A204, A206, and A301 to 302. All revision A. All dated 08/09/2023

1.5 The Coastal Engineering Assessment Report was prepared by Horton Coastal Engineering, reference number lrJ0697, and dated 9 October 2023. The report has been attached as an appendix.

2. Site Description

2.1 The site was inspected on the 24th August, 2023.

2.2 This residential property is near level. It is on the E side of the road and occupies the foredune of Narrabeen Beach.

2.3 At the road frontage (Photo 1), a concrete and brick-paved driveway runs to a garage attached to the W side of the house (Photo 2). Between the road frontage and the house is a level lawn (Photo 3). The two-story brick house is supported on brick walls (Photo 2). No significant signs of movement were observed in the supporting walls. A gently sloping lawn extends off the E side of the house and continues towards the E boundary and the beach beyond (Photo 4). A moderate to steeply graded sand

dune slope is located downhill of the property (Photo 5). The top edge of the slope is estimated to be set back ~8m from the downhill property boundary and ~20m from the proposed works E of the house. Horton Coastal Engineering (2023) concluded that the proposed development will 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 of their report. See the attached Coastal Engineering Assessment Report.

3. Geology

The Sydney 1:100 000 Geological Sheet indicates the site is underlain by medium to fine marine sand (Qhf) of the foredune.

4. Subsurface Investigation

Four hand Auger Holes (AH) were put down to identify the soil materials. Seven Dynamic Cone Penetrometer (DCP) tests were put down to determine the relative densities of the sands through the profile. The locations of the tests are shown on the site plan attached. It should be noted that a level of caution should be applied when interpreting DCP test results. The test will not pass through hard buried objects so in some instances it can be difficult to determine whether refusal has occurred on an obstruction in the profile or on the natural rock surface. This is expected to have occurred for DCPs 3, 4, 5, & 6. But due to the possibility that the actual ground conditions vary from our interpretation there should be allowances in the excavation and foundation budget to account for this. We refer to the appended "Important Information about Your Report" to further clarify. The results are as follows:

GROUND TEST RESULTS ON THE NEXT PAGE

AUGER HOLE 1 (~RL10.6) **–** AH1 (Photo 6)

Depth (m)	Material Encountered
0.0 to 0.6	**TOPSOIL**, sandy, brown, Loose to Medium Dense, dry, fine to medium grained.
0.6 to 1.5	**SAND**, light brown, Dense to Medium Dense, dry, medium grained.
1.5 to 2.6	**SAND**, yellow-orange, Medium Dense, dry, medium grained.
2.6 to 2.7	**SAND**, brown Medium Dense, damp, medium grained.

End of hole @ 2.7m in Medium Dense Sand. No water table encountered.

AUGER HOLE 2 (~RL10.7) **–** AH2 (Photo 7)

Depth (m)	Material Encountered
0.0 to 0.7	**FILL**, sandy, brown-gold, Loose to Medium Dense, dry, medium.
0.7 to 0.8	**FILL**, clayey, dark brown, Medium Dense, damp, medium to coarse grained, pebble inclusions.
0.8 to 1.5	**SAND**, brown, Medium Dense, damp, fine to medium grained, soil inclusions throughout.

Refusal @ 1.5m in Medium Dense Sand. Auger grinding on unknown object. No water table encountered.

AUGER HOLE 3 (~RL10.3) **–** AH3 (Photo 8)

Depth (m)	Material Encountered
0.0 to 0.6	**FILL**, sandy, brown-gold, Loose to Medium Dense, dry, fine to medium.
0.6 to 1.2	**FILL**, clayey, dark brown, Dense to Medium Dense, damp, medium to coarse grained, maroon sandstone fragments present.
1.2 to 1.8	**SAND**, golden, Medium Dense, dry, medium grained.

End of hole @ 1.8m in Medium Dense Sand. No water table encountered.

AUGER HOLE 4 (~RL10.9) **–** AH4 (Photo 9)

Depth (m)	Material Encountered
0.0 to 0.4	**TOPSOIL**, sandy, brown, Loose, dry, fine to medium grained, fine trace organic matter.
0.4 to 0.9	**SAND**, yellow-brown, Medium Dense, dry, medium grained.
0.9 to 1.3	**SAND**, orange, Medium Dense, dry, medium grained.

End of hole @ 1.3m in Medium Dense Sand. No water table encountered.

DCP TEST RESULTS – Dynamic Cone Penetrometer

Equipment: 9kg hammer, 510mm drop, conical tip. Standard: AS1289.6.3.2 - 1997

Depth(m) Blows/0.3 m	DCP 1 (~RL10.4)	DCP 2 (~RL10.3)	DCP 3 (~RL10.6)	DCP 4 (~RL10.8)	DCP 5 (~RL10.7)	DCP 6 (~RL10.9)	DCP 7 (~RL10.9)
0.0 to 0.3	2	2	8	9	14	2	2
0.3 to 0.6	8	8	12	14	21	#	4
0.6 to 0.9	12	10	#	#	8		7
0.9 to 1.2	7	6			#		9
1.2 to 1.5	8	8					10
1.5 to 1.8	12	9					13
1.8 to 2.1	9	12					#
2.1 to 2.4	10	15					
2.4 to 2.7	10	15					
2.7 to 3.0	#	#					
	End of Test @ 2.7m	End of Test @ 2.7m	Refusal @ 0.6m	Refusal @ 0.4m	Refusal @ 0.8m	Refusal @ 0.2m	End of Test @ 1.8m

#refusal/end of test. F = DCP fell after being struck showing little resistance through all or part of the interval.

DCP Notes:

DCP1 – End of test @ 2.7m, DCP still slowly going down, coarse yellow beach sand on damp tip.

DCP2 – End of test @ 2.7m, DCP still slowly going down, coarse yellow beach sand on damp tip.

