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From: not relevant @watertech.com.au>
Sent: Friday, 12 February 2016 9:29 AM
To: Christopher M Sykes
Subject: Nelly Bay - Alternative Options Analysis - Report
Attachments: 4231-01_R01v02.pdf

Hi Chris

In response to our earlier discussions, attached please find our amended report.

Regards

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Nelly Bay
Alternative Options Analysis

January 2016

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Cover Photo: Nelly Bay Beach: Road bridge at northern end of the beach providing access to southern breakwater. Photo taken one hour before low tide 21st December 2015.

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1. INTRODUCTION

In recent years the sandy foreshores of Nelly Bay Beach on Magnetic Island have been experiencing erosion which threatens public and private infrastructure. The location of Nelly Bay Beach within its regional context is shown in Figure 1-1, whilst Figure 1-2 shows its location with respect to nearby Nelly Bay Harbour. Typical erosion of the beach is illustrated on Figure 1-3.

In May 2010 Coastal Engineering Solutions Pty Ltd completed a Shoreline Erosion Management Plan (SEMP) for Nelly Bay Beach (CES, 2010). The Executive Summary of the SEMP Report is enclosed as Appendix A to this report.

The objectives of the SEMP were as follows:

- to enable the Townsville City Council to proactively plan for erosion management in a way that is consistent with all relevant legislation (Commonwealth, State and Local) as well as all relevant coastal and environmental policies;
- to investigate and address the underlying causes of shoreline erosion and its likely future progression at the local scale;
- to determine cost effective and sustainable erosion management strategies that maintain natural coastal processes and resources; and
- to consider community needs in both the short- and long-term.

The SEMP recommended that future management of the eroding Nelly Bay shoreline be achieved through a strategy of Beach Nourishment. That strategy basically consists of:

- Initial Nourishment - through the placement of a sufficient volume of sand to establish sand buffers that accommodate the erosion caused by a nominated Design Event.
- Ongoing Renourishment - given that the nourished foreshore experiences long-term erosion processes, it will be necessary to recharge these erosion buffers by periodic placement of additional sand.

The implementation of this beach nourishment strategy for Nelly Bay Beach will establish and maintain natural erosion buffers along foreshore sections that are threatened by erosion over the 50 year planning period of the SEMP.

However local coastal processes are such that some of the sand placed for beach nourishment will be transported into the beach/breakwater corner at the northern-most end of Nelly Bay Beach. As discussed later in this report, there is a requirement to maintain tidal flow under a road bridge that connects the southern harbour breakwater with the shoreline. Consequently to be effective, the recommended beach nourishment strategy needed to accommodate this requirement.

The SEMP therefore recommended that this be achieved by intercepting the northward moving sand by construction of a training wall alongside the southern breakwater. This will prevent sand from being transported into the “gap” between the breakwater and the shoreline; thereby facilitating tidal flow in the channel beneath the bridge. The sand naturally accumulated against the training wall will form a stable sand “fillet” having a plan orientation determined by the seasonal wave climate on Nelly Bay Beach. The SEMP estimated that a training wall of around 70 metres length would be required to provide a stable beach planform, as well as to facilitate tidal flow beneath the adjacent bridge.

However subsequent advice was received from the Great Barrier Reef Marine Park Authority (GBRMPA) that any intrusion of this training wall into the Marine Park would not be approved by the Authority. Since the Department of Transport and Main Roads (DTMR) is responsible for ensuring the tidal flow beneath the bridge, the Department engaged Water Technology to investigate the required length of the training wall in more detail. The commissioned Alternative Options Analysis is to consider alternatives to the full length training wall as recommended by the SEMP. This report presents the findings of investigations for the Alternative Options Analysis.

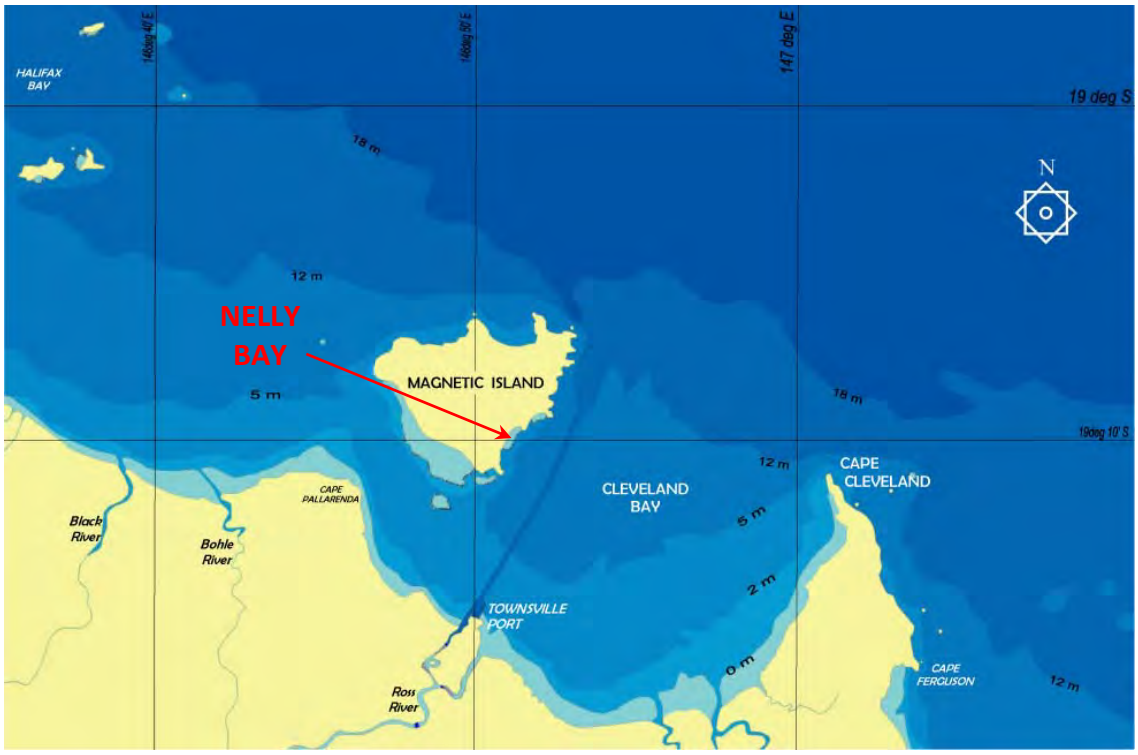


Figure 1-1 Study Locale

Figure 1-2 Nelly Bay Beach

Figure 1-3 Beach erosion on Nelly Bay Beach

2. SAND TRANSPORT PROCESSES

The naturally occurring processes that shape the Nelly Bay foreshore are discussed in significant detail in the SEMP Report (CES, 2010). Nevertheless a summary of those processes is warranted in this current discussion since it provides the context for subsequent appraisal of options for sand management on Nelly Bay Beach.

The coastal environment of Nelly Bay is characterised by an extensive fringing intertidal reef platform, with a sandy beach along the immediate foreshore. The distance between the toe of the beach and the reef crest at the seaward edge of the reef platform varies from about 400 metres at the northern end of the beach to only some 80 metres at its southern end.

2.1 Prior to Harbour Construction

Prior to commencing the construction of Nelly Bay Harbour in 1989, the natural supply of sand to local foreshores was derived from sediments being conveyed by Gustav Creek - primarily during significant flows induced by heavy rainfall events. Sand from the creek's steep inland catchment was delivered into the shoals at the creek entrance alongside Bright Point.

The opposing influences of creek discharges and longshore sand transport caused the lower reaches of Gustav Creek to meander as it approached its entrance to Nelly Bay. Historically the seaward-most reach of the creek flowed northward behind a low sand spit before then discharging in the northern-most corner of Nelly Bay against the rocky flank of Bright Point. Gustav Creek's entrance arrangement is evident in old surveys and historical photographs - as illustrated in the aerial photograph of Figure 2-1.

Wave action then transported the deposited sand off the entrance shoals. The prevailing coastal processes in Nelly Bay at that time resulted in a north-to-south transport of sand along the foreshore between Bright Point and Hawkings Point - apart from in the northern corner where Gustav Creek originally discharged into Nelly Bay.

Natural processes slowly carried sand from the entrance area southward along Nelly Bay Beach. In other words, natural ongoing supply of sand from Gustav Creek to its northern end was keeping the foreshore of Nelly Bay nourished with sand.

Figure 2-1 Nearshore coastal environment prior to harbour construction

2.2 Subsequent to Harbour Construction

As a consequence of Nelly Bay Harbour's construction, the natural ongoing supply of sand to local foreshores has ceased. Gustav Creek now discharges into the sheltered waters of the Harbour.

As part of the original harbour construction works, a sedimentation basin was built in the lower reaches of Gustav Creek to intercept sand delivered to the shoreline by the creek - so that it did not discharge into the harbour basin. The intent of capturing this sand was not only to prevent ongoing sedimentation within the harbour, but that it be used to regularly nourish the downdrift foreshores of Nelly Bay Beach.

This strategy of mechanical extraction of sand from the basin at the downstream end of Gustav Creek and its placement on Nelly Bay Beach was the means by which the natural sand pathway from the creek onto the foreshore was to be restored following harbour construction.

Figure 2-2 Nearshore coastal environment subsequent to harbour construction

Whilst this basin has been successful in trapping most of the sand delivered by Gustav Creek, its clearance and placement on the downdrift foreshore (thereby replicating natural supply mechanisms prior to harbour construction) has not been as extensive as planned.

The longshore transport processes on Nelly Bay Beach itself have still been moving sand naturally southward along the beach at the same rate as previously. However because of the diminished sand supply from Gustav Creek, the longshore sand transport on the beach is greater than the rate that sand is now being mechanically supplied from the sedimentation basin. Consequently the beach has been steadily eroding since completion of the harbour.

In addition to inhibiting the natural supply of sand to Nelly Bay Beach, the new harbour has altered the wave climate and longshore sand transport regime on the northern end of the beach. As a consequence of the southern breakwater, there are localised wave diffraction processes that now move some of the sand northwards along the beach (towards the road bridge at the end of Kelly Street that connects to the breakwater).

The changes to sand supply and sand transport processes as a consequence of harbour construction are shown conceptually on Figure 2-3 (which has been taken from CES, 2010).

Figure 2-3 Recent Changes to Sand Supply and Transport Processes (from CES, 2010)

This natural sand movement causes a build-up of a sand "fillet" in the beach/breakwater corner which fills the channel under the road bridge - thereby preventing tidal flow between the reef flat and the sheltered harbour waters. Queensland's Department of Transport and Main Roads (with the assistance of Townsville City Council) clears sand from this area generally once a year so as to reinstate partial tidal flow beneath the road bridge.

The removed sand is placed on Nelly Bay Beach further to the south. However the prevailing coastal processes return it to the northern beach/breakwater corner, where it must then again be removed each year to reinstate the flow beneath the bridge. Typical sand deposition and subsequent clearance in this area is shown on Figure 2-4.

(a) Sand blocking tidal flow beneath bridge

(b) Sand cleared from beneath bridge to allow tidal flow

Figure 2-4 Sand deposition and clearance beneath the Kelly Street bridge

3. MARINE PARKS PERMIT FOR NELLY BAY HARBOUR

3.1 Conditions of Permit

The Marine Parks Permit issued for the construction, maintenance and operation of Nelly Bay Harbour is included as Appendix B of this report. It states in part:

> *"The Permittee must maintain water flow at Mean Low Water Mark under the breakwater bridge and around the breakwater on all sides with connection to the ocean and must ensure that such water flow is maintained continuously thereafter, ….."*[1]

This permit requirement is therefore incorporated into Clause 3.1 of the *Nelly Bay Harbour Operational Plan*.

As discussed in the preceding Section 2.2, the construction of Nelly Bay Harbour has resulted in some changes to natural sand transport mechanisms at the northern end of Nelly Bay Beach. Some sand is now transported northward and collects in the corner formed by the beach and the southern harbour breakwater. This tends to fill the "gap" beneath the breakwater bridge (as shown in Figure 2-4) thereby inhibiting the required tidal flow at Mean Low Water Mark (MLWM).

Consequently Queensland's Department of Transport and Main Roads undertakes annual clearance of sand from this area to ensure that the required tidal flows at MLW are reinstated beneath the road bridge by 1st July of each year.

Mean Low Water Mark was chosen as the required ocean level for tidal flow beneath the bridge since it represents the landward boundary of the Great Barrier Reef Marine Park (GBRMP) as proclaimed by the Great Barrier Reef Marine Park Act 1975. The Marine Parks Permit for the Harbour states that:

> *"Mean Low Water Mark (MLWM) at Nelly Bay Harbour means the tidal plane passing through -0.696 m AHD."*[2]

The landward boundary of the GBRMP along the foreshores of Nelly Bay is therefore defined by the RL -0.696 m AHD contour.

Advice has been received from the Department of Transport and Main Roads as well as Townsville City Council that the GBRMPA would not approve any erosion management structure recommended by the SEMP that crossed this boundary contour since it would therefore extend into the Marine Park.

3.2 Implications to Training Wall Location

In order to properly define the actual landward boundary of the Marine Park, a survey of the foreshore and adjoining intertidal flats at the northern end of Nelly Bay Beach was undertaken by Townsville City Council in August 2015. This is one of several such surveys undertaken over the years.

The position of the RL-0.7m AHD contour on the intertidal flats off the beach is shown on Figure 3-1. This is of particular relevance since it is effectively the position of the landward boundary of the Great Barrier Reef Marine Park (i.e. RL -0.696 m AHD).

[1] Clause 27 on page 6 of Marine Parks Permit No G03/2321.1. Issued on 1st June 2003 under the then Great Barrier Reef Marine Park Regulations 1983 (Commonwealth) and Marine Parks Regulations 1990 (Queensland).
[2] Definitions listed on page 3 of Marine Parks Permit No G03/2321.1. Issued on 1st June 2003 under the then Great Barrier Reef Marine Park Regulations 1983 (Commonwealth) and Marine Parks Regulations 1990 (Queensland).

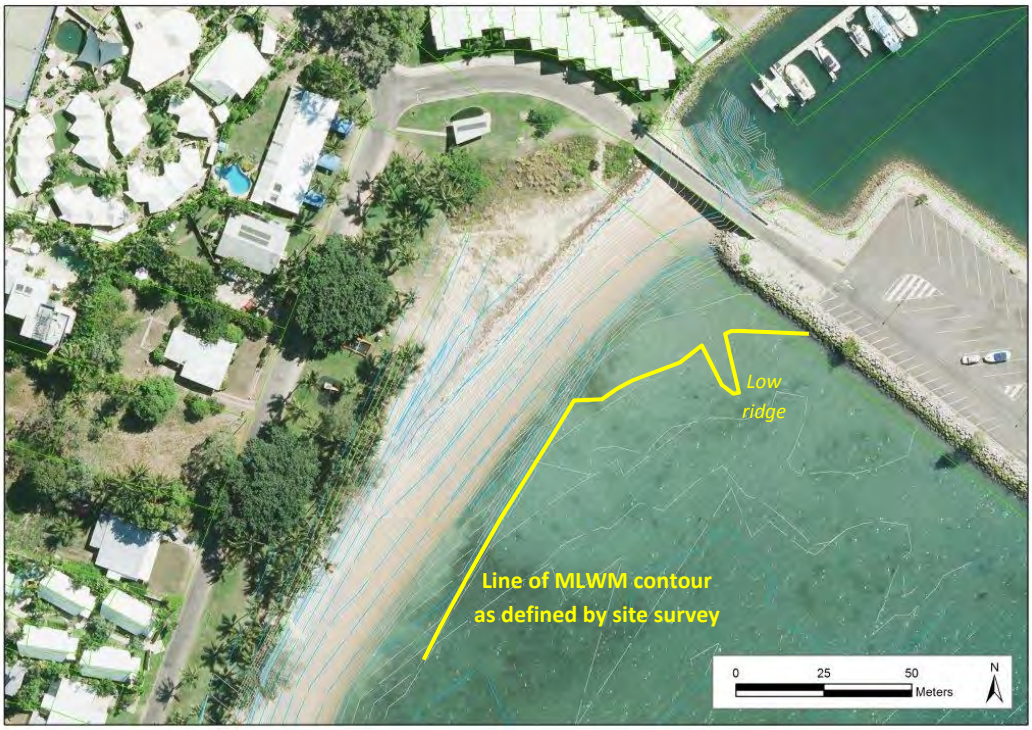


Figure 3-1 Location of MLWM (GBRMP boundary) off Nelly Bay Beach

When compared to previous surveys undertaken by Townsville City Council it is evident that the location of this contour has not noticeably changed in the vicinity of the SEMP's proposed training wall – despite the beach immediately inshore undergoing significant changes. This implies that the boundary of the Marine Park on the intertidal reef flat does not change in this area.

It is pertinent to note that the survey identifies a natural low ridge feature on the intertidal reef platform that extends slightly seaward in this area. Given that the contours defining this feature are the same in several surveys undertaken over the years, it is evident that this is a natural and permanent feature of the reef platform. A visual inspection of the reef platform at low tide on 21st December 2015 confirmed this conclusion.

The crest of this ridge is above the line of MLWM, and it is therefore outside of the Great Barrier Reef Marine Park. The crest of this natural ridge is therefore a suitable position and alignment for the training wall originally proposed by the 2010 SEMP.

4. OPTIONS FOR RETAINING NELLY BAY BEACH

Within the context of the prevailing coastal processes shaping the foreshores of Nelly Bay, a number of options for managing and retaining the northern end of the beach have been evaluated. The following discussions identify the various opportunities and constraints afforded by each.

4.1 Training Wall as Recommended by the SEMP

As stated previously, the 2010 SEMP recommended a beach nourishment strategy for mitigating the ongoing threat of erosion along the Nelly Bay foreshore. To facilitate that strategy it was further recommended that a trial training wall be built at the northern end of the beach. Figure 4-1 (taken from CES, 2010) illustrates the training wall arrangement recommended by the SEMP.

Figure 4-1 Trial Training Wall Recommended by the SEMP (CES, 2010)

The natural orientation of the sand fillet that forms against this training wall would be such that it faced out towards the south-easterly fetches that exist across Cleveland Bay towards Townsville. The shoreline of the fillet would align itself with the predominant wave energy - which in this northern corner of the beach would be towards the south-east. Numerical modelling undertaken as part of the technical work for the SEMP was able to identify the stable plan orientation of this sand fillet – but not its overall planform.

The training wall would need to be of a sufficient length to hold this fillet in place without any sand spilling around its offshore end - which would otherwise compromise the required tidal flows beneath the breakwater bridge. In other words, if the wall was too short then sand would spill around its end and there would still be a requirement for intermittent mechanical clearance of sand from beneath the bridge – albeit at a somewhat reduced frequency.

Estimating the length of wall required to contain the beach presented a technical challenge to the SEMP - since such sophisticated morphological modelling was beyond the scope of that study.

Nevertheless in order to assess potential viability and indicative costs, it was estimated from consideration of the wave climate modelled for the SEMP that the training wall would need to extend approximately 70 metres beyond the toe of the beach (which was captured on surveys at that time). It transpires that the estimated end of such a training wall would be located within the Great Barrier Reef Marine Park – an unacceptable outcome to the GBRMPA.

Consequently the length of training wall required to contain a stable beach plan has been re-investigated as part of this Alternative Options Analysis. An objective of this closer examination has been to see whether a training wall located entirely outside of the boundary of the Marine Park could still maintain a stable beach and prevent sand from spilling around its end (thereby compromising its function of keeping beneath the bridge clear of sand).

In the absence of detailed numerical modelling, considerable insight to likely beach behaviour is available from consideration of the circumstances leading up to the completion of Nelly Bay Harbour. Major construction works for the harbour commenced in mid-1989 but were not completed until 2003. The project experienced significant delays during construction as a consequence of financial failures of a significant stakeholder and a major financier. As a consequence, construction was suspended and the breakwaters were left in place for many years whilst only partially completed.

There was no "gap" beneath the breakwater bridge during this time, instead there was a barrier bund in place to prevent tidal flow into the partially completed harbour basin. The bund blocking the gap beneath the breakwater bridge at that time is shown overleaf in the photos of Figure 4-2.

Uninterrupted natural littoral processes acting on the shortened Nelly Bay Beach had approximately a decade to shape the northern end of the beach to its naturally stable plan alignment. In other words, Nelly Bay Beach was able to align itself to its naturally preferred orientation at its northern end (i.e. against the flank of the southern breakwater) for many years prior to 2003. This gives considerable insight into how the beach would now naturally stabilise itself against the proposed training wall alignment. Reference to Figure 4-3 illustrates how this insight is achieved.

The top image of that Figure shows the shape of the stable sand beach which naturally formed against the cross-shore barrier of the southern breakwater (remembering there is a bund to prevent sand spilling under the bridge). Of particular relevance is the shape and seaward extent of that beach – as defined by the toe of the sloping beach face. Essentially this shape and extent of beach would be replicated against the cross-shore barrier of the proposed training wall, which would only be some 20 metres away. As can be seen from the lower of the two images in Figure 4-3, that training wall would be outside of the GBRMP if it was located on the crest of the low ridge that naturally exists as a local morphological feature of the intertidal reef flat.

This indicates that contrary to previous perceptions, the erosion mitigation works proposed by the SEMP can be implemented without the necessary training wall component of the strategy being located within the GBRMP.

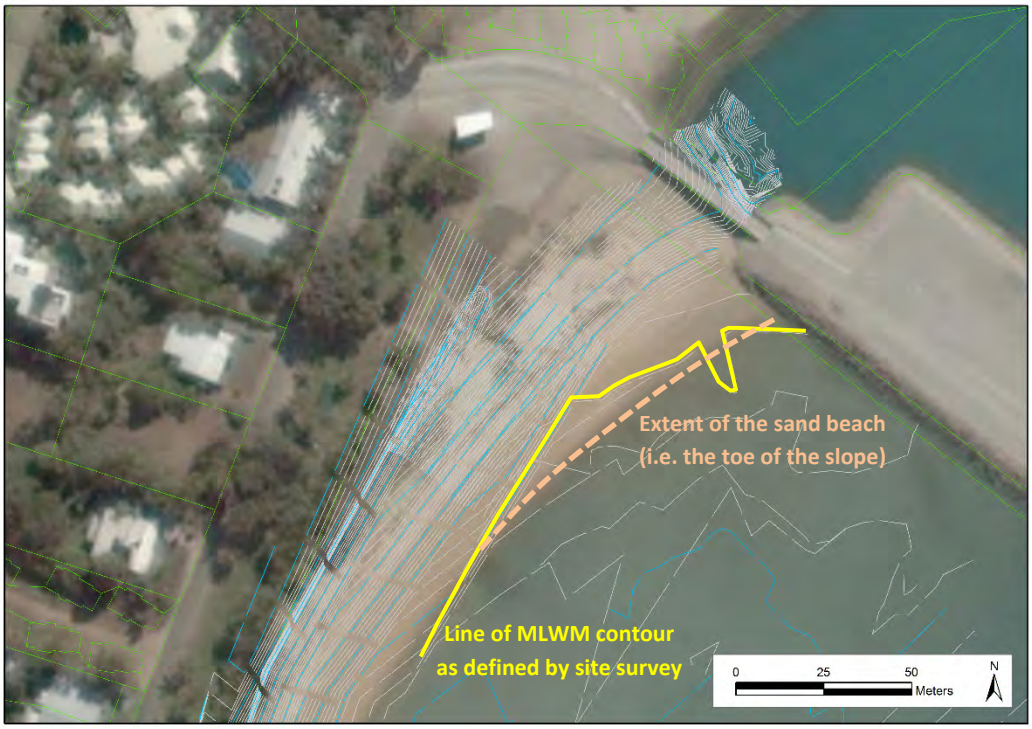
The SEMP recommended that the training wall be constructed as a trial structure. It is envisaged that it would be constructed of sand filled geotextile bags, similar to that of the trial training walls at Mundy Creek on Rowes Bay. The trial structural concept is illustrated in Figure 4-4, which shows the application of sand-filled geotextile containers to create the Mundy Creek training walls.

The rationale for a trial structure at the northern end of Nelly Bay Beach is presented in the SEMP as follows:

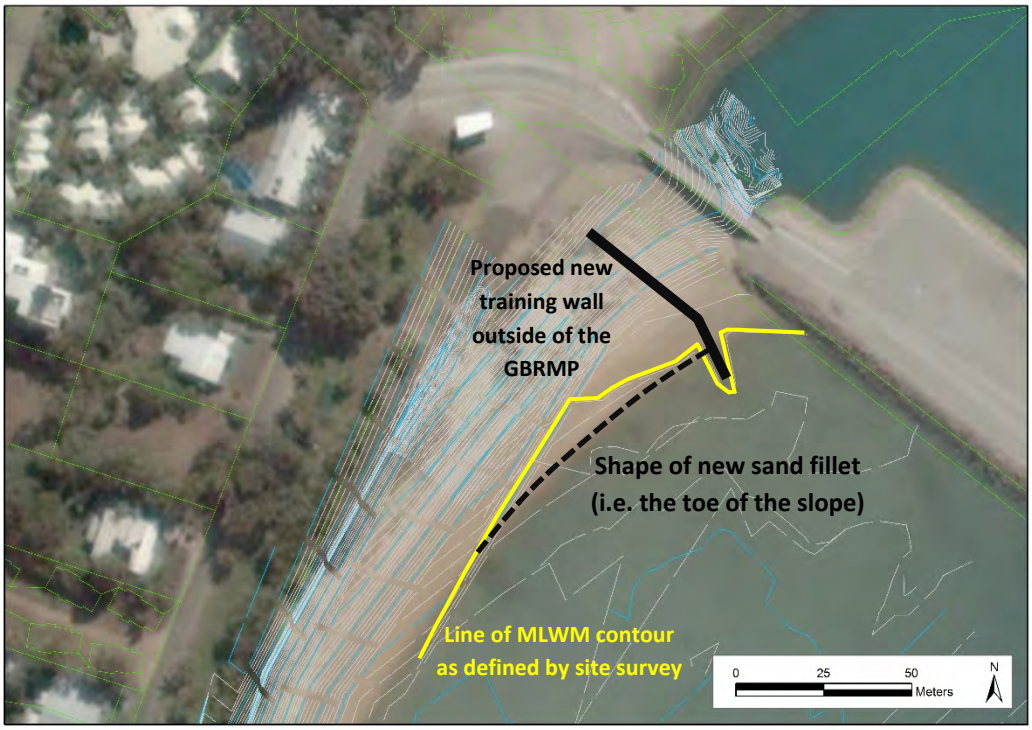
> *"Detailed coastal processes modelling could be undertaken prior to the implementation phase of the project to more accurately determine the length of the training wall. The particularly complex natural processes are such that any predicted outcomes of the modelling would nevertheless have to be treated with some caution. Greater confidence in outcomes would be achieved by application of a prototype trial for the training works."*

and ……..

Figure 4-2 Bund preventing tidal flow beneath bridge (circa 2002)



(a) Location of the GBRMP landward boundary overlain on a 2002 aerial photo



(b) Proposed training wall location with inferred planform of resulting sand fillet

Figure 4-3 Inferred stable beach and training wall configuration

Figure 4-4 Trial training wall at Mundy Creek, Rowes Bay

> *"The training wall would be placed on its estimated optimum alignment and length; then its effectiveness monitored during the trial. As the performance of the temporary training wall became evident, changes to its length, height and even its location could be implemented with reasonable ease during the trial. The results obtained from monitoring an actual prototype scenario are likely to provide greater accuracy than any numerical modelling……."*

Both of these comments and recommendations are endorsed by this Alternative Options Analysis – particularly given the close proximity of the GBRMP boundary to the structure. Once the most appropriate training wall arrangement has been determined by the trial, the temporary structure could be made more permanent by the placement of armour rock over it.

If for some reason, the trial indicated that the beach shape and/or sand retention was not satisfactory, or the training of the tidal flow beneath the bridge was not appropriate, then the temporary structure could be very easily removed. An excavator fitted with a ripping-tyne could quite simply tear open and remove the geotextile bags, allowing the filling sand to spill back into the natural littoral system of Nelly Bay Beach.

4.2 Bund Beneath the Breakwater Bridge

The option of replicating the arrangement of the temporary construction bund that existed beneath the bridge in the years prior to 2003 has also been considered as part of this Alternative Options Analysis. The arrangement would be similar to that shown in Figure 4-2. This would simply allow the northern end of Nelly Bay Beach to naturally form against the flank of the southern harbour breakwater. When compared to the option of a training wall (as discussed in Section 4.1) this option has much less intervention and disruption of the natural coastal processes currently sustaining the northern end of Nelly Bay Beach and the intertidal reef platform.

Sand on Nelly Bay Beach would be able to adopt its naturally preferred orientation alongside the flank of the southern breakwater. There would be no permanent "footprint" of a training wall on the crest of the natural low ridge of the intertidal reef platform.

This would at first seem to compromise the requirement to have tidal flow beneath the bridge at MLWM. However consideration of surveys of the area indicates that this does not happen anyway. Figure 4-5 shows that the ocean water level of MLW in Nelly Bay is such that the tide is not high enough to inundate the reef so as to link with the level of MLW in the harbour.

A site inspection was undertaken at low tide on 21st December 2015 to investigate this conclusion. The low tide on that day was RL-0.68m AHD, slightly higher than Mean Low Water of RL-0.969 m AHD. Observations on that tide confirmed that there is no linkage of tidal levels across the intertidal reef flat at MLW.

The observations on 21st December 2015 also confirm surveys that indicate the tide across the nearshore reef flats first links with that occurring under the bridge only when the tide is higher than approximately RL-0.4 m AHD.

Whilst it is possible to excavate a channel through the reef platform at or below MLW so as to artificially facilitate this linkage, very regular clearance of this excavated flow channel through the intertidal reef platform would be required to prevent it from being silted up. Significant sedimentation in any such channel is likely to occur due to the fine nature of the sediments across the adjacent intertidal reef platform. Appropriate disposal of the removed fine sediments also presents substantial environmental challenges.

Inspection of earlier surveys of this area suggest that the flow beneath the breakwater bridge at MLW may never have occurred at any time subsequent to the construction of Nelly Bay Harbour.

In which case, simply allowing the beach to naturally build up against the southern breakwater (which includes construction of a low bund beneath the bridge) will not change the scenario that has existed since well before the completion of the harbour in 2003.

