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Date: 14 February 2024

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Our reference: PA3720-RHD-XX-XX-CO-X-1

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Classification: Project related

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Enclosures Form No. 1

Dear Rob

DA2023/1548 - ALTERATIONS AND ADDITIONS TO A DWELLING HOUSE AND ASSOCIATED WORKS, 3 WARATAH ROAD, PALM BEACH, NSW

ESTUARINE RISK MANAGEMENT REPORT

I refer to our recent discussions regarding the above matter and your request that I prepare an Estuarine Risk Management Report in response to the letter issued by Northern Beaches Council (Council) dated 10 January 2024. This letter constitutes the Estuarine Risk Management Report.

1 SUITABLY QUALIFIED COASTAL ENGINEER

This report has been prepared by Greg Britton, Technical Director of Royal HaskoningDHV (RHDHV). A brief portrait for Greg is provided below.

Greg is a Fellow of Engineers Australia and has 47 years professional experience in the investigation, design, documentation, planning, and environmental assessment of coastal, estuary, and maritime projects. He has a Bachelor of Engineering (Civil) (Hons 1) and a Master of Engineering Science specialising in Coastal Engineering.

Greg has provided expert advice on coastal, estuary, maritime, and environmental engineering to the NSW Land and Environment Court, NSW Supreme Court, Queensland Supreme Court, Federal Court of Australia, and several Commissions of Inquiry.

He has been appointed by the NSW Minister for Planning to the Sydney and Regional Planning Panels as an Expert in coastal engineering. At the 2019 NSW Coastal Conference he was awarded the Ruth Readford Award for Lifetime Achievement, which honours an individual who has dedicated significant energies, time, and commitment to improving planning and/or management of the NSW coast.

Greg is considered suitably qualified to prepare this report.

2 BRIEF DESCRIPTION OF THE PROPOSED DEVELOPMENT

According to the Statement of Environmental Effects submitted with the DA (DFP Planning, 2023) the proposed development comprises:

- Alterations and additions to an existing dwelling house;
- Alterations and additions to an existing garage; and
- Construction of a home office/studio above the garage.

More specifically, and relevant to this Estuarine Risk Management Report, the alterations and additions near ground level comprise:

- Extension to the existing internal ground floor bathroom; and
- Extension to the existing garage.

The proposed extension to the existing internal ground floor bathroom has an area of approximately 4m². According to the site survey, the level of the floor of the bathroom would be approximately 2.57m AHD.

The proposed extension to the existing garage has an area of approximately 12m². According to the site survey, the level of the garage floor would be approximately 2.53m AHD.

Both the extension to the ground floor bathroom and to the garage are located on the south-east side of the existing dwelling house and garage respectively. The distance between the closest seawall along the Pittwater waterway and the potential estuarine water entry points to each of the extensions is approximately 90m.

3 COUNCIL LETTER OF 10 JANUARY 2024

The Council letter dated 10 January 2024 noted that the finished ground floor level of the extended garage and associated developments (taken to be the ground floor bathroom) is below the adopted Estuarine Planning Level (EPL). This EPL was previously advised in Council's Natural Environment Unit Referral Response dated 15 November 2023 (refer Section 4).

The Council letter further advised that an Estuarine Risk Management Report is required if the finished floor level (FFL) 'of the boatshed' is below the EPL. The subject DA does not involve a boatshed and reference to a boatshed in Council's letter would appear erroneous.

In accordance with Appendix 7 – Estuarine Risk Management Policy for Development in Pittwater, included within the Pittwater 21 DCP, the letter also stated that applicants may seek their own professional advice on determination of estuarine planning levels from a suitably qualified Coastal Engineer through an Estuarine Risk Management Report. This approach has been taken by the applicant, as set out in Section 5 and Section 6.