DCP3 – Refusal on unknown obstruction @ 0.6m, DCP bouncing, white impact dust on dry tip.
DCP4 – Refusal on unknown obstruction @ 0.4m, DCP bouncing, white impact dust on dry tip.
DCP5 – Refusal on unknown obstruction @ 0.8m, DCP bouncing, white impact dust on dry tip.
DCP6 – Refusal on unknown obstruction @ 0.2m, DCP bouncing, white impact dust on dry tip.
DCP7 – End of test @ 1.8m, DCP still slowly going down, yellow sand on damp tip.

5. Geological Observations/Interpretation

The site is underlain by topsoil and sands that were encountered to the extent of the testing. Manmade fill has been placed to level the property to a maximum depth of ~1.2m. To summarise the test results, where there is not fill, a loose sandy topsoil overlies Medium Dense to Dense Sands that occupy the top ~2.7m of the profile. Rock was not encountered to the extent of the tests at ~2.7m. See the Type Section attached for a diagrammatical representation of the expected ground materials.

6. Groundwater

Normal ground water seepage is expected to descend rapidly through the sand profile towards the water table. Due to the elevation of the block, the water table is expected to be below the base of the proposed pool excavation.

7. Surface Water

No evidence of significant surface flows were observed on the property during the inspection. Normal sheet wash is expected to be quickly absorbed into the sandy soil where surfaces are unsealed.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above, below, or beside the property. The proposed excavation collapsing onto the work site and impacting on the S neighbouring property before the pool structure is in place is a potential hazard (**Hazard One**). The proposed excavation undercutting the footings for the house is a potential hazard (**Hazard Two**).

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The unsupported cut batter of the excavation for the pool (~2.0m) collapsing onto the work site and impacting on the S neighbouring property before permanent support is in place.	The proposed pool excavation undercutting the footings of the house causing failure.
LIKELIHOOD	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (25%)	'Medium' (35%)
RISK TO PROPERTY	'Moderate' (2×10^{-4})	'Moderate' (2×10^{-4})
RISK TO LIFE	5.9×10^{-5}/annum	5.3×10^{-5}/annum
COMMENTS	This level of risk to life and property is 'UNACCEPTABLE'. To move risk to 'ACCEPTABLE' levels, the recommendations in **Section 13 and 14** are to be followed.	This level of risk to life and property is 'UNACCEPTABLE'. To move risk to 'ACCEPTABLE' levels, the recommendations in **Section 13** are to be followed.

(See Aust. Geomech. Jnl. Mar 2007 Vol. 42 No 1, for full explanation of terms)

9. Suitability of the Proposed Development for the Site

The proposed development is suitable for the site. No geotechnical hazards will be created by the completion of the proposed development provided it is carried out in accordance with the requirements of this report and good engineering and building practice.

10. Stormwater

The fall is away from the street. The stormwater engineer is to refer to council stormwater policy for suitable options for stormwater disposal.

11. Excavations

An excavation to a maximum depth of ~2.0m is required to install the proposed pool. The excavation is expected to be taken through fill and topsoil, with Medium Dense to Dense Sand expected at depths of 0.6 to 1.2m below the current surface.

Excavations through fill, topsoil, and sand can be carried out with an excavator and bucket.

12. Vibrations

No excessive vibrations will be generated by excavation through sand. Any vibrations generated by a domestic machine and bucket up to 16 ton will be below the threshold limit for infrastructure or building damage.

13. Excavation Support Requirements

The excavation for the proposed pool will reach a maximum depth of ~2.0m. The setbacks from the proposed excavation to the existing structures/boundaries are as follows:

- Flush with the subject house.
- ~1.6m from the S common boundary.

The S common boundary fence is to be braced before the excavation commences.

Taking into account the excavation setbacks and proposed depths, the subject house and S common boundary are within the zone of influence of the proposed excavation. In this instance, the zone of influence is the area above a theoretical 30° line through sand from the base of the excavation towards the surrounding boundaries or structures.

To protect the integrity of the Subject House and the Southern Common Boundary it is recommended contiguous piles or a similar be installed to support the proposed excavation prior to it commencing. The piles can be temporarily supported by embedment but are to be permanently braced by the pool structure once it is installed. The embedment depths are to be calculated by the structural engineer using the earth properties provided in “14. Retaining

Structures" section to follow and allowing for the surcharge loads from the house. Alternatively, the house could be underpinned prior to the commencement of the excavation. Due to the presence of loose sand and the required depth (at least 2.4m for a standard 1.8m deep pool), we foresee this process as slow and difficult, and carried out at not more than one underpin at a time. The southern boundary will require temporary shoring installed as the excavation is progressed so cut batters are not left unsupported. The structural engineer will need to provide plans with the details of the staged construction required for this temporary shoring.

Due to the depth of the excavation through sand and to ensure the integrity of the S neighbouring property, we recommend all remaining sides of the excavation be temporarily supported with sacrificial form ply or a similar form of support, until the pool structure is in place. The shoring is to be designed/approved by the structural engineer. See the site plan attached showing the minimum extent of the required shoring in blue.

The materials and labour to construct the pool structure are to be organised so on completion of the excavation it can be installed as soon as possible. The excavation is to be carried out during a dry period. No excavations are to commence if heavy or prolonged rainfall is forecast.

All excavation spoil is to be removed from site following the current Environmental Protection Agency (EPA) waste classification guidelines.

14. Retaining Structures

For cantilever or singly-propped retaining structures, it is suggested the design be based on a triangular pressure distribution of lateral pressures using the parameters shown in Table 1.

