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Our reference:	PA1438_TechnicalReview	Email:	james.lewis@rhdhv.com
Classification:	Project related		
Enclosures:	Evan Watterson		

RHDHV Preliminary Review - Innovative Expertise Cooktown Foreshore Development Technical Report

Dear Robert,

Following our previous communication, Royal HaskoningDHV (RHDHV) were engaged to provide a preliminary review to the update of the Cooktown Foreshore Development (CFD) – Technical Review – Final Report (*the Report*) undertaken by Tony Byrne of Innovative Expertise (IE), dated 11th September 2016. The Report incorporated information gathered from IE site visits, review of available literature, meetings with previous design engineers as well as a review and adoption of the RHDHV Wave Modelling Study. The following is the RHDHV response to the findings of each of the sections of the report.

It is noted that due to lack of information available, it is not possible for RHDHV to provide a complete review on design works presented in this report. RHDHV to date have not been present at any site visits, attained any design documents or spoken to previous design engineers. As such the following review is made with the information laid out in the aforementioned Report.

Overall Wall Stability

- RHDHV agree with the reasoning of IE and the finding of the Report that the wall has most probably undergone the highest load conditions within its first two years of service.
- It is recommended that a soil sample and grading be undertaken of the fill material behind the wall and that prior to certification, design and/or as-constructed drawings be attained and assessed in conjunction with the results of the geotechnical investigation.

Piping Failures

- The critical hydraulic gradients of fine piping particles inside a seawall become smaller with the increase in water level fluctuation cycles. Due to the 3m+ tidal cycle in Cooktown it

is essential that mechanisms for piping are identified and reduced if found to be present.

- RHDHV agree with the recommendations made in the Report as to the immediate remediation of areas found to have piping failure. It is also advised that regular inspection of the concrete path on top of the wall for cracking take place as well as the identification of any sink holes be reported by Council staff and assessed by qualified engineers.
- RHDHV recommend inspection of the seawall face be undertaken at spring low tide (or similar) to observe any large gaps in the armour rock or if there is evidence of any core/filter exposure.
- RHDHV recommend that prior to certification or further design, that design/as-constructed drawings be attained and assessed.
- The remediation materials proposed in the Report for the pool section also appear to be appropriate for the size of armour rock proposed in this area.

Armour Failure

- The approach recommended by IE is typical of that incorporated for intermittent remediation of seawalls; the replacement of undersize armour rocks with larger rocks to influence the grading curve towards a suitable design. RHDHV believe this to be both a time and cost efficient undertaking in order for remediation of a failing or undersize seawall.
- Without direct measurement of each area (and armour depth) of the seawall and an estimation as to the number of rocks contained within, it is not possible for RHDHV to confirm the recommended appropriate number of undersize rocks that need to be removed in order to adequately alter the average and median rock size and grading curve. It is assumed that IE have made appropriate estimates of the volume to be replaced.
- Following the procedure detailed in IE's report, RHDHV believe that the values provided within for the replacement of armour stone are essentially conservative in nature. RHDHV agree with this approach for the selection of both wave parameters and for the calculation and subsequent selection of armour units.
- RHDHV agree with the selection of the sizing for the replacement armour units for the specified 5~10% level of damage.

Armour Sourcing

- As mentioned briefly (p3 of Report) it was noticed that there was a large quantity of existing armour units that were rounded in shape. It is recommended that selection of replacement armour rock be undertaken with a bias towards more angular-shaped rocks, whilst at the same time maintaining the recommended < 1:3 (Height : Length) side ratio.
- RHDHV also agree with the comments made in the Report that an active dialogue be initiated and continued with local quarry operators to ensure a stockpile of larger rock is available should it be needed in the future.
- If not already undertaken, it is advised that the quality of the rock be assessed using:
 - i) Quarry specification reports; Los Angeles Value Report, Particle Density and Water Absorption Report, Wet/Dry Variation Report, etc.
 - ii) Inspection of rock by a suitably qualified coastal engineer.

Overtopping

- Without knowing the free-board of the seawall, it is difficult for RHDHV to replicate the overtopping calculations made within the report. However if using the empirical Eurotop formulae for the envelope of Hs and Tp values found from the modelling, it is possible to work backwards to determine if damage to the promenade would be expected (>300 l/m/sec) under 20yr ARI water level (+1.7m)..

- For an armoured simple slope with 2 layers of permeable core and the largest wave/water level combination condition: $H_s = 2.08\text{m}$, $T_p = 9.2\text{ sec}$, $WL = +1.7\text{mMSL}$, the height of the seawall will need to be $>2.35\text{m}$ above MSL to ensure no damage to the paved promenade i.e.; less than 300l/m/sec .
- RHDHV are in agreeance with the Report that public access to the promenade during these times needs to be restricted and all endeavours should be made to enforce this.

Sheet Pile Walls

- It is difficult for RHDHV to comment on the integrity of the sheet pile wall without sufficient design drawings, geotechnical or bathymetric survey. However the placement of an armoured seawall in front of the decommissioned swimming lagoon will increase the stability of the wall as a whole.
- The rock sizing selected in the Report is in-line with the specifications recommended for the existing seawall and as such should be sufficient for this section of the development.

In general, the report appears to make the best informed decisions as to remediation of damaged infrastructure for the information that is at hand. RHDHV recommend additional geotechnical and high resolution bathymetric survey of both the seawall and the toe of the sheet pile wall in order to better inform future design calculations. It is also imperative that both the design and as-constructed drawings for each of the structures be attained in order to correctly assess the levels of damage and to inform remediation design and certification.

Kind Regards,



James Lewis

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