Horton Coastal Engineering
Coastal & Water Consulting

HORTON COASTAL ENGINEERING PTY LTD
18 Reynolds Cres
Beacon Hill NSW 2100
+61 (0)407 012 538
peter@hortoncoastal.com.au
www.hortoncoastal.com.au
ABN 31 612 198 731
ACN 612 198 731

57 The Avenue Pty Ltd
C/- Essex Develop Pty Ltd
Attention: Sammy Soliman
Suite 14, 26-32 Pirrama Road
Pyrmont NSW 2009
(sent by email only to sammy@essexdevelop.com.au)

17 October 2022

Estuarine Risk Management Report on 122-128 Crescent Road and 55-57 The Avenue Newport

1. INTRODUCTION AND BACKGROUND

It is proposed to demolish the existing buildings and subdivide 122-128 Crescent Road and 55-57 The Avenue Newport into nine lots, along with undertaking associated servicing and stormwater drainage works. A Development Application (DA) was submitted to Northern Beaches Council for these activities, but was returned due to an estuarine risk management report not being submitted, amongst other matters.

As the properties are potentially affected by estuarine hazards, they are subject to the *Pittwater 21 Development Control Plan* (DCP)[1], in particular Chapter B3.10 for a subdivision. They are also subject to the *Estuarine Risk Management Policy for Development in Pittwater* (Estuarine Policy, which is Appendix 7 of Part D of the DCP).

Horton Coastal Engineering Pty Ltd was engaged to complete the estuarine risk management report required by Council, as set out herein. The report author is Peter Horton [BE (Hons 1) MEngSc MIEAust CPEng NER]. Peter has postgraduate qualifications in coastal engineering and 30 years of coastal engineering experience, including numerous studies along the Pittwater shoreline and particularly at Newport. He is a Member of Engineers Australia and Chartered Professional Engineer (CPEng) registered on the National Engineering Register. Peter is also a member of the National Committee on Coastal and Ocean Engineering (NCCOE) and NSW Coastal, Ocean and Port Engineering Panel (COPEP) of Engineers Australia. He has inspected the area in the vicinity of the subject properties on several occasions in the last two decades or so, including a specific recent inspection of the properties on 12 August 2022.

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

2. INFORMATION PROVIDED

Horton Coastal Engineering was provided with an architectural envelope plan of the proposed subdivision prepared by Scott Carver, Ref 20220005, Dwg No AD-DA903, and Revision D dated

[1] The version up to Amendment 27 (effective from 18 January 2021) was considered herein.

26 May 2022. A site survey by Boxall Surveyors (Drawing No. 11369-001-A dated 5 May 2022) was also provided.

3. EXISTING SITE DESCRIPTION

The subject properties are located at the SE end of the Pittwater waterway, within Winji Jimmi Bay, with a broad aerial view depicted in Figure 1.