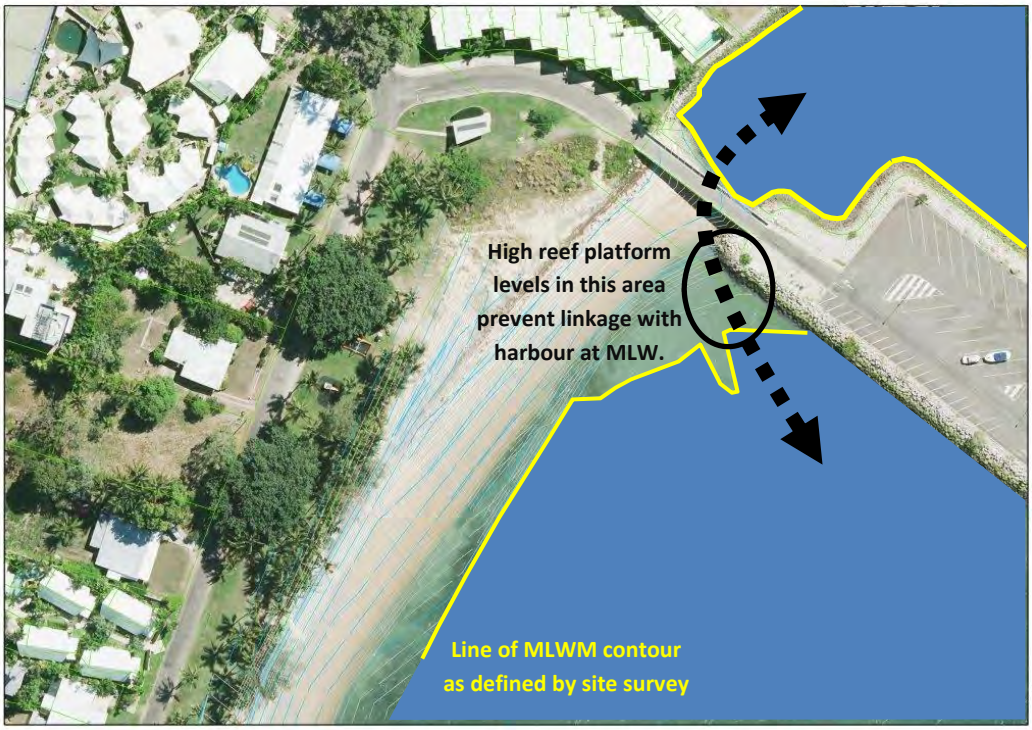


Figure 4-5 Ocean water levels at MLW in the vicinity of the breakwater bridge

Closing off the shallow 30 metre wide gap beneath the bridge means that the natural exchange of water within the harbour and that in the ocean will be reduced somewhat when the tide is above approximately RL -0.4m AHD at Nelly Bay. However given the very substantial tidal exchange that occurs through the deep 100 metre wide harbour entrance, such closure of the shallow and narrow gap beneath the bridge is not expected to have any significant bearing on the water quality within the harbour basin.

Should DTMR wish to further investigate the option of bunding beneath the bridge (as a means of naturally containing the northern end of the beach, with minimal interference to the naturally prevailing coastal processes) it is recommended that numerical modelling of tidal flushing for such a scenario be undertaken.

4.3 Other Options

Other options for accommodating the natural sand transport processes on Nelly Bay Beach have been considered as part of this Alternative Options Analysis. These have included options suggested in the

Brief sent from TCC[3] such as reducing the width and/or depth of the gap beneath the breakwater bridge. The presumed intent of those suggestions are to allow some sand accumulation to occur – thereby reducing the ongoing requirement for annual mechanical clearance.

However the natural longshore sand transport processes causing sand to accumulate in the vicinity of the bridge are such that there is no practical benefit in making the gap shallower and/or narrower. The extent and frequency of mechanical clearing will be substantially unaffected.

An alternative of installing a shore-parallel breakwater at the northern end of the beach was investigated in considerable detail as part of this Alternative Options Analysis. The intent of such a structure being to significantly reduce the longshore sand transport on the beach in its lee - thereby inducing sand to accumulate in this area rather than further north beneath the bridge.

However technical work undertaken to investigate whether a shore-parallel breakwater could contain the northern end of Nelly Bay Beach determined that for it to be successful it would need to be located substantially within the GBRMP. Given that outcomes of this Alternative Options Analysis are to ensure any shoreline protection works are located outside of the Marine Park boundaries, this option was deemed inappropriate.

4.4 Estimated Costs

Indicative costs for the implementation of the two options discussed in Sections 4.1 and 4.2 have been estimated to assist in determining the most cost effective strategy. These being:

- Training wall as recommended by the 2010 SEMP (refer Section 4.1)

  Design & construction of trial training wall using sand-filled geotextile bags: $280,000
  Two year monitoring of trial training wall: $15,000
  Convert to permanent structure: $130,000

  Estimated cost = $425,000

- Bund beneath the breakwater bridge (refer Section 4.2)

  Design & construction of bund using sand-filled geotextile bags: $125,000
  Convert to permanent structure: $50,000

  Estimated cost = $175,000

As can be seen, the option of bunding beneath the bridge and allowing the sand to naturally form against the flank of the southern breakwater is the most cost effective of the two options.

These estimates do not include the costs associated with placing additional sand on Nelly Bay Beach, as recommended by the SEMP. The volume and placement methods would be the same for each of the above two options.

5. CONCLUSIONS AND RECOMMENDATIONS

The objective of this Alternative Options Analysis is to identify options to better manage the accumulation and subsequent clearance of sand from beneath the breakwater bridge at the northern end of Nelly Bay Beach. Currently mechanical clearance of accumulated sand occurs annually to reinstate tidal flows beneath the bridge.

[3] Email dated 09th December 2015 sent by Mr Chris Pronk of Townsville City Council to Mr. not relevant f Water Technology.

The SEMP completed in 2010 proposed a strategy of beach nourishment combined with a cross-shore training wall at the breakwater bridge. However the physical characteristics of a cross-shore training wall (which forms an integral part of the strategy to mitigate shoreline erosion) was subsequently deemed inappropriate because it extended into the GBRMP.

Subsequent investigations undertaken for this Analysis has identified that a training wall located outside of the GBRMP could contain the northern end of the sandy beach; as well as allow tidal flow beneath the bridge; and significantly reduce any requirement for ongoing mechanical clearance of sand from beneath the bridge. Indeed it is possible that such a structure could mitigate the need for future sand clearance campaigns entirely.

The beach nourishment strategy recommended by the 2010 SEMP could be implemented by DTMR. This would include the construction of a carefully designed and located cross-shore training wall to contain the northern end of Nelly Bay Beach and to facilitate tidal flows beneath the breakwater bridge.

An alternative strategy of reinstating the bund that existed beneath the bridge prior to 2003 and then allowing sand to naturally accrete against this bund (and the southern harbour breakwater) could also be adopted. Compared to the training wall option, this results in less disruption to the natural coastal processes currently sustaining the northern end of Nelly Bay Beach and the intertidal reef platform. Sand on Nelly Bay Beach would be able to adopt its naturally preferred orientation alongside the flank of the southern breakwater. There would also be no permanent “footprint” of a training wall on the crest of the natural low ridge of the intertidal reef platform, nor would there be complex flow patterns imposed on the intertidal reef platform.

However despite these advantages, this option has implications to the Conditions of the Marine Parks Permit for Nelly Bay Harbour, as well as some small influences to tidal flushing of the harbour basin. Resolution of these issues would require further discussions with the Great Barrier Reef Marine Park Authority in conjunction with numerical modelling to determine any impacts of tidal flushing and associated water quality within the harbour basin.

APPENDIX A EXECUTIVE SUMMARY FROM THE *SHORELINE EROSION MANAGEMENT PLAN* FOR NELLY BAY BEACH

COASTAL ENGINEERING SOLUTIONS

NELLY BAY SHORELINE EROSION MANAGEMENT PLAN

FINAL REPORT

prepared for

Townsville City Council

March 2010

Project Title	**Nelly Bay Shoreline Erosion Management Plan**
Document Title	**Final Report**
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First Issue Date	18th March 2010

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EXECUTIVE SUMMARY

The Nelly Bay foreshore offers a diversity of seascapes and landscapes - providing extensive recreational and lifestyle opportunities to residents and visitors that are enhanced by considerable environmental, social and cultural values.

The complex interaction of waves, tides, winds and creek flows have continually shaped and reshaped the shoreline of Nelly Bay. The dynamic nature of the coastal environment means that sections of the foreshore are experiencing erosion which is threatening essential infrastructure and adversely affecting social and environmental values.

In recognition of the need to preserve this foreshore as a natural resource and to accommodate the ever increasing pressures of urban development on an eroding shoreline, Townsville City Council has commissioned this *Shoreline Erosion Management Plan*.

OBJECTIVES

The objectives of the Shoreline Erosion Management Plan are:

- to enable the Townsville City Council to proactively plan for erosion management in a way that is consistent with all relevant legislation (Commonwealth, State and Local) as well as all relevant coastal and environmental policies;
- to investigate and address the underlying causes of shoreline erosion and its likely future progression at the local scale;
- to determine cost effective and sustainable erosion management strategies that maintain natural coastal processes and resources; and
- to consider community needs in both the short- and long-term.

RECOMMENDED SHORELINE EROSION MANAGEMENT STRATEGY

Following a review of the prevailing coastal processes, risks and values of the Nelly Bay foreshore the following activities are recommended by this Shoreline Erosion Management Plan:

Beach Nourishment

- Beach nourishment is recommended at the northern end of Nelly Bay beach. The extent of the work is shown in the Figure on page iv.
- Place sand as initial nourishment on the shoreline along the Esplanade ocean frontage. The sand quantities required will depend upon the location of a Coastal Defence Line nominated by Council; and the degree of protection required (ie. the selected Design Event). Some guidance on the quantities of sand required in erosion buffers is provided in this Shoreline Erosion Management Plan.

- It is recommended that the sand for this initial nourishment be sourced from the accumulation of sand in the lower reaches of Gustav Creek.
- The location and operation of the extraction process require further consideration before implementation. This will require consideration of the findings of previous studies as well as the objectives of the *Gustav Creek Management Plan* prepared by Townsville City Council in 2005.
- Implement appropriate dune management practices on the newly nourished foreshore. As a minimum, this entails the planting and protection of native dune vegetation, the ongoing clearing of noxious weed species and ensuring adequate controlled access is maintained through new dune areas.
- Undertake ongoing beach renourishment along the Esplanade ocean frontage through the annual placement of 1,000 m^3 of sand sourced from the lower reaches of Gustav Creek. This is simply providing a mechanical means of reinstating the natural littoral supply processes that nourished Nelly Bay beach prior to the construction of Nelly Bay Harbour.
- Again the location and extraction of this renourishment sand is to be confirmed by investigations and consideration of the catchment management plan for the creek.
- Annual volumes may need to be amended in response to the results of ongoing monitoring of beach performance.

Training Works for Tidal Flows at the Breakwater Bridge

- It is recommended that a training wall for managing the flow of tidal water around the landward end of the southern breakwater of Nelly Bay Harbour be constructed. The proposed arrangement is shown conceptually in the Figure on page iv. The proposed structure will also assist in retaining a stable beach along this section of foreshore.
- Implement a trial of tidal training works alongside the breakwater bridge. This is to facilitate the permanent flow of tidal waters around the landward end of the breakwater. It is to be implemented either by using sand-filled geotextile bags (requiring approximately 580 m^3 of sand to fill) or by using existing precast concrete cubes to initially construct the training wall.
- The wall should extend approximately 70m beyond the toe of the newly nourished beach; and be aligned parallel to but 30 metres to 40 metres from the toe of the southern breakwater.
- Place sand to create a stable beach orientation in a fillet of sand against the southern flank of the training wall. Approximately 1,750 m^3 is estimated as being required for this purpose. The sand for this initial creation of the fillet should be sourced from the accumulation of sand in the lower reaches of Gustav Creek. The location and operation of this sand extraction process requires further consideration before implementation.
- Implement appropriate dune management practices on the newly created sand fillet.
- Monitor the effectiveness of training works alongside the bridge, making any alterations to the length and height of the wall if appropriate.

- Upon successful completion of the trial, armour the temporary training wall for a more permanent arrangement. Alternatively completely remove the sand-filled geotextile bags or concrete blocks that constitute the wall, allowing sand to return to the beach system.

Project Monitoring

- Establish and undertake initial pre-project monitoring survey on approximately twelve beach transects to be located on the Nelly Bay shoreline.
- Undertake surveys twice annually on these transects, with additional surveys immediately after major erosion events.
- All surveys are to extend offshore for a minimum distance of 200m from the line of mean sea level on the beach.
- The exception to this is the initial pre-project survey which should extend at least 500 metres offshore of the seaward edge of the reef flat into deep water (ie. 500 metres seaward of the reef crest).

Project Design and Approvals

- Townsville City Council (in consultation with other stakeholders) to select the Design Event for which the erosion mitigation strategies recommended by this Shoreline Erosion Management Plan are to accommodate. This requires consideration and acceptance of the risk that such an event will occur (or be exceeded) within a 50 year planning period. Guidance on risk is offered in this Shoreline Erosion Management Plan. Nominating the Design Event simply requires selecting the Average Recurrence Interval (ARI) cyclone for which immunity is required.
- Townsville City Council (in consultation with other stakeholders) to select the alignment of an appropriate Coastal Defence Line along the Nelly Bay shoreline. Throughout the 50 year planning period, property and infrastructure landward of the Coastal Defence Line remain protected from long-term erosion effects; short-term erosion caused by the Design Event; and recession as a consequence of future climate change. Foreshore areas seaward of the Coastal Defence Line lie within the active beach system (ie. within the erosion buffers).
- Undertake engineering designs for works associated with the initial beach nourishment along the Esplanade ocean frontage.
- Undertake engineering designs for works associated with the trial of a training wall alongside the breakwater bridge opposite Kelly Street; and for the initial beach nourishment to create the sand fillet in the beach/training wall corner.
- Prepare and submit appropriate approval applications based on designs for the proposed works.

Recommended Shoreline Erosion Management Plan

ESTIMATED COSTS

The estimated costs associated with the above recommended strategies are summarised below.

At this early stage, these estimates must be considered as indicative only - since no detailed design has been undertaken. They have been based on an approximation of sand volumes for initial beach nourishment to provide a buffer to an assumed Coastal Defence Line - the location of which requires confirmation or amendment by the project's stakeholders.

SEMP component	Cost	On-going Cost
Project Design and Approvals		
Design of trial training wall at the breakwater bridge	$10,000	
Design of initial beach nourishment	$10,000	
Obtain appropriate approvals	$20,000	
Project Monitoring		
Establish & undertake initial pre-project surveys	$24,000	
Twice annual beach transect survey		$18,000
Beach Nourishment		
Implementation of initial beach nourishment :		
for 50 year ARI immunity	*$237,000*	
for 100 year ARI immunity	*$252,000*	
for 200 year ARI immunity	*$280,000*	
for 500 year ARI immunity	*$305,000*	
for 1,000 year ARI immunity	*$312,000*	
On-going renourishment with sand from Gustav Creek		$25,000
Implementation / maintenance of dune management program	$80,000	$12,000
Maintain Tidal Flow at Southern Breakwater		
Implementation of trial training wall (2 years)	$220,000	
Convert to permanent training wall	$110,000	
Maintenance of training walls		$5,000
Totals (for various initial beach nourishment options)		
for 50 year ARI immunity	**$711,000**	**$60,000**
for 100 year ARI immunity	**$726,000**	**$60,000**
for 200 year ARI immunity	**$754,000**	**$60,000**
for 500 year ARI immunity	**$779,000**	**$60,000**
for 1,000 year ARI immunity	**$786,000**	**$60,000**

APPENDIX B CONDITIONS OF MARINE PARKS PERMIT FOR NELLY BAY HARBOUR

Marine Parks Permit

Great Barrier Reef Marine Park Regulations 1983 (Commonwealth)
Marine Parks Regulations 1990 (Queensland)

This/these permission/s remain/s in force,
unless sooner surrendered or revoked, for the period:

01-JUL-2003 to 30-JUN-2023

Permit No: G03/2321.1

Permission/s is/are granted to

Permittee: The State of Queensland Acting Through Queensland Transport

Address: PO Box 1293
TOWNSVILLE QLD 4810

for use of and entry to zones in the following Great Barrier Reef Marine Park Sections/Queensland Marine Parks as established by the Commonwealth *Great Barrier Reef Marine Park Act 1975* and Queensland *Marine Park Act 1982* ('the Marine Park'):

CENTRAL SECTION

in accordance with ~~the~~ details as stated in Part A, and subject to conditions stated in Part B on the reverse side.

date 1/7/2003 ..... date .....

Delegate of
the Great Barrier Reef Marine Park Authority

Delegate of
the Executive Director, Queensland Parks and Wildlife Service

Part A:
The purpose/s of use and entry may only be undertaken in the zone/s and location/s described below.
Zone/s and location/s to which the permission/s applies:

GENERAL USE 'A' ZONE - Nelly Bay (Magnetic Island) and waters adjacent thereto.

Purpose/s of use and entry authorised by permission/s:

The operation, minor construction, and maintenance of a structure, being Nelly Bay Harbour, in accordance with Schedule 1 (hereinafter referred to as "the operations").

WARNING

This permission extends to all employees of the Permittee, or other persons, who are acting on behalf of, or at the direction of, the Permittee for the purposes specified in this permission.

This permission(s) is not intended to extinguish any native title.

INTERPRETATION

A word or phrase in this permission has the same meaning as that word or phrase in the *Great Barrier Reef Marine Park Act 1975*, the *Great Barrier Reef Marine Park Regulations 1983*, and the zoning plan relevant to this Permit, unless a contrary intention appears.

A note or heading may be used to give assistance in interpreting conditions in case of ambiguity.

A reference to a date includes that date.

A reference to a zone is a reference to a zone of that name or a corresponding nature in the zoning plan (from time to time) in force for the part of the Great Barrier Reef Marine Park that is relevant to this Permit.

'Person' shall include a corporation or a company.

DEFINITIONS

'the Act' means the *Great Barrier Reef Marine Park Act 1975* as amended from time to time.

'AHD' means Australian Height Datum.

'Approval Officer' means any person delegated by the Great Barrier Reef Marine Park Authority (pursuant t its power in section 61 of the *Great Barrier Reef Marine Park Act 1975*) to grant or refuse permission to a perso for the operations and works contemplated under this Permit.

'Authority' means the Great Barrier Reef Marine Park Authority, or its delegate, a member of staff of that Authority or a person referred to in Section 42 of the *Great Barrier Reef Marine Park Act 1975* performing functions or exercising powers under that Act in accordance with arrangements made or entered into pursuant to that section.

'clean up' includes removing wastes and materials and dispersing, removing or rendering harmless, oil and other pollution and contaminants.

"Deed" means the Deed of Agreement referred to in condition 5 of this Permit.

'Environment' means all aspects of the surroundings of human beings, including:
(a) the physical factors of those surroundings, such as the land, the waters and the atmosphere; and
(b) the biological factors of those surroundings, such as the animals, plants and other forms of life; and
(c) the aesthetic factors of those surroundings, such as their appearance, sounds, smells, tastes and textures.

'Environmental Site Supervisor' means the person from time to time nominated in writing by the Authority to the Permittee, funded by the Permittee, and under contract to the Authority.

'Harbour' means the harbour constructed at Nelly Bay, Magnetic Island, pursuant to Permit No. G99/194.

'Harbour Basin' means in relation to Nelly Bay Harbour, the area of the harbour which was designed to a depth of -2.566 LAT as per the approved drawing 1436_12 WD-01 D "Site Plan Outer Breakwater" or such other drawings as may be approved in writing from time to time.

'Harbour Channel' means in relation to Nelly Bay Harbour, the area of the harbour which was designed to a depth of -3.566 LAT as per the approved drawing NB-CB-201G "Entrance Channel Dredging Plan" or such other drawings as may be approved in writing from time to time.

'Harbour Operational Plan' means the Harbour Operational Plan for Nelly Bay Harbour contemplated by the Deed of Agreement annexed to Permit No. G03/2321.1, prepared by the Permittee (or at its direction), and approved in writing by the Approval Officer.

'Harm' in relation to the Environment, includes any direct or indirect alteration to the environment that has the effect of degrading the environment and, without limiting the generality of the foregoing, includes any act or omission that results in pollution of the Marine Park.

'Hazardous Chemical' means any chemical, chemical compound, or mixture of compounds which is a physical, environmental, and/or health hazard.

'LAT' means Lowest Astronomical Tide.

'the Marine Park' means the Great Barrier Reef Marine Park established by the Act.

'Mean Low Water Mark' (MLWM) at Nelly Bay Harbour means the tidal plane passing through -0.696 m AHD.

'Monitoring Consultant' means the monitoring contractor selected by the Authority and funded by the Permittee to develop and undertake the Operational Environmental Monitoring Program.

'Operational Environmental Monitoring Program' means the Operational Environmental Monitoring Program for Nelly Bay Harbour contemplated by the Deed of Agreement annexed to Permit No. G03/2321.1, prepared by the Monitoring Consultant, and approved in writing by the Approval Officer.

'the Permittee' means the State of Queensland acting through Queensland Transport.

'Vessel Live Aboard' means the use of a vessel as a primary place of residence.

''Waters adjacent' means in relation to a reef, the waters enclosed by 'the 500 metre line' and in relation to an island or the mainland, the waters enclosed by 'the coastal 500 metre line' (as defined by the zoning plan from time to time that applies to those waters).

'works' means and includes all plant and materials comprising or used in connection with all constructions, erections, dredging, installations, structures, facilities, vessels or aircraft of any kind associated directly or indirectly with this Permit, including but not limited to, the conduct of 'the operations'.

'Waste' has the same meaning as that term in sub-section 38J(7) of the *Great Barrier Reef Marine Park Act 1975*.

STANDARD CONDITIONS

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1) All activities must be undertaken in accordance with the provisions of all applicable laws in force from time to time in the State of Queensland.

2) The Permittee must ensure that when operations are conducted in the Marine Park under this Permit, the Permit or a certified copy of it, is available at the site of operation for inspection.

3) The Permittee must inform all participants in the operation and maintenance of the Harbour (including but not limited to the Permittee, and its employees, officers, sub-contractors and agents) of all relevant restrictions and conditions of this Permit (including the deed), the relevant zoning plan, the *Great Barrier Reef Marine Park Act 1975*, the *Great Barrier Reef Marine Park Regulations 1983*, the Harbour Operational Plan and any other plan or program contemplated by this Permit.

4) The terms and conditions of the Permit, the Deed, the Harbour Operational Plan and any other plan or program contemplated by the Permit extend to all employees and officers of the Permittee, and any other person acting on behalf of, or under the direction of, the Permittee, and the Permittee shall ensure that they comply with all such terms and conditions.

DEED CONDITIONS

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5) Prior to the date of commencement of works under this permission or within 30 days of the date of commencement this permit, whichever is the earlier, the Permittee must execute, seal and deliver as a Deed of Agreement to the Great Barrier Reef Marine Park Authority, a Deed of Agreement in the form annexed to this permission, identified with the permit number of this permission and marked 'Deed of Agreement'.

6) The Permittee must observe and perform its obligations under and pursuant to such Deed and for the purposes of this Permit any breach by the Permittee of its obligations under and pursuant to such Deed shall be a breach of this condition.

7) The Permittee must remove any works permitted herein in accordance with the terms of the Deed referred to in condition 5 hereof.

8) The Permittee must clean up the Marine Park in accordance with the terms of the Deed referred to in condition 5 hereof.

9) The Permittee must pay all costs in accordance with the terms of the Deed referred to in condition 5 hereof.

HARBOUR OPERATIONAL PLAN CONDITIONS

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10) The Permittee must prepare, or have prepared at its direction and expense in accordance with the Deed, a Harbour Operational Plan.

11) The Permittee must not undertake works or operations permitted herein within the Marine Park unless the Approval Officer has advised the Permittee in writing that the Harbour Operational Plan, or the relevant stage of that Harbour Operational Plan, has been approved.

12) The Permittee must ensure that all activities permitted herein are conducted in accordance with the Harbour Operational Plan approved by the Approval Officer from time to time. This approved Plan must be made available, or placed in a position so as to be available, to any person involved in the operation or maintenance of the Harbour, including but not limited to the employees, contractors, and agents of the Permittee, the permittees of other structures within or adjacent to the Harbour, and commercial and other operators using the Harbour.

OPERATIONAL ENVIRONMENTAL MONITORING PROGRAM CONDITIONS

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13) The Permittee must fund the preparation and implementation of the Operational Environmental Monitoring Program, including all costs, charges and expenses in accordance with the Deed.

OPERATIONAL AND MAINTENANCE CONDITIONS

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14) The Permittee must notify the Authority in writing within seven (7) days of any change in contact details for the Permittee. Details to include: the name of the responsible Department, the Department Contact (executive contact), the Project Officer (primary contact), a physical address of the said Department, a postal address, the telephone number of the project officer, and an after hours contact telephone number in the event of emergencies.

15) The Permittee must not undertake dredging in association with the works, except as required to maintain the Mean Low Water Mark in accordance with condition 27.

16) The Permittee must ensure that all employees, contractors and sub-contractors, prior to carrying out any works in connection with this Permit, are advised of their duty to comply with the restrictions and/or conditions of this Permit, the Act, the Regulations, and the relevant zoning plan.

17) The Permittee must ensure that the Harbour is not used for Vessel Live Aboard purposes.

18) The Permittee must ensure that sewage and/or grey water are not discharged into the Harbour.

19) The Permittee must take all reasonable measures to ensure that the works and the environment around the works are kept free of:
(i) litter; and
(ii) rubbish;
regardless of whether the Permittee is responsible for the presence of such litter or rubbish.

20) The Permittee must ensure that the works and environment around the works are kept free of Hazardous Chemicals, except to the extent authorised by the Harbour Operational Plan, regardless of whether the Permittee is responsible for the presence of such Hazardous Chemicals.

21) Where the Approval Officer has formed the view in his/her opinion that a condition of this Permit is not being complied with, or that there is a likelihood of Harm to the Environment, or that the Marine Park or property or things in the Marine Park are in danger of being damaged or destroyed (otherwise than as contemplated under this Permit), the Approval Officer may by notice in writing do all or any of the following (in addition to and not in derogation of any other action or remedy (statutory or otherwise) which may be available to the Authority):
(i) order the Permittee to modify the conduct of operations so as to mitigate or avoid the occurrence of Harm to the Environment and the Permittee must immediately upon receipt of the order modify the conduct of the operations in the manner specified; or
(ii) order the Permittee to cease all or any part of the operations and the Permittee must upon receipt of the order, immediately cease those operations until such time as the Approval Officer gives written notice that those operations can re-commence; or
(iii) order the Permittee to effect removal of all or any part of the works and the Permittee must effect removal of such works and in accordance with the written notice; or
(vi) order the Permittee to provide to the Authority a report duly certified by an appropriately qualified engineer detailing the structural integrity of the works nominated and advising whether the structural integrity of those works have been maintained to design specifications; or
(v) order the appointment of an Environmental Site Supervisor, who shall undertake supervision in accordance with conditions 23 to 26, so as to mitigate or avoid the occurrence of Harm to the Environment; or
(vi) order the implementation and, if necessary, the preparation of or any amendment to an Operational Environmental Monitoring Program to assess the environmental risk associated with any aspect of the works or operations and to provide advice on potential management responses; or
(vii) order the cessation of the implementation of an Operational Environmental Monitoring Program.

22) Where the Approval Officer orders the Permittee to effect removal of any of the works or to cease or to modify the conduct of operations under condition 21, the conduct of the Permittee must::
(i) be in accordance with the Harbour Operational Plan (if such works or operations are dealt with in the Harbour Operational Plan); or
(ii) be in accordance with the Deed (where (i) does not apply); or
(iii) be in accordance with best environmental practice as determined by the Approval Officer (where (i) and (ii) do not apply);
(iv) be in accordance with any directions in the written order provided that any such directions are not inconsistent with (i), (ii) or (iii) above; and
(v) be in accordance with any reasonable directions given by the Environmental Site Supervisor (where an Environmental Site Supervisor has been appointed) provided that any such directions are not inconsistent with (i), (ii), (iii) or (iv)

ENVIRONMENTAL SITE SUPERVISION CONDITIONS

23) The Environmental Site Supervisor is authorised to stop or suspend or give other direction in relation to any activity or works which in his/her reasonable opinion are likely to cause Harm to the Environment.

24) Not later than 14 days prior to the commencement of works necessitating an Environmental Site Supervisor, the Permittee must nominate in writing to the Authority an on-site liaison officer with whom the Environmental Site Supervisor can contact and liaise with, as and when required.

25) The Permittee and its employees, contractors, sub-contractors and agents must comply with any reasonable direction given by the Environmental Site Supervisor for the purpose specified in condition 23.

26) The Permittee must pay to the Authority within thirty (30) days of an invoice being submitted to the Permittee, all costs, charges and expenses reasonably incurred by the Authority (including but not limited to the costs of and incidental to the Authority managing the operations and the works authorised by the Permit) and/or the agents of the Authority, including but not limited to the Environmental Site Supervisor.

MAINTENANCE OF THE MEAN LOW WATER MARK CONDITIONS

27) The Permittee must maintain water flow at the Mean Low Water Mark under the breakwater bridge and around the breakwater on all sides with connection to the ocean and must ensure that such water flow is maintained continuously thereafter, in accordance with the Harbour Operational Plan and the following drawings, and in accordance with such other drawings as may be approved, in writing, from time to time by the Approval Officer:

(a) International Coastal Management - Nelly Bay Harbour Sand Trap - NB-01 A (Locality Plan);
(b) International Coastal Management - Nelly Bay Harbour Sand Trap - NB-02 D (Site Plan);
(c) International Coastal Management - Nelly Bay Harbour Sand Trap - NB-03 B (Typical X-Section of Works); and
(d) International Coastal Management - Nelly Bay Harbour Sand Trap - NB-04 A(Long -Section of Works);
(e) International Coastal Management - Nelly Bay Harbour Sand Trap - NB-05 (Extent of Works);
(f) Nelly Bay Harbour Reprofiling - As Constructed Plan of Nelly Bay Beach - RT03320/SK2 A

28) The Permittee must provide to the Authority, at the Permittee's expense, a report duly certified by an appropriately qualified person detailing whether the flow of water at the Mean Low Water Mark has been maintained in accordance with the design specifications referred to or contemplated by condition 27 and in accordance with the Harbour Operational Plan:
(i) at each 12 month anniversary from the commencement of this Permit; and
(ii) at any other time within twenty-one (21) days of being issued written notice to do so by the Authority.

