18 December 2023

WRL Ref: WRL2023082 LR20231218 JTC

Jo Zancanaro
Acting Manager, Development Assessment
Waverley Council
Corner Paul Street and Bondi Road
Bondi Junction NSW 2022

By email: jo.zancanaro@waverley.nsw.gov.au

UNSW
Water Research
Laboratory

Dear Jo,

Re: Bronte SLSC redevelopment – peer review

1. Introduction

The Water Research Laboratory (WRL) of the School of Civil and Environmental Engineering at UNSW Sydney is pleased to provide this letter report to Waverley Council (hereafter "Council") for Bronte SLSC – peer review.

The review was undertaken by WRL's Principal Coastal Engineer, James Carley.

The following document was reviewed:

- Royal HaskoningDHV and Warren and Mahoney (RHDHV, 2023), "Bronte SLSC Redevelopment: Seawall and Related Elements Detailed Design: Concept Design and Coastal Engineering Assessment Report", Reference: PA3572-RHDV-RP-S1-RP-FC-0001, Draft/P00.01, 5 December 2023

The RHDV (2023) report is in response to a WRL review dated 23 October 2023 (ref: WRL2023082 LR20231023 JTC) of three previous documents associated with this project, and a meeting between WRL, RHDV, Warren and Mahoney, and Council on Monday, 13 November 2023.

2. Summary of peer review

The document, "Bronte SLSC Redevelopment: Seawall and Related Elements Detailed Design: Concept Design and Coastal Engineering Assessment Report" (RHDHV, 2023) was reviewed by WRL's Principal Coastal Engineer, James Carley. The document is of a good professional standard, particularly in light of the short time available to prepare it.

The proposed upgraded seawall and likely reinforced concrete construction of the proposed new SLSC building is likely to better serve the function of surf life saving at Bronte.

The works proposed are likely to be able to manage coastal hazards for appropriate and foreseeable design events and sea level rise over the next 50 to 70 years subject to additional engineering design. The predominant hazard to be managed will be coastal inundation and wave forces through wave overtopping. For the existing and proposed new SLSC building, the hazards of erosion and recession are/will be managed through the presence of a seawall, provided that the seawall does not fail.

RHDHV (2023) canvassed available existing studies regarding numerous inputs for the project (e.g. extreme water levels), however, many sections of the report would benefit from a short summary of what was actually adopted, especially when there are differences between existing studies and/or interpretation required.

It is noted that substantial calculations regarding overtopping have been undertaken in RHDHV (2023). These calculations appear to be predominantly sound, with the following caveats.

The most extreme ARI calculated was 100 year ARI. Some valid discussion was provided that indicated that the assumptions behind this were "conservative". While this is somewhat accepted, an additional ARI in the range 500 to 2500 years is recommended to comply with a range of standards. Furthermore, while no comparisons are known to WRL, the use of 6 hour wave height rather than 1 hour is potentially non-conservative, however, it is a common, but not universal practice.

The assumption that the seaward face of the SLSC structure is in the same cross shore position as the seawall is very conservative. While difficult to locate, some techniques are available to account for the setback – such as in the FEMA (USA) Guidelines for Coastal Flood Hazard Analysis and Mapping for the Pacific Coast of the United States (2005) and Coastal Construction Manual (2011).

No calculations were undertaken in RHDV (2023) for a wave return wall. This is highly likely to be able to substantially reduce wave overtopping to tolerable or acceptable levels. Desktop design methods for wave return walls are available, however, physical modelling would be required for detailed design of this feature.

As noted in RHDHV (2023), physical modelling will be required for detailed design to progress, with the calculations presented informing preliminary and concept design. Physical modelling reduces the risk of both underdesign (unanticipated failure) and overdesign (excessive capital cost).

Based on the reviewer's experience in comparable locations, it is likely that an appropriate certifiable detailed design can be developed within the presented concept design if additional design work is undertaken.

For high sea level rise scenarios, the future of a sandy beach at Bronte may require active management, noting that the present SLSC proposal does not significantly change the status quo, except for extending the life of the present situation/seawall alignment.

3. Detailed peer review of RHDHV (2023)

RHDHV (2023) is of a good professional standard.

In many places "Waverly" should be spelt as Waverley. WRL has not reviewed for any other spelling or grammar issues.

Section 1.2
The proposed seawall protects the promenade and buildings from erosion and inundation, where inundation is due to wave runup and overtopping.

Add “potentially” before “increased storm frequency”.

Add that the existing seawall has no parapet or wave return wall.

Section 2.1
Minimal details of the SBEACH modelling are presented, however, it is noted that it was undertaken by Baird for ARUP (2016). This has not been sighted by WRL. Therefore, while WRL agrees with the statement that the ARUP (2016) design scour levels appear to be high (elevated), no details are known.