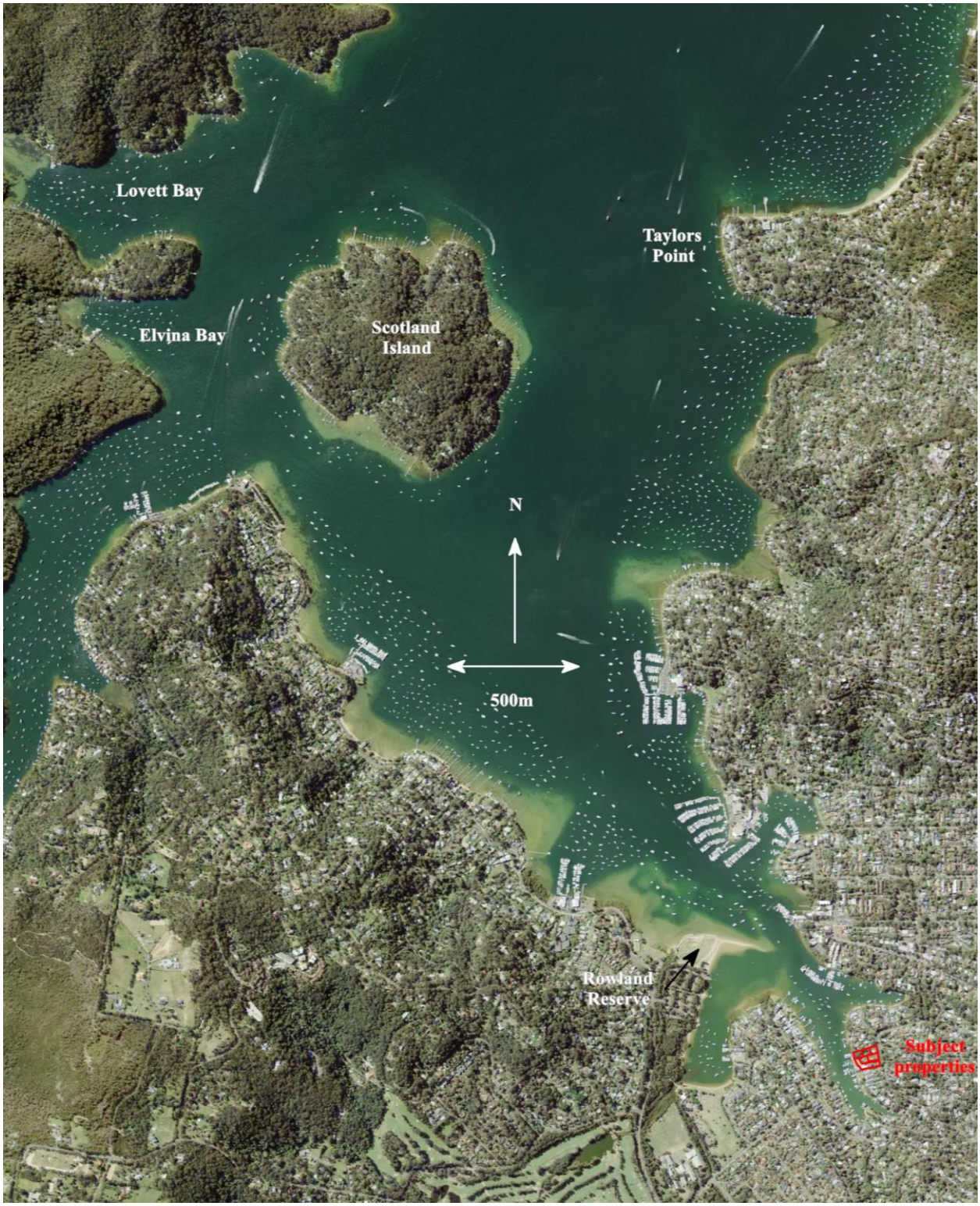

Figure 1: Aerial view of subject properties on 30 August 2018

The properties are most exposed to a wind-wave fetch from the NW from the vicinity of Scotland Island (fetch length of about 3km), although the sand spit extending east from Rowland Reserve would limit the penetration of wind-waves towards the properties.

Based on the site survey, a concrete seawall is generally located along the foreshore seaward of the subject properties, with a crest level of about 2.5m AHD. There are gaps in the seawall at a boat ramp and slipway (both with a crest elevation of about 2.4m AHD).

The seaward edge of the northern properties is at about 2.3m AHD, steeply rising to about 6.7m AHD over a densely vegetated area, and then further rising to about 8m AHD at the No. 57 dwelling, 11m AHD at the No. 55 dwelling, and 16m AHD at the No. 128 dwelling.

A retaining wall straddles the seaward boundary of the central properties, with the concrete level at the base of the wall at about 2.3m to 3.3m AHD (increasing moving north), the top of the wall at about 4m AHD, and then levels rising steeply over a grassed area to about 7m AHD. Elevations continue to rise moving landward, to about 12m AHD at the No. 126 dwelling and 16m AHD at Crescent Road.