TABLE 1 ON THE NEXT PAGE

Table 1 – Likely Earth Pressures for Retaining Structures

Unit	Earth Pressure Coefficients			
	Unit weight (kN/m^3)	'Active' K_a	'At Rest' K_0	Passive
Fill	20	0.40	0.55	N/A
Loose Sands	20	0.40	0.55	K_p = 3.0 'ultimate'
Medium Dense Sands	20	0.40	0.55	K_p = 3.8 'ultimate'

For rock classes refer to Pells et al "Design Loadings for Foundations on Shale and Sandstone in the Sydney Region". Australian Geomechanics Journal 1978.

It is to be noted that the earth pressures in Table 1 assume a level surface above the structure, do not account for any surcharge loads, and assume retaining structures are fully drained. It should be noted that passive pressure is an ultimate value and should have an appropriate safety factor applied. No passive resistance should be assumed for the top 0.4m to account for any disturbance from the excavation. Rock strength and relevant earth pressure coefficients are to be confirmed on site by the geotechnical consultant.

All retaining structures are to have sufficient back-wall drainage and be backfilled immediately behind the structure with free-draining material (such as gravel). This material is to be wrapped in a non-woven Geotextile fabric (i.e. Bidim A34 or similar), to prevent the drainage from becoming clogged with silt and clay. If no back-wall drainage is installed in retaining structures, the likely hydrostatic pressures are to be accounted for in the structural design.

15. Foundations

The proposed extensions and balcony can be supported on spread footings taken to a depth of 0.4m into the underlying Medium Dense to Dense Sands of the natural profile. The footing excavation walls are to be shored with timber to prevent collapse prior to the concrete pour.

The Pool, Spa and Deck are to be founded following the advice in Section 7 of the attached Coastal Engineering Assessment Report provided by Horton Coastal Engineering (2023).

A maximum allowable bearing pressure of 100kPa can be assumed for footings supported on Medium Dense Sands of the natural profile.

The base of the footing excavations in sand should be compacted as the excavation will loosen the upper sands. This can be carried out with a hand-held plate compactor. Water may be used to assist in compaction in sand but footing materials should be kept damp but not saturated. As a guide to the level of compaction required a density index of >85% is to be achieved.

All footing surfaces are to be cleaned of loose material just prior to the placing of steel and concrete.

NOTE: If the contractor is unsure of the footing material required, it is more cost-effective to get the geotechnical consultant on site at the start of the footing excavation to advise on footing depth and material. This mostly prevents unnecessary over-excavation in clay-like shaly-rock but can be valuable in all types of geology.

16. Inspections

The client and builder are to familiarise themselves with the following required inspections as well as council geotechnical policy. We cannot provide geotechnical certification for the regulating authorities or the owner if the following inspections have not been carried out during the construction process.

- The geotechnical consultant is to inspect the ground materials while the first pile for the ground support is being dug to assess the ground strength and to ensure it is in line with our expectations. All finished pile holes for the piled wall/excavations for ground support are to be inspected and measured before concrete is placed.

- The geotechnical consultant is to inspect and test the compacted base of all footing excavations while the compaction equipment and contractors are still on site and before steel reinforcing is placed or concrete is poured. This is to ensure the required density has been achieved during compaction.

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Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6: AH1 – Downhole is from top to bottom

Photo 7: AH2 – Downhole is from top to bottom

Photo 8: AH3 – Downhole is from top to bottom

Photo 9: AH4 – Downhole is from top to bottom

Important Information about Your Report

It should be noted that Geotechnical Reports are documents that build a picture of the subsurface conditions from the observation of surface features and testing carried out at specific points on the site. The spacing and location of the test points can be limited by the location of existing structures on the site or by budget and time constraints of the client. Additionally, the test themselves, although chosen for their suitability for the particular project, have their own limiting factors. The testing gives accurate information at the location of the test, within the confines of the test's capability. A geological interpretation or model is developed by joining these test points using all available data and drawing on previous experience of the geotechnical consultant. Even the most experienced practitioners cannot determine every possible feature or change that may lie below the earth. All of the subsurface features can only be known when they are revealed by excavation. As such, a Geotechnical report can be considered an interpretive document. It is based on factual data but also on opinion and judgement that comes with a level of uncertainty. This information is provided to help explain the nature and limitations of your report.

With this in mind, the following points are to be noted:

- If upon the commencement of the works the subsurface ground or ground water conditions prove different from those described in this report, it is advisable to contact White Geotechnical Group immediately, as problems relating to the ground works phase of construction are far easier and less costly to overcome if they are addressed early.

- If this report is used by other professionals during the design or construction process, any questions should be directed to White Geotechnical Group as only we understand the full methodology behind the report's conclusions.