4 COUNCIL NATURAL ENVIRONMENT UNIT REFERRAL RESPONSE

The Natural Environment Unit Referral Response stated, among other things, that:

- In accordance with the Pittwater Estuary Mapping of Sea Level Rise Impact Study (Cardno, 2015):
 - a base EPL of 2.74m AHD for the relevant foreshore location has been adopted by Council for the year 2050, if the design life of the proposed development is 30 years or less;
 - if the design life is higher, it is advisable to consider a base EPL of 3.24m AHD (this corresponds to the year 2100); and
 - a reduction factor based upon the distance from the foreshore of the proposed development may also apply at a rate of a 0.08m reduction to the EPL for every 5m distance from the foreshore edge up to a maximum distance of 40m. No further reduction in the EPL is applicable¹.

As noted in Section 2, the minimum distance between the Pittwater foreshore (seawall) and the potential estuarine water entry points to each of the proposed extensions is approximately 90m. As such, a reduction of $40/5 \times 0.08\text{m} = 0.64\text{m}$ would apply to the base EPLs in 2050 (2.74m AHD) and 2100 (3.24m AHD). The EPLs so calculated are set out in Table 4-1 compared to the proposed FFLs of the extensions.

It is apparent that the FFLs are above the Council advised EPLs in the year 2050 but are below the Council advised EPLs in the year 2100, by some 30mm (bathroom) and 70mm (garage).

For a number of reasons set out in Section 5 and summarised in Section 6, the proposed extension to the bathroom and to the garage are not considered to be at an unacceptable risk from estuarine processes.

Table 4-1 EPLs according to Council advice compared to the proposed FFLs

Year	EPL	Level (m AHD)		Difference (m)	
		FFL		Bathroom	Garage
		Bathroom	Garage		
2050	2.1	2.57	2.53	+0.47	+0.43
2100	2.6	2.57	2.53	-0.03	-0.07

5 DISCUSSION OF ESTUARINE PLANNING LEVEL AND COMPONENTS

5.1 Discussion of the Basis for the EPLs advised by Council

The EPLs for the subject property advised by Council are taken from the Pittwater Estuary Mapping of Sea Level Rise Impact Study (Cardno, 2015). The subject property is situated within Foreshore Location 2 - Snapperman Beach. The foreshore type relevant to the EPL for the subject property is a vertical seawall with a crest level at 1.0m AHD.

¹ The reduction in EPL with distance from the foreshore edge is outlined in Appendix 7 of the Pittwater DCP.

Due to the low level of the crest of the foreshore seawall relative to the local elevated still water level in the design 100-year Average Recurrence Interval (ARI) storm, the mechanism for overtopping of the seawall and inundation of the foreshore land is depicted in Plate B3 Appendix B of Cardno (2015), which is reproduced below in Figure 5-1.

For the situation depicted in Figure 5-1, the base EPL is defined as follows:

- local elevated still water level in the 100-year ARI storm, plus
- half the approaching wave height in the 100-year ARI storm, plus;
- sea level rise, plus
- freeboard

The numerical additions to arrive at the base EPLs for 2050 and 2100 are summarised in Table 5-1.

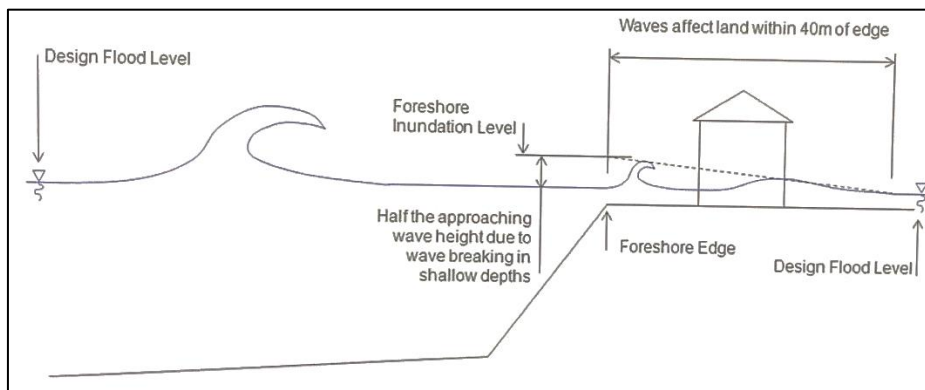


Figure 5-1 Overtopping when the local still water level is above the seawall crest
(Source: Plate B3 in Cardno (2015))