The seaward boundary of the southern properties is at about 2.4m AHD, with the floor level of the No. 122 workshop at 2.4m AHD. Ground levels increase moving landward to about 6m AHD at the No. 122 landward building and 15m AHD at Crescent Road.

An oblique aerial view of the properties is provided in Figure 2. A zoomed aerial view of the properties is provided in Figure 3. Photographs of the properties are provided in Figure 4 and Figure 5.

Figure 2: Oblique aerial view of subject properties (main structures at arrows) on 5 April 2022, facing NE

Figure 3: Zoomed aerial view of subject properties (red outline) on 5 April 2022 (boundaries are approximate)

Figure 4: View of foreshore over central and southern portion of subject properties on 12 August 2022, facing south to SE

Figure 5: View of foreshore over northern portion of subject properties on 12 August 2022, facing east

4. PROPOSED DEVELOPMENT

It is proposed to demolish the existing buildings and subdivide 122-128 Crescent Road and 55-57 The Avenue Newport into nine lots, along with undertaking associated servicing and stormwater drainage works.

It is understood that land levels over the subdivision are expected to generally remain the same as existing, to avoid extensive cut and fill. It is also understood that land levels over the subdivision and landward of the Foreshore Building Line will be above 2.5m AHD.

5. DESIGN LIFE

In the Estuarine Policy, it is noted that a design project life of 100 years should be adopted, unless otherwise justified. A 60-year design life (that is, at 2082) has been adopted for the proposed development. This is the same design life as adopted in the *Coastal Zone Management Plan [CZMP] for Bilgola Beach (Bilgola) and Basin Beach (Mona Vale)* that was prepared by the author for Council and gazetted on 14 July 2017. Although this CZMP does not geographically apply at the subject properties, it is the only gazetted CZMP in the former Pittwater Council area, and hence is relevant to consider in the selection of design life.

As justified in the CZMP, a 60 year life is considered to be appropriate for infill residential development as it is consistent with the design life used in various Australian Standards (eg *AS 3600 – Concrete structures*), tax legislation, and community expectations.

6. ESTUARINE PROCESSES

6.1 Design Still Water Level at End of Design Life

In Cardno (2015), the 100-year Average Recurrence Interval (ARI) present day water level in the region covering the subject properties is reported as 1.57m AHD. This includes the effects of astronomical tide and storm surge (combined level of 1.44m AHD), plus local wind setup (0.13m). Wave action can temporarily and periodically increase water levels above this level, particularly in severe storms if they generate wind-waves that propagate towards the properties.

Cardno (2015) estimated a 2050 Estuarine Planning Level (EPL) of 2.52m AHD, and 3.00m AHD at 2100, at the foreshore[2]. These EPL's include wave runup and overtopping effects and a freeboard of 0.3m[3], and do not include any reduction with distance landward of the foreshore.

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

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

For the proposed design life of 60 years (at 2082), it would be possible to interpolate between the 2050 and 2100 benchmarks. However, given the non-linear rate of sea level rise, it is considered to be most appropriate to directly derive sea level rise values from Intergovernmental Panel on Climate Change [IPCC] (2021), which is widely accepted by competent scientific opinion.

Using the same methodology applied in the acceptable risk assessment in the *Coastal Zone Management Plan for Bilgola Beach (Bilgola) and Basin Beach (Mona Vale)*, and using a base year of 2010 as Cardno (2015) water levels were derived at 2010, the sea level rise values presented in Table 1 (at 2082) were determined for the five illustrative scenarios (shared socioeconomic pathways, SSP's[4]) considered in IPCC (2021)[5].

This includes regional sea level rise variations at Sydney as reported by the Physical Oceanography Distributed Active Archive Center (PO.DAAC), a NASA Earth Observing System Data and Information System data centre operated by the Jet Propulsion Laboratory in Pasadena, California. The sea level rise values were determined at 2082, relative to the average sea level from a 1995-2014 baseline (taken to be at 2005).