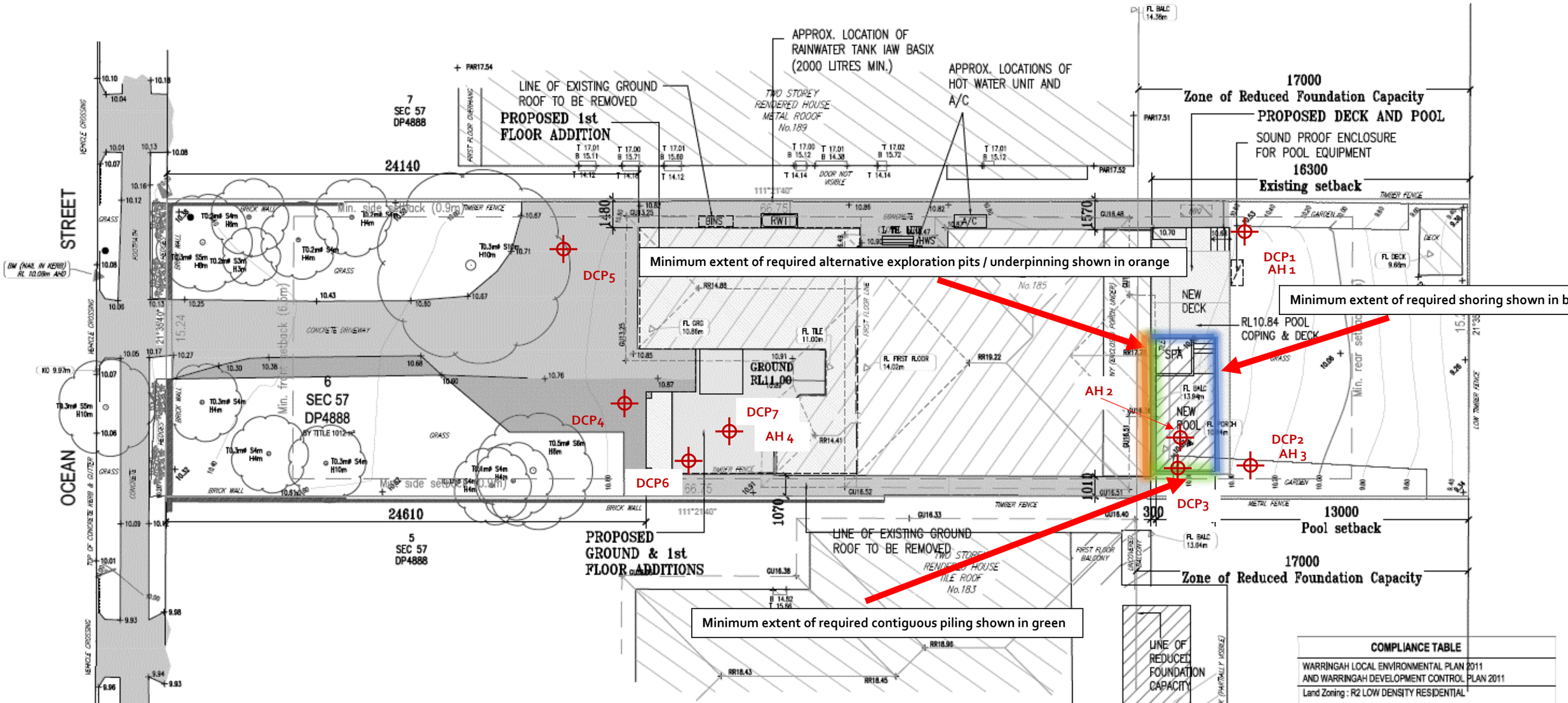
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- This report should not be applied to any other project other than that outlined in section 1.0.

- This report is to be read in full and should not have sections removed or included in other documents as this can result in misinterpretation of the data by others.

- It is common for the design and construction process to be adapted as it progresses (sometimes to suit the previous experience of the contractors involved). If alternative design and construction processes are required to those described in this report, contact White Geotechnical Group. We are familiar with a variety of techniques to reduce risk and can advise if your proposed methods are suitable for the site conditions.

SITE PLAN – showing minimum extent of required shoring / exploration pits / underpinning



1 SITE PLAN AND COMPLIANCE TABLE
1:200

BOUNDARY LINES
EXISTING
DEMOLISH
NEW DEVELOPMENT
REMOVE TREE SUBJECT TO COUNCIL PERMIT

COMPLIANCE TABLE

WARRINGAH LOCAL ENVIRONMENTAL PLAN 2011
AND WARRINGAH DEVELOPMENT CONTROL PLAN 2011

Land Zoning : R2 LOW DENSITY RESIDENTIAL

Site Area: 1012 m²

note: floor areas are measured from inside face of external walls

Standard / Control	EXISTING	PROPOSED	Compliance
Ground floor area	162 m²	200 m²	N/A
First floor area excl. voids	137 m²	255 m²	N/A
Dwellings gross floor area	299 m²	455 m²	N/A
Attached garage	66 m²	unchanged	
Existing Ground patio	31 m²	unchanged	
Existing first floor balcony	31 m²	unchanged	
Proposed first floor balcony	-	5,4 m²	N/A
Max. height limit		8,46 m	8,5 m-YES
Max. wall height limit		5,93 m	7,2 m-YES
Front setback	24.14m - unchanged		6,5 m-YES
Side setbacks	1,48 m - North- unchanged 1.01 m - South- unchanged		0,90 m-YES
Hard surface		227 m²	
Landscaping	EXISTING 527 m² 52,0%	PROPOSED > 405 m² 40%	40%-YES