Table 5-1 Base EPL for subject property from Cardno (2015)

Component	Base EPL	
	2050	2100
Local elevated still water level	1.49m AHD	1.49m AHD
Half approaching wave height	0.55m	0.55m
Sea level rise	0.4m	0.9m
Freeboard	0.3m	0.3m
Total	2.74m AHD	3.24m AHD

A number of factors can be considered in assessing the EPL which should apply in practice for the proposed extensions at 3 Waratah Road, Palm Beach:

- the reasonable design life for the extensions, which influences the planning horizon adopted for determination of the EPL;
- the sea level rise predictions which could be applied, noting that the sea level rise predictions which are included in Cardno (2015) of 0.4m at 2050 and 0.9m at 2100, relative to 1990, are no longer NSW government policy and more recent predictions exist, e.g., from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6); and

- the actual effect of waves at the location of the extensions given that the maximum inland extent of wave inundation included in Cardno (2015) is taken to be 40m from the edge treatment (foreshore) crest and the extensions are located well beyond this distance at approximately 90m from the foreshore crest. This has an influence on the freeboard required at the location of the extensions, which is included to account for uncertainty in water levels and which it is noted in Cardno (2015) is greatest for wave run-up, but waves would not reach the location of the extensions.

The above factors are considered separately in the following sections.

5.2 Design life and planning horizon for the extensions

It is questionable whether a planning horizon for the proposed extensions to the year 2100, which would imply a design life for the extensions of approximately 75 years, is reasonable.

The existing dwelling was constructed in the early 2000's and is approximately 20 years old. At the year 2100 the original dwelling would be approximately 95 years old. This is more than the design life commonly adopted for residential structures in the assessment of coastal hazards.

It can be shown that the FFLs of the proposed extensions would satisfy an EPL calculated according to the components in Cardno (2015) if a planning horizon to 2090 rather than 2100 was adopted, i.e., a life for the extension of approximately 65 years or a life for the original dwelling of approximately 85 years. This outcome in itself is considered reasonable, before more recent predictions of sea level rise (Section 5.3) and freeboard requirements (Section 5.4) are also considered below.

5.3 Sea Level Rise Predictions

More up to date predictions of sea level rise than those included in Cardno (2015) are now available. The most authoritative predictions are generally accepted as those contained within the IPCC AR6.

Using the NASA Sea Level Projection Tool, the sea level rise median predictions at 2100, relative to a 1995-2014 baseline, for two Shared Socioeconomic Pathways (SSPs) climate change scenarios are set out in Table 5-2.

Table 5-2 Sea level rise predictions to 2100 from IPCC AR6 for two SSP climate change scenarios relative to 1995-2014 baseline

SSP Climate Change Scenario and Description	Sea Level Rise at 2100
SSP3-7.0 (High) An intermediate to high reference scenario resulting from no additional climate policy under the SSP3 socioeconomic development narrative. CO ₂ emissions roughly double from current levels by 2100. SSP3-7.0 has particularly high non-CO ₂ emissions including high aerosols emissions.	0.68m
SSP5-8.5 (Very High) A high-reference scenario with no additional climate policy. CO ₂ emissions roughly double from current levels by 2050. Emission level as high as SSP-8.5 are not obtained by integrated assessment models under any of the SSPs other than the fossil-fuelled SSP5 socio-economic development pathway.	0.78m

It is considered unlikely that the SSP5-8.5 (Very High) scenario would represent the world's climate future, having regard to the existing national policies and expected future policies regarding fossil fuels and renewable energy, i.e., the assumptions underlying this scenario (refer Table 5-2) are unlikely to prevail in practice.

For this reason, the SSP3-7.0 (High) scenario is considered reasonable to adopt for the subject assessment which would give a median sea level rise prediction at 2100 relative to the 1995-2014 baseline of 0.68m. Strictly speaking, it is necessary to discount this prediction for the sea level rise which occurred at Fort Denison over the period from the 1995-2014 baseline to the current time (2024). This would amount to approximately 0.03 to 0.04m giving an adjusted median sea level rise prediction at 2100 of approximately 0.65m.