WRL agrees that the June 2016 storm was probably a 20 to 40 year ARI, however, no attribution is given to RHDHV’s comment that it was a 30 year ARI.

Section 2.3
Figures 2-7, 2-8 and 2-9 could be portrayed in landscape mode for better legibility.

Section 2.5.4
Page is blank.

Section 4.1
Add “at present” before “approximately equal to Mean Sea Level”. Suggest replacing “Australian” by “NSW” in “at the Australian coastline”.

Section 4.7
The most extreme ARI calculated was 100 year ARI. Some valid discussion was provided that indicated that the assumptions behind this were “conservative”. While this is somewhat accepted, and likely acceptable for the inundation hazard, an additional ARI in the range 500 to 2500 years for structural design is recommended to comply with a range of standards.

Last paragraph on page 27, check sentence and punctuation in “(refer to Figure 4-5). British Standards. This probability may be unacceptably high …”

RHDHV later noted that the probability of a 100 year ARI storm event over the 70- year design life “… may be unacceptably high …”

The relatively elevated design scour levels are likely acceptable due to the presence of bedrock.

While WRL concurs that the design waves at the site will be depth limited, larger offshore waves cause larger nearshore wave setup and therefore the potential for larger depth limited waves.

Section 4.8.2
The 100 year ARI water level of 1.5 m AHD (WorleyParson, 2011) is slightly higher than the 1.44 m AHD (Watson and Lord, 2008) value presented in Section 4.8.4, however, this 0.06 m difference is minor.

As later stated in RHDHV (2023), the full quantum of wave setup may not be realised at the seawall. This is because typical wave setup calculations are at the shoreline of a beach, the seawall truncates the surf zone at Bronte during large wave events.

Section 4.8.4

Reword sentence "This is like be the corresponding value reported by Manly Hydraulics Laboratory (MHL) (Manly Hydraulics Laboratory, 2018)[2]".

Section 4.9

While no known comparisons are known to WRL, the use of 6 hour wave height rather than 1 hour is potentially non-conservative. However, it is a common, but not universal practice.

Section 5.2

A plot of the coastal erosion hazard lines in the event of seawall failure would assist in understanding the erosion hazard and the dependence on the seawall as management of the hazard.

Section 5.2.1.2

This section confuses the volume of sand available on the beach (180 m^3/m) with the design erosion volume (250 m^3/m), but indicates that there is insufficient sand to meet the design erosion volume, and hence the need for a seawall.

Section 5.2.2

The "average beach width" is presumably mid tide with small waves.

The third paragraph is repeated (in the fourth paragraph).

Section 5.3.1

WRL agrees that there was no significant structural damage in the storms of 1974 and 2016, but notes that there was damage to landscaping and roller shutters.

It is well accepted that the current promenade is unsafe to pedestrians during extreme storms. This applies to many beachfront promenades and is usually managed through access restrictions. For the renewed SLSC building and associated new seawall, the management issue is the avoidance of structural damage to the building and seawall, and restricting inundation to an acceptable or tolerable level.

Section 5.3.2.1

WRL has found that the wave runup method of Mase (1989) has performed well, however, it is only strictly applicable to natural beaches, and cannot readily incorporate a seawall. A note should be made to this effect, but given that wave overtopping calculations are undertaken elsewhere in RHDHV (2023), the Mase (1989) calculations can be retained as a first approximation.

Words to the effect of the following should be added: A wave return wall is likely to be able to reduce wave overtopping to acceptable or tolerable levels over the design life, provided that a physical model is undertaken within detailed design.

Section 5.3.2.3

The following notes are made regarding the wave overtopping calculations:

- A 100 year ARI event is likely acceptable for inundation, but not wave forces on the building
- It is acknowledged that the derivation of the 100 year ARI event may be conservative
- The addition of full wave setup at the seawall may be conservative, as it is likely to be truncated at the seawall – more detailed numerical modelling and/or later physical modelling can resolve this

Case 6 and 7 in Table 5-5 and Table 5-6 may be reversed, or this may be an artefact of the calculation procedure changing equations due to different inputs.

No calculations were undertaken in RHDV (2023) for a wave return wall. Some initial calculations should be undertaken. This is highly likely to be able to substantially reduce wave overtopping to tolerable or acceptable levels. Desktop design methods for wave return walls are available, however, physical modelling would be required for detailed design of this feature.

The assumption that the seaward face of the SLSC structure is in the same cross shore position as the seawall is very conservative. While difficult to locate, some techniques are available to account for the setback – such as in the FEMA (USA) Coastal Construction Manual (2011).

As noted in RHDHV (2023), physical modelling will be required for detailed design to progress, with the calculations presented informing preliminary and concept design.