house plan.design.drafting

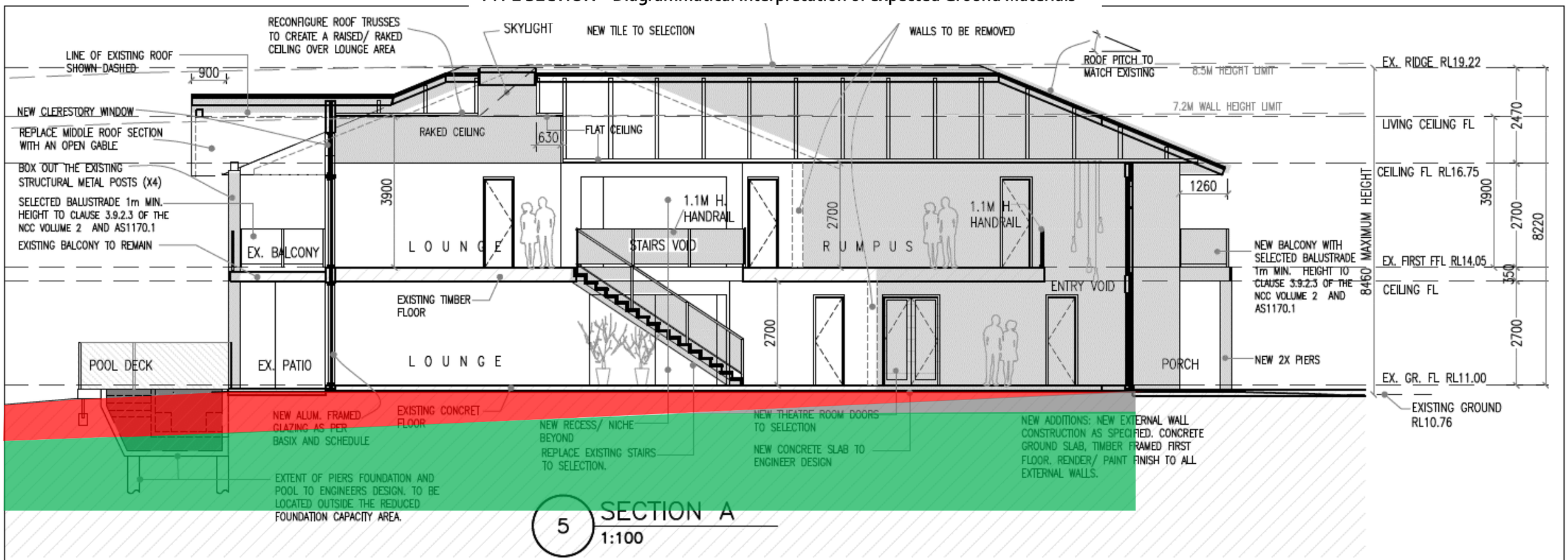
Address: 185 OCEAN STREET NARRABEEN NSW 2101
LOT 6 SEC 57 DP 4888

Project: CONSTRUCTION OF ALTERATIONS, ADDITIONS & A POOL

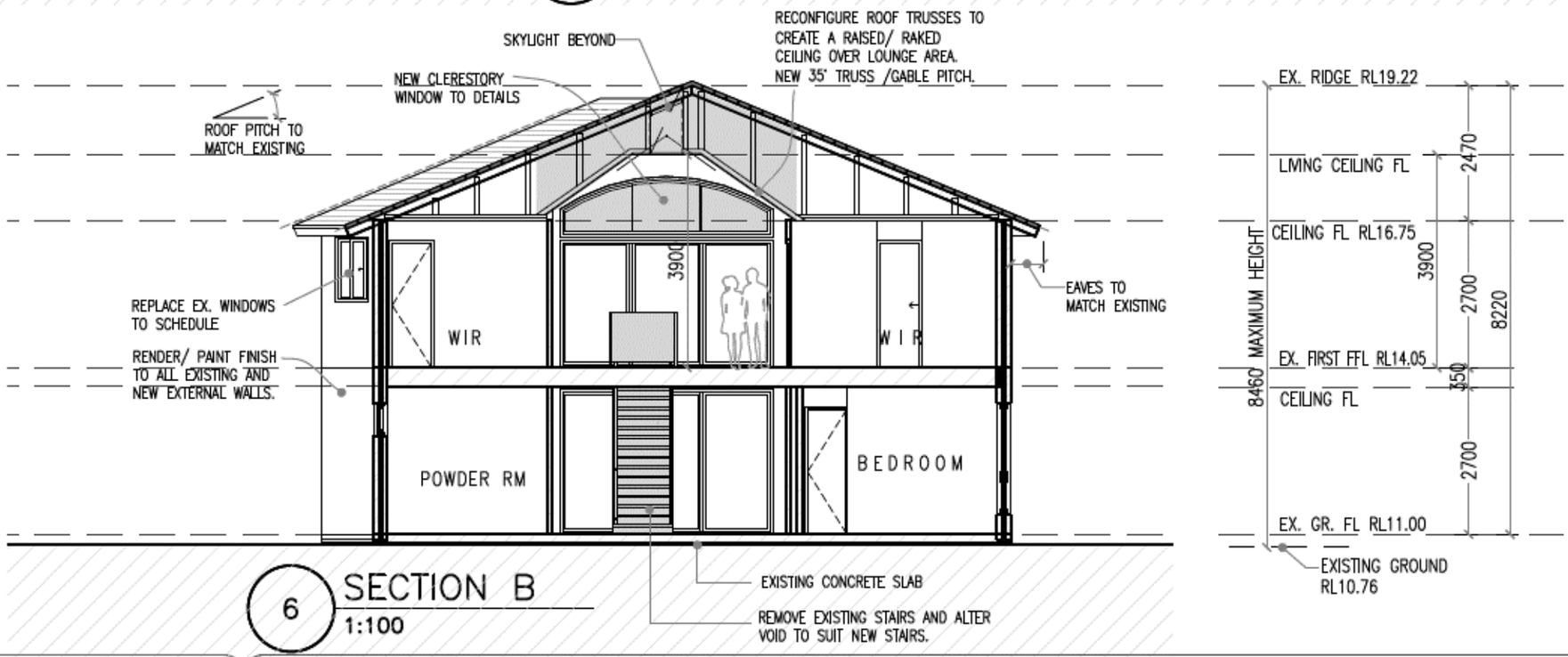
Drawing Title: SITE PLAN AND COMPLIANCE TABLE