Selection of the median sea level rise prediction is considered reasonable for an extension to an internal bathroom and a garage given their function. It follows that taking a value of 0.65m for predicted sea level rise at 2100 rather than the value of 0.9m in Cardno (2015) would give an EPL at 2100 of 2.35m AHD, and the FFLs for the extensions would be above this value. Adopting a lesser planning horizon for the extensions, as discussed in Section 5.2, would mean that the FFLs for the extensions would be even further above the EPL.

5.4 Required Freeboard

As noted above, Cardno (2015) states that the freeboard of 0.3m is included in the EPL to allow for uncertainty in the determination of water level which it is noted is greatest for wave run-up.

The proposed extensions to the internal ground floor bathroom and garage are located approximately 90m from foreshore crest, whereas the effects of waves are limited to 40m from the foreshore crest according to Cardno (2015), which is considered reasonable.

The question arises as to why the full freeboard of 0.3m which includes consideration of waves would need to be applied 90m from the foreshore crest when waves would not reach this far inland.

Taking the EPLs according to Council advice and the FFLs as listed in Table 4-1, the available freeboards at 2100 for the internal ground floor bathroom and the garage would be as follows:

- Internal ground floor bathroom: 0.27m
- Garage: 0.23m

These freeboards are considered satisfactory given that the major component of the elevated still water level is due to regional processes (astronomical tide plus storm surge) which have a high degree of certainty based on long term records available from the Fort Denison tide gauge.

The available freeboards would be even higher if a lesser planning horizon and/or a reduced value for future sea level rise is adopted as discussed above.

6 ASSESSMENT OF ESTUARINE RISK

For a number of reasons summarised below the proposed extensions to the existing internal ground floor bathroom and existing garage are not considered to be at an unacceptable risk from estuarine processes.

If a planning horizon to 2090 is adopted rather than 2100, which is considered reasonable in terms of the life of the existing dwelling, the FFLs of the extensions would be above the EPL, adopting all other components of the EPL as per Cardno (2015).

If an up to date sea level rise prediction to 2100 from IPCC AR6 is adopted, the FFLs of the extensions would be above the EPL, adopting all other components of the EPL as per Cardno (2015).

If the EPL at 2100 advised by Council is adopted, the available freeboards to the FFLs would be 0.23m (garage) and 0.27m (bathroom) which are considered reasonable given that wave action, a contributing allowance normally within freeboard, would not reach as far inland as the extensions being located 90m from the closest seawall crest.

In practice, the factors of design life/planning horizon, and an up to date sea level rise prediction, could be considered in conjunction, adding further to the acceptability of the proposed extensions in relation to estuarine risk.

I trust the above satisfies your current requirements. A completed copy of Form 1 from Appendix 7 within Pittwater 21 DCP is also attached.



Greg Britton

Technical Director
Water & Maritime

FORM NO. 1

To be submitted with Estuarine Risk Management Report

Development Application for <u>STEPHEN & SUSAN JONES</u>	Name of Applicant
Address of site <u>3 WARRATAH ROAD, PALM BEACH</u>	

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

I, KEVIN BELTON on behalf of HASKONING AUSTRALIA PTY LTD
(Insert Name) (Trading or Company Name)
on this the 14 FEBRUARY 2024
(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.

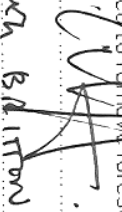
Estuarine Risk Management Report Details:

Report Title:	DA 2023/1548 - ALTERATIONS AND ADDITIONS TO A DWELLING HOUSE AND ASSOCIATED WORKS, 3 WAREHAM ROAD, PALM BEACH, NSW
Report Date:	14 FEBRUARY 2024
Author:	KEEN BRITTON

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

STATEMENT OF ENVIRONMENTAL EFFECTS (DEFP PLANNING, 2023)
DETAIL of BOUNDARY IDENTIFICATION SURVEY (C & A SURVEYORS, VZ 22/9/23)
ARCHITECTURAL DRAWINGS (TWO FIRM ARCHITECTURE + INTERIOR DESIGN)

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 KEEN BRITTON

Chartered Professional Status

Membership No 264242