SCHEDULE 1 TO PERMIT G03/2321.1

This Permit permits the operation, minor construction associated with the operation, and maintenance of Nelly Bay Harbour including the Harbour Basin, Harbour Channel, Breakwaters (including emergency helicopter landing pad, landscaping and public boat ramp), Breakwater Bridge and Revetments Walls in accordance with the following engineer certified construction drawings, and in accordance with such other drawings as may be approved, in writing, from time to time by the Approval Officer:

(a)	1436_10 WD-01D	Proposed Entry Beacons Site Plan;
(b)	1436_12 WD-01D	Site Plan Outer Breakwater;
(c)	1436_12 WD-02C	Outer Breakwater Plan;
(d)	1436_12 WD-03B	Sections Outer Breakwater;
(e)	2078-30	Acid Sulphate Disposal Cells;
(f)	6632/59B	Plan of As Constructed Detail Precincts 2-4 Nelly Bay 1 of 2;
(g)	6632/59B	Plan of As Constructed Detail Precincts 2-4 Nelly Bay 2 of 2;
(h)	6632/42E	Contour & Level Plan;
(i)	6632/40J	Plan of Subdivision;
(j)	BCT007-S-DK-001 to 007	Bridge General Layout;
(k)	CUR2840-20 S	Stormwater Drainage Layout Plan;
(l)	CUR2860-02D	Emergency Helipad Location, Arrangement and Details;
(m)	ICM - NB-01 to NB05	Nelly Bay Harbour Sand Trap;
(n)	RT03320/SK2 A	As Constructed Plan of Nelly Bay Beach;
(o)	NB-CB-001 Q	Development Plan;
(p)	NB-CB-204 AA	Bulk Earthworks Plan;
(q)	NB-CB-100.1 F	Section 86 Approvals Stage 1;
(r)	NB-CB-201 G	Entrance Channel Dredging Plan;
(s)	NB-CB-203 E	Existing Lease and Cadastral Plan
(t)	NB-CB-205.1 K	Canal Sections;
(u)	NB-CB-205.2 G	Canal Sections;
(v)	NB-CB-205.3 C	Revetment Concrete Masonry Wall Sections;
(w)	NB-CB-205.4B	Type C Wall Section;
(x)	NB-CB-205 T	Revetment Sections and Beach Sections;
(y)	NB-CB-206C	Carpark and Boat Ramp Plan;
(z)	NB-CB-208 L	Sediment Basin Plan and Details;
(aa)	NB-CB-330 A	Reinforced Concrete Boat Ramp;
(bb)	NB-CB-331 A	Reinforced Concrete Boat Ramp.

Australian Government
Great Barrier Reef
Marine Park Authority

The State of Queensland
A/T Department of Transport and Main Roads
C/- Major Infrastructure Projects
Attn: Ms Karen Mooney
PO Box 2439
BRISBANE QLD 4001

File No.: 17/176 (3)
Permit No: G03/2321.1

Dear Ms Mooney

RE: Application to Vary Marine Park Permit G03/2321.1

I refer to your correspondence dated 6 May 2011, in which you request a variation to your Marine Park permit G03/2321.1.

By virtue of this correspondence and in accordance with Great Barrier Reef Marine Park Regulation 88ZP(2) please note the following variations to your permit:

CONDITIONS OF PERMIT

Delete (bb) of Schedule 1 and replace with the following:

(ab) NB-CB-331 A Reinforced Concrete Boat Ramp;

Add the following to Schedule 1:

(ac) H300-003 Floating Walkway and Pontoon

Jason Vains
Delegate of the Great Barrier Reef
Marine Park Authority

THIS LETTER MUST BE AVAILABLE WITH THE PERMIT FOR INSPECTION AT ALL TIMES

2 - 68 Flinders St PO Box 1379
Townsville Qld 4810 Australia
Phone + 61 7 4750 0700
Fax + 61 7 4772 6093
info@gbrmpa.gov.au
www.gbrmpa.gov.au

Craig D Hough

From: Chris Pronk <Chris.Pronk@townsville.qld.gov.au>
Sent: Monday, 14 December 2015 3:25 PM
To: not relevant Christopher M Sykes
Cc: Adam King
Subject: RE: Nelly Bay alternative options analysis report

Hi NR

We and the Department of Transport and Main Roads (TMR) are happy to proceed with the proposed Options Analysis. Both Chris Sykes from TMR and myself are available to accompany you on a site visit this Monday the 21/12/15 if you are still available at this time? TMR will be funding the study, please 'reply all' advising whether you'd like a purchase order raised by TMR in advance or whether you are happy just to invoice them upon completion.

I'll make myself available to pick you up and drop you off at the airport etc. on the day.

Regards,

Chris Pronk

From: not relevant @watertech.com.au]
Sent: Friday, 11 December 2015 2:07 PM
To: Chris Pronk
Subject: RE: Nelly Bay alternative options analysis report

Hi Chris

Attached please find our proposal to undertake the Options Analysis.
Should you have any queries whatsoever, please just call me on not relevant

Regards

not relevant
Senior Principal Engineer | FIEAust CPEng RPEQ

WATER TECHNOLOGY ● **+61 7 3105 1460** ● **www.watertech.com.au** ●

We have moved!
Our new office as of Monday 21st September 2015 is
Level 3, 43 Peel Street South Brisbane QLD 4101.
Please note, all other details are the same.

From: Chris Pronk [mailto:Chris.Pronk@townsville.qld.gov.au]
Sent: Wednesday, December 9, 2015 9:47 AM
To: not relevant watertech.com.au>; NR @coastengsol.com.au'
NR coastengsol.com.au>
Subject: Nelly Bay alternative options analysis report

H NR

As discussed; recent discussions with TMR, the Mayor, and the state MP have resulted in a decision to investigate potential options to address the beach erosion and sand accumulation in the harbour issue, with an intent to explore options for directly addressing this issue at the breakwater bridge (hereafter referred to as 'the hole'). The options would need to be presented in reference to the relevant section of the current approval conditions, and comment made on the likely efficacy of the options (in relation to adjacent beach erosion and sand accumulation in the harbour) and how the options will impact on the approval conditions. It is envisaged that suggested options would be implementable as a trial (e.g. constructed of removable geofabric) and may necessitate an amendment to the current relevant permit conditions.

Ideas of options to include:

- Filling in/blocking the hole
- Narrowing the hole (to still allow for tidal flushing)
- Raising the level (baseline depth) of the hole (to still allow for some intermittent tidal flushing)
- Installing a training wall parallel to the breakwater at closer proximity than recommended in the SEMP (potentially only a few meters from the breakwater as opposed to around 30) and extending not beyond the marine park boundary (this would allow for roughly a 35m length, give or take)

Please see applicable marine parks permit attached (condition 27)

Could you please provide a cost estimate for production of this report?

Please feel free to call me to discuss/clarify.

Regards,

Chris Pronk
Environmental Management Officer - Coastal
Integrated Sustainability Services

P 07 4417 5156
M not relevant
E chris.pronk@townsville.qld.gov.au
W www.townsville.qld.gov.au

Townsville City Council
143 Walker Street

PO Box 1268
Townsville Qld 4810

We acknowledge the Bindal and Wulgurukaba traditional custodians of this land that we work, live and play on, and pay our respect to their cultures, their ancestors and to the elders, past, present and all future generations.

Craig D Hough

From: Justine A Aylward
Sent: Monday, 14 December 2015 3:06 PM
To: Christopher M Sykes
Cc: Jayne E Stuckey; Craig D Hough; Bradley L Chandler
Subject: Re: Nelly Bay alternative options analysis report
Attachments: twitter.jpg; linkedin.jpg

Hi Chris

I've been racing between meetings today so sorry I haven't returned your call, I will do so tomorrow.

In the meantime I approve your proposal to fund the works.

Sent from my iPhone

On 14 Dec 2015, at 10:40 AM, Christopher M Sykes <christopher.m.sykes@tmr.qld.gov.au> wrote:

> Hi Justine and Jayne
>
> Can I please have funding approved for NR ayable to Water Technology who have been approached by TCC to complete an options analysis for the Nelly Bay groyne proposal. Water Technology were formally known as Coastal Engineering Solutions and they completed the Nelly Bay Shoreline Erosion Management Plan for TCC in March 201. This analysis is a follow up to ongoing discussions I have held with TCC in finding a long term solution to the construction of a groyne at Nelly Bay beach which Craig and Brad have also been part of.
>
> During a meeting I attended with TCC and Scott Stewart MP on 17 November, Scott did make a verbal commitment to TCC that he had already secured funding from Minister Bailey for this issue and it was able to be used to assist with the options analysis, concept and design process. I have also checked with TCC and they state they are not able to fund this initial options analysis, which will only further delay progress.
>
> I think it is very important that we fund this work and progress this issue while the iron is hot!
>
> **Regards**
> **Chris Sykes**
> Advisor (Boat Harbour Operations) | Strategic Property Management
> **Portfolio Investment & Programming** | Department of Transport and Main Roads
>
> Floor 5 | 445 Flinders Street | Townsville Qld 4810
> PO Box 1089 | Townsville Qld 4810
> P: (07) 4421 8785 | M: not relevant F: (07) 4421 8827
> E: christopher.m.sykes@tmr.qld.gov.au
> W: www.tmr.qld.gov.au
>
> <image002.gif>

From: Chris Pronk [mailto:Chris.Pronk@townsville.qld.gov.au]
Sent: Monday, 14 December 2015 9:35 AM
To: Christopher M Sykes <christopher.m.sykes@tmr.qld.gov.au>
Cc: Adam King <Adam.King@townsville.qld.gov.au>
Subject: FW: Nelly Bay alternative options analysis report

Hi Chris,

Please see below and attached. Is this something TMR are able to proceed with? The quote is from not relevant who produced the SEMP, although under a new agglomerated company name (Water Technology have merged with Coastal Engineering Solutions). Not sure if you will require further quotes?

I'm happy to accompany NR and yourself if you're keen to go along on any of the potential site visit dates (note 21/12/15 date would need to be confirmed with NR by 17/12/15).

Let me know.

Regards,

Chris Pronk
Environmental Management Officer - Coastal
Integrated Sustainability Services

P 07 4417 5156
M not relevant
E chris.pronk@townsville.qld.gov.au
W www.townsville.qld.gov.au

Townsville City Council
143 Walker Street

PO Box 1268
Townsville Qld 4810

We acknowledge the Bindal and Wulgurukaba traditional custodians of this land that we work, live and play on, and pay our respect to their cultures, their ancestors and to the elders, past, present and all future generations.

From: not relevant @watertech.com.au]
Sent: Friday, 11 December 2015 2:07 PM
To: Chris Pronk
Subject: RE: Nelly Bay alternative options analysis report

Hi Chris

Attached please find our proposal to undertake the Options Analysis.
Should you have any queries whatsoever, please just call me on not relevant

Regards

not relevant
Senior Principal Engineer | FIEAust CPEng RPEQ


<image001.jpg>

From: Chris Pronk [mailto:Chris.Pronk@townsville.qld.gov.au]
Sent: Wednesday, December 9, 2015 9:47 AM
To: not relevant @watertech.com.au> not relevant coastengsol.com.au' not relevant @coastengsol.com.au>
Subject: Nelly Bay alternative options analysis report

Hi NR

As discussed; recent discussions with TMR, the Mayor, and the state MP have resulted in a decision to investigate potential options to address the beach erosion and sand accumulation in the harbour issue, with an intent to explore options for directly addressing this issue at the breakwater bridge (hereafter referred to as 'the hole'). The options would need to be presented in reference to the relevant section of the current approval conditions, and comment made on the likely efficacy of the options (in relation to adjacent beach erosion and sand accumulation in the harbour) and how the options will impact on the approval conditions. It is envisaged that suggested options would be implementable as a trial (e.g. constructed of removable geofabric) and may necessitate an amendment to the current relevant permit conditions.

Ideas of options to include:

- Filling in/blocking the hole
- Narrowing the hole (to still allow for tidal flushing)
- Raising the level (baseline depth) of the hole (to still allow for some intermittent tidal flushing)
- Installing a training wall parallel to the breakwater at closer proximity than recommended in the SEMP (potentially only a few meters from the breakwater as opposed to around 30) and extending not beyond the marine park boundary (this would allow for roughly a 35m length, give or take)

Please see applicable marine parks permit attached (condition 27)

Could you please provide a cost estimate for production of this report?

Please feel free to call me to discuss/clarify.

Regards,

Chris Pronk
Environmental Management Officer - Coastal
Integrated Sustainability Services

P 07 4417 5156
M not relevant
E chris.pronk@townsville.qld.gov.au
W www.townsville.qld.gov.au

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<4231-99_P02v01.pdf>

Craig D Hough

From: Chris Pronk <Chris.Pronk@townsville.qld.gov.au>
Sent: Monday, 14 December 2015 9:35 AM
To: Christopher M Sykes
Cc: Adam King
Subject: FW: Nelly Bay alternative options analysis report
Attachments: 4231-99_P02v01.pdf

Hi Chris,

Please see below and attached. Is this something TMR are able to proceed with? The quote is from NR NR who produced the SEMP, although under a new agglomerated company name (Water Technology have merged with Coastal Engineering Solutions). Not sure if you will require further quotes?

I'm happy to accompany NR nd yourself if you're keen to go along on any of the potential site visit dates (note 21/12/15 date would need to be confirmed with NR by 17/12/15).

Let me know.

Regards,

Chris Pronk
Environmental Management Officer - Coastal
Integrated Sustainability Services

P 07 4417 5156
M not relevant
E chris.pronk@townsville.qld.gov.au
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From NR [mail NR @watertech.com.au]
Sent: Friday, 11 December 2015 2:07 PM
To: Chris Pronk
Subject: RE: Nelly Bay alternative options analysis report

Hi Chris

Attached please find our proposal to undertake the Options Analysis.
Should you have any queries whatsoever, please just call me on 0418716595.

Regards

not relevant
Senior Principal Engineer | FIEAust CPEng RPEQ

WATER TECHNOLOGY ● +61 7 3105 1460 ● www.watertech.com.au ●

From: Chris Pronk [mailto:Chris.Pronk@townsville.qld.gov.au]
Sent: Wednesday, December 9, 2015 9:47 AM
To: not relevant @watertech.com.au NR @coastengsol.com.au'
not relevant @coastengsol.com.au>
Subject: Nelly Bay alternative options analysis report

H NR

As discussed; recent discussions with TMR, the Mayor, and the state MP have resulted in a decision to investigate potential options to address the beach erosion and sand accumulation in the harbour issue, with an intent to explore options for directly addressing this issue at the breakwater bridge (hereafter referred to as 'the hole'). The options would need to be presented in reference to the relevant section of the current approval conditions, and comment made on the likely efficacy of the options (in relation to adjacent beach erosion and sand accumulation in the harbour) and how the options will impact on the approval conditions. It is envisaged that suggested options would be implementable as a trial (e.g. constructed of removable geofabric) and may necessitate an amendment to the current relevant permit conditions.

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- Filling in/blocking the hole
- Narrowing the hole (to still allow for tidal flushing)
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Please see applicable marine parks permit attached (condition 27)

Could you please provide a cost estimate for production of this report?

Please feel free to call me to discuss/clarify.

Regards,

Chris Pronk
Environmental Management Officer - Coastal
Integrated Sustainability Services

P 07 4417 5156
M not relevant
E chris.pronk@townsville.qld.gov.au
W www.townsville.qld.gov.au

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WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS
ABN: 60 093 377 283
ACN: 093 377 283

11 December 2015

Mr. Chris Pronk
Integrated Sustainability Services
Townsville City Council
Rowes Bay Sustainability Centre
56 Cape Pallarenda Road
Townsville QLD 4520

Our Ref: 4231-99_P02v01.docx

Dear Chris,

Nelly Bay Alternative Options Analysis

We offer this proposal for coastal engineering services in response to your email of 09th December 2015. The scope of services required is quite clearly set out in that email. We suggest that the work be undertaken in two parts, namely:

- Site visit; and
- Desktop study

Site Visit

Our proposed services would be provided by NR who undertook and managed the preparation of the SEMP for the Nelly Bay Beach by Coastal Engineering Solutions in 2009/10. However we believe it prudent for not relevant o undertake a site inspection to refresh our understanding of the local coastal conditions – as well as the physical characteristics of the Nelly Bay Breakwater and the bridge at its connection with the foreshore.

The site visit by our Brisbane-based not relevant could be achieved in a single day. We suggest that there is considerable merit in undertaking that inspection when the low tide on the day is at (or very close to) Mean Low Water (ie. MLW). You will recall that maintaining flows beneath the Breakwater Bridge at MLW is a significant issue under the current approval conditions for the marine parks permit.

Favourable tides occur during daylight hours on the following days:

- Monday 21st December 2015 at approx. 1238 hours
- Monday 11th January 2016 at approx. 1636 hours
- Wednesday 20th January 2016 at approx. 1337 hours

We suggest that the site visit occur on one of the above dates.

Desktop Study

Once the site visit has been completed, we would undertake a desktop study that would identify and assess the various options for mitigating beach erosion on the adjacent sandy foreshore using the findings of the SEMP for guidance. Such options would include those nominated in your email of 09th December, namely:

- Filling in/blocking the span beneath the Breakwater Bridge;
- Narrowing the span (but still allow for tidal flushing);
- Raising the baseline depth of the span (but still allow for some intermittent tidal flushing);
- Installing a groyne parallel to the breakwater in closer proximity than recommended in the SEMP, and not extending beyond the local marine park boundary;
- Other options that may emerge during the Options Analysis.

The implications to the existing conditions of the marine parks permit would be assessed, along with any possible amendments to those conditions.

When considering viable options and their impacts, we would utilise some of the findings of the numerical modelling of waves and longshore / cross-shore sand transport processes undertaken by Coastal Engineering Solutions. We have access to those computer files.

To assist in undertaking the desktop study, we request that the documents nominated in Clause 27 of the Marine Parks Permit No. G03/2321.1 (relating to the Nelly Bay Harbour) be made available to us at no cost. We also request a copy of the most recent survey of the Nelly Bay Beach be made available, as well as any records held by Council or the Department of Transport & Main Roads regarding volumes of sand annually removed from near the Breakwater Bridge and placed on the beach to the south.

Upon completion of our technical work we would provide a report which would assist in determining an appropriate strategy for progressing a strategy to mitigate the on-going erosion of Nelly Bay Beach and the requirement for annual back-passing of sand from beneath the Breakwater Bridge.

Schedule and Fees

The schedule for undertaking the services proposed above depends upon the timing of any commission. The approaching Christmas and New Year holiday season will impact upon our services.

A site visit on 21st December 2015 could be undertaken if we were to be commissioned by COB 17th December. However the desktop study would not start until during the week commencing 04th January 2016. That study would then be completed within three weeks.

Should the timing of any commission require the site visit on our recommended days in January, then the desktop study would be completed within three weeks of completing the Site Visit.

Our fees for undertaking the Options Analysis would be NR (excluding GST). That fee includes all expenses associated with a one day site inspection by our not relevant

Yours sincerely

Water Technology Pty Ltd

not relevant

Senior Principal Engineer

Craig D Hough

From: Chris Pronk <Chris.Pronk@townsville.qld.gov.au>
Sent: Wednesday, 9 December 2015 9:50 AM
To: Christopher M Sykes
Subject: FW: Nelly Bay alternative options analysis report

Hi Chris, FYI below, I'll let you know what I hear back.

Regards,

Chris Pronk

From: Chris Pronk
Sent: Wednesday, 9 December 2015 9:47 AM
To: NR @watertech.com.au'; NR @coastengsol.com.au'
Subject: Nelly Bay alternative options analysis report

Hi NR

As discussed; recent discussions with TMR, the Mayor, and the state MP have resulted in a decision to investigate potential options to address the beach erosion and sand accumulation in the harbour issue, with an intent to explore options for directly addressing this issue at the breakwater bridge (hereafter referred to as 'the hole'). The options would need to be presented in reference to the relevant section of the current approval conditions, and comment made on the likely efficacy of the options (in relation to adjacent beach erosion and sand accumulation in the harbour) and how the options will impact on the approval conditions. It is envisaged that suggested options would be implementable as a trial (e.g. constructed of removable geofabric) and may necessitate an amendment to the current relevant permit conditions.

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Please see applicable marine parks permit attached (condition 27)

Could you please provide a cost estimate for production of this report?

Please feel free to call me to discuss/clarify.

Regards,

Chris Pronk
Environmental Management Officer - Coastal
Integrated Sustainability Services

P 07 4417 5156
M not relevant
E chris.pronk@townsville.qld.gov.au
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Townsville City Council
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Australian Government
Great Barrier Reef Marine Park Authority

File No.: P010964
Ref.: G41201.1

STATE OF QUEENSLAND
Acting through the Department of Transport and Main Roads
PO Box 1089
TOWNSVILLE QLD 4810
ATTN: Mr Christopher SYKES

Dear Mr Sykes

RE: Marine Parks Permit Application (G41201.1)

In accordance with Regulation 88PD of the *Great Barrier Reef Marine Park Regulations 1983* and Part 3, Section 15 of the *Qld Marine Parks Regulation 2017,* the Great Barrier Reef Marine Park Authority (GBRMPA) and the Queensland Parks and Wildlife Service (QPWS) consider that the granting of a permission to undertake works to construct a research facility, being a sand bag groyne at Nelly Bay Magnetic Island, may restrict the reasonable use by the public of a part of the Marine Park. In order to proceed with the assessment of your application, public advertising is required. The costs associated with undertaking this public advertising will be the responsibility of the STATE OF QUEENSLAND Acting through the Department of Transport and Main Roads.

The advertisement must be published using the standard format outlined in the Terms of Reference (Attachment A), completed by **5 December 2018** and in the manner outlined below. If not satisfactorily completed by this date then in accordance with Regulation 88PP of the *Great Barrier Reef Marine Park Regulations 1983* and Part 3, Section 15 (5) of the *Qld Marine Parks Regulation 2017* the application will be taken to have been withdrawn.

Public Advertising – requirements:

- Submit a draft of the proposed advertisement and information package to the GBRMPA for approval no less than 14 days prior to the proposed date of publication. Examples of recent public advertisement information packages can be found on the GBRMPA website at http://www.gbrmpa.gov.au/about-us/consultation

- Publish the approved advertisement in a newspaper circulating in that part of the State of Queensland adjacent to that part of the Marine Park in which the proposed facility is to be operated (e.g. The Townsville Bulletin).

- Make available an information package describing your proposal for distribution, on request, to interested members of the public. This must be published on your website and you must provide the webpage address to the GBRMPA. This information must be of sufficient detail to adequately inform the public of the nature and scope of your proposal and should include at least the following details:
  - instructions on how to make a submission (Attachment B);
  - a project introduction inclusing the background of the project;
  - an overview of works or the program to be undertaken including, if relevant, construction, works and/or operation facts and timelines;
  - duration of research facility installation;

- a description of how environmental impacts will be managed;
- maps of the proposed location, showing the relevant site management arrangements (zoning, settings, etc.) and a drawing of the proposal;
- details of relevant monitoring programs;
- Details of how the temporary structure will be decommissioned if uncessful in achieving its aims/objectives;
- how the proposal will impact access by other users; and
- frequently asked questions, relevant policies and contact details.

Such an advertisement does not imply approval for the project. Comments received by the GBRMPA in relation to these notices will be given due consideration before the making of a decision in respect of your application. At the time you publish the advertisement, the GBRMPA will post the advertisement on its external website.

If you have any questions regarding your application, please contact Thea Waters on telephone (07) 4750 0746 or email assessments@gbrmpa.gov.au.

Yours sincerely

not relevant

not relevant

Rean Gilbert
Assistant Director – Assessments and Permissions
Environmental Assessment and Protection
Great Barrier Reef Marine Park Authority

7 August 2018

Saskia Salmeron-Rodriguez
Team Leader – Northern Marine Assessments
Queensland Parks and Wildlife Service
Department of Environment and Science

6 August 2018

ATTACHMENT A – TERMS OF REFERENCE

PUBLIC NOTICE PURSUANT TO REG 88PD OF *GREAT BARRIER REEF MARINE PARK REGULATIONS 1983*
PUBLIC NOTICE PURSUANT TO S15 OF *MARINE PARKS REGULATIONS 2017* (QLD)

PROPOSAL TO [Describe] AT [Location]

Notice is hereby given that [applicant/company] has applied to the Great Barrier Reef Marine Park Authority (GBRMPA) for permission to [describe proposal] at [location] in the Townsville/Whitsunday Management Area of the Great Barrier Reef Marine Park.

[Detailed description of proposal, including listing all facilities that are proposed in the Marine Park – approx. 50 words – include GPS coordinates & local site names]

An information package including further details of the proposal are available from the GBRMPA website at http://www.gbrmpa.gov.au/about-us/consultation
or from the Applicant:

[contact name]
[applicant/company]
[postal address]
[website]

Interested persons, especially those who believe that the proposed use will restrict their reasonable use of this part of the Marine Park, are invited to lodge written comments on the proposal with GBRMPA by [minimum 20 business days after advertisement date – longer if overlaps with holidays]. Comments should be forwarded to:

Great Barrier Reef Marine Park Authority
Environmental Assessment and Protection Unit
PO Box 1379
Townsville QLD 4810
or email: assessments@gbrmpa.gov.au

Comments will not be regarded as confidential unless confidentiality is specifically requested. This notice does not imply approval for the project. Due consideration will be given to public comments before GBRMPA makes any decisions in relation to the proposed use.

ATTACHMENT B – INSTRUCTIONS FOR MAKING A SUBMISSION

Please include these words at the front of your information package:

All comments and submissions to:

Great Barrier Reef Marine Park Authority
Environmental Assessment and Protection Unit
PO Box 1379
Townsville QLD 4810
Email: assessments@gbrmpa.gov.au

Website: www.gbrmpa.gov.au/about-us/consultation

We now seek any public comment under regulation 88PD of the *Great Barrier Reef Marine Parks Regulations 1983* (Cth) and s15 of the *Marine Parks Regulations 2017* (Qld). Public submissions will be considered by the Great Barrier Reef Marine Park Authority (GBRMPA) and the Queensland Parks and Wildlife Service (QPWS) in making a decision on this permit application.

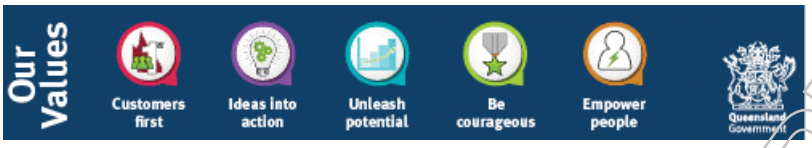
Stephanie Threlfall

From: Christopher M Sykes
Sent: Monday, 16 July 2018 12:01 PM
To: 'assessments'
Subject: FW: Acknowledgement letter G41201 [SEC=UNCLASSIFIED]
Attachments: Nelly Bay Alternative Options Analysis Jan16.pdf

FYI

Chris Sykes
Advisor (Boat Harbours) | **Property Management**
Strategic Property Management | Department of Transport and Main Roads

Floor 5 | 445 Flinders Street | Townsville Qld 4810
PO Box 1089 | Townsville Qld 4810
(07) 4421 8785 | M: not relevant
christopher.m.sykes@tmr.qld.gov.au
www.tmr.qld.gov.au



From: Christopher M Sykes
Sent: Monday, 16 July 2018 11:57 AM
To: 'Rean Gilbert' <Rean.Gilbert@gbrmpa.gov.au>
Cc: Stephanie Threlfall <Stephanie.Z.Threlfall@tmr.qld.gov.au>
Subject: RE: Acknowledgement letter G41201 [SEC=UNCLASSIFIED]

Hi Rean

Thanks for your Email. As far as I am aware Tonia is the primary contact for the majority of TMR permits, however, I am the primary contact for the Nelly Bay beach groyne project.

I have also attached the 2016 Alternative Options Analysis Report, which for some reason, I was not able to attach with the online permit application.

Chris Sykes
Advisor (Boat Harbours) | **Property Management**
Strategic Property Management | Department of Transport and Main Roads

Floor 5 | 445 Flinders Street | Townsville Qld 4810
PO Box 1089 | Townsville Qld 4810
(07) 4421 8785 | M: not relevant
christopher.m.sykes@tmr.qld.gov.au
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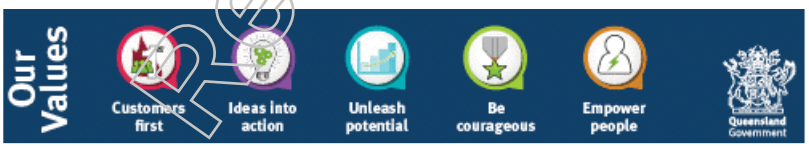


From: Rean Gilbert [mailto:Rean.Gilbert@gbrmpa.gov.au]
Sent: Friday, 13 July 2018 4:04 PM
To: Christopher M Sykes <christopher.m.sykes@tmr.qld.gov.au>

Cc: stephanie.Threlfall@tmr.qld.gov.au; Thea Waters <Thea.Waters@gbrmpa.gov.au>
Subject: Acknowledgement letter G41201 [SEC=UNCLASSIFIED]

Dear Chris,

For some reason your acknowledgement letter went to Tonia Richard as she is down as the primary contact for ALL TMR permits. If this is not the case can you please let me know and I can change that.

Please find attached your acknowledgement letter for your research facility. As discussed with Stephanie the application will need to be publically advertised. We will be in touch in the next two weeks to give you further information on how to go about publically advertising your proposal.

Any questions, please let me know.