Date	Scale	Drw no	Revision
08/09/2023	AS NOTED @ A3	A102	A

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



5 SECTION A
1:100



6 SECTION B
1:100

Fill
Topsoil
Sand - Medium Dense to Dense

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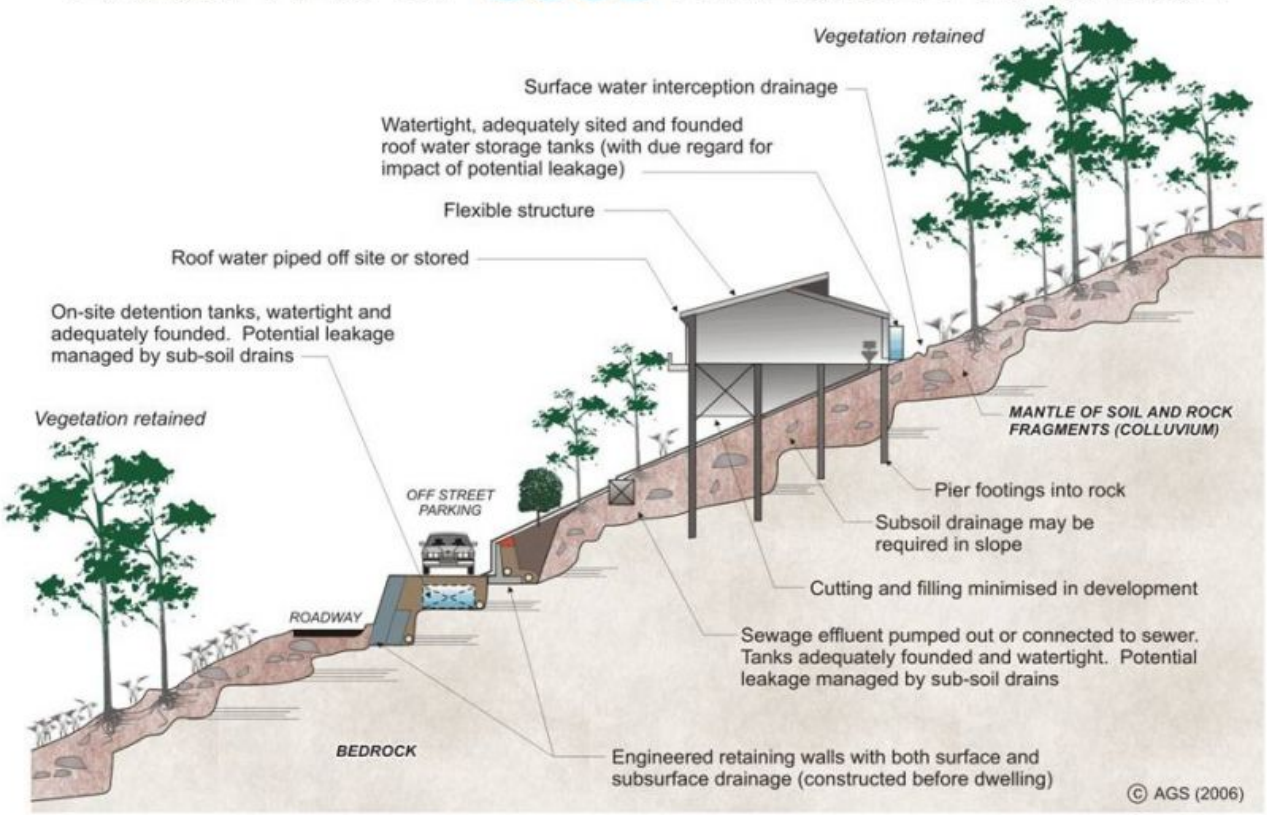
LOT 6 SEC 57 DP 4888
Project: CONSTRUCTION OF ALTERATIONS, ADDITIONS & A POOL