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[2] Assuming that the seawall had a crest level of 2.0m AHD.
[3] Use of a freeboard is not considered to be appropriate in a wave runup scenario.
[4] Known as representative concentration pathways in the previous IPCC (2013) assessment.
[5] The five illustrative scenarios represent varying projected greenhouse gas emissions, land use changes and air pollutant controls in the future.

Table 1: Mean sea level rise (m) at Sydney from a 1995-2014 average level (taken at 2005) to 2082 derived from IPCC (2021) and PO.DAAC

Emissions Scenario (Shared Socioeconomic Pathway)	Exceedance Probability		
	95% exceedance	Median	5% exceedance
SSP1-1.9	0.12	0.26	0.52
SSP1-2.6	0.15	0.31	0.59
SSP2-4.5	0.23	0.40	0.70
SSP3-7.0	0.29	0.48	0.80
SSP5-8.5	0.34	0.54	0.90
Average	0.23	0.40	0.70

Taking the median exceedance probability and average of the 5 SSP's, a sea level rise value of 0.40m at 2082 (relative to 2005) was derived. Given that Cardno (2015) water levels were derived at 2010, the sea level rise should be determined relative to 2010. Watson (2020) found that the rate of sea level rise from satellite altimetry in the SE Australia region was 3.5mm/year from 1992-2019. Applying this rate from 2005 to 2010, the projected sea level rise from 2010 to 2082 at Sydney is 0.38m.

Therefore, the design 100 year ARI estuarine still water level at 2082 is 1.95m AHD. This still water level is about 0.5m below the seawall crest level.

6.2 Wave Action

Cardno (2015) estimated that the 100 year ARI wave climate in the region covering the subject properties was a significant wave height of 0.46m (average of the highest one-third of waves) and mean wave period of 1.8s (or peak spectral wave period of 2.5s assuming a 1.4 multiplier).

In the design event, waves would break at and may overtop the crest of the seawall and propagate landward. Only limited overtopping would be expected, but to be conservative it is considered reasonable to adopt an Estuarine Planning Level (EPL) of 2.7m AHD at the foreshore.

However, note that wave runup would not be expected to reach the developable area of the subject properties in the design event at any significant depth. This is because:

- Lots 7, 8 and 9 are well elevated and have a 15m foreshore (Foreshore Building Line) setback; and
- the Lot 6 property is setback 20m to 24m from the seawall.

For simplicity, an EPL of 2.5m AHD was adopted at the Foreshore Building Line.

7. MERIT ASSESSMENT

7.1 Chapter B3.10 of the *Pittwater 21 DCP*

The subdivision of land requires the area of land contained on the landward side of the Foreshore Building Line for each additional allotment created to be at or above the Estuarine Planning Level. Given that all lots are to be above 2.5m AHD on the landward side of the Foreshore Building Line, this has been satisfied.

Based on the DCP (numbering added herein for convenience):

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

With regard to Item 1, the proposed subdivision would not significantly change estuarine processes nor increase the level of risk in surrounding areas for the design event, as the movement of water and waves over the area seaward of the seawall would not be significantly altered. With the lots on the landward side of the Foreshore Building Line above the EPL, the risk of the proposed subdivision being adversely affected by estuarine processes would be suitably mitigated. Therefore, Item 1 is satisfied.

For a subdivision, there are no details on proposed structures at this stage. However, there is no reason to expect that Items 2-5 cannot be satisfied for future development of structures at the properties, which will be considered as part of future DA's. Item 6 would not need to be applied in these future DA's.

With regard to Item 7, occupants are not at significant risk of injury at the site for the design coastal storm event, with the subdivision (landward of the Foreshore Building Line) above the EPL. Occupants would be able to shelter-in-place in future dwellings without any need for evacuation. It is further noted that the largest component of elevated water level is astronomical tide, which is entirely predictable and independent of the storm event, so early warning is available. The inundation peak would also only have a duration of around 2 hours (at high tide).