Regards,
Rean

Rean Gilbert BSc MSc CEnvP
Assistant Director - Assessments & Permissions
Environmental Assessment and Protection
Great Barrier Reef Marine Park Authority
2-68 Flinders Street Townsville | PO Box 1379 Townsville QLD 4810
Phone: (07) 4750 0813
Email: Rean.Gilbert@gbrmpa.gov.au

Introducing PERMITS ONLINE – your online application and permit management portal

We acknowledge the traditional custodians of the Great Barrier Reef and throughout Australia. We pay our respects to their elders past, present and future.

www.gbrmpa.gov.au

Nelly Bay
Alternative Options Analysis

January 2016

DOCUMENT STATUS

Version	Doc type	Reviewed by	Approved by	Distributed to	Date issued
v02	Report	not relevant	not relevant	Chris Sykes	12/02/2016

PROJECT DETAILS

Project Name	Nelly Bay Alternative Options Analysis
Client	Department of Transport and Main Roads
Client Project Manager	Mr. Chris Sykes
Water Technology Project Manager	not relevant
Report Authors	not relevant
Job Number	4231-01
Report Number	R01
Document Name	4231-01_R01v02.docx

Cover Photo: Nelly Bay Beach: Road bridge at northern end of the beach providing access to southern breakwater. Photo taken one hour before low tide 21st December 2015.

Level 3, 43 Peel Street
South Brisbane QLD 4101

Telephone (07) 3105 1460
Fax (07) 3846 5144

ACN No. 093 377 283
ABN No. 60 093 377 283

TABLE OF CONTENTS

LIST OF FIGURES

1. INTRODUCTION

In recent years the sandy foreshores of Nelly Bay Beach on Magnetic Island have been experiencing erosion which threatens public and private infrastructure. The location of Nelly Bay Beach within its regional context is shown in Figure 1-1, whilst Figure 1-2 shows its location with respect to nearby Nelly Bay Harbour. Typical erosion of the beach is illustrated on Figure 1-3.

In May 2010 Coastal Engineering Solutions Pty Ltd completed a Shoreline Erosion Management Plan (SEMP) for Nelly Bay Beach (CES, 2010). The Executive Summary of the SEMP Report is enclosed as Appendix A to this report.

The objectives of the SEMP were as follows:

- to enable the Townsville City Council to proactively plan for erosion management in a way that is consistent with all relevant legislation (Commonwealth, State and Local) as well as all relevant coastal and environmental policies;
- to investigate and address the underlying causes of shoreline erosion and its likely future progression at the local scale;
- to determine cost effective and sustainable erosion management strategies that maintain natural coastal processes and resources; and
- to consider community needs in both the short- and long-term.

The SEMP recommended that future management of the eroding Nelly Bay shoreline be achieved through a strategy of Beach Nourishment. That strategy basically consists of:

- Initial Nourishment - through the placement of a sufficient volume of sand to establish sand buffers that accommodate the erosion caused by a nominated Design Event.
- Ongoing Renourishment - given that the nourished foreshore experiences long-term erosion processes, it will be necessary to recharge these erosion buffers by periodic placement of additional sand.

The implementation of this beach nourishment strategy for Nelly Bay Beach will establish and maintain natural erosion buffers along foreshore sections that are threatened by erosion over the 50 year planning period of the SEMP.

However local coastal processes are such that some of the sand placed for beach nourishment will be transported into the beach/breakwater corner at the northern-most end of Nelly Bay Beach. As discussed later in this report, there is a requirement to maintain tidal flow under a road bridge that connects the southern harbour breakwater with the shoreline. Consequently to be effective, the recommended beach nourishment strategy needed to accommodate this requirement.

The SEMP therefore recommended that this be achieved by intercepting the northward moving sand by construction of a training wall alongside the southern breakwater. This will prevent sand from being transported into the "gap" between the breakwater and the shoreline; thereby facilitating tidal flow in the channel beneath the bridge. The sand naturally accumulated against the training wall will form a stable sand "fillet" having a plan orientation determined by the seasonal wave climate on Nelly Bay Beach. The SEMP estimated that a training wall of around 70 metres length would be required to provide a stable beach planform, as well as to facilitate tidal flow beneath the adjacent bridge.

However subsequent advice was received from the Great Barrier Reef Marine Park Authority (GBRMPA) that any intrusion of this training wall into the Marine Park would not be approved by the Authority. Since the Department of Transport and Main Roads (DTMR) is responsible for ensuring the tidal flow beneath the bridge, the Department engaged Water Technology to investigate the required length of the training wall in more detail. The commissioned Alternative Options Analysis is to consider alternatives to the full length training wall as recommended by the SEMP. This report presents the findings of investigations for the Alternative Options Analysis.

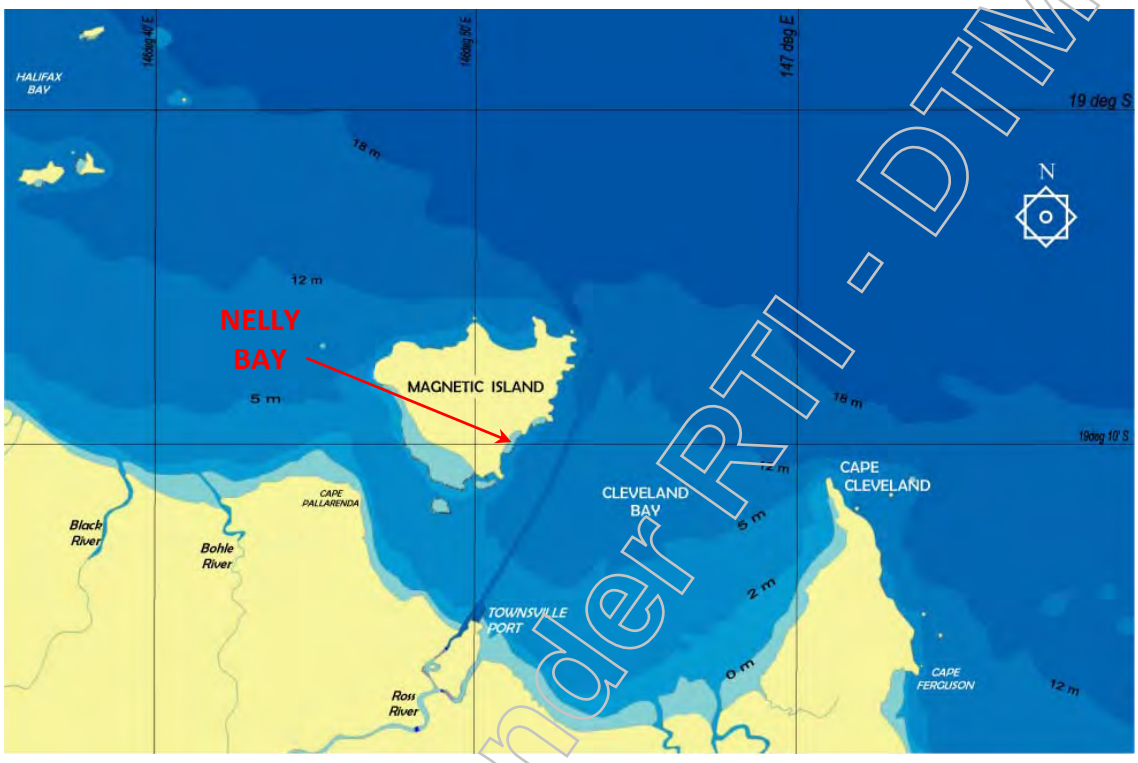


Figure 1-1 Study Locale

Figure 1-2 Nelly Bay Beach

Figure 1-3 Beach erosion on Nelly Bay Beach

2. SAND TRANSPORT PROCESSES

The naturally occurring processes that shape the Nelly Bay foreshore are discussed in significant detail in the SEMP Report (CES, 2010). Nevertheless a summary of those processes is warranted in this current discussion since it provides the context for subsequent appraisal of options for sand management on Nelly Bay Beach.

The coastal environment of Nelly Bay is characterised by an extensive fringing intertidal reef platform, with a sandy beach along the immediate foreshore. The distance between the toe of the beach and the reef crest at the seaward edge of the reef platform varies from about 400 metres at the northern end of the beach to only some 80 metres at its southern end.

2.1 Prior to Harbour Construction

Prior to commencing the construction of Nelly Bay Harbour in 1989, the natural supply of sand to local foreshores was derived from sediments being conveyed by Gustav Creek - primarily during significant flows induced by heavy rainfall events. Sand from the creek's steep inland catchment was delivered into the shoals at the creek entrance alongside Bright Point.

The opposing influences of creek discharges and longshore sand transport caused the lower reaches of Gustav Creek to meander as it approached its entrance to Nelly Bay. Historically the seaward-most reach of the creek flowed northward behind a low sand spit before then discharging in the northern-most corner of Nelly Bay against the rocky flank of Bright Point. Gustav Creek's entrance arrangement is evident in old surveys and historical photographs - as illustrated in the aerial photograph of Figure 2-1.

Wave action then transported the deposited sand off the entrance shoals. The prevailing coastal processes in Nelly Bay at that time resulted in a north-to-south transport of sand along the foreshore between Bright Point and Hawkings Point - apart from in the northern corner where Gustav Creek originally discharged into Nelly Bay.

Natural processes slowly carried sand from the entrance area southward along Nelly Bay Beach. In other words, natural ongoing supply of sand from Gustav Creek to its northern end was keeping the foreshore of Nelly Bay nourished with sand.

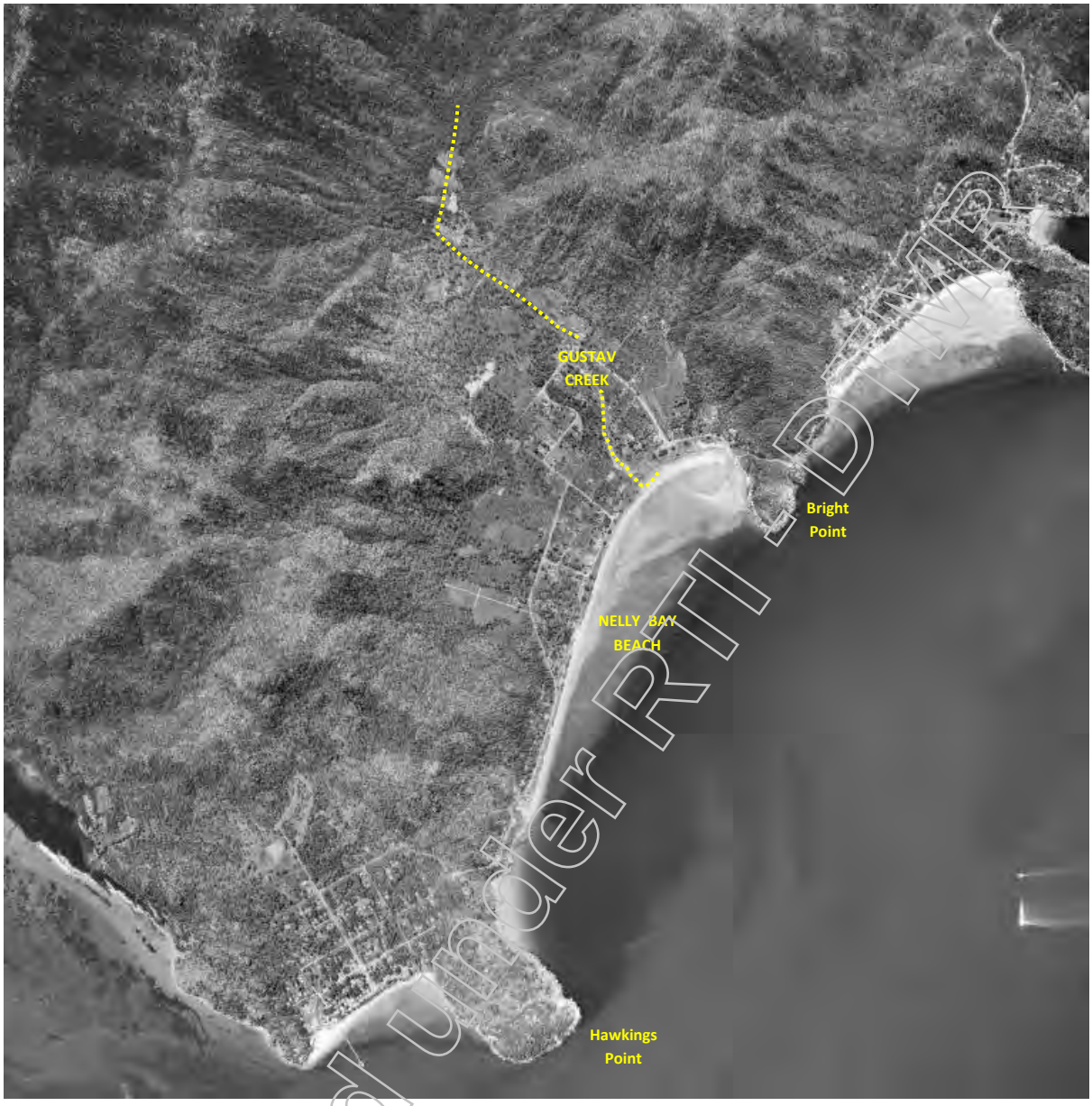


Figure 2-1 Nearshore coastal environment prior to harbour construction

2.2 Subsequent to Harbour Construction

As a consequence of Nelly Bay Harbour's construction, the natural ongoing supply of sand to local foreshores has ceased. Gustav Creek now discharges into the sheltered waters of the Harbour.

As part of the original harbour construction works, a sedimentation basin was built in the lower reaches of Gustav Creek to intercept sand delivered to the shoreline by the creek - so that it did not discharge into the harbour basin. The intent of capturing this sand was not only to prevent ongoing sedimentation within the harbour, but that it be used to regularly nourish the downdrift foreshores of Nelly Bay Beach.

This strategy of mechanical extraction of sand from the basin at the downstream end of Gustav Creek and its placement on Nelly Bay Beach was the means by which the natural sand pathway from the creek onto the foreshore was to be restored following harbour construction.

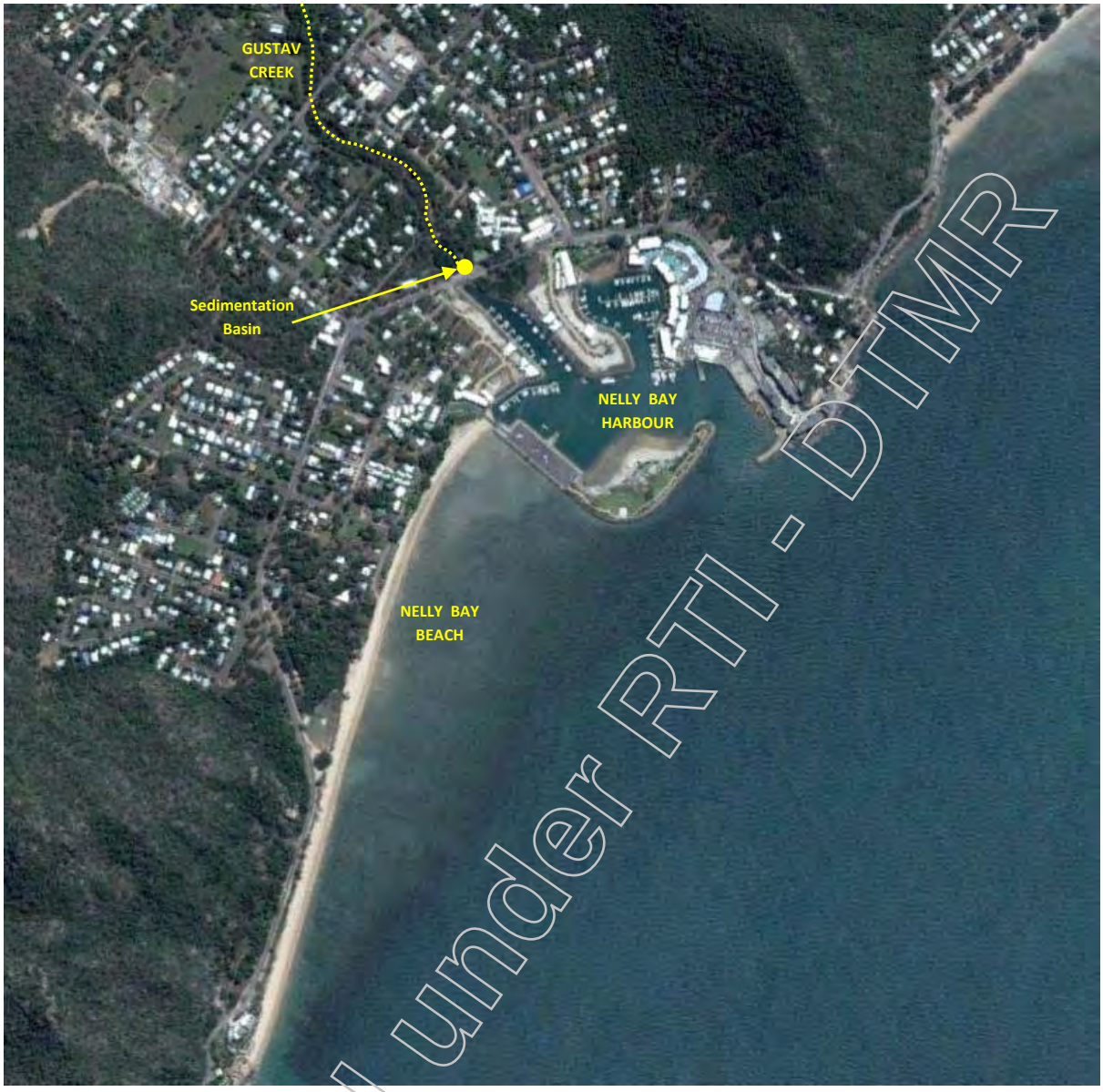


Figure 2-2 Nearshore coastal environment subsequent to harbour construction

Whilst this basin has been successful in trapping most of the sand delivered by Gustav Creek, its clearance and placement on the downdrift foreshore (thereby replicating natural supply mechanisms prior to harbour construction) has not been as extensive as planned.

The longshore transport processes on Nelly Bay Beach itself have still been moving sand naturally southward along the beach at the same rate as previously. However because of the diminished sand supply from Gustav Creek, the longshore sand transport on the beach is greater than the rate that sand is now being mechanically supplied from the sedimentation basin. Consequently the beach has been steadily eroding since completion of the harbour.

In addition to inhibiting the natural supply of sand to Nelly Bay Beach, the new harbour has altered the wave climate and longshore sand transport regime on the northern end of the beach. As a consequence of the southern breakwater, there are localised wave diffraction processes that now move some of the sand northwards along the beach (towards the road bridge at the end of Kelly Street that connects to the breakwater).

The changes to sand supply and sand transport processes as a consequence of harbour construction are shown conceptually on Figure 2-3 (which has been taken from CES, 2010).

Figure 2-3 Recent Changes to Sand Supply and Transport Processes (from CES, 2010)

This natural sand movement causes a build-up of a sand "fillet" in the beach/breakwater corner which fills the channel under the road bridge - thereby preventing tidal flow between the reef flat and the sheltered harbour waters. Queensland's Department of Transport and Main Roads (with the assistance of Townsville City Council) clears sand from this area generally once a year so as to reinstate partial tidal flow beneath the road bridge.

The removed sand is placed on Nelly Bay Beach further to the south. However the prevailing coastal processes return it to the northern beach/breakwater corner, where it must then again be removed each year to reinstate the flow beneath the bridge. Typical sand deposition and subsequent clearance in this area is shown on Figure 2-4.

(a) Sand blocking tidal flow beneath bridge

(b) Sand cleared from beneath bridge to allow tidal flow

Figure 2-4 Sand deposition and clearance beneath the Kelly Street bridge

3. MARINE PARKS PERMIT FOR NELLY BAY HARBOUR

3.1 Conditions of Permit

The Marine Parks Permit issued for the construction, maintenance and operation of Nelly Bay Harbour is included as Appendix B of this report. It states in part:

> *"The Permittee must maintain water flow at Mean Low Water Mark under the breakwater bridge and around the breakwater on all sides with connection to the ocean and must ensure that such water flow is maintained continuously thereafter, ..."*[1]

This permit requirement is therefore incorporated into Clause 3.1 of the *Nelly Bay Harbour Operational Plan*.

As discussed in the preceding Section 2.2, the construction of Nelly Bay Harbour has resulted in some changes to natural sand transport mechanisms at the northern end of Nelly Bay Beach. Some sand is now transported northward and collects in the corner formed by the beach and the southern harbour breakwater. This tends to fill the "gap" beneath the breakwater bridge (as shown in Figure 2-4) thereby inhibiting the required tidal flow at Mean Low Water Mark (MLWM).

Consequently Queensland's Department of Transport and Main Roads undertakes annual clearance of sand from this area to ensure that the required tidal flows at MLW are reinstated beneath the road bridge by 1st July of each year.

Mean Low Water Mark was chosen as the required ocean level for tidal flow beneath the bridge since it represents the landward boundary of the Great Barrier Reef Marine Park (GBRMP) as proclaimed by the Great Barrier Reef Marine Park Act 1975. The Marine Parks Permit for the Harbour states that:

> *"Mean Low Water Mark (MLWM) at Nelly Bay Harbour means the tidal plane passing through -0.696 m AHD."*[2]

The landward boundary of the GBRMP along the foreshores of Nelly Bay is therefore defined by the RL -0.696 m AHD contour.

Advice has been received from the Department of Transport and Main Roads as well as Townsville City Council that the GBRMPA would not approve any erosion management structure recommended by the SEMP that crossed this boundary contour since it would therefore extend into the Marine Park.

3.2 Implications to Training Wall Location

In order to properly define the actual landward boundary of the Marine Park, a survey of the foreshore and adjoining intertidal flats at the northern end of Nelly Bay Beach was undertaken by Townsville City Council in August 2015. This is one of several such surveys undertaken over the years.

The position of the RL -0.7m AHD contour on the intertidal flats off the beach is shown on Figure 3-1. This is of particular relevance since it is effectively the position of the landward boundary of the Great Barrier Reef Marine Park (i.e. RL -0.696 m AHD).

[1] Clause 27 on page 6 of Marine Parks Permit No G03/2321.1. Issued on 1st June 2003 under the then Great Barrier Reef Marine Park Regulations 1983 (Commonwealth) and Marine Parks Regulations 1990 (Queensland).
[2] Definitions listed on page 3 of Marine Parks Permit No G03/2321.1. Issued on 1st June 2003 under the then Great Barrier Reef Marine Park Regulations 1983 (Commonwealth) and Marine Parks Regulations 1990 (Queensland).

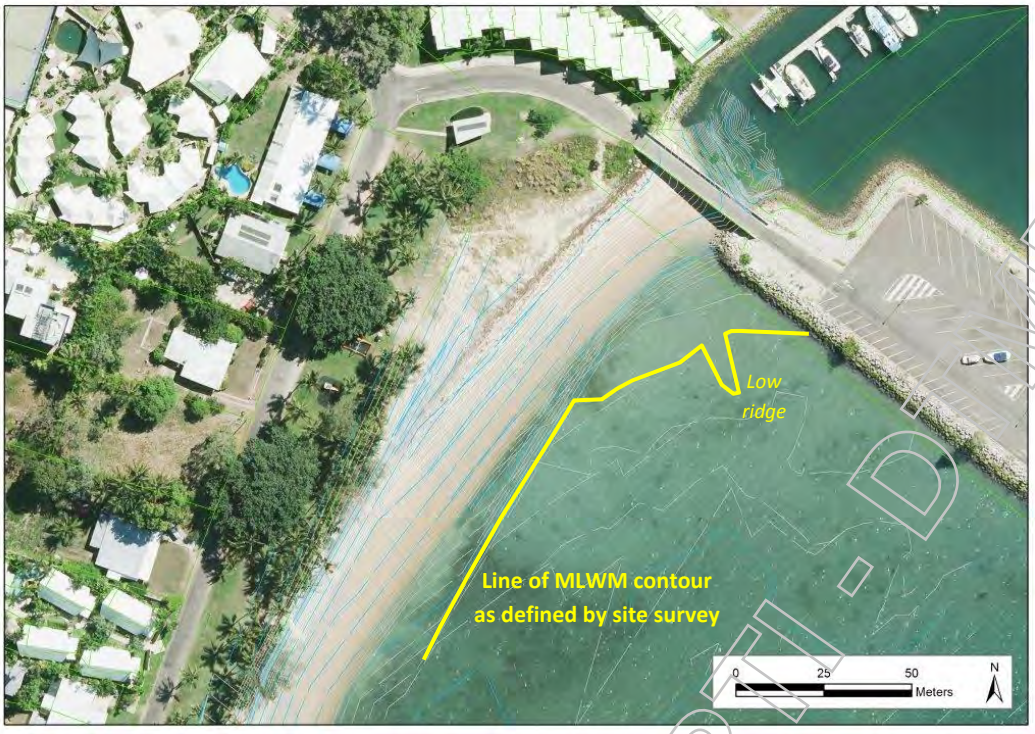


Figure 3-1 Location of MLWM (GBRMP boundary) off Nelly Bay Beach

When compared to previous surveys undertaken by Townsville City Council it is evident that the location of this contour has not noticeably changed in the vicinity of the SEMP's proposed training wall – despite the beach immediately inshore undergoing significant changes. This implies that the boundary of the Marine Park on the intertidal reef flat does not change in this area.

It is pertinent to note that the survey identifies a natural low ridge feature on the intertidal reef platform that extends slightly seaward in this area. Given that the contours defining this feature are the same in several surveys undertaken over the years, it is evident that this is a natural and permanent feature of the reef platform. A visual inspection of the reef platform at low tide on 21st December 2015 confirmed this conclusion.

The crest of this ridge is above the line of MLWM, and it is therefore outside of the Great Barrier Reef Marine Park. The crest of this natural ridge is therefore a suitable position and alignment for the training wall originally proposed by the 2010 SEMP.

4. OPTIONS FOR RETAINING NELLY BAY BEACH

Within the context of the prevailing coastal processes shaping the foreshores of Nelly Bay, a number of options for managing and retaining the northern end of the beach have been evaluated. The following discussions identify the various opportunities and constraints afforded by each.

4.1 Training Wall as Recommended by the SEMP

As stated previously, the 2010 SEMP recommended a beach nourishment strategy for mitigating the ongoing threat of erosion along the Nelly Bay foreshore. To facilitate that strategy it was further recommended that a trial training wall be built at the northern end of the beach. Figure 4-1 (taken from CES, 2010) illustrates the training wall arrangement recommended by the SEMP.

Figure 4-1 Trial Training Wall Recommended by the SEMP (CES, 2010)

The natural orientation of the sand fillet that forms against this training wall would be such that it faced out towards the south-easterly fetches that exist across Cleveland Bay towards Townsville. The shoreline of the fillet would align itself with the predominant wave energy - which in this northern corner of the beach would be towards the south-east. Numerical modelling undertaken as part of the technical work for the SEMP was able to identify the stable plan orientation of this sand fillet – but not its overall planform.

The training wall would need to be of a sufficient length to hold this fillet in place without any sand spilling around its offshore end - which would otherwise compromise the required tidal flows beneath the breakwater bridge. In other words, if the wall was too short then sand would spill around its end and there would still be a requirement for intermittent mechanical clearance of sand from beneath the bridge – albeit at a somewhat reduced frequency.

Estimating the length of wall required to contain the beach presented a technical challenge to the SEMP - since such sophisticated morphological modelling was beyond the scope of that study.

Nevertheless in order to assess potential viability and indicative costs, it was estimated from consideration of the wave climate modelled for the SEMP that the training wall would need to extend approximately 70 metres beyond the toe of the beach (which was captured on surveys at that time). It transpires that the estimated end of such a training wall would be located within the Great Barrier Reef Marine Park – an unacceptable outcome to the GBRMPA.

Consequently the length of training wall required to contain a stable beach plan has been re-investigated as part of this Alternative Options Analysis. An objective of this closer examination has been to see whether a training wall located entirely outside of the boundary of the Marine Park could still maintain a stable beach and prevent sand from spilling around its end (thereby compromising its function of keeping beneath the bridge clear of sand).

In the absence of detailed numerical modelling, considerable insight to likely beach behaviour is available from consideration of the circumstances leading up to the completion of Nelly Bay Harbour. Major construction works for the harbour commenced in mid-1989 but were not completed until 2003. The project experienced significant delays during construction as a consequence of financial failures of a significant stakeholder and a major financier. As a consequence, construction was suspended and the breakwaters were left in place for many years whilst only partially completed.

There was no "gap" beneath the breakwater bridge during this time, instead there was a barrier bund in place to prevent tidal flow into the partially completed harbour basin. The bund blocking the gap beneath the breakwater bridge at that time is shown overleaf in the photos of Figure 4-2.

Uninterrupted natural littoral processes acting on the shortened Nelly Bay Beach had approximately a decade to shape the northern end of the beach to its naturally stable plan alignment. In other words, Nelly Bay Beach was able to align itself to its naturally preferred orientation at its northern end (i.e. against the flank of the southern breakwater) for many years prior to 2003. This gives considerable insight into how the beach would now naturally stabilise itself against the proposed training wall alignment. Reference to Figure 4-3 illustrates how this insight is achieved.

The top image of that Figure shows the shape of the stable sand beach which naturally formed against the cross-shore barrier of the southern breakwater (remembering there is a bund to prevent sand spilling under the bridge). Of particular relevance is the shape and seaward extent of that beach – as defined by the toe of the sloping beach face. Essentially this shape and extent of beach would be replicated against the cross-shore barrier of the proposed training wall, which would only be some 20 metres away. As can be seen from the lower of the two images in Figure 4-3, that training wall would be outside of the GBRMP if it was located on the crest of the low ridge that naturally exists as a local morphological feature of the intertidal reef flat.

This indicates that contrary to previous perceptions, the erosion mitigation works proposed by the SEMP can be implemented without the necessary training wall component of the strategy being located within the GBRMP.