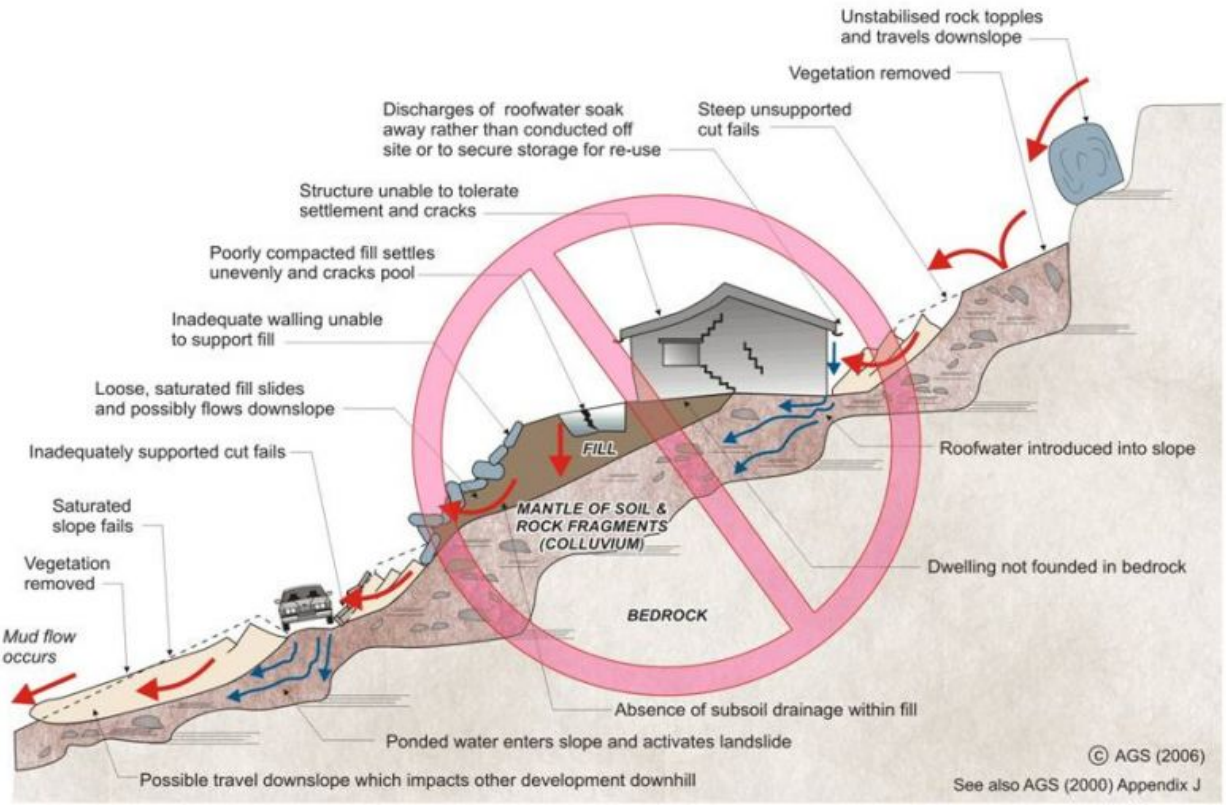
Drawing Title: SECTIONS

Date	Scale	Drw no	Revision
08/09/2023	AS NOTED @ A3	A107	A

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE



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C/- Mattrix Group
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Campbelltown NSW 2560
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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.

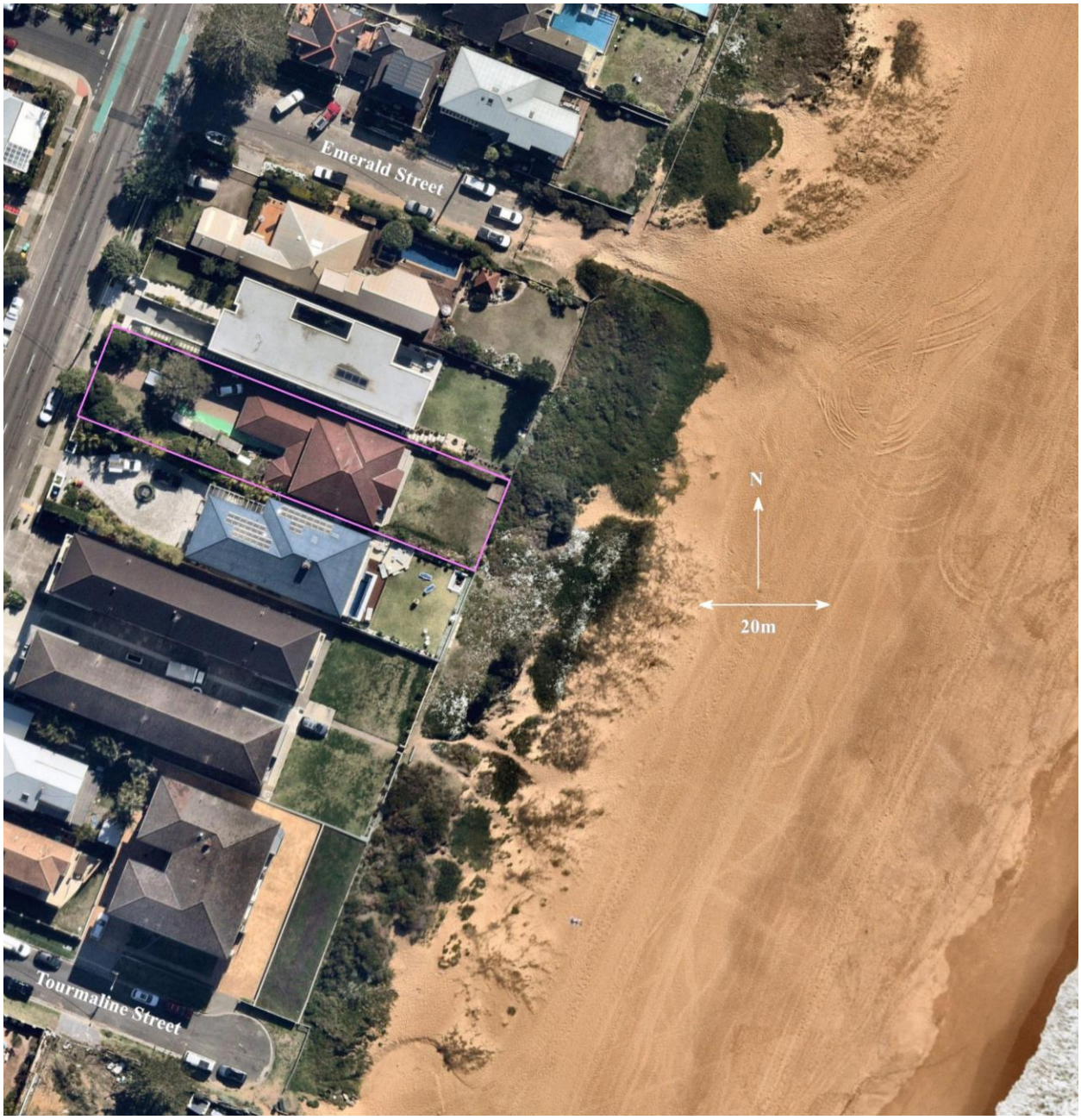


Figure 1: Aerial view of site (surveyed boundary in pink) on 30 August 2023

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].