With regard to another item in Chapter B3.10 of the DCP, no mitigation works are proposed below the EPL that would significantly modify the wave action or tidal inundation behaviour within the development site (including the filling of land, the construction of retaining structures and the construction of wave protection walls).

7.2 *Estuarine Risk Management Policy for Development in Pittwater*

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

- estuarine processes and the Estuarine Planning Level in Section 6; and

- the controls in Chapter B3.10 of the Pittwater 21 DCP in Section 7.1.

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

7.3 *State Environmental Planning Policy (Resilience and Hazards) 2021*

Based on *State Environmental Planning Policy (Resilience and Hazards) 2021* (SEPP Resilience) and its associated mapping, the subject properties are within a "coastal environment area" and a "coastal use area". The provisions of SEPP Resilience would more appropriately be considered as part of future DA's for structures over the subdivision. That stated, there is no expectation of any issues in meeting the requirements of SEPP Resilience in future DA's, with the subdivision itself not causing increased risk of coastal hazards on that land or other land.

8. CONCLUSIONS

It is proposed to demolish the existing buildings and subdivide 122-128 Crescent Road and 55-57 The Avenue Newport into nine lots, along with undertaking associated servicing and stormwater drainage works. For a design life of 60 years, the adopted Estuarine Planning Level (EPL) is 2.5m AHD at the Foreshore Building Line, with all land levels over the subdivision and landward of the Foreshore Building Line above the EPL.

The proposed subdivision satisfies the requirements of Chapter B3.10 of the Pittwater 21 DCP and the *Estuarine Risk Management Policy for Development in Pittwater*. With regard to *State Environmental Planning Policy (Resilience and Hazards) 2021*, the subdivision itself would not cause increased risk of coastal hazards on that land or other land.

9. REFERENCES

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

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

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

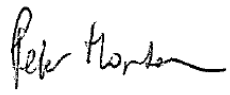
Intergovernmental Panel on Climate Change [IPCC] (2021), *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, [V Masson-Delmotte, P Zhai, A Pirani, SL Connors, C Péan, S Berger, N Caud, Y Chen, L Goldfarb, MI Gomis, M Huang, K Leitzell, E Lonnoy, JBR Matthews, TK Maycock, T Waterfield, O Yelekçi, R Yu and B Zhou (editors)], Cambridge University Press, in press

Watson, Phil J (2020), "Updated Mean Sea-Level Analysis: Australia", *Journal of Coastal Research*, Volume 36, Issue 5, September, pp. 915-931

10. 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

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

FORM NO. 1
To be submitted with Estuarine Risk Management Report

Development Application for Essex Develop Pty Ltd

Name of Applicant

Address of site 122-128 Crescent Road and 55-57 The Avenue Newport

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

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

on this the 17th October 2022 (date)

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

Please mark appropriate box

× I have prepared the detailed Estuarine Risk Management Report referenced below in accordance with the Estuarine Risk Management Policy for Development in Pittwater

☐ I am willing to technically verify that the detailed Estuarine Risk Management Report referenced below has been prepared in accordance with the Estuarine Risk Management Policy for Development in Pittwater

☐ I have examined the site and the proposed development/alteration in detail and, as detailed in my report, am of the opinion that the Development Application only involves Minor Development/Alterations or is sited such that a detailed Estuarine Risk Management Report is not required.

Estuarine Risk Management Report Details:

Report Title:

Estuarine Risk Management Report on 122-128 Crescent Road and 55-57 The Avenue Newport

Report Date:

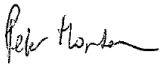
17 October 2022

Author: Horton Coastal Engineering Pty Ltd

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

See Section 2 and Section 9 of report

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

Signature	
Name	Peter Horton
Chartered Professional Status	MIEAust CPEng
Membership No.	452980