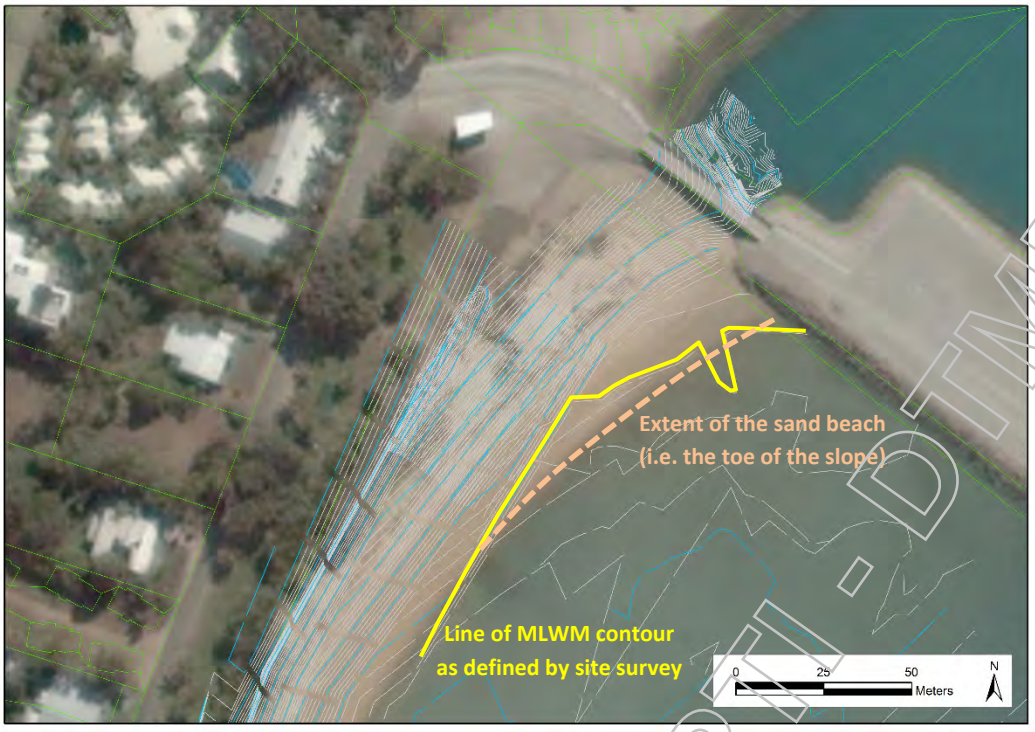
The SEMP recommended that the training wall be constructed as a trial structure. It is envisaged that it would be constructed of sand filled geotextile bags, similar to that of the trial training walls at Mundy Creek on Rowes Bay. The trial structural concept is illustrated in Figure 4-4, which shows the application of sand-filled geotextile containers to create the Mundy Creek training walls.

The rationale for a trial structure at the northern end of Nelly Bay Beach is presented in the SEMP as follows:

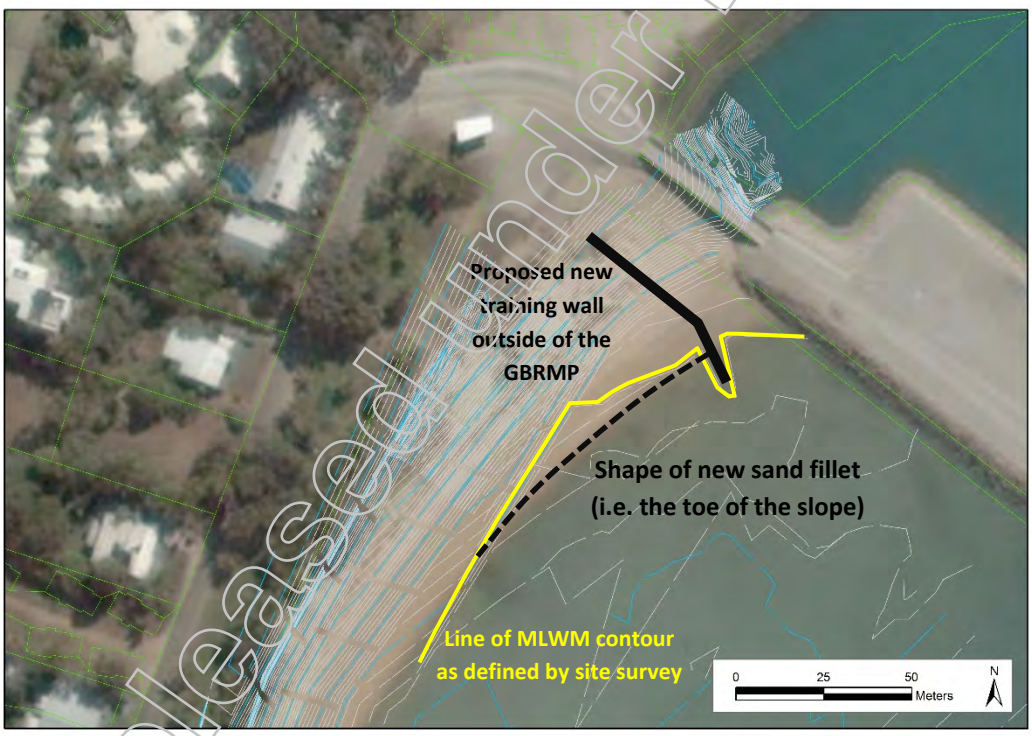
> *"Detailed coastal processes modelling could be undertaken prior to the implementation phase of the project to more accurately determine the length of the training wall. The particularly complex natural processes are such that any predicted outcomes of the modelling would nevertheless have to be treated with some caution. Greater confidence in outcomes would be achieved by application of a prototype trial for the training works."*

and …….

Figure 4-2 Bund preventing tidal flow beneath bridge (circa 2002)



(a) Location of the GBRMP landward boundary overlain on a 2002 aerial photo



(b) Proposed training wall location with inferred planform of resulting sand fillet

Figure 4-3 Inferred stable beach and training wall configuration

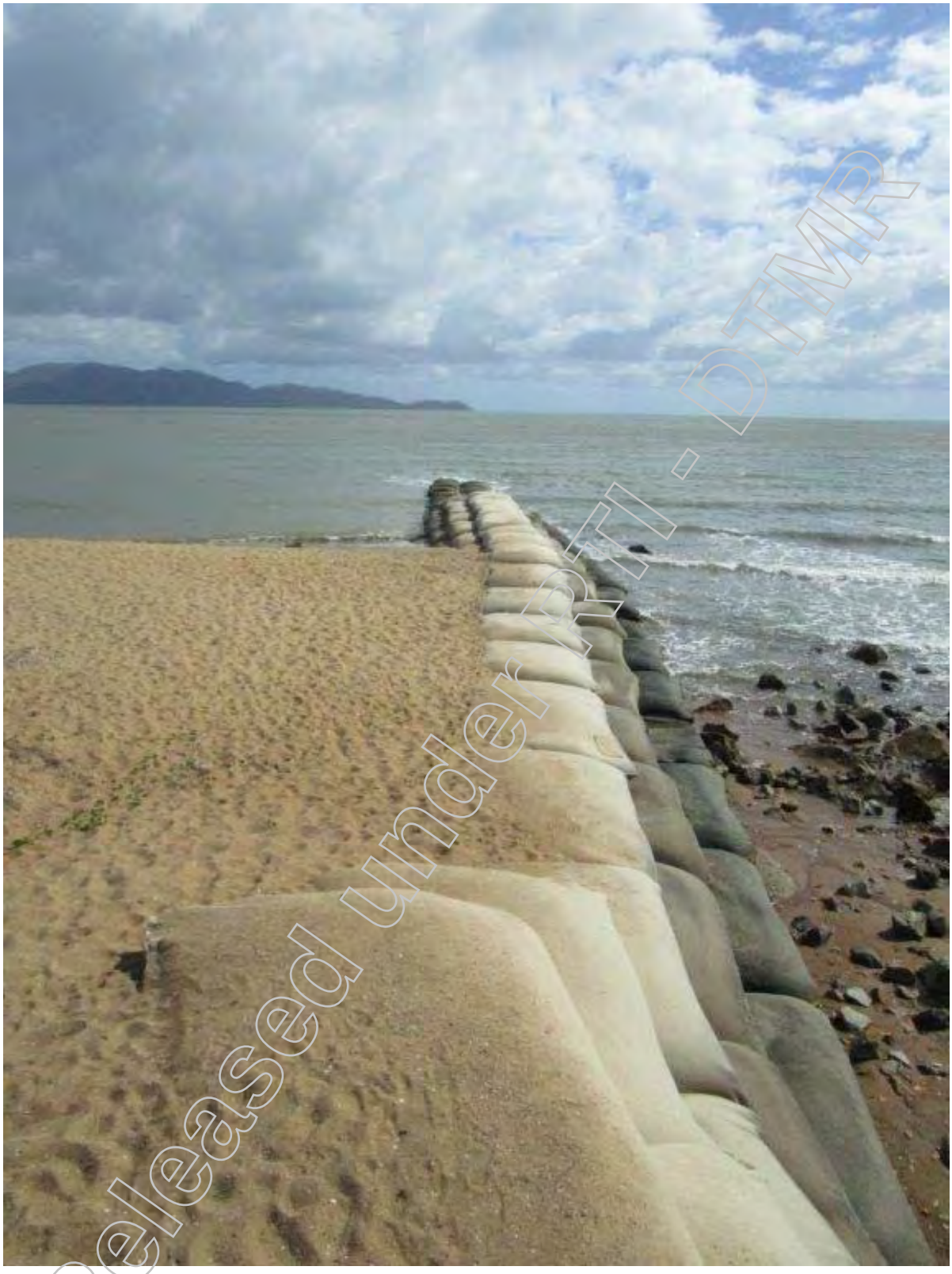


Figure 4-4 Trial training wall at Mundy Creek, Rowes Bay

"The training wall would be placed on its estimated optimum alignment and length; then its effectiveness monitored during the trial. As the performance of the temporary training wall became evident, changes to its length, height and even its location could be implemented with reasonable ease during the trial. The results obtained from monitoring an actual prototype scenario are likely to provide greater accuracy than any numerical modelling……."

Both of these comments and recommendations are endorsed by this Alternative Options Analysis – particularly given the close proximity of the GBRMP boundary to the structure. Once the most appropriate training wall arrangement has been determined by the trial, the temporary structure could be made more permanent by the placement of armour rock over it.

If for some reason, the trial indicated that the beach shape and/or sand retention was not satisfactory, or the training of the tidal flow beneath the bridge was not appropriate, then the temporary structure could be very easily removed. An excavator fitted with a ripping-tyne could quite simply tear open and remove the geotextile bags, allowing the filling sand to spill back into the natural littoral system of Nelly Bay Beach.

4.2 Bund Beneath the Breakwater Bridge

The option of replicating the arrangement of the temporary construction bund that existed beneath the bridge in the years prior to 2003 has also been considered as part of this Alternative Options Analysis. The arrangement would be similar to that shown in Figure 4-2. This would simply allow the northern end of Nelly Bay Beach to naturally form against the flank of the southern harbour breakwater. When compared to the option of a training wall (as discussed in Section 4.1) this option has much less intervention and disruption of the natural coastal processes currently sustaining the northern end of Nelly Bay Beach and the intertidal reef platform.

Sand on Nelly Bay Beach would be able to adopt its naturally preferred orientation alongside the flank of the southern breakwater. There would be no permanent "footprint" of a training wall on the crest of the natural low ridge of the intertidal reef platform.

This would at first seem to compromise the requirement to have tidal flow beneath the bridge at MLWM. However consideration of surveys of the area indicates that this does not happen anyway. Figure 4-5 shows that the ocean water level of MLW in Nelly Bay is such that the tide is not high enough to inundate the reef so as to link with the level of MLW in the harbour.

A site inspection was undertaken at low tide on 21st December 2015 to investigate this conclusion. The low tide on that day was RL-0.68m AHD, slightly higher than Mean Low Water of RL-0.969 m AHD. Observations on that tide confirmed that there is no linkage of tidal levels across the intertidal reef flat at MLW.

The observations on 21st December 2015 also confirm surveys that indicate the tide across the nearshore reef flats first links with that occurring under the bridge only when the tide is higher than approximately RL-0.4 m AHD.

Whilst it is possible to excavate a channel through the reef platform at or below MLW so as to artificially facilitate this linkage, very regular clearance of this excavated flow channel through the intertidal reef platform would be required to prevent it from being silted up. Significant sedimentation in any such channel is likely to occur due to the fine nature of the sediments across the adjacent intertidal reef platform. Appropriate disposal of the removed fine sediments also presents substantial environmental challenges.

Inspection of earlier surveys of this area suggest that the flow beneath the breakwater bridge at MLW may never have occurred at any time subsequent to the construction of Nelly Bay Harbour.

In which case, simply allowing the beach to naturally build up against the southern breakwater (which includes construction of a low bund beneath the bridge) will not change the scenario that has existed since well before the completion of the harbour in 2003.

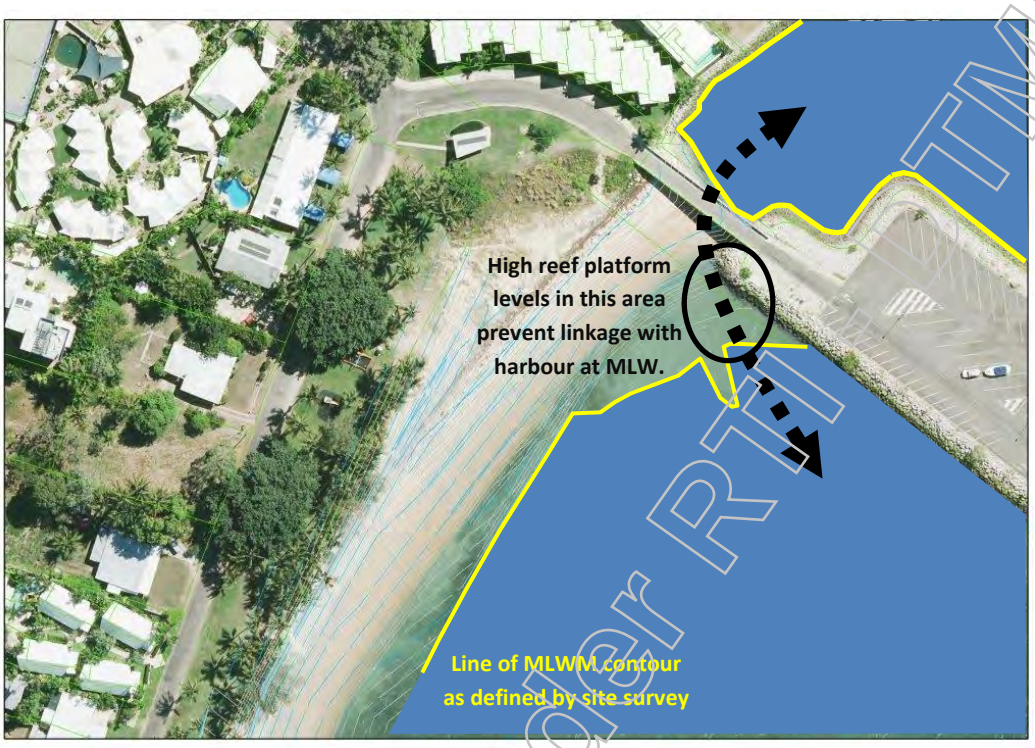


Figure 4-5 Ocean water levels at MLW in the vicinity of the breakwater bridge

Closing off the shallow 30 metre wide gap beneath the bridge means that the natural exchange of water within the harbour and that in the ocean will be reduced somewhat when the tide is above approximately RL -0.4m AHD at Nelly Bay. However given the very substantial tidal exchange that occurs through the deep 100 metre wide harbour entrance, such closure of the shallow and narrow gap beneath the bridge is not expected to have any significant bearing on the water quality within the harbour basin.

Should DTMR wish to further investigate the option of bunding beneath the bridge (as a means of naturally containing the northern end of the beach, with minimal interference to the naturally prevailing coastal processes) it is recommended that numerical modelling of tidal flushing for such a scenario be undertaken.

4.3 Other Options

Other options for accommodating the natural sand transport processes on Nelly Bay Beach have been considered as part of this Alternative Options Analysis. These have included options suggested in the

The SEMP completed in 2010 proposed a strategy of beach nourishment combined with a cross-shore training wall at the breakwater bridge. However the physical characteristics of a cross-shore training wall (which forms an integral part of the strategy to mitigate shoreline erosion) was subsequently deemed inappropriate because it extended into the GBRMP.

Subsequent investigations undertaken for this Analysis has identified that a training wall located outside of the GBRMP could contain the northern end of the sandy beach; as well as allow tidal flow beneath the bridge; and significantly reduce any requirement for ongoing mechanical clearance of sand from beneath the bridge. Indeed it is possible that such a structure could mitigate the need for future sand clearance campaigns entirely.

The beach nourishment strategy recommended by the 2010 SEMP could be implemented by DTMR. This would include the construction of a carefully designed and located cross-shore training wall to contain the northern end of Nelly Bay Beach and to facilitate tidal flows beneath the breakwater bridge.

An alternative strategy of reinstating the bund that existed beneath the bridge prior to 2003 and then allowing sand to naturally accrete against this bund (and the southern harbour breakwater) could also be adopted. Compared to the training wall option, this results in less disruption to the natural coastal processes currently sustaining the northern end of Nelly Bay Beach and the intertidal reef platform. Sand on Nelly Bay Beach would be able to adopt its naturally preferred orientation alongside the flank of the southern breakwater. There would also be no permanent "footprint" of a training wall on the crest of the natural low ridge of the intertidal reef platform, nor would there be complex flow patterns imposed on the intertidal reef platform.

However despite these advantages, this option has implications to the Conditions of the Marine Parks Permit for Nelly Bay Harbour, as well as some small influences to tidal flushing of the harbour basin. Resolution of these issues would require further discussions with the Great Barrier Reef Marine Park Authority in conjunction with numerical modelling to determine any impacts of tidal flushing and associated water quality within the harbour basin.

Brief sent from TCC[3] such as reducing the width and/or depth of the gap beneath the breakwater bridge. The presumed intent of those suggestions are to allow some sand accumulation to occur – thereby reducing the ongoing requirement for annual mechanical clearance.

However the natural longshore sand transport processes causing sand to accumulate in the vicinity of the bridge are such that there is no practical benefit in making the gap shallower and/or narrower. The extent and frequency of mechanical clearing will be substantially unaffected.

An alternative of installing a shore-parallel breakwater at the northern end of the beach was investigated in considerable detail as part of this Alternative Options Analysis. The intent of such a structure being to significantly reduce the longshore sand transport on the beach in its lee - thereby inducing sand to accumulate in this area rather than further north beneath the bridge.

However technical work undertaken to investigate whether a shore-parallel breakwater could contain the northern end of Nelly Bay Beach determined that for it to be successful it would need to be located substantially within the GBRMP. Given that outcomes of this Alternative Options Analysis are to ensure any shoreline protection works are located outside of the Marine Park boundaries, this option was deemed inappropriate.

4.4 Estimated Costs

Indicative costs for the implementation of the two options discussed in Sections 4.1 and 4.2 have been estimated to assist in determining the most cost effective strategy. These being:

- Training wall as recommended by the 2010 SEMP (refer Section 4.1)

  Design & construction of trial training wall using sand-filled geotextile bags: $280,000
  Two year monitoring of trial training wall: $15,000
  Convert to permanent structure: $130,000

  Estimated cost = $425,000

- Bund beneath the breakwater bridge (refer Section 4.2)

  Design & construction of bund using sand-filled geotextile bags: $125,000
  Convert to permanent structure: $50,000

  Estimated cost = $175,000

As can be seen, the option of bunding beneath the bridge and allowing the sand to naturally form against the flank of the southern breakwater is the most cost effective of the two options.

These estimates do not include the costs associated with placing additional sand on Nelly Bay Beach, as recommended by the SEMP. The volume and placement methods would be the same for each of the above two options.

5. CONCLUSIONS AND RECOMMENDATIONS

The objective of this Alternative Options Analysis is to identify options to better manage the accumulation and subsequent clearance of sand from beneath the breakwater bridge at the northern end of Nelly Bay Beach. Currently mechanical clearance of accumulated sand occurs annually to reinstate tidal flows beneath the bridge.

[3] Email dated 09th December 2015 sent by Mr Chris Pronk of Townsville City Council to Mr. not relevant of Water Technology.

APPENDIX A EXECUTIVE SUMMARY FROM THE *SHORELINE EROSION MANAGEMENT PLAN* FOR NELLY BAY BEACH

COASTAL ENGINEERING SOLUTIONS

NELLY BAY SHORELINE EROSION MANAGEMENT PLAN

FINAL REPORT

prepared for

Townsville City Council

March 2010

Project Title	**Nelly Bay Shoreline Erosion Management Plan**
Document Title	**Final Report**
Client	Townsville City Council
Job Number	09-0510nel
Document Code	09-0510nel-pobrp
First Issue Date	18th March 2010

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EXECUTIVE SUMMARY

The Nelly Bay foreshore offers a diversity of seascapes and landscapes - providing extensive recreational and lifestyle opportunities to residents and visitors that are enhanced by considerable environmental, social and cultural values.

The complex interaction of waves, tides, winds and creek flows have continually shaped and reshaped the shoreline of Nelly Bay. The dynamic nature of the coastal environment means that sections of the foreshore are experiencing erosion which is threatening essential infrastructure and adversely affecting social and environmental values.

In recognition of the need to preserve this foreshore as a natural resource and to accommodate the ever increasing pressures of urban development on an eroding shoreline, Townsville City Council has commissioned this *Shoreline Erosion Management Plan*.

OBJECTIVES

The objectives of the Shoreline Erosion Management Plan are:

- to enable the Townsville City Council to proactively plan for erosion management in a way that is consistent with all relevant legislation (Commonwealth, State and Local) as well as all relevant coastal and environmental policies;
- to investigate and address the underlying causes of shoreline erosion and its likely future progression at the local scale;
- to determine cost effective and sustainable erosion management strategies that maintain natural coastal processes and resources; and
- to consider community needs in both the short- and long-term.

RECOMMENDED SHORELINE EROSION MANAGEMENT STRATEGY

Following a review of the prevailing coastal processes, risks and values of the Nelly Bay foreshore the following activities are recommended by this Shoreline Erosion Management Plan:

Beach Nourishment

- Beach nourishment is recommended at the northern end of Nelly Bay beach. The extent of the work is shown in the Figure on page iv.
- Place sand as initial nourishment on the shoreline along the Esplanade ocean frontage. The sand quantities required will depend upon the location of a Coastal Defence Line nominated by Council; and the degree of protection required (ie. the selected Design Event). Some guidance on the quantities of sand required in erosion buffers is provided in this Shoreline Erosion Management Plan.

- It is recommended that the sand for this initial nourishment be sourced from the accumulation of sand in the lower reaches of Gustav Creek.
- The location and operation of the extraction process require further consideration before implementation. This will require consideration of the findings of previous studies as well as the objectives of the *Gustav Creek Management Plan* prepared by Townsville City Council in 2005.
- Implement appropriate dune management practices on the newly nourished foreshore. As a minimum, this entails the planting and protection of native dune vegetation, the ongoing clearing of noxious weed species and ensuring adequate controlled access is maintained through new dune areas.
- Undertake ongoing beach renourishment along the Esplanade ocean frontage through the annual placement of 1,000 m^3 of sand sourced from the lower reaches of Gustav Creek. This is simply providing a mechanical means of reinstating the natural littoral supply processes that nourished Nelly Bay beach prior to the construction of Nelly Bay Harbour.
- Again the location and extraction of this renourishment sand is to be confirmed by investigations and consideration of the catchment management plan for the creek.
- Annual volumes may need to be amended in response to the results of ongoing monitoring of beach performance.

Training Works for Tidal Flows at the Breakwater Bridge

- It is recommended that a training wall for managing the flow of tidal water around the landward end of the southern breakwater of Nelly Bay Harbour be constructed. The proposed arrangement is shown conceptually in the Figure on page iv. The proposed structure will also assist in retaining a stable beach along this section of foreshore.
- Implement a trial of tidal training works alongside the breakwater bridge. This is to facilitate the permanent flow of tidal waters around the landward end of the breakwater. It is to be implemented either by using sand-filled geotextile bags (requiring approximately 580 m^3 of sand to fill) or by using existing precast concrete cubes to initially construct the training wall.
- The wall should extend approximately 70m beyond the toe of the newly nourished beach; and be aligned parallel to but 30 metres to 40 metres from the toe of the southern breakwater.
- Place sand to create a stable beach orientation in a fillet of sand against the southern flank of the training wall. Approximately 1,750 m^3 is estimated as being required for this purpose. The sand for this initial creation of the fillet should be sourced from the accumulation of sand in the lower reaches of Gustav Creek. The location and operation of this sand extraction process requires further consideration before implementation.
- Implement appropriate dune management practices on the newly created sand fillet.
- Monitor the effectiveness of training works alongside the bridge, making any alterations to the length and height of the wall if appropriate.

- Upon successful completion of the trial, armour the temporary training wall for a more permanent arrangement. Alternatively completely remove the sand-filled geotextile bags or concrete blocks that constitute the wall, allowing sand to return to the beach system.

Project Monitoring

- Establish and undertake initial pre-project monitoring survey on approximately twelve beach transects to be located on the Nelly Bay shoreline.
- Undertake surveys twice annually on these transects, with additional surveys immediately after major erosion events.
- All surveys are to extend offshore for a minimum distance of 200m from the line of mean sea level on the beach.
- The exception to this is the initial pre-project survey which should extend at least 500 metres offshore of the seaward edge of the reef flat into deep water (ie. 500 metres seaward of the reef crest).

Project Design and Approvals

- Townsville City Council (in consultation with other stakeholders) to select the Design Event for which the erosion mitigation strategies recommended by this Shoreline Erosion Management Plan are to accommodate. This requires consideration and acceptance of the risk that such an event will occur (or be exceeded) within a 50 year planning period. Guidance on risk is offered in this Shoreline Erosion Management Plan. Nominating the Design Event simply requires selecting the Average Recurrence Interval (ARI) cyclone for which immunity is required.
- Townsville City Council (in consultation with other stakeholders) to select the alignment of an appropriate Coastal Defence Line along the Nelly Bay shoreline. Throughout the 50 year planning period, property and infrastructure landward of the Coastal Defence Line remain protected from long-term erosion effects; short-term erosion caused by the Design Event; and recession as a consequence of future climate change. Foreshore areas seaward of the Coastal Defence Line lie within the active beach system (ie. within the erosion buffers).
- Undertake engineering designs for works associated with the initial beach nourishment along the Esplanade ocean frontage.
- Undertake engineering designs for works associated with the trial of a training wall alongside the breakwater bridge opposite Kelly Street; and for the initial beach nourishment to create the sand fillet in the beach/training wall corner.
- Prepare and submit appropriate approval applications based on designs for the proposed works.

Recommended Shoreline Erosion Management Plan

ESTIMATED COSTS

The estimated costs associated with the above recommended strategies are summarised below.

At this early stage, these estimates must be considered as indicative only - since no detailed design has been undertaken. They have been based on an approximation of sand volumes for initial beach nourishment to provide a buffer to an assumed Coastal Defence Line - the location of which requires confirmation or amendment by the project's stakeholders.

SEMP component	Cost	On-going Cost
Project Design and Approvals		
Design of trial training wall at the breakwater bridge	$10,000	
Design of initial beach nourishment	$10,000	
Obtain appropriate approvals	$20,000	
Project Monitoring		
Establish & undertake initial pre-project surveys	$24,000	
Twice annual beach transect survey		$18,000
Beach Nourishment		
Implementation of initial beach nourishment :		
for 50 year ARI immunity	*$237,000*	
for 100 year ARI immunity	*$252,000*	
for 200 year ARI immunity	*$280,000*	
for 500 year ARI immunity	*$305,000*	
for 1,000 year ARI immunity	*$312,000*	
On-going renourishment with sand from Gustav Creek		$25,000
Implementation / maintenance of dune management program	$80,000	$12,000
Maintain Tidal Flow at Southern Breakwater		
Implementation of trial training wall (2 years)	$220,000	
Convert to permanent training wall	$110,000	
Maintenance of training walls		$5,000
Totals (for various initial beach nourishment options)		
for 50 year ARI immunity	**$711,000**	**$60,000**
for 100 year ARI immunity	**$726,000**	**$60,000**
for 200 year ARI immunity	**$754,000**	**$60,000**
for 500 year ARI immunity	**$779,000**	**$60,000**
for 1,000 year ARI immunity	**$786,000**	**$60,000**

APPENDIX B CONDITIONS OF MARINE PARKS PERMIT FOR NELLY BAY HARBOUR

Marine Parks Permit

Great Barrier Reef Marine Park Regulations 1983 (Commonwealth)
Marine Parks Regulations 1990 (Queensland)

This/these permission/s remain/s in force,
unless sooner surrendered or revoked, for the period:

01-JUL-2003 to 30-JUN-2023

Permit No: G03/2321.1

Permission/s is/are granted to

Permittee: The State of Queensland Acting Through Queensland Transport

Address: PO Box 1293
TOWNSVILLE QLD 4810

for use of and entry to zones in the following Great Barrier Reef Marine Park Sections/Queensland Marine Parks as established by the Commonwealth *Great Barrier Reef Marine Park Act 1975* and Queensland *Marine Park Act 1982* ('the Marine Park'):

CENTRAL SECTION

in accordance with ~~the~~ details as stated in Part A, and subject to conditions stated in Part B on the reverse side.

date 1/7/2003 ..... date .....

Delegate of the Great Barrier Reef Marine Park Authority

Delegate of the Executive Director, Queensland Parks and Wildlife Service

Part A:
The purpose/s of use and entry may only be undertaken in the zone/s and location/s described below.
Zone/s and location/s to which the permission/s applies:

GENERAL USE 'A' ZONE - Nelly Bay (Magnetic Island) and waters adjacent thereto.

Purpose/s of use and entry authorised by permission/s:

The operation, minor construction, and maintenance of a structure, being Nelly Bay Harbour, in accordance with Schedule 1 (hereinafter referred to as "the operations").

WARNING

This permission extends to all employees of the Permittee, or other persons, who are acting on behalf of, or at the direction of, the Permittee for the purposes specified in this permission.

This permission(s) is not intended to extinguish any native title.

INTERPRETATION

A word or phrase in this permission has the same meaning as that word or phrase in the *Great Barrier Reef Marine Park Act 1975*, the *Great Barrier Reef Marine Park Regulations 1983*, and the zoning plan relevant to this Permit, unless a contrary intention appears.

A note or heading may be used to give assistance in interpreting conditions in case of ambiguity.

A reference to a date includes that date.

A reference to a zone is a reference to a zone of that name or a corresponding nature in the zoning plan (from time to time) in force for the part of the Great Barrier Reef Marine Park that is relevant to this Permit.

'Person' shall include a corporation or a company.

DEFINITIONS

'the Act' means the *Great Barrier Reef Marine Park Act 1975* as amended from time to time.

'AHD' means Australian Height Datum.

'Approval Officer' means any person delegated by the Great Barrier Reef Marine Park Authority (pursuant t its power in section 61 of the *Great Barrier Reef Marine Park Act 1975*) to grant or refuse permission to a perso for the operations and works contemplated under this Permit.