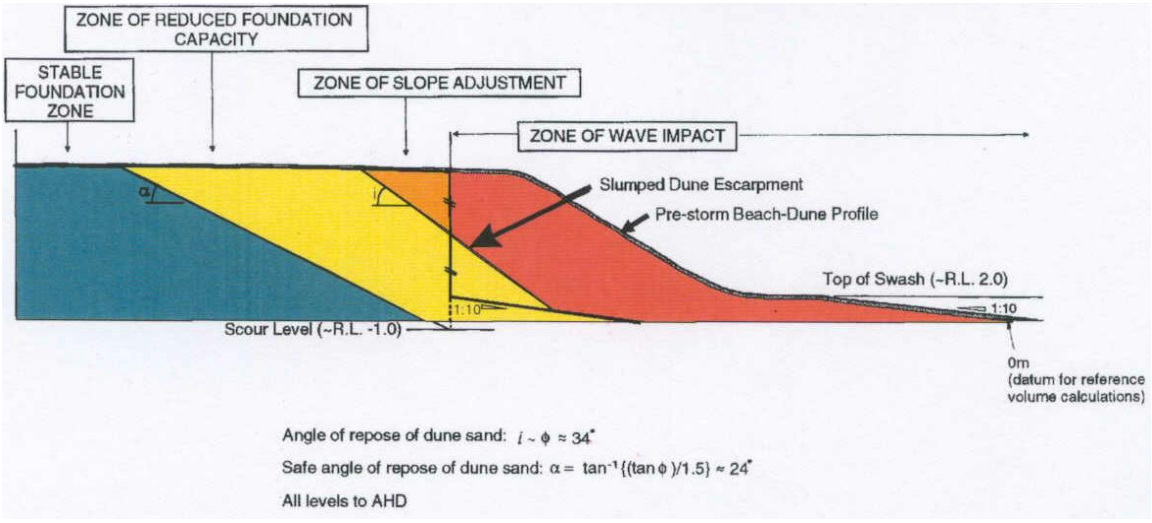


Figure 4: Schematic representation of coastline hazard zones (after Nielsen et al, 1992)

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.

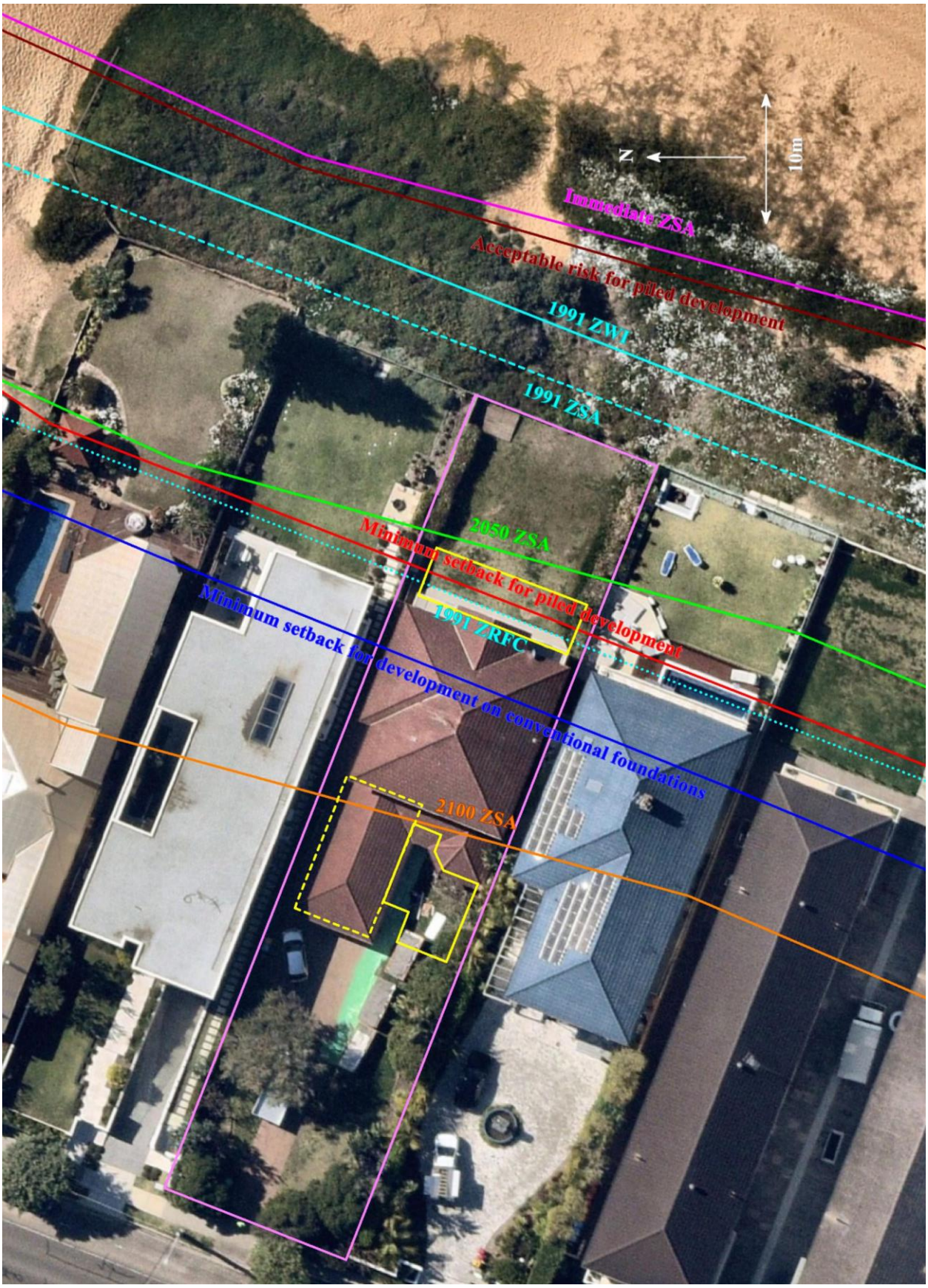


Figure 5: Coastal hazard lines and CZMP setbacks at site, with proposed development outlines in yellow (dashed line shows first floor addition, solid line on seaward side shows deck with pool and spa within this footprint, and solid line on landward side shows ground and first floor addition), and aerial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

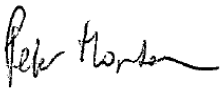
Nielsen, AF; Lord, DB and HG Poulos (1992), "Dune Stability Considerations for Building Foundations", *Australian Civil Engineering Transactions*, Institution of Engineers Australia, Volume CE34, No. 2, June, pp. 167-173

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
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