WRL agrees that "… Cases 5 and 6 could potentially cause structural damage …" , however, the building could be designed to withstand these forces; the forces may be conservative due to the calculations being undertaken without a setback for the building; a wave return wall could reduce the wave forces at the building.

Section 5.3.2.4
WRL concurs with the management options presented. With regard to glazing, toughened or laminated glass will be required for a public building regardless of wave forces, but it may be required to be stronger than that required for wind loads.

Section 5.3.3
WRL accepts that the desktop methods are likely conservative. This risk of overdesign can be reduced with a physical model as suggested. WRL notes that there are desktop methods available to allow for a building to be set back behind a seawall (FEMA, 2011). However, it is also noted that in some circumstances, physical modelling results exceed desktop methods, with the physical modelling able to reduce the risk of unanticipated failure.

Case 6 and 7 in Table 5-7 may be reversed, or this may be an artefact of the calculation procedure changing equations due to different inputs.

Section 6
Change "rock wall" to sloping rock rubble revetment. This is to avoid confusion with vertical sandstone walls such as at Manly.

Change the format of the footnote (5) in "130kN/m[5] ", as it connotes a power on the metres unit.

Figure 6-1: The high portions of the ramp may also need a wave return wall, and/or the wave return wall could be on the ramp, not the main seawall.

Section 7
As stated previously, physical modelling reduces the risk of both underdesign (unanticipated failure) and overdesign (excessive capital cost).

Section 8
All opinions on planning acts and policies within RHDHV (2023) have been deferred until later drafts.

4. Summary

Thank you for the opportunity to provide this peer review. Please contact James Carley on 0414385053 should you require further information.

Yours sincerely,

Francois Flocard
Acting Director, Industry Research

23 October 2023

WRL Ref: WRL2023082 LR20231023 JTC

COMMERCIAL IN CONFIDENCE

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RECEIVED
Waverley Council

Application No: DA-455/2022

Date Received: 23/11/2023

Dear Jo,

RE: Bronte SLSC – peer review

1. Introduction

The Water Research Laboratory (WRL) of the School of Civil and Environmental Engineering at UNSW Sydney is pleased to provide this letter report to Waverley Council (hereafter "Council") for Bronte SLSC – peer review.

The review was undertaken by WRL's Principal Coastal Engineer, James Carley.

The following documents were reviewed:

- (Horton, 2023), *Coastal Risk Assessment and Coastal Engineering Advice on Bronte Surf Lifesaving Club and Community Facility Redevelopment report prepared by Horton Coastal Engineering Pty Ltd dated 31 July 2023*
- Warren and Mahoney (2023a), *Project: Bronte Surf Life Saving Club; Drawing Title: Sea wall layout; Drawing No SK.123 Revision A*
- Warren and Mahoney (2023b) Coastal protection peer review, November 2023 Revision A <20231108_Coastal Peer Review Presentation.pdf>

The following items were specifically requested by Council to be reviewed by WRL:

a. Overview and assessment of recommended coastal works proposed
b. Detailed risk assessment (including physical modelling, where possible or available)
c. Performance of works proposed in terms of coastal inundation and management of risk

2. Summary of peer review

Three documents (reports/drawings/presentations) were reviewed by WRL's Principal Coastal Engineer, James Carley. The documents are of a good professional standard.

The proposed upgraded seawall and likely reinforced concrete construction of the proposed new SLSC building is likely to better serve the function of surf life saving at Bronte.

The works proposed are likely to be able to manage coastal hazards for appropriate and foreseeable design events and sea level rise over the next 50 to 70 years subject to additional engineering design. The predominant hazard to be managed will be coastal inundation and wave forces through wave overtopping. For the existing and proposed new SLSC building, the hazards of erosion and recession are/will be managed through the presence of a seawall.

However, there are no calculations presented regarding wave runup and overtopping. Such calculations are complex – they could be initially undertaken using desktop methods such as EurOtop (2018) supplemented with physical modelling, or undertaken solely in a physical model.

Nevertheless, based on the reviewer's experience in comparable locations, it is likely that an appropriate certifiable detailed design can be developed within the presented concept design if additional design work is undertaken.

For high sea level rise scenarios, the future of a sandy beach at Bronte may require active management, noting that the present SLSC proposal does not significantly change the status quo, except for extending the life of the present situation/seawall alignment.

3. Detailed peer review

3.1 Horton (2023)

Horton (2023) is of a good professional standard.

The works proposed are likely to be able to manage coastal hazards for appropriate and foreseeable design events and sea level rise over the next 50 to 70 years subject to additional engineering design. The predominant hazard to be managed will be coastal inundation and wave forces through wave overtopping. For the existing and proposed new SLSC building, the hazards of erosion and recession are/will be managed through the presence of a seawall.