'Authority' means the Great Barrier Reef Marine Park Authority, or its delegate, a member of staff of that Authority or a person referred to in Section 42 of the *Great Barrier Reef Marine Park Act 1975* performing functions or exercising powers under that Act in accordance with arrangements made or entered into pursuant to that section.

'clean up' includes removing wastes and materials and dispersing, removing or rendering harmless, oil and other pollution and contaminants.

"Deed" means the Deed of Agreement referred to in condition 5 of this Permit.

'Environment' means all aspects of the surroundings of human beings, including:
(a) the physical factors of those surroundings, such as the land, the waters and the atmosphere; and
(b) the biological factors of those surroundings, such as the animals, plants and other forms of life; and
(c) the aesthetic factors of those surroundings, such as their appearance, sounds, smells, tastes and textures.

'Environmental Site Supervisor' means the person from time to time nominated in writing by the Authority to the Permittee, funded by the Permittee, and under contract to the Authority.

'Harbour' means the harbour constructed at Nelly Bay, Magnetic Island, pursuant to Permit No. G99/194.

'Harbour Basin' means in relation to Nelly Bay Harbour, the area of the harbour which was designed to a depth of -2.566 LAT as per the approved drawing 1436_12 WD-01 D "Site Plan Outer Breakwater" or such other drawings as may be approved in writing from time to time.

'Harbour Channel' means in relation to Nelly Bay Harbour, the area of the harbour which was designed to a depth of -3.566 LAT as per the approved drawing NB-CB-201G "Entrance Channel Dredging Plan" or such other drawings as may be approved in writing from time to time.

'Harbour Operational Plan' means the Harbour Operational Plan for Nelly Bay Harbour contemplated by the Deed of Agreement annexed to Permit No. G03/2321.1, prepared by the Permittee (or at its direction), and approved in writing by the Approval Officer.

'Harm' in relation to the Environment, includes any direct or indirect alteration to the environment that has the effect of degrading the environment and, without limiting the generality of the foregoing, includes any act or omission that results in pollution of the Marine Park.

'Hazardous Chemical' means any chemical, chemical compound, or mixture of compounds which is a physical, environmental, and/or health hazard.

'LAT' means Lowest Astronomical Tide.

'the Marine Park' means the Great Barrier Reef Marine Park established by the Act

'Mean Low Water Mark' (MLWM) at Nelly Bay Harbour means the tidal plane passing through -0.696 m AHD.

'Monitoring Consultant' means the monitoring contractor selected by the Authority and funded by the Permittee to develop and undertake the Operational Environmental Monitoring Program.

'Operational Environmental Monitoring Program' means the Operational Environmental Monitoring Program for Nelly Bay Harbour contemplated by the Deed of Agreement annexed to Permit No. G03/2321.1, prepared by the Monitoring Consultant, and approved in writing by the Approval Officer.

'the Permittee' means the State of Queensland acting through Queensland Transport.

'Vessel Live Aboard' means the use of a vessel as a primary place of residence.

''Waters adjacent' means in relation to a reef, the waters enclosed by 'the 500 metre line' and in relation to an island or the mainland, the waters enclosed by 'the coastal 500 metre line' (as defined by the zoning plan from time to time that applies to those waters).

'works' means and includes all plant and materials comprising or used in connection with all constructions, erections, dredging, installations, structures, facilities, vessels or aircraft of any kind associated directly or indirectly with this Permit, including but not limited to, the conduct of 'the operations'.

'Waste' has the same meaning as that term in sub-section 38J(7) of the *Great Barrier Reef Marine Park Act 1975*.

STANDARD CONDITIONS

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1) All activities must be undertaken in accordance with the provisions of all applicable laws in force from time to time in the State of Queensland.

2) The Permittee must ensure that when operations are conducted in the Marine Park under this Permit, the Permit or a certified copy of it, is available at the site of operation for inspection.

3) The Permittee must inform all participants in the operation and maintenance of the Harbour (including but not limited to the Permittee, and its employees, officers, sub-contractors and agents) of all relevant restrictions and conditions of this Permit (including the deed), the relevant zoning plan, the *Great Barrier Reef Marine Park Act 1975*, the *Great Barrier Reef Marine Park Regulations 1983*, the Harbour Operational Plan and any other plan or program contemplated by this Permit.

4) The terms and conditions of the Permit, the Deed, the Harbour Operational Plan and any other plan or program contemplated by the Permit extend to all employees and officers of the Permittee, and any other person acting on behalf of, or under the direction of, the Permittee, and the Permittee shall ensure that they comply with all such terms and conditions.

DEED CONDITIONS

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5) Prior to the date of commencement of works under this permission or within 30 days of the date of commencement this permit, whichever is the earlier, the Permittee must execute, seal and deliver as a Deed of Agreement to the Great Barrier Reef Marine Park Authority, a Deed of Agreement in the form annexed to this permission, identified with the permit number of this permission and marked 'Deed of Agreement'.

6) The Permittee must observe and perform its obligations under and pursuant to such Deed and for the purposes of this Permit any breach by the Permittee of its obligations under and pursuant to such Deed shall be a breach of this condition.

7) The Permittee must remove any works permitted herein in accordance with the terms of the Deed referred to in condition 5 hereof.

8) The Permittee must clean up the Marine Park in accordance with the terms of the Deed referred to in condition 5 hereof.

9) The Permittee must pay all costs in accordance with the terms of the Deed referred to in condition 5 hereof.

HARBOUR OPERATIONAL PLAN CONDITIONS

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10) The Permittee must prepare, or have prepared at its direction and expense in accordance with the Deed, a Harbour Operational Plan.

11) The Permittee must not undertake works or operations permitted herein within the Marine Park unless the Approval Officer has advised the Permittee in writing that the Harbour Operational Plan, or the relevant stage of that Harbour Operational Plan, has been approved.

12) The Permittee must ensure that all activities permitted herein are conducted in accordance with the Harbour Operational Plan approved by the Approval Officer from time to time. This approved Plan must be made available, or placed in a position so as to be available, to any person involved in the operation or maintenance of the Harbour, including but not limited to the employees, contractors, and agents of the Permittee, the permittees of other structures within or adjacent to the Harbour, and commercial and other operators using the Harbour.

OPERATIONAL ENVIRONMENTAL MONITORING PROGRAM CONDITIONS

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13) The Permittee must fund the preparation and implementation of the Operational Environmental Monitoring Program, including all costs, charges and expenses in accordance with the Deed.

OPERATIONAL AND MAINTENANCE CONDITIONS

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14) The Permittee must notify the Authority in writing within seven (7) days of any change in contact details for the Permittee. Details to include: the name of the responsible Department, the Department Contact (executive contact), the Project Officer (primary contact), a physical address of the said Department, a postal address, the telephone number of the project officer, and an after hours contact telephone number in the event of emergencies.

15) The Permittee must not undertake dredging in association with the works, except as required to maintain the Mean Low Water Mark in accordance with condition 27.

16) The Permittee must ensure that all employees, contractors and sub-contractors, prior to carrying out any works in connection with this Permit, are advised of their duty to comply with the restrictions and/or conditions of this Permit, the Act, the Regulations, and the relevant zoning plan.

17) The Permittee must ensure that the Harbour is not used for Vessel Live Aboard purposes.

18) The Permittee must ensure that sewage and/or grey water are not discharged into the Harbour.

19) The Permittee must take all reasonable measures to ensure that the works and the environment around the works are kept free of:
(i) litter; and
(ii) rubbish;
regardless of whether the Permittee is responsible for the presence of such litter or rubbish.

20) The Permittee must ensure that the works and environment around the works are kept free of Hazardous Chemicals, except to the extent authorised by the Harbour Operational Plan, regardless of whether the Permittee is responsible for the presence of such Hazardous Chemicals.

21) Where the Approval Officer has formed the view in his/her opinion that a condition of this Permit is not being complied with, or that there is a likelihood of Harm to the Environment, or that the Marine Park or property or things in the Marine Park are in danger of being damaged or destroyed (otherwise than as contemplated under this Permit), the Approval Officer may by notice in writing do all or any of the following (in addition to and not in derogation of any other action or remedy (statutory or otherwise) which may be available to the Authority):
(i) order the Permittee to modify the conduct of operations so as to mitigate or avoid the occurrence of Harm to the Environment and the Permittee must immediately upon receipt of the order modify the conduct of the operations in the manner specified; or
(ii) order the Permittee to cease all or any part of the operations and the Permittee must upon receipt of the order, immediately cease those operations until such time as the Approval Officer gives written notice that those operations can re-commence; or
(iii) order the Permittee to effect removal of all or any part of the works and the Permittee must effect removal of such works and in accordance with the written notice; or
(vi) order the Permittee to provide to the Authority a report duly certified by an appropriately qualified engineer detailing the structural integrity of the works nominated and advising whether the structural integrity of those works have been maintained to design specifications; or
(v) order the appointment of an Environmental Site Supervisor, who shall undertake supervision in accordance with conditions 23 to 26, so as to mitigate or avoid the occurrence of Harm to the Environment; or
(vi) order the implementation and, if necessary, the preparation of or any amendment to an Operational Environmental Monitoring Program to assess the environmental risk associated with any aspect of the works or operations and to provide advice on potential management responses; or
(vii) order the cessation of the implementation of an Operational Environmental Monitoring Program.

22) Where the Approval Officer orders the Permittee to effect removal of any of the works or to cease or to modify the conduct of operations under condition 21, the conduct of the Permittee must::
(i) be in accordance with the Harbour Operational Plan (if such works or operations are dealt with in the Harbour Operational Plan); or
(ii) be in accordance with the Deed (where (i) does not apply); or
(iii) be in accordance with best environmental practice as determined by the Approval Officer (where (i) and (ii) do not apply);
(iv) be in accordance with any directions in the written order provided that any such directions are not inconsistent with (i), (ii) or (iii) above; and
(v) be in accordance with any reasonable directions given by the Environmental Site Supervisor (where an Environmental Site Supervisor has been appointed) provided that any such directions are not inconsistent with (i), (ii), (iii) or (iv)

ENVIRONMENTAL SITE SUPERVISION CONDITIONS

23) The Environmental Site Supervisor is authorised to stop or suspend or give other direction in relation to any activity or works which in his/her reasonable opinion are likely to cause Harm to the Environment.

24) Not later than 14 days prior to the commencement of works necessitating an Environmental Site Supervisor, the Permittee must nominate in writing to the Authority an on-site liaison officer with whom the Environmental Site Supervisor can contact and liaise with, as and when required.

25) The Permittee and its employees, contractors, sub-contractors and agents must comply with any reasonable direction given by the Environmental Site Supervisor for the purpose specified in condition 23.

26) The Permittee must pay to the Authority within thirty (30) days of an invoice being submitted to the Permittee, all costs, charges and expenses reasonably incurred by the Authority (including but not limited to the costs of and incidental to the Authority managing the operations and the works authorised by the Permit) and/or the agents of the Authority, including but not limited to the Environmental Site Supervisor.

MAINTENANCE OF THE MEAN LOW WATER MARK CONDITIONS

27) The Permittee must maintain water flow at the Mean Low Water Mark under the breakwater bridge and around the breakwater on all sides with connection to the ocean and must ensure that such water flow is maintained continuously thereafter, in accordance with the Harbour Operational Plan and the following drawings, and in accordance with such other drawings as may be approved, in writing, from time to time by the Approval Officer:

(a) International Coastal Management - Nelly Bay Harbour Sand Trap - NB-01 A (Locality Plan);
(b) International Coastal Management - Nelly Bay Harbour Sand Trap - NB-02 D (Site Plan);
(c) International Coastal Management - Nelly Bay Harbour Sand Trap - NB-03 B (Typical X-Section of Works); and
(d) International Coastal Management - Nelly Bay Harbour Sand Trap - NB-04 A(Long -Section of Works);
(e) International Coastal Management - Nelly Bay Harbour Sand Trap - NB-05 (Extent of Works);
(f) Nelly Bay Harbour Reprofiling - As Constructed Plan of Nelly Bay Beach - RT03320/SK2 A

28) The Permittee must provide to the Authority, at the Permittee's expense, a report duly certified by an appropriately qualified person detailing whether the flow of water at the Mean Low Water Mark has been maintained in accordance with the design specifications referred to or contemplated by condition 27 and in accordance with the Harbour Operational Plan:
(i) at each 12 month anniversary from the commencement of this Permit; and
(ii) at any other time within twenty-one (21) days of being issued written notice to do so by the Authority.

SCHEDULE 1 TO PERMIT G03/2321.1

This Permit permits the operation, minor construction associated with the operation, and maintenance of Nelly Bay Harbour including the Harbour Basin, Harbour Channel, Breakwaters (including emergency helicopter landing pad, landscaping and public boat ramp), Breakwater Bridge and Revetments Walls in accordance with the following engineer certified construction drawings, and in accordance with such other drawings as may be approved, in writing, from time to time by the Approval Officer:

(a)	1436_10 WD-01D	Proposed Entry Beacons Site Plan;
(b)	1436_12 WD-01D	Site Plan Outer Breakwater;
(c)	1436_12 WD-02C	Outer Breakwater Plan;
(d)	1436_12 WD-03B	Sections Outer Breakwater;
(e)	2078-30	Acid Sulphate Disposal Cells;
(f)	6632/59B	Plan of As Constructed Detail Precincts 2-4 Nelly Bay 1 of 2;
(g)	6632/59B	Plan of As Constructed Detail Precincts 2-4 Nelly Bay 2 of 2;
(h)	6632/42E	Contour & Level Plan;
(i)	6632/40J	Plan of Subdivision;
(j)	BCT007-S-DK-001 to 007	Bridge General Layout;
(k)	CUR2840-20 S	Stormwater Drainage Layout Plan;
(l)	CUR2860-02D	Emergency Helipad Location, Arrangement and Details;
(m)	ICM - NB-01 to NB05	Nelly Bay Harbour Sand Trap;
(n)	RT03320/SK2 A	As Constructed Plan of Nelly Bay Beach;
(o)	NB-CB-001 Q	Development Plan;
(p)	NB-CB-204 AA	Bulk Earthworks Plan;
(q)	NB-CB-100.1 F	Section 86 Approvals Stage 1;
(r)	NB-CB-201 G	Entrance Channel Dredging Plan;
(s)	NB-CB-203 E	Existing Lease and Cadastral Plan
(t)	NB-CB-205.1 K	Canal Sections;
(u)	NB-CB-205.2 G	Canal Sections;
(v)	NB-CB-205.3 C	Revetment Concrete Masonry Wall Sections;
(w)	NB-CB-205.4B	Type C Wall Section;
(x)	NB-CB-205 T	Revetment Sections and Beach Sections;
(y)	NB-CB-206C	Carpark and Boat Ramp Plan;
(z)	NB-CB-208 L	Sediment Basin Plan and Details;
(aa)	NB-CB-330 A	Reinforced Concrete Boat Ramp;
(bb)	NB-CB-331 A	Reinforced Concrete Boat Ramp.

Australian Government
Great Barrier Reef Marine Park Authority

The State of Queensland
A/T Department of Transport and Main Roads
C/- Major Infrastructure Projects
Attn: Ms Karen Mooney
PO Box 2439
BRISBANE QLD 4001

File No.: 17/176 (3)
Permit No: G03/2321.1

Dear Ms Mooney

RE: Application to Vary Marine Park Permit G03/2321.1

I refer to your correspondence dated 6 May 2011, in which you request a variation to your Marine Park permit G03/2321.1.

By virtue of this correspondence and in accordance with Great Barrier Reef Marine Park Regulation 88ZP(2) please note the following variations to your permit:

CONDITIONS OF PERMIT

Delete (bb) of Schedule 1 and replace with the following:

(ab) NB-CB-331 A Reinforced Concrete Boat Ramp;

Add the following to Schedule 1:

(ac) H300-003 Floating Walkway and Pontoon

not relevant

Jason Vains
Delegate of the Great Barrier Reef
Marine Park Authority

THIS LETTER MUST BE AVAILABLE WITH THE PERMIT FOR INSPECTION AT ALL TIMES

2 - 68 Flinders St PO Box 1379
Townsville Qld 4810 Australia
Phone + 61 7 4750 0700
Fax + 61 7 4772 6093
info@gbrmpa.gov.au
www.gbrmpa.gov.au

Australian Government
Great Barrier Reef
Marine Park Authority

Ref.: G41201.1
Customer Ref.: 7870973646

STATE OF QUEENSLAND Acting through the Department of Transport and Main Roads
GPO Box 1549
BRISBANE QLD 4001
ATTN: Mr Christopher SYKES

Dear Mr SYKES

RE: Marine Parks permit application

I acknowledge receipt of your new permit application received on 13 July 2018. Reference number G41201.1 has been allocated to this application and this number should be quoted in all future dealings with the Great Barrier Reef Marine Park Authority (GBRMPA) regarding this application.

In accordance with Regulation 88AA of the Great Barrier Reef Marine Park Regulations 1983, this notice is to advise you that your application has been accepted as being properly made under Regulation 88A. Your application will be assessed in accordance with a Public Information Package assessment approach. Applications for permissions requiring this assessment approach are considered against GBRMPA's publicly available Assessment and Decision Guidelines.

I will be the contact officer for this application and if you have any questions regarding your application, please contact me either on telephone (07) 4750 0813 or email assessments@gbrmpa.gov.au.

Yours sincerely

Ms Rean Gilbert
Environmental Assessment and Protection
Great Barrier Reef Marine Park Authority

13 July 2018

New Permit Application:	**# 41201**
Status:	**Not Submitted**
Applicant:	**STATE OF QUEENSLAND Acting through the Department of Transport and Main Roads**
Primary Contact:	**Mr Christopher SYKES**
Is any of the proposed activity of a commercial nature?	**No**
Do you want to operate on the Mainland or island National Parks adjoining the Marine Parks (including any beach access)?	**Yes**
Please specify details:	**This permit application is for the construction of a trial groyne constructed with sand filled geotextile bags to be situated at the northern end of Nelly Bay beach and into the adjacent ocean area.**
Do you want to operate in rivers and streams between Mission Beach and the Starcke River?	**No**
Do you want to operate in the Green Island Recreational Area of Management (RAM)?	**No**
Conduct Research	
Enter a short title for your research project. If you are seeking an 'umbrella' permit to cover a broad research program, type 'umbrella permit for [topic]':	**Nelly Bay beach trial groyne project.**
Provide an abstract (brief summary) of your proposed research. This should include its objectives and key methods:	**Construction of a trial groyne at the northern end of the Nelly Bay beach is based on the recommendations outlined in the Nelly Bay Shoreline Erosion Management Plan completed in 2010 and an Options Analysis Report completed in 2016 which addresses beach erosion issues and the build up of sand under the adjacent Breakwater Bridge. The objective of trialling this groyne is to modify existing sand movement behaviours to reduce beach erosion and the build up of sand under the Breakwater Bridge which will also ensure compliance with condition 27 of Marine Parks Permit G03/2321.1 issued to the Department of Transport and Main Roads for Nelly Bay Harbour. Construction of this groyne is based on a design by a suitably qualified expert and the success of the groyne will be closely monitored by using appropriately qualified surveyors to complete regular surveys of beach transect lines and beach profiling. It is proposed that the groyne will be trialled for a period of 5 years at which time submitting a further permit application to make the groyne a more permanent structure will be considered.**

In addition to entering data in this online application system, you may also upload an experimental design, photos/diagrams of equipment and/or detailed methodology to support your application. This is optional however.	**~41201-53111-20-50m-design-drawings-5208-01_d02v01-Mar2018.pdf,application/pdf~41201-53111-20-Nelly-Bay-Beach-Monitoring-Plan.docx,application/vnd.openxmlformats-officedocument.wordprocessingml.document~41201-53111-20-Attachment-1---NBH-Proposed-Groyne-Technical-Review.docx,application/vnd.openxmlformats-officedocument.wordprocessingml.document~41201-53111-20-Nelly-Bay-Shoreline-EMP.pdf,application/pdf**
Are 20 or more people (researchers and support staff) expected to be involved in the research at any one time per location?	**No**
Requested Permit Duration:	**5 years**
Does your research involve commercial biodiscovery?	**No**
How do you propose to move through the Marine Park?	**Construction equipment will be situated on Nelly Bay beach and includes using a small excavator to fill the geotextile bags with sand and then to move the bags into place to construct the trial groyne. Machinery and equipment will be transported to Nelly Bay via the barge.**
If you will only use certain locations for specific purposes, please provide further detail:	**The proposed trial groyne will be constructed on the northern end of Nelly Bay beach on Magnetic Island.**
Are you seeking permission to conduct research in Marine National Park Zones or Buffer Zones?	**No**
Are you seeking permission to conduct research in Preservation Zones?	**No**
Are you seeking to conduct research in Scientific Research Zones?	**No**
Please explain your proposed inspection and maintenance schedule for any equipment being deployed for more than 6 months:	**N/A**

Please provide any further information you feel will assist the agencies in considering your application:	**If the groyne is effective after 5 years of monitoring, TMR will apply for a permit for the trial structure to be made permanent. In the event this trial groyne is not effective, the trial groyne can be easily removed and the sand returned to the natural beach system. TMR has previous experience with a similar trial at Bribie Island where a sandbag groyne was constructed to manage the movement of sand away from a popular boat ramp. Excessive amounts of sand were building up on this ramp causing access issues. With agreement from approval authorities, this trial was monitored and found to be effective for the intended purpose while also maintaining natural coastal processes. This solution has subsequently been included as a permanent feature of future boat ramp upgrade works.** **To provide context to this matter, it must be noted that TMR was not the proponent of the Nelly Bay Harbour Development. TMR inherited the harbour and the coastal process problems that the harbour works have created. In good faith, TMR and Townsville City Council are working together in attempting to return natural sand transport processes (as much as is possible) to Nelly Bay beach and to continue to meet the terms and conditions of Permit G03/2321.1.** **It would be greatly appreciated if GBRMPA would concur to this proposed strategy in order to implement this trial as soon as possible. On gaining approval from GBRMPA, TMR will prepare a Draft EMP which will cover the installation, operational monitoring and decommissioning of the structure to form the basis of the research permit along with a works schedule. Given this is a low risk trial implemented to alleviate changes caused to the beach system by the harbour development, TMR will be happy to notify the community of the trial but request that the assessment is not delayed by a legislative public comment period.**
Generated:	**11 July 2018**

Australian Government
Great Barrier Reef Marine Park Authority

File No.: P007364
Ref.: G39715.1

STATE OF QUEENSLAND
Acting Through the Department of Transport and Main Roads
313 Adelaide Street
GPO Box 1549
BRISBANE QLD 4000
Attn: Christopher Sykes

Dear Mr Sykes

RE: Marine Parks permit application G39715.1 – application withdrawn

I refer to the further information request notices issued under regulation 88E of the *Great Barrier Reef Marine Park Regulations 1983* and sub regulation 12 of the *Marine Parks Regulation 2017*, dated 13 February 2018. This letter advised you that additional information was required to be provided to the Great Barrier Reef Marine Park Authority (GBRMPA) by 29 June 2018.

An application is taken to be withdrawn where the applicant does not provide the additional information or document to the Authority within the specified time. This letter confirms that your **application has been withdrawn**.

If you have any queries regarding this matter, please contact me on telephone (07) 4750 0813 or email assessments@gbrmpa.gov.au.

Yours sincerely

not relevant

Rean Gilbert
Assistant Director- Assessments and Permissions
Environmental Assessment and Protection

5 July 2018

cc: QPWS, Cairns
QPWS, Townsville
QPWS, Airlie

You are reminded that the conduct of an activity in the Great Barrier Reef Marine Park without a relevant permission where one is required, may result in civil and/or criminal penalties. In addition, upon conviction, a court may order the forfeiture of anything used or otherwise involved in the commission of an offence.

Penalties also apply in the Queensland Great Barrier Reef Coast Marine Park.

Stephanie Threlfall

From: Rean.Gilbert@gbrmpa.gov.au
Sent: Friday, 20 April 2018 8:57 AM
To: Christopher M Sykes
Cc: Tonia A Richard
Subject: Nelly Bay application G39715.1 [SEC=UNCLASSIFIED]

Dear Department of Transport and Main Roads
Attn: Mr Christopher Sykes

On 17 April 2018 senior members of the Townsville City Council (TCC) met with senior members of the Great Barrier Reef Marine Park Authority to discuss the progress (or lack thereof) of permit application G39715.1. A number of issues were raised that I would like to clarify in this email.

1. TCC was concerned about the timeframe for progressing the permit application.

   GBRMPA indicated to the TCC that the permit application process was currently in the hands of TMR as we sent a further information request on 13 February 2018 and this information was due by 29 June 2018. We also spoke about the content of the further information request and that one of the first steps was to provide an options analysis that examines feasible and prudent alternatives to the proposed conduct and that this report must be developed by a pre-approved suitably experienced consultant. We note that TMR has not as yet, sought approval for the suitably experienced consultant from GBRMPA.

2. If TMR is concerned about the information requested then GBRMPA is happy to provide further clarity.

   Please call me personally on 07 4750 0813 to arrange a meeting time.

3. Based on TCC's advice it appears that hydrodynamic modelling has already been completed for the previous 2010 works.

   If this is the case please provide us with the hydrodynamic modelling that has already been conducted in order for us to test the assumptions of the model.

4. According to TCC extensive consultation has already taken place for the shoreline management plan and TCC is of the view that no further consultation is required.

   Please summarise the type of consultation that has already occurred and any concerns that were raised at the time or since about the proposed option to install a sand bag groyne. This information will be used to determine the need for further consultation on the current proposal noting it is likely to impact on access to the beach area and may have social impacts on amenity/visual concerns to adjacent landholders.

Chris, I would recommend a meeting between DTMR, GBRMPA and TCC after we have received the response to the further information request and the information requested in this email to discuss the boundary issues and a way forward.

I look forward to your response at your earliest convenience. Please note that I am out of the office from 23-27 April inclusive but can meet with you after that time in May if that suits.

Regards,
Rean

Rean Gilbert BSc MSc CEnvP
Assistant Director - Assessments & Permissions
Environmental Assessment and Protection
Great Barrier Reef Marine Park Authority
2-68 Flinders Street Townsville | PO Box 1379 Townsville QLD 4810
Phone: (07) 4750 0813

Email: Rean.Gilbert@gbrmpa.gov.au

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We acknowledge the traditional custodians of the Great Barrier Reef and throughout Australia. We pay our respects to their elders past, present and future.

www.gbrmpa.gov.au

Stephanie Threlfall

From: assessments <assessments@gbrmpa.gov.au>
Sent: Tuesday, 13 February 2018 3:41 PM
To: Christopher M Sykes
Subject: G39715.1 Nelly Bay Groyne FINFO [SEC=UNCLASSIFIED]
Attachments: FINFO-signed.pdf

Hi Chris,

Attached is the Request for further information (FINFO) that was committed to you when we met a few weeks ago. Please read through the document and if you require clarification don't hesitate to contact me.

Please note that the information requested is due by 29 Jun 18. If you find you cannot meet that date please inform the Agency in writing before the 29th so an extension can be considered. If you fail to provide the information by the due date the application will be considered to be withdrawn.

Cheers,

Guy

Assessments and Permissions
Environmental Assessment and Protection
Great Barrier Reef Marine Park Authority
2-68 Flinders Street East | PO Box 1379 Townsville QLD 4810
Permits Hotline Phone: (07) 4750 0860 (9am – 2pm EST weekdays)
General Phone: (07) 4750 0700 business hours
Email: assessments@gbrmpa.gov.au

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Keep up-to-date with Marine Park management visit Onboard The Tourism Operator's Handbook

 (Document Ref: GD659)

Australian Government
Great Barrier Reef
Marine Park Authority

File No.: P007364
Ref.: G39715.1

STATE OF QUEENSLAND
Acting Through the Department of Transport and Main Roads
313 Adelaide Street
GPO Box 1549
BRISBANE QLD 4000
Attn: Christopher Sykes

Dear Mr Sykes

RE: Marine Parks permit application – G39715.1

I refer to your application, dated 16 Apr 2017 for permission to conduct works in the Great Barrier Reef Marine Park being the construction of a groyne using sand filled geotextile bags at the northern end of Nelly Bay beach.

So that your application may be properly considered, you are required, pursuant to Regulation 88E of the *Great Barrier Reef Marine Park Regulations 1983*, and sub regulation 12 of the *Marine Parks Regulation 2017* to provide additional information in writing regarding your proposed activities.

Specifically, we require you to provide an options analysis report that examines feasible and prudent alternatives to the proposed conduct. This report must developed by a pre-approved suitably experienced consultant. Ultimately it will be up to the Department of Transport and Main Roads to demonstrate a need to conduct the activity, what the relevant impacts are of the activity and the options for avoiding, mitigating, and managing those impacts.

The proposed report should include but not be limited to:

- The report options must be based on hydrodynamic and sediment transport modelling. The modelling must examine the current sediment transportation, deposition systems and siltation rates compared to the altered sediment flow paths for each option. Model scenarios will need to be run for typical daily events, maximum seasonal patterns and Q100 cyclonic events.
    - Metocean data used within the model must be derived from local measurements and must be representative of all seasonal conditions.
    - Provide information on sediment characteristics and possible chemical contamination of sediments within Nelly Bay beach area that encompass the construction area and any materials considered to be used during construction. Data collected about the sediment will be important inputs to the hydrodynamic modelling.
    - The modelling must be validated and provided separately and in a format that enables a third party review. Please note that if necessary the Great Barrier Reef Marine Park Authority will have the results of the modelling reviewed by a third party.
    - Provide baseline ecological survey about the construction area and the resultant sediment deposition area of the most feasible alternative. Please provide a map showing the location of any sensitive receptors in these areas.
    - Provide an indicative schedule for the work to be undertaken including any restrictions on the construction works to be imposed around tides and public access.

This additional information must be forwarded to the Great Barrier Reef Marine Park Authority by 29 June 2018. If the additional information is not received by this date, your application will be taken to have been withdrawn in accordance with Regulation 88E (3) and sub regulation 12(3) of the *Marine Parks Regulation 2017*.

If you find you cannot comply with this request in the time allowed, please contact the GBRMPA in writing so a possible extension of time may be considered.

If you have any queries regarding the above please contact Guy Dugdale on telephone (07) 4750 0779 or email assessments@gbrmpa.gov.au.

