Summary

In response to discussions with Patrick Johnson of Australian Coastal Walls Pty Ltd (ACW), NSW Public Works Manly Hydraulics Laboratory (MHL) conducted 2D physical modelling of stability and overtopping of a proposed generic design (**Appendix A**) for a se wall utilising the ACW block (**Appendix A**).

The model testing of the proposed design of the sea wall resulted in the following conclusions and recommendations:

- Wave condition and water level. The wave conditions tested were characterised by waves with high surf similarity parameters (exceeding that typical of plunging waves) and resulted in a large number of surging waves. The incident wave conditions were evaluated using reflection analysis (Appendix B). Testing was carried out at water levels covering a range of predicted high water levels for the relevant return periods and also took into consideration sea level rise (SLR) due to climate change.

- The structure was tested at extreme high water levels (100-year ARI (Average Recurrence Interval) and greater) resulting in extreme broken wave conditions at the structure on the coastline.

- Stability of sea wall section 1 – placement density 11.9 units/m^2, 3.45m AHD (Australian Height Datum) crest level (**Figure 3.1**). Tested at water levels 1.5m AHD (100-year ARI water level), 1.65m AHD (1-year ARI +0.4m for SLR water level) and 1.9m AHD (100-year ARI + 0.4m for SLR water level). The testing indicated that at this placement density no damage to the structure was observed.

- Stability of sea wall section 2 – placement density 10.8 units/m^2, 3.45m AHD crest level. Tested at water levels 1.5m AHD (100-year ARI water level), 1.6m AHD (1-year ARI +0.4m for SLR water level) and 1.9m AHD (100-year ARI + 0.4m for SLR water level). The testing indicated that at this placement density no damage to the structure was observed at water levels 1.5m AHD and 1.6m AHD. At 1.9m AHD three units were displaced, resulting in less than 1% damage.

- Average wave overtopping values for a seawall crest height of 3.45m AHD. Wave overtopping estimates at a water level of 1.5m AHD were found to be acceptable and meet the criteria for a lightly protected promenade. Overtopping at 1.6m AHD indicated conditions are unsafe for pedestrians, albeit acceptable for a lightly protected promenade. At 1.9m AHD, conditions would be unacceptable for pedestrians, albeit acceptable for vehicles moving at low speeds. At higher crest heights overtopping would be reduced. A wave deflector could also be used to reduce wave overtopping

- Testing modes of failure. Although the structure did not fail during testing it is customary to initiate possible modes of failure and test these modes under design conditions. Two possible modes of failure were tested, the first consisting of a single unit being removed from the structure. The subsequent testing using 2000 waves did not result in any progressive deterioration to the stability condition of the structure. The second mode of failure consisted of two adjacent units being removed. Similar to the previous result there was no further deterioration to the stability of the structure.

- .Other possible modes of failure – loss of underlayer material. Suitable filter materials should be incorporated in the prototype design in order to satisfy filet rules and avoid washout of underlayer materials as well as ensure efficient drainage of overtopping waves. The leaching of sand from behind the model structure highlighted the structural significance of utilising a suitable geofabric filters such as Terrafix 1200R, 900R and Elcomax 600R.

- Other possible modes of failure – toe scour. Since sand cannot be scaled accurately in a Froude mode, scour was not modelled. The tow was pinned to the floor to ensure that no toe movement took place during the modelling. Notwithstanding this modelling constraint, toe scour is expected to be a possible mode of failure for this structure. As for any rigid coastal structure, instability at the toe can lead to progressive and/or sudden collapse of the structure. As such, proper toe design by a suitably experienced coastal engineer should be considered mandatory to ensure the stability of the structure.

- Scaling effects. For the average return intervals tested (1 year to 100 years) the criteria for scaling effect used indicate that there would be negligible scaling effects during testing

THESE NOTES AND THE TEXT HIGHLIGHTING HAVE BEEN ADDED BY AUSTRALIAN COASTAL WALLS (ACW):

- *ALL HIGHLIGHTING HAS BEEN ADDED*
- *THE RECOMMENDED PLACEMENT BY ACW IS 12 UNITS/M^2*
- *THE TESTING AT MHL WAS PERFORMED WITH LOOSE SLABS TOPPING THE MODEL SEAWALL INSTEAD OF A "SOLID" WALKWAY WHICH IS RECOMMENED BY ACW*