Horton (2023) documented two major coastal inundation events and reported other events over the past 100 years.

Horton listed a range of suitable techniques to manage wave forces and inundation.

However, there are no calculations presented regarding wave runup and overtopping. Such calculations are complex – they could be initially undertaken using desktop methods such as EurOtop (REF) supplemented with physical modelling, or undertaken solely in a physical model.

Nevertheless, based on the reviewer's experience in comparable locations, it is likely that an appropriate certifiable detailed design can be developed within the concept design presented in Horton (2023).

Furthermore, no adaptive pathways in response to future climate change are presented. An example could be the future construction of a wave return wall when a threshold of future sea level rise is reached – with such a structure possibly not required in the present day.

It is suggested that a range of design event Average Recurrence Intervals be developed and presented. The structural elements of the proposed new SLSC building are largely covered within the Building Code of Australia, Australian Standard 1170.0 and AS 4997.

An appropriate design event for other components of the project is not specifically covered by published standards, but the project would benefit from stated design conditions.

Examples of suggested components (subject to further discussion) could be:

- Structural elements of building and seawall (Building Code of Australia, AS1170.0 Structural design actions: General principles and AS 4997-2005, Guidelines for the design of maritime structures):
    - 500 to 2500 year ARI
- Replaceable building elements (e.g. Shutters, doors and windows):
    - 10 to 100 year ARI
- Inundation of building:
    - 10 to 100 year ARI
- Wave overtopping of promenade:
    - 1 month to 10 year ARI

A portion of the proposed works occupy a portion of sandy beach. The revised layout by Warren and Mahoney (2023a) reduces this portion and simplifies the layout.

The estimated recession due to sea level rise may be overstated by Horton (2023). WRL accepts the use of the Bruun Rule with a Bruun Factor of 50. It is recommended that recession be tabulated in a similar manner to Table 2 of Horton for each sea level rise scenario.

Horton (2023) and studies referenced within it indicate that Bronte Beach has remained stable or accreted over past decades while the sea has risen an average of 1.9 mm per year. This value was calculated by (Watson, 2020) based on data from 1914 to 2018 at Fort Denison, and accounts for changes in sea surface level and vertical land motion to determine the velocity of SLR relative to land. That is, the future recession due to sea level rise could be discounted by the sea level rise that has been occurring, making the recession calculated by Horton an overestimate. Although speculative, sources of sand supply could be offshore shelf supply and cliff erosion.

Therefore, calculated recession for 2103 (0.55 m of sea level rise) could be reduced by approximately 8 m from the values presented by Horton (2023).

It should also be noted that the beach will be narrower than its MSL width more than 50% of the time due to tides, wave setup and wave runup. Desktop, high level calculations for other locations by WRL have typically assessed the beach width at approximately 2 m AHD, while more comprehensive studies have undertaken an hourly assessment of ocean conditions, wave runup and the estimated hourly actual dry beach width.

Thus, for high sea level rise scenarios, the future of a sandy beach at Bronte may require active management, noting that the present SLSC proposal does not significantly change the status quo, except for extending the life of the present situation/seawall alignment.

Horton (2023) also suggested beach scraping as a means of accelerating beach recovery following storm events – this is supported by the reviewer, noting that there may be limits to this under future high sea level rise scenarios.

3.2 Warren and Mahoney (2023a)

Warren and Mahoney (2023a) is of a good professional standard. Warren and Mahoney (2023a) provides a simplified layout for the seawall and beach access over the Horton (2023) design and occupies less present sandy beach space.

Similar comments apply as to Horton (2023) regarding calculation of wave overtopping and wave forces. That is, there are no calculations presented regarding wave runup and overtopping. Such calculations are complex – they could be initially undertaken using desktop methods such as EurOtop supplemented with physical modelling, or undertaken solely in a physical model.

Nevertheless, based on the reviewer’s experience in comparable locations, it is likely that an appropriate certifiable detailed design can be developed within the concept design presented in Warren and Mahoney.

3.3 Warren and Mahoney (2023b)

Warren and Mahoney (2023b) is of a good professional standard. It is a presentation providing comparison between the original design of Horton (2023) and the revised design in Warren and Mahoney (2023a).

The only comments specific to Warren and Mahoney (2023b) are that a raised seawall crest combined with a wave return wall are indicated in front of the proposed new SLSC building. As discussed previously, there are no calculations presented regarding wave runup and overtopping. Such calculations are complex – they could be initially undertaken using desktop methods such as EurOtop supplemented with physical modelling, or undertaken solely in a physical model.

4. Summary

Thank you for the opportunity to provide this peer review. Please contact James Carley on 0414385053 should you require further information.

Yours sincerely,

Brett Miller
Director, Industry Research