Yours sincerely

not relevant

Rean Gilbert
Assistant Director
Assessments and Permissions
Reef Protection
Great Barrier Reef Marine Park Authority

Tania Brugmann
A/Team Leader - Northern Marine
Assessments
Queensland Parks and Wildlife Service
Department of Environment and Science

Australian Government
Great Barrier Reef Marine Park Authority

Ref.: G39715.1

STATE OF QUEENSLAND Acting Through the Department of Transport and Main Roads
GPO Box 1549
BRISBANE QLD 4001
ATTN: Mr Christopher SYKES

Dear Mr SYKES

RE: Marine Parks permit application

I acknowledge receipt of your new permit application received on 16 May 2017. Reference number G39715.1 has been allocated to this application and this number should be quoted in all future dealings with the Great Barrier Reef Marine Park Authority (GBRMPA) regarding this application.

I will be the contact officer for this application and if you have any questions regarding your application, please contact me either on telephone 0747500813 or email assessments@gbrmpa.gov.au.

Yours sincerely

not relevant

Ms Rean Gilbert
Delegate for the Great Barrier Reef Marine Park Authority
Environmental Assessment and Protection
26 May 2017

Stephanie Threlfall

From: Christopher M Sykes
Sent: Tuesday, 16 May 2017 12:52 PM
To: 'assessments@gbrmpa.gov.au'
Subject: FW: Marine Parks Permit Application from TMR for construction of a groyne at Nelly Bay Beach
Attachments: Preliminary Design NBH Groyne.pdf; Marine Parks Permit Application form 16.5.17.pdf

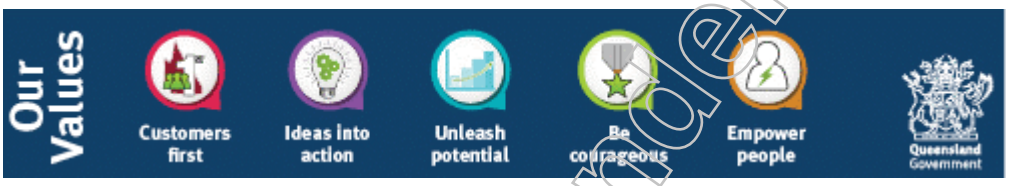
Hi

Please find attached a Marine Parks Permit application and supporting documentation for the construction of a groyne at Nelly Bay Beach, Magnetic Island.

Do not hesitate to contact me if you require any further information in regard to this application.

Regards
Chris Sykes
Advisor (Boat Harbour Operations) | Property Management
Strategic Property Management | Department of Transport and Main Roads

Floor 5 | 445 Flinders Street | Townsville Qld 4810
PO Box 1089 | Townsville Qld 4810
P: (07) 4421 8785 | M: nr F: (07) 4421 8827
E: christopher.m.sykes@tmr.qld.gov.au
W: www.tmr.qld.gov.au



MARINE PARKS PERMIT APPLICATION
TOURISM / STRUCTURES / WORKS

February 2017

Joint Permits
The Great Barrier Reef Marine Park Authority (GBRMPA) and the Queensland Parks and Wildlife Service (QPWS) operate a joint Marine Parks permit process that generally is administered by GBRMPA. Joint Marine Parks permits grant access to both the Great Barrier Reef Marine Park (Commonwealth) and the Great Barrier Reef Coast Marine Park (State) for certain purposes.

About this application form
This form is to be used when applying for permissions under the *Great Barrier Reef Marine Park Act 1975* (Cth) and/or the *Marine Parks Act 2004* (Qld) to undertake the following activities in the Great Barrier Reef Marine Park and/or the Great Barrier Reef Coast Marine Park:

- Commercial tourist operations
- Non-tourist commercial charters
- Installation and/or use of moorings
- Installation and/or use of structures/facilities
- Installation and/or use of aquaculture facilities
- Construction and/or use of marinas
- Discharge of waste from a fixed structure
- Works in the Marine Parks

For activities not mentioned above (such as harvest fisheries, collecting, research and education) different application forms are available. Please download the appropriate form from the GBRMPA's website, or phone one of the numbers below.

If you wish to apply for permission to install a major structure (such as a marina, pontoon, jetty, or aquaculture facility) you should complete this form and attach relevant supporting information. GBRMPA will contact you regarding further information following the receipt of your application.

More information
Visit GBRMPA's website to obtain information about other types of Marine Parks permits and the application process (www.gbrmpa.gov.au/zoning-permits-and-plans/permits/), or contact GBRMPA for a permit application information package. For information on State-only Marine Parks permits, please visit the QPWS website (www.nprsr.qld.gov.au) or phone one of the QPWS numbers below.

For tourist program operators, GBRMPA's Onboard Tourism Operator's Handbook contains important information about conducting a tourism operation in the Great Barrier Reef Marine Park, including permit information. 'Onboard' is available from GBRMPA's website (www.gbrmpa.gov.au and click on the Onboard icon). If you do not have internet access, please contact GBRMPA.

For further information please contact GBRMPA's Environmental Assessment and Protection team or the Marine Parks section of the QPWS office in your region.

Great Barrier Reef Marine Park Authority (www.gbrmpa.gov.au)	Townsville	Tel: (07) 4750 0700 Fax: (07) 4772 6093
Department of National Parks, Sport and Racing Queensland Parks and Wildlife Service (www.nprsr.qld.gov.au)	Cairns	Tel: (07) 4222 5282 Fax: (07) 4222 5060
	Townsville	Tel: 1300 130 372 Fax: (07) 4722 5311
	Airlie Beach	Tel: (07) 4967 7355 Fax: (07) 4967 7389
	Rockhampton	Tel: (07) 4936 0511 Fax: (07) 4936 2171

Australian Government
Great Barrier Reef Marine Park Authority

Queensland Government

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) provides for the protection of the environment, especially matters of national environmental significance (NES). Under the EPBC Act, a person must not take an action that has, will have, or is likely to have a significant impact on any of the matters of NES without approval from the Australian Government Environment Minister. The Great Barrier Reef Marine Park is now a matter of NES under the EPBC Act (sections 24B and 24C).

To help you decide whether or not your proposed action requires approval from the Environment Minister, guidance is available from the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) website (www.environment.gov.au/epbc). Where approval from the Environment Minister is required, a proposed action will need to be referred by the applicant to the DSEWPaC. The purpose of a referral is to obtain a decision on whether the proposed action will need formal assessment and approval under the EPBC Act. A referral form can be obtained from the DSEWPaC website.

Referral of an action under the EPBC Act is deemed to be an application under the *Great Barrier Reef Marine Park Act 1975* (see section 37AB, *Great Barrier Reef Marine Park Act 1975*). The DSEWPaC will forward the referral to GBRMPA to commence its permit processes as required under the *Great Barrier Reef Marine Park Regulations 1983*. For more information on the EPBC Act and making a referral, call the DSEWPaC's Community Information Unit on 1800 803 772 or visit the website at www.environment.gov.au/epbc.

HOW TO APPLY

- Print out and complete the application form;
- Scan and email the completed application form (and attachments if applicable) to assessments@gbrmpa.gov.au;
- Forward the signed original application (and attachments if applicable) to:

Great Barrier Reef Marine Park Authority
PO Box 1379
TOWNSVILLE QLD 4810
Attn: Environmental Assessment and Protection

Applications for State only permits should be forwarded to your nearest QPWS office (see contact details on the first page).

All applicants should complete **Parts A, B and G** of this form.
Complete **all Parts**, where relevant, for all new permit applications to:

- conduct a tourist program; or
- install a mooring, structure or facility; or
- conduct other works in the Marine Park/s.

Information Box
HOW TO APPLY AND FEES
Applications should be lodged as early as possible, preferably at least four (4) months prior to the date the permit is required.
An application for a Marine Parks permit to conduct commercial activities requires the payment of a Permit Application Assessment Fee (PAAF). More information on the application fee and payment details can be obtained by visiting www.gbrmpa.gov.au/zoning-permits-and-plans/permits/permit-application-assessment-fee or by contacting the GBRMPA.

If the applicant is applying to continue an existing permit, complete **Parts C, D and E** only if this information has changed since the previous application.

PLEASE NOTE:
It is important that GBRMPA and QPWS receive correct information about your permit application. There are significant penalties for giving false or misleading information.

The information you provide may be given to other Commonwealth and State agencies, which have a role in the management of the area.

Please read and complete this form carefully as incorrect or insufficient information may delay consideration of your application.

PART A

Proposed Permit Holder Details

If there is insufficient space on this form to fully address any of the questions, please attach additional pages to your application.

1. Is the proposed permit holder a company?
(see information box)

Yes ☐ No ☐ ▸ Go to next question 2

Information Box (Question 1)
Permits can be granted to:

- a REGISTERED COMPANY
- an INDIVIDUAL
- multiple INDIVIDUALS/COMPANIES

Registered company name:	Department of Transport & Main Roads	~~ACN~~/ABN:	39407690291
Registered office street address:	Level 5, 445 Flinders St, Townsville	**Postcode:**	4810
Postal Address:	PO Box 1089, Townsville	**Postcode:**	4810

▾ Go to Question 3

2. Is the proposed permit holder an individual, more than one individual, or an individual plus a company (partners etc.)?

Yes ☐

▾ Please list the names and addresses of all persons who are proposed to be included on the permit.

Full name(s):			
Residential address:		**Postcode:**	

Postal address:		Postcode:	
Full name(s):			
Residential address:		Postcode:	
Postal address:		Postcode:	

Full name(s):			
Residential address:		Postcode:	
Postal address:		Postcode:	

If insufficient space, please attach further information

3. Does the proposed permit holder wish to include a trading name on its permit?

Yes ☐ No ☒ ▸ Go to Question 4

Trading name:	

4. Contact person:

Title:	Mr	Name:	Chris Sykes		
Employment Position:	Advisor (Boat Harbours)			Mob:	not relevant
Email:	christopher.m.sykes@tmr.qld.gov.au	Tel:	44218785	Fax:	

NOTE: The nominated contact person will need to be available to respond to any queries that arise during the assessment of the application. Non-availability may result in processing delays.

PART B
Current Permit Details

5. Has the proposed permit holder (individual/s or company) held a Marine Parks permit within the last three (3) years?

Yes ☒ No ☐ ▸ Go to PART C

Permit/s held:	G03/2321.1 G03/1838.1

6. Is the proposed permit holder applying for the replacement/continuation of an existing permit?

Yes ☐ No ☒ ▸ Go to PART C

Information Box (Question 6)
If your application is accepted by GBRMPA before your existing permit expires, you may continue to operate in accordance with your existing permit until a decision has been made on your application.

Permit/s to be replaced:	

7. Does the proposed permit holder wish to change anything about its existing permit?

Yes ☐ ▸ Go to PART C No ☐ ▸ Go to PART D

PART C

New permit OR change to existing permit

Information Box
CHANGE TO EXISTING PERMIT
For permit holders wishing to change anything about an existing permit, only complete those questions relating to the change.

8. In which Management Area(s) of the Marine Park does the proposed permit holder wish to operate?

- ☐ Far Northern Management Areas
- ☐ Cairns/Cooktown Management Areas
- ☒ Townsville/Whitsunday Management Areas
- ☐ Mackay/Capricorn Management Areas

Information Box (Question 8)
The Marine Parks are divided into four Management Areas to help simplify management. These Management Areas are identified on the Zoning Maps.

9. Does the proposed permit holder wish to operate more frequently in specific locations (for example, more than 2 visits to a specific location in a 7 day period)? Please list each location of the Marine Park.

Yes ☐ ▼ No ☒ ▷ Go to Question 10

Information Box (Question 9)
Check the zoning maps on GBRMPA's website for your preferred location/s. Check that the activities for which you are applying are permitted at that location.

Specific location/s (e.g. reef name, specific zone number e.g. CP-14-4018)	Zone (for example, Marine National Park Zone, General Use Zone)	How often do you wish to access each location?

10. Does the proposed permit holder intend to extend its operation to:

A. Mainland or island National Parks adjoining the Marine Parks (including any beach access)?

Yes ☐ ▼ No ☒

Please specify: _____

Information Box (Question 10)
Separate permits are required from QPWS to conduct commercial operations on mainland or island National Parks and in the Green Island RAM area. Application forms will be mailed to you if you ticked 'YES' to parts A or B.
If you intend to access the rivers and streams between Mission Beach and the Starcke River, please attach a list of rivers / streams / inlets you wish to operate to, and contact your nearest QPWS office to discuss your application.

B. Green Island RAM (Recreational Area of Management)?

Yes ☐ No ☒

C. Rivers and streams between Mission Beach and the Starcke River?

Yes ☐ ▼ No ☒

Please specify: _____

11. Is this an application for a tourist operation permit?

Yes ☐ No ☒ ▸ Go to PART D

A. Please tick the type of tourist operation the proposed permit holder wishes to undertake:

- ☐ Vessel operation (including fishing charters)
- ☐ Aircraft operation (landing)
- ☐ Aircraft operation – scenic flights (non-landing)
- ☐ Cruise ship operation (vessel >70m)
- ☐ Hire operation
  - ☐ Dinghy hire
  - ☐ Motorised equipment
  - ☐ Non-motorised equipment
- ☐ Guided tour operation (e.g. kayak, canoe, craft tours)
  - ☐ Motorised, please specify: _____
  - ☐ Non-motorised, please specify: _____
- ☐ Bareboat operation (*Please indicate if this operation is to be conducted outside of the Whitsundays Planning Area* – Yes ☐ No ☐)
- ☐ Other, please specify: _____

B. Please tick the activities that the proposed permit holder wishes to undertake as part of the above operation(s):

- ☐ Standard activities (including swimming, snorkelling, SCUBA diving, fishing, fish feeding, passenger transfers, non-tourist commercial charters (includes transport for researchers, film crews and technicians etc.)
- ☐ Non-motorised watersports (for example, kayaks, windsurfers etc.). Please specify: _____
- ☐ Motorised watersports (for example, water skiing, parasailing, tube riding etc.). Please specify: _____
- ☐ Glass-bottom boat / semi-submersible tours (coral viewing)
- ☐ Other, please specify: _____

12. Please list the details of any vessels or aircraft to be included on this permit, which are intended to be used as the main mode of transportation in the Marine Park/s.

Vessel name/aircraft type	Vehicle Identification Number (VIN/BIN/AIN) (where applicable – see Information Box below)	Registration number	Vessel length (m)	Surveyed passenger capacity	Max number of participants in program (passengers & crew)	Usual home port or aircraft departure point

If insufficient space, please attach further information

13. Does the proposed permit holder wish to obtain a VIN / BIN / AIN for its vessel(s)/aircraft?

Yes ☐ No ☐

Information Box (Question 13)
Vessel, Bareboat and Aircraft Identification Numbers (VIN, BIN or AIN) provide greater flexibility for permit holders, by allowing them to choose the vessel or aircraft that they may use on a particular day. VIN/BIN/AIN's are like car number plates that allow permit holders to operate a range of similar vessels or aircraft, depending on their operating requirements. Please visit the 'Onboard' section on GBRMPA's website for further information. Note that a fee applies for each VIN/BIN/AIN (plus postage). Check with GBRMPA for current costs.

14. **Does the proposed permit holder intend to use any equipment, including ancillary vessels, in its operation?**

Yes ☐ No ☐ ▸ Go to PART D

Information Box (Question 14)
Some examples of equipment include tender vessels, glass-bottom boats and semi-subs, jet skis, catamarans, dinghies, kayaks and surf skis etc.

Equipment/vessel type	Number	Passenger capacity

PART D
Moorings, Structures and Facilities

15. **Does the proposed permit holder wish to install and/or operate a mooring, structure and/or other facility in the Marine Parks?**

Yes ☒ No ☐ ▸ Go to PART E

16. **Does the proposed permit holder wish to install and/or operate a mooring at any location in the Marine Park/s? (OR if the proposed permit holder has previously installed moorings please provide recent DGPS co-ordinates in the table below). Quote datum used e.g. GDA94.**

Yes ☐ No ☒ ▸ Go to Question 17

Location of mooring/s (e.g. reef name)	Mooring Reference Number (if applicable)	DGPS location	Type of mooring/s (fore & aft or single point, block/s, multiple points etc.)	Ancillary or primary

IMPORTANT: If you are applying for continuation of a permit for previously installed moorings, you MUST provide a copy of the approved drawing and your most recent approved compliance certificate with this application.

Information Box (Question 16)
The policy 'Moorings in the Great Barrier Reef Marine Park' (Moorings Policy) provides for the consistent and effective use and management of moorings in the Marine Parks. The Moorings Policy is available from GBRMPA's website (www.gbrmpa.gov.au/visit-the-reef/moorings).
If you wish to apply for a permit to install and/or operate a mooring facility, please enclose a sketch, copy of relevant zoning map and/or aerial photographs of the proposed site showing the intended location of the mooring (include DGPS coordinates and datum) and the location of other moorings and fixed objects in the vicinity. You will be required to supply a mooring design certified by a marine engineer or naval architect before installation occurs. Under certain circumstances (see Mooring Policy) a schematic drawing may be accepted.
GBRMPA provides each approved mooring with a Mooring Reference Number (e.g. GM0632), which must be displayed on the mooring. Some moorings also require authorisation by Maritime Safety Queensland (MSQ) and the Department of Agriculture, Fisheries and Forestry (DAFF). Contact your nearest MSQ office for further information.
You may be required to use a mooring when accessing some locations in the Marine Parks. You will be notified of this during the application assessment.

17. Does the proposed permit holder wish to perform works, install or operate structures or facilities, discharge waste, dredge and/or conduct other types of works in the Marine Park/s?

Yes ☒ No ☐ ▸ Go to PART E

Please provide a brief description of the proposal:

Construction of a groyne wall using sand filled geo-textile bags on the northern end of Nelly Bay beach, adjacent to the Breakwater Bridge that links Yule St to the Presto Breakwater in Nelly Bay Harbour.

Information Box (Question 17)
This includes, but is not restricted to, installation of pontoons, jetties, wharfs, helipads, marinas, conduct of dredging activities, installation of discharge and intake pipes, aquaculture facilities, and revetments. If the answer to Question 17 is 'Yes', please contact the relevant Managing Agency for pre-lodgement discussions prior to lodging an application. If you wish to install moorings as part of your operation, please ensure that you have completed Question 16. Detailed information including certified engineering drawings and details of prudent and feasible alternatives will be required to complete an assessment and should be provided with this application if possible. Contact GBRMPA for more detailed information if required. If a proposal is regarded as having the potential for significant environmental impact, consideration under the *Environment Protection and Biodiversity Conservation Act 1999*, potentially including an Environmental Impact Statement or Public Environment Report, may be required.

PART E

18. Is the proposed permit holder in the process of obtaining OR does it have Eco Certification at the Ecotourism or Advanced Ecotourism level?

Yes ☐ No ☒ ▸ Go to Question 21

Information Box (Question 18)
If you are certified at the Ecotourism or Advanced Ecotourism level of the Eco Certification Program, you are eligible to apply for a 15-year permit term at no additional cost. You must supply a copy of your current Eco Certification certificate with your application. Please be aware that, to retain a 15-year permit term, you must maintain certification at all times. For more information visit www.gbrmpa.gov.au or contact GBRMPA directly.

19. Does the proposed permit holder wish to apply for a 15-year permit?

Yes ☐ No ☒ ▸ Go to Question 21

Information Box
DURATION OF PERMIT
Please note, for tourist programs, new applicants are normally granted a permit for one year, whilst existing permit holders are normally granted a permit for six years. Certified high standard operators can be granted a permit for up to 15 years.

20. Is the proposed permit holder's Eco Certification certificate attached?

Yes ☐ No ☐ ▸ Go to Question 21

21. Please indicate what best describes the proposed permit holder's primary operation by placing a 1 in one of the boxes below. You are able to place a 2 to describe a secondary role, where applicable.

Information Box (Question 21)
By letting us know what you do, GBRMPA can contact you with information on issues that are relevant to you.

Day or part day trip
☐ Diving ☐ Snorkelling and other _____
☐ Fishing

Extended/Overnight charter
☐ Diving ☐ Sailing and other _____
☐ Fishing

Other
☐ Watersports – Tours ☐ Watersports – Hire ☐ Aircraft
☐ Bareboat ☐ Super-yacht ☐ Cruise ship
☐ Pontoon ☒ Ferry/Passenger transport

PART F
Authority to act

Information Box
Where this application is made for and on behalf of a person or company, and the contact person is not a Director of the company nor the person who is applying for the permit, a written authority from the company or person authorising the contact person to act on their behalf in matters regarding Marine Parks permits be provided.

Authority to act on Company's behalf

I Craig Hough

Director of Property Management Dept of Transport & Main Roads

(~~ACN~~ ABN 39407690291) authorise

Chris Sykes (Full Name)

Advisor (Boat Harbours) (Position)

to act on behalf of Dept of Transport & Main Roads regarding:

☒ all Marine Park/s permit matters (including, but not limited to applications, permits, bookings and EMC) or;
☐ the following limited Marine Park/s permit matters (please provide details): _____

Name of Director: CRAIG HOUGH (Block Letters)

Signature not relevant Date 16/05/17

PART G
Proposed Permit Holder's Declaration: Please read the following carefully.

Privacy Notice – GBRMPA
Personal information you provide to GBRMPA in your permit application is protected by the *Privacy Act 1988* (the Privacy Act). The information provided by you will be used by GBRMPA to assess your application and to assist it to make decisions whether to grant you a relevant permission. GBRMPA may also use the personal information you provide to notify you of any subsequent matters affecting any permission granted to you, including any changes to your permission, information about management arrangements for the Great Barrier Reef Marine Park, and information about relevant policies implemented by GBRMPA. The authority to collect this information is in the *Great Barrier Reef Marine Park Act 1975* and the *Great Barrier Reef Marine Park Regulations 1983* (the Regulations).

Who do we give it to:
This joint application form may be used by both GBRMPA and the Department of National Parks, Sport and Racing (NPSR) to assess your application for a Marine Parks permit. If your application comprises an application for permission to conduct activities in a Marine Park of the State of Queensland, then identifying information collected on this form will be given to NPSR. If GBRMPA considers that the granting of the permission may restrict the reasonable use by the public of part of the Marine Park, then it may also require you to publish an advertisement containing any information about your application that GBRMPA reasonably requires.

Under the Regulations, if you are granted a permit, a copy of the permit document, which may include some identifying information such as your name and address, will be published on the Internet. GBRMPA will not otherwise disclose your personal information to any third party without your consent, unless it is required to do so by law.

More information
For more information on privacy and the Privacy Act, see the Privacy Commissioner's website at www.privacy.gov.au.

Privacy Statement – QPWS

The Department of National Parks, Sport and Racing (NPSR) is collecting the information on this form to assess your application for a Marine Parks permit and to process your enquiry, provide notices, reminders and other related administrative matters. This Information is authorised by the *Marine Parks Act 2004*, *Nature Conservation Act 1992*, *Forestry Act 1959* and *Recreation Areas Management Act 2006*. Information may be disclosed by NPSR to the Great Barrier Reef Marine Park Authority and Queensland government agencies involved in the administration of this legislation including the Department of Agriculture, Fisheries and Forestry and the Department of Environment and Heritage Protection. Information received by NPSR may also be disclosed in accordance with the *Right to Information Act 2009* and the *Evidence Act 1977*. Your personal information will only be accessed by authorised employees and will not be disclosed to any other parties unless authorised or required by law. For queries in relation to your personal information, please contact the Privacy Contact Officer, Department of Environment and Heritage Protection, PO Box 2454 Brisbane QLD 4001 or email: privacy@ehp.qld.gov.au.

Declaration under the Oaths Act 1867 - Queensland

Note: If you have not told the truth in this application, you may be liable for prosecution under the relevant Acts or Regulations.

I do solemnly and sincerely declare that:

1. The information provided in this permit application is true and correct to the best of my knowledge.
2. Where the applicant is a company, I am duly authorised by the company to sign this permit application on its behalf.

and I make this solemn declaration conscientiously believing the same to be true and by virtue of the provisions of the *Oaths Act 1867 (Qld)*.

Name (Block Letters)	Signature	Date
CHRIS SYKES	not relevant	10·5·2017

NOTE: Where this application is submitted by or on behalf of more than one person, the above declaration must be signed by all joint permit applicants. Where this application is submitted for and on behalf of a company, it must be signed in the name of the company by a person who is duly authorised by the company. The name and position of that person must be provided. If you are not a Director of the company that is making this application, you must provide an authority from the company to act on its behalf in matters regarding Marine Park/s permits.

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Nelly Bay Beach Training Wall
Preliminary Design of Structural Options

September 2016

DOCUMENT STATUS

Version	Doc type	Reviewed by	Approved by	Distributed to	Date issued
v01	Report	not relevant	not relevant	Chris Sykes TMR, and Adam King TCC	21/09/2016

PROJECT DETAILS

Project Name	Nelly Bay Beach Training Wall
Client	Department of Transport and Main Roads
Client Project Manager	Mr. Chris Sykes
Water Technology Project Manager	not relevant
Report Authors	not relevant
Job Number	4231-02
Report Number	R01
Document Name	4231-02_R01v01.docx

Cover Photo: Nelly Bay Beach: Road bridge at northern end of the beach providing access to southern breakwater. Photo taken one hour before low tide 21st December 2015.

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1. INTRODUCTION

In May 2010 Coastal Engineering Solutions Pty Ltd completed a *Shoreline Erosion Management Plan* (SEMP) for Nelly Bay Beach (CES, 2010). The SEMP recommended that future management of the eroding Nelly Bay shoreline be achieved through a strategy of Beach Nourishment. That strategy basically consists of:

- Initial Nourishment - through the placement of a sufficient volume of sand to establish sand buffers that accommodate the erosion caused by a nominated Design Event.
- Ongoing Renourishment - given that the nourished foreshore experiences long-term erosion processes, it will be necessary to recharge these erosion buffers by periodic placement of additional sand.

The implementation of this beach nourishment strategy for Nelly Bay Beach will establish and maintain natural erosion buffers along foreshore sections that are threatened by erosion over the 50-year planning period of the SEMP.

However local coastal processes are such that some of the sand placed for beach nourishment will be transported into the beach/breakwater corner at the northern-most end of Nelly Bay Beach. A condition of the Marine Parks Permit issued by the Great Barrier Reef Marine Park Authority (GBRMPA) for the operation of Nelly Bay Harbour is a requirement to maintain tidal flow under a road bridge that connects the southern harbour breakwater with the shoreline. Currently mechanical clearance of accumulated sand occurs annually to reinstate tidal flows beneath this bridge. Therefore, to be effective the recommended beach nourishment strategy needs to accommodate this requirement for tidal flow.

The SEMP therefore recommended that this be achieved by intercepting the northward moving sand by construction of a training wall alongside the southern breakwater. This will prevent sand from being transported into the "gap" between the breakwater and the shoreline; thereby facilitating tidal flow in the channel beneath the bridge.

Sand naturally accumulating against the training wall will form a stable sand "fillet" having a plan orientation determined by the seasonal wave climate on Nelly Bay Beach. The SEMP estimated that a training wall of around 70 metres length would be required to provide a stable beach planform, as well as to facilitate tidal flow beneath the adjacent bridge.

However subsequent advice was received from GBRMPA that any intrusion of this training wall into the Marine Park would not be approved by the Authority. Since the Department of Transport and Main Roads is responsible for ensuring the tidal flow beneath the bridge, the Department engaged Water Technology to investigate the required length of the training wall in more detail so as to better understand where the structure would be located in relation to the GBRMP boundary.

An *Alternative Options Analysis* was prepared (Water Technology, 2016) and reported on options to better manage the accumulation and subsequent clearance of sand from beneath the breakwater bridge at the northern end of Nelly Bay Beach. Those investigations identified that a training wall located outside of the GBRMP could contain the northern end of the sandy beach; as well as allow tidal flow beneath the bridge. This would significantly reduce any requirement for ongoing mechanical clearance of sand from beneath the bridge.

Indeed, it is possible that such a structure could mitigate the need for future sand clearance campaigns entirely.

Following this finding, the Department of Transport and Main Roads (in conjunction with Townsville City Council) commissioned Water Technology to prepare preliminary designs for two different structural options for the training wall, namely:

- A structure comprising sand-filled geotextile containers, similar to those used for the construction of training walls at the entrance to Mundy Creek at Rowes Bay in Townsville.
- A rock-armoured structure.

This report presents details as to the physical characteristics of those structural options, as well as indicative costs for their construction.

2. STRUCTURAL OPTIONS FOR THE TRAINING WALL

2.1 Location of the Structure

The Marine Parks Permit issued for the construction, maintenance and operation of Nelly Bay Harbour states in part:

> *"The Permittee must maintain water flow at Mean Low Water Mark under the breakwater bridge and around the breakwater on all sides with connection to the ocean and must ensure that such water flow is maintained continuously thereafter, ..."*[1]

This permit requirement is therefore incorporated into Clause 3.1 of the *Nelly Bay Harbour Operational Plan*.

At the northern end of Nelly Bay Beach, sand is transported northward and collects in the corner formed by the beach and the southern harbour breakwater. This tends to fill the "gap" beneath the breakwater bridge thereby inhibiting the required tidal flow at Mean Low Water Mark (MLWM). Consequently, Queensland's Department of Transport and Main Roads undertakes annual clearance of sand from this area to ensure that the required tidal flows at MLW are reinstated beneath the road bridge by 1st July of each year.

Mean Low Water Mark was chosen as the required ocean level for tidal flow beneath the bridge since it represents the landward boundary of the Great Barrier Reef Marine Park (GBRMP) as proclaimed by the Great Barrier Reef Marine Park Act 1975. The Marine Parks Permit for the Harbour states that:

> *"Mean Low Water Mark (MLWM) at Nelly Bay Harbour means the tidal plane passing through -0.696 m AHD."*[2]

The landward boundary of the GBRMP along the foreshores of Nelly Bay is therefore defined by the RL -0.696 m AHD contour. Advice has been received from the Department of Transport and Main Roads as well as Townsville City Council that GBRMPA would not approve any erosion management structure that crossed this boundary contour since it would therefore extend into the Marine Park.

In order to properly define the actual landward boundary of the Marine Park, a survey of the foreshore and adjoining intertidal flats at the northern end of Nelly Bay Beach was undertaken by Townsville City Council in August 2015. That was one of several such surveys undertaken over the years.

The position of the RL-0.7m AHD contour on the intertidal flats off the beach is shown on Figure 2-1. This is of particular relevance since it is effectively the position of the landward boundary of the Great Barrier Reef Marine Park (i.e. RL -0.696 m AHD).

When compared to previous surveys undertaken by Townsville City Council it is evident that the location of this contour has not noticeably changed in the vicinity of the proposed training wall – despite the beach immediately inshore undergoing significant changes. This implies that the boundary of the Marine Park on the intertidal reef flat does not change in this area.

[1] Clause 27 on page 6 of Marine Parks Permit No G03/2321.1. Issued on 1st June 2003 under the then Great Barrier Reef Marine Park Regulations 1983 (Commonwealth) and Marine Parks Regulations 1990 (Queensland).

[2] Definitions listed on page 3 of Marine Parks Permit No G03/2321.1. Issued on 1st June 2003 under the then Great Barrier Reef Marine Park Regulations 1983 (Commonwealth) and Marine Parks Regulations 1990 (Queensland).

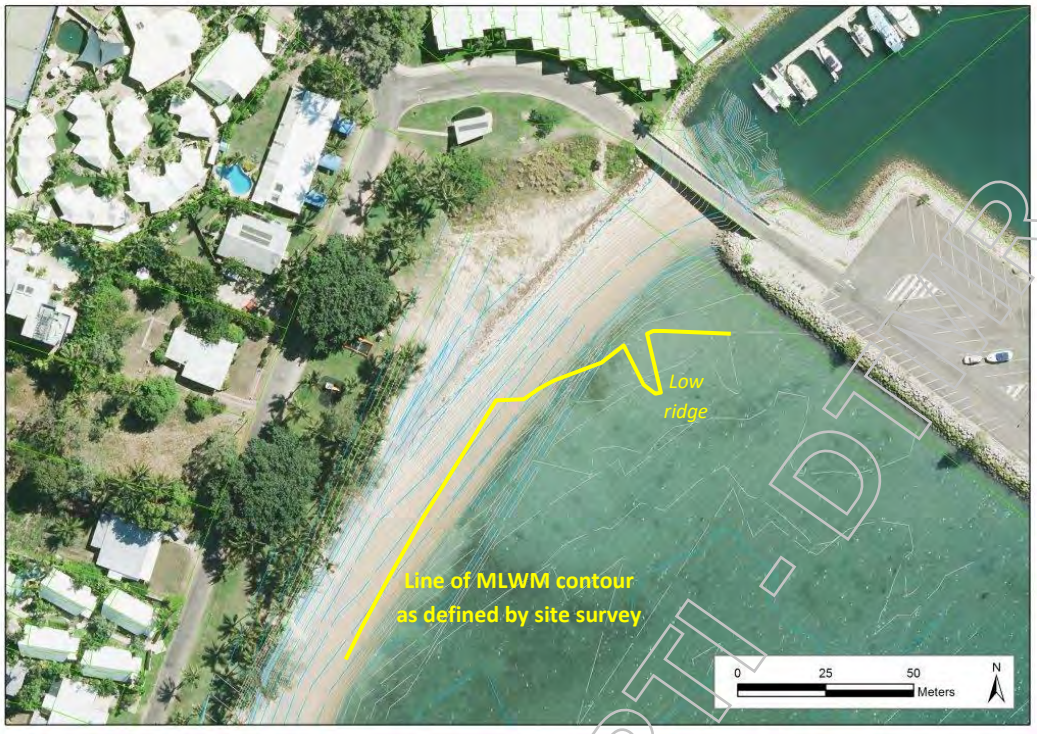

Figure 2-1 Location of MLWM (GBRMP boundary) off Nelly Bay Beach

It is pertinent to note that the survey identifies a natural low ridge feature on the intertidal reef platform that extends slightly seaward in this area. Given that the contours defining this feature are similar in several surveys undertaken over the years, it is evident that this is a natural and permanent feature of the reef platform. A visual inspection of the reef platform at low tide on 21st December 2015 confirmed this conclusion.

The crest of this ridge is above the line of MLWM, and it is therefore outside of the Great Barrier Reef Marine Park. The crest of this natural ridge is therefore a suitable location for the training wall.

2.2 Sand-filled Geotextile Containers

The structural concept of sand-filled geotextile containers as a training wall has been developed to Preliminary Design stage. The design has been prepared using the 100 year ARI storm conditions (outlined in the original SEMP document) as the Design Event. The concept utilises the Elcorock proprietary system. For the application at Nelly Bay Beach, standard Elcorock containers of 2.5 cu.m. have been adopted.

The same system has been used to successfully train the entrance to Mundy Creek at the southern end of Rowes Bay in Townsville. Figure 2-2 shows the arrangement at Mundy Creek and offers an example of what the structure at the northern end of Nelly Bay Beach would look like.

These sand-filled containers weigh around 5 tonnes each, so require specialised equipment and techniques for filling, handling and placement.

Rather than remove sand from the local beach to fill the containers, it is recommended that clean sand sourced from the existing sand-trap at the Sooning Street bridge be utilised. This is the same sand source recommended by the SEMP for beach nourishment purposes. The Preliminary Design for this structural option is shown in Appendix A on:

- Drawing No. 4231-02_D01V02_001; and
- Drawing No. 4231-02_D01V02_002.

Figure 2-2 Trial training wall at Mundy Creek, Rowes Bay

2.3 Rock-armoured Structure

The structural concept for a rock-armoured training wall has been developed to Preliminary Design stage. The design has been prepared using the 100 year ARI storm conditions (outlined in the original SEMP document) as the Design Event.

Various methods for calculating the size of rock armour under wave attack have been proposed by coastal engineers in the past few decades. The decision as to which mathematical technique is the most appropriate has been the subject of much deliberation, however most practitioners are now generally agreed that the formulae originally developed by van der Meer (1988) are the most appropriate. They are based upon an extensive series of physical model tests, which included a wide range of incident wave conditions, nearshore bathymetry, core / underlayer permeabilities, and rock characteristics. The application of these algorithms to the design of rock armoured structures is well documented in CIRIA et.al. (2007).

Consequently, the design techniques attributed to van der Meer have been applied in the development of the engineering design for the training wall at the northern end of Nelly Bay Beach. In doing so, the extent of damage that is deemed to be acceptable under the 100 year ARI design criteria has been selected as 5%. This is in keeping with widely accepted practice when designing rock armoured works.

The concept utilises two distinct armour sizes, namely:

- Primary outer armour of nominally 2 tonne rocks (allowable range 0.75tonne to 4 tonne);
- Secondary underlying armour of nominally 500kg rocks (allowable range 100kg to 750kg).

The Preliminary Design for this structural option is shown in Appendix A on:

- Drawing No. 4231-02_D01V02_003; and
- Drawing No. 4231-02_D01V02_004.

3. ESTIMATED COSTS

3.1 Sand-filled Geotextile Containers

Unit rates for the supply of 2.5cu.m. containers from Geofabrics Australasia's store in Townsville have been utilised for cost estimating purposes. Approximately 260 of such containers are required. These would be a mix of standard bags, bags having vandal-deterrent coatings and bags with scour flaps.

It is assumed that filling and placement of the containers would be undertaken by Townsville City Council labour and equipment resources. This proved to be an effective construction arrangement for the initial construction of the training walls at Mundy Creek, as well as additions subsequently made to lengthen the structures and to incorporate protection to nearby bridge abutments. However, an allowance has been made for the hire of specialised filling and handling equipment to supplement Council's expected plant and equipment deployment.

The cost estimate for this structural concept is as follows:

Item	Details	Subtotals
Mobilise/Demob	secure site, traffic management, etc.	not relevant
Procure materials	260 No. containers, ex Townsville store	
	standard	
	vandal-deterrent	
	vandal-deterrent with flap	
	Texcel foundation	
	sand to fill bags	
	transport to site	
Fill & place bags	260 No. containers	
	subtotal	not relevant
	allow contingency of 15%	
	say,	**$195,000**

3.2 Rock-armoured Structure

Advice from Townsville City Council officers is that licenses for previous quarry operations on Magnetic Island have lapsed. Due to the costs and timeframes required to revive those operations, it is very likely that it will be more cost effective to instead rely on established quarry operations in the Townsville region for supply of appropriate armour.

There is nevertheless a high degree of uncertainty regarding costs to transport armour rocks from mainland quarries to the island. Costs would depend upon the disposition of the local construction industry and tendering regime at the time of implementation. It is for this reason that an additional 25% contingency is applied to the transport of rock armour to the Nelly Bay site from the mainland. It is likely that the transfer of this rock product would be via barge, with it being transhipped via the barge ramp located on the southern breakwater inside of Nelly Bay Harbour.

Item	Details	Subtotals
Mobilise	secure site, traffic management, etc.	not relevant
Procure materials	ex quarry, primary outer armour	
	ex quarry, secondary filter armour	
	transport rock to site	
	allow 25% contingency on transport	
Place armour	primary armour	
	secondary armour	
Demobilise	clean up, replace beach sand	
	subtotal	not relevant
	allow contingency of 15%	
	say,	**$460,000**

5. REFERENCES

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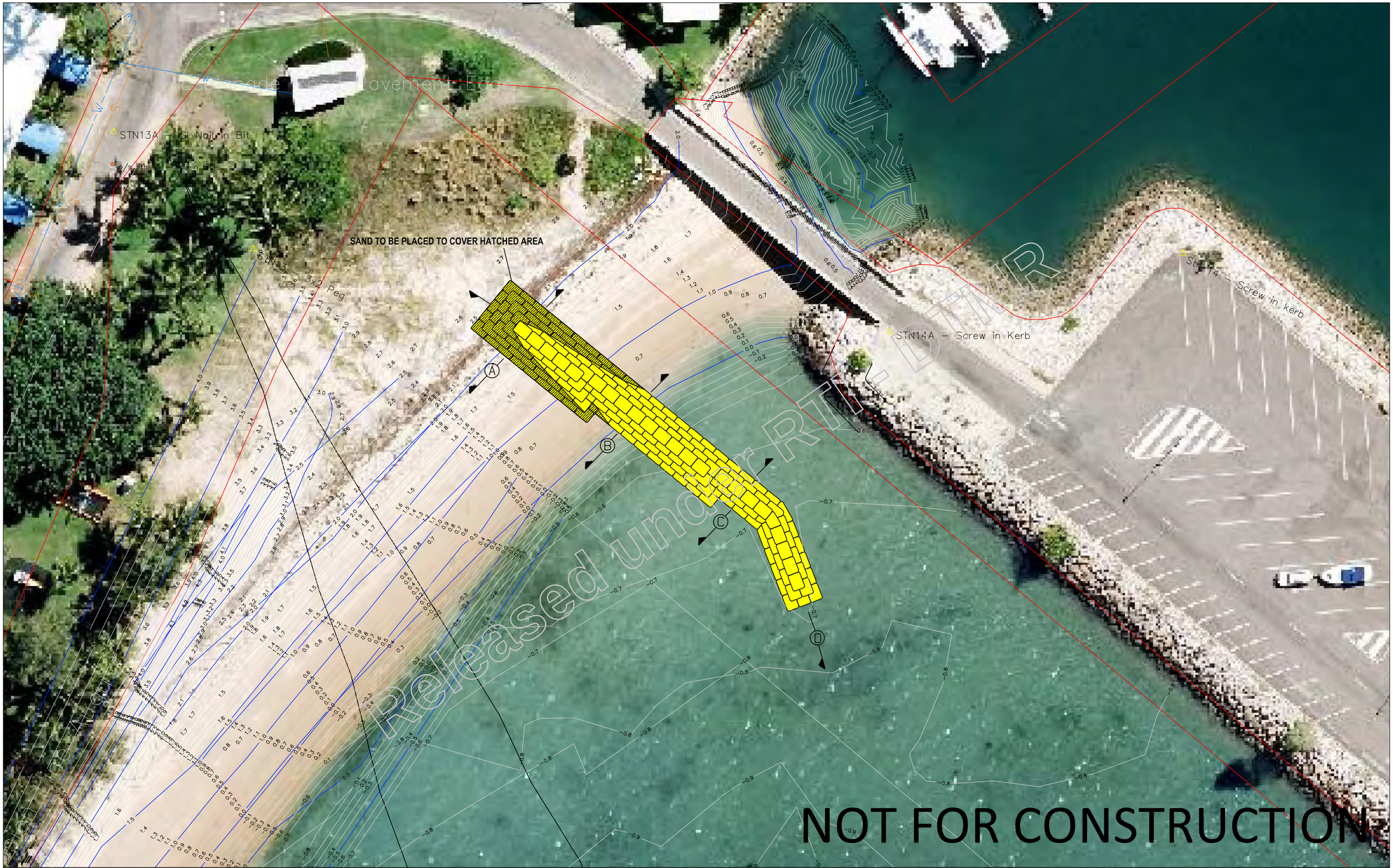
Coastal Engineering Solutions (2007). *Nelly Bay Shoreline Erosion Management Plan.* Report No. 09-0510nel-pobrp. RevB. Prepared for Townsville City Council. 18 March 2010.

Van der Meer, J.W., 1988. *Rock slopes and gravel beaches under wave attack.* Published as PhD dissertation; also Delft Hydraulics Communication No. 396.

Water Technology (2016). *Nelly Bay Alternative Options Analysis.* Document 4231-01_R01v02, dated 12February 2016. Prepared for Department of Transport and Main Roads.

APPENDIX A PRELIMINARY DESIGN DRAWINGS



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V01	ISSUED FOR COMMENTS	15/09/2016	RJD
V02	ISSUED FOR COMMENTS	22/09/2016	RJD

CLIENT:

Queensland Department of Transport and Main Roads
Townsville City Council

Queensland Government

SUPPORTED BY City of Townsville

CONSULTANT:
Water Technology Pty Ltd
ABN: 60 093 377 283
Melbourne T +61 3 8526 0800

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

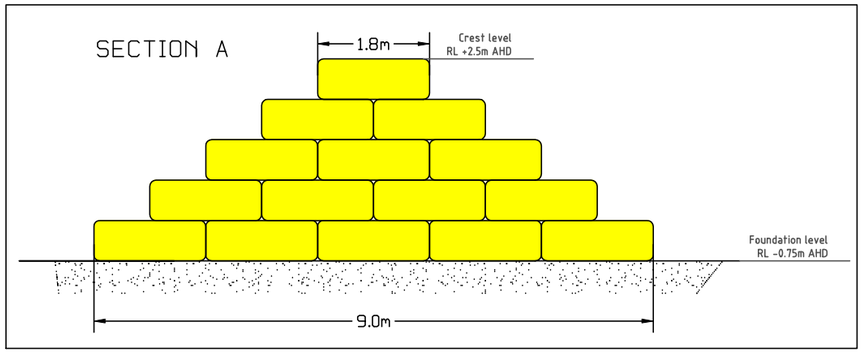
Designed	not relevant	SEPTEMBER 2016
Drawn		SEPTEMBER 2016
Checked		SEPTEMBER 2016

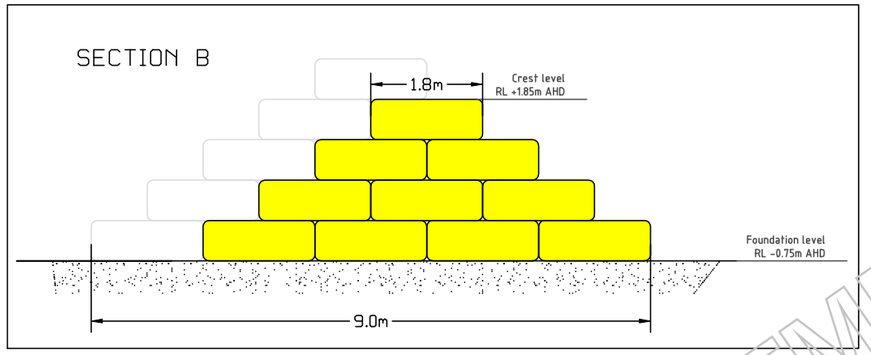
NELLY BAY BEACH

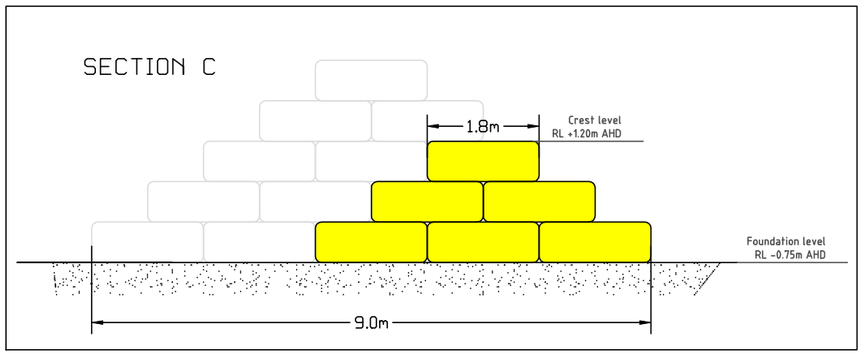
TRAINING WALL OPTIONS
GEOTEXTILE BAG WALL - FOOTPRINT

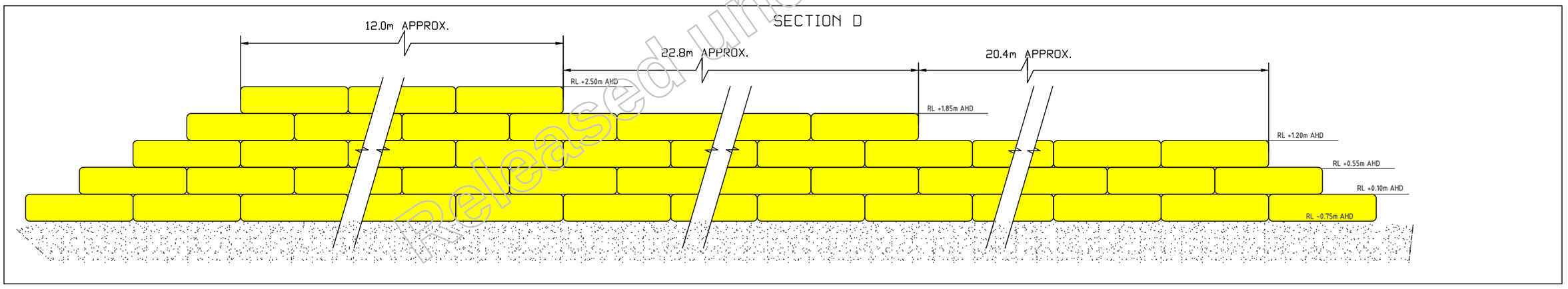
JOB NO. J4231-02
SHEET 1 of 4

Drawing No. 4231-02_D01V02_001 SCALE: 1:500
Rev No. V02
A3









NOT FOR CONSTRUCTION

REVISIONS			
REV.	DESCRIPTION	DATE	INIT.
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V02	ISSUED FOR COMMENTS	22/09/2016	RJD

CLIENT:
Queensland Department of Transport and Main Roads
Townsville City Council

Queensland Government

SUPPORTED BY City of Townsville

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WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Designed	not relevant	SEPTEMBER 2016
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Checked		SEPTEMBER 2016

NELLY BAY BEACH
TRAINING WALL OPTIONS
GEOTEXTILE BAG WALL SECTION
JOB NO. J4231-02
SHEET 2 of 4

Drawing No. 4231-02_D01V02_002 SCALE: 1:100
Rev No. V02
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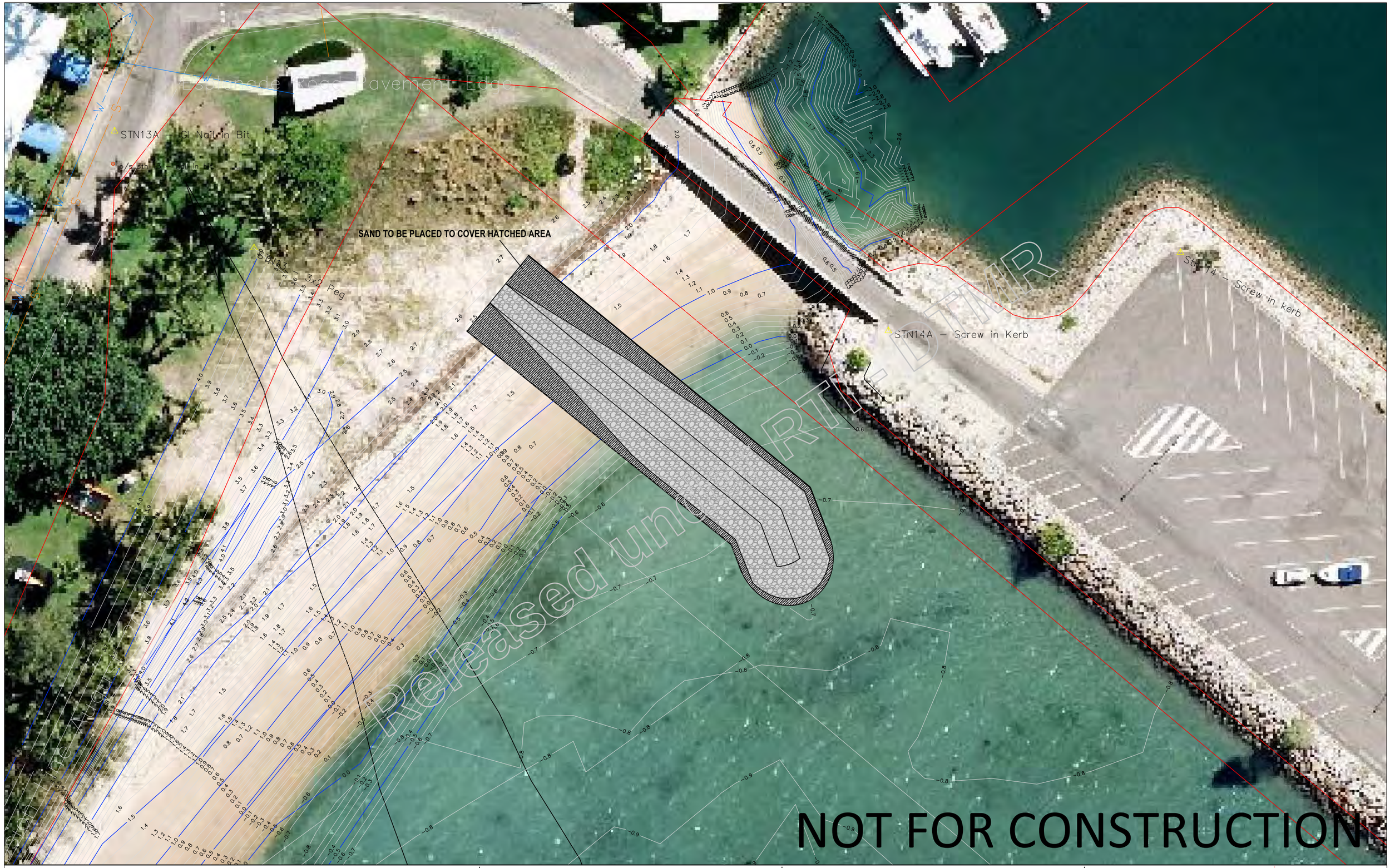

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CLIENT:

Queensland Department of Transport and Main Roads
Townsville City Council

Queensland Government

SUPPORTED BY City of Townsville

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WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

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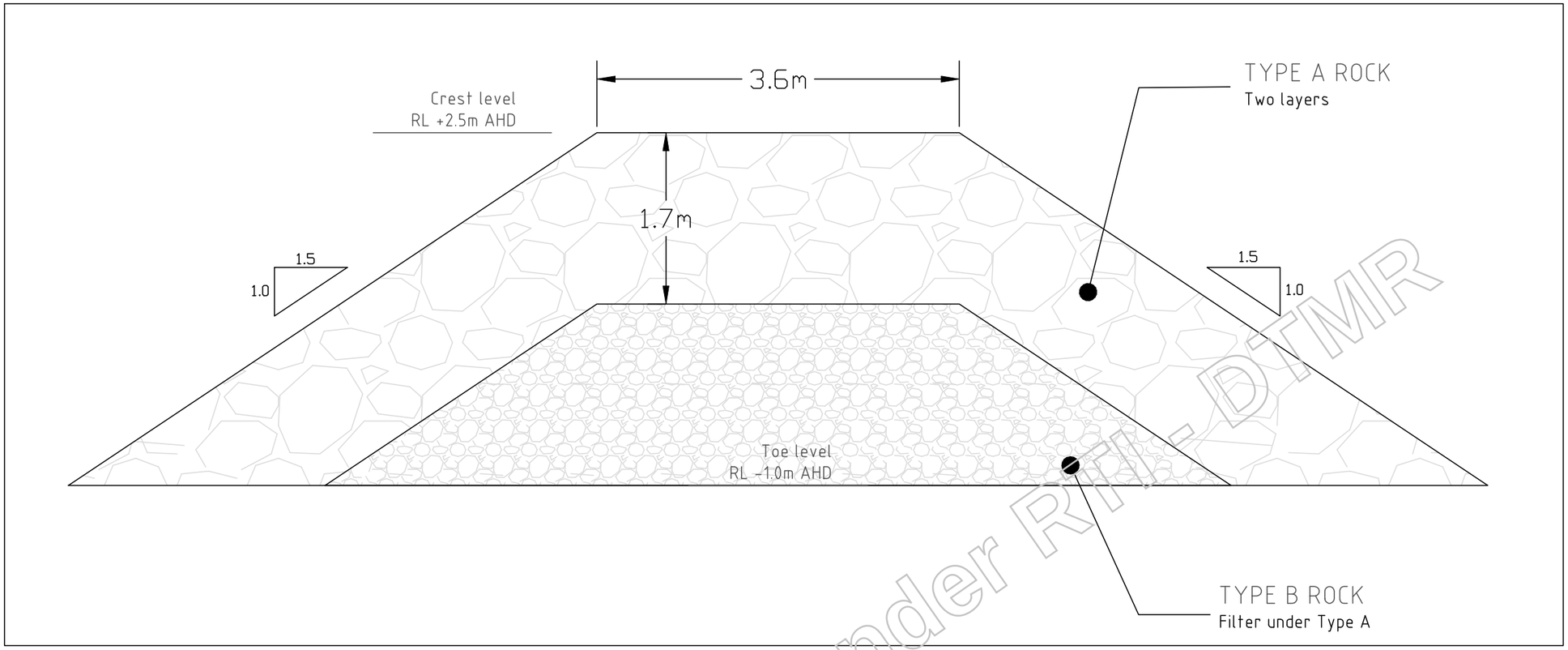
NELLY BAY BEACH
TRAINING WALL OPTIONS
ROCKWALL FOOTPRINT PLAN

JOB NO. J4231-02
SHEET 3 of 4

Drawing No. 4231-02_D01V02_003 SCALE: 1:500
Rev No. V02 A3



ROCK ARMOUR TYPES:

TYPE A - PRIMARY ARMOUR

TO BE CONFIRMED BY DETAILED DESIGN

- Notional size is 2 tonnes.
- Notional allowable range in size is 0.75 tonne to 4 tonne, 50% of rocks (by number) must be greater than 2 tonnes.
- Minimum of 2 layers placed on front slope of revetment.
- Notional thickness of primary armour is 1.7 metres.

TYPE B - FILTER ARMOUR

TO BE CONFIRMED BY DETAILED DESIGN

- Notional size is 500kg
- Allowable range in size is 100kg to 0.75 tonne, 50% of rocks (by number) must be greater than 500kg.
- Placed directly beneath Type A primary armour.

NOT FOR CONSTRUCTION

REVISIONS			
REV.	DESCRIPTION	DATE	INIT.
V01	ISSUED FOR COMMENTS	15/09/2016	RJD
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CLIENT:
Queensland Department of Transport and Main Roads
Townsville City Council

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SUPPORTED BY City of Townsville

CONSULTANT:
Water Technology Pty Ltd
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WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

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NELLY BAY BEACH
TRAINING WALL OPTIONS
ROCKWALL SECTION
JOB NO. J4231-02
SHEET 4 of 4

Drawing No. 4231-02_D01V02_004 SCALE: 1:50
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A3

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

NELLY BAY HARBOUR – INVESTIGATIONS FOR BEACH AND BREAKWATER MODIFICATIONS

FEBRUARY 2016

DOCUMENT STATUS

VERSION	DOC TYPE	REVIEWED BY	APPROVED BY	DATE ISSUED
v01	Proposal	not relevant	not relevant	24/02/2016

PROJECT DETAILS

PROJECT NAME	Nelly Bay Harbour – Investigations for Beach and Breakwater Modifications
CLIENT	Department of Transport and Main Roads
CLIENT PROJECT MANAGER	Chris Sykes
WATER TECHNOLOGY PROJECT MANAGER	not relevant
PROPOSAL AUTHORS	not relevant
PROPOSAL NUMBER	4231-98
VERSION NUMBER	P01
DOCUMENT NAME	4231-98_P01v01_Nelly_Bay_Harbour.docx_Seawall

24 February 2016

Chris Sykes
Department of Transport and Main Roads
PO Box 1089
Townsville
QLD 4810

Dear Chris,

Nelly Bay Harbour – Investigations for Beach and Breakwater Modifications.

Water Technology is pleased to provide this fee proposal in response to a request by Department of Transport and Main Roads. Our fixed fee for undertaking the design optimisation of the rock-armoured seawall for this site is not relevant

The specialised coastal engineers we have assigned to the project have the experience and skills to deliver the necessary outcomes in a timely and cost effective manner. We have a strong track record of delivering results that are of the highest quality and bring about improved and cost effective solutions that make a real difference.

We have made sure that the resources dedicated to this project have the capacity to complete this commission without delay. Outlined in this document is a project methodology which will deliver the outcomes of the investigations for beach and breakwater modifications. Water Technology prides itself on delivering what we promise, working in close partnership with our clients, delivering our services on time, and on budget.

If you have any queries regarding any aspect of our proposal whatsoever Chris, please do not hesitate to contact me on 3105 1460, or alternatively on not relevant

Yours sincerely

not relevant

not relevant

Senior Principal Engineer
not relevant @watertech.com.au
WATER TECHNOLOGY PTY LTD

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 Preamble

Water Technology is pleased to provide this proposal to undertake the professional services required to support the Department of Transport and Main Road's *Development Approval* submission regarding improvements to sand management practices on Nelly Bay Beach.

Our proposed team has extensive experience in coastal management throughout Australia and overseas. We specialise in, and are well recognised for our skills in coastal engineering – which include optimising shoreline erosion mitigation strategies and designing foreshore protection works.

Our proposal has been structured to include:

- Demonstration of the study team's appreciation of the study area and the study requirements;
- An outline of the skills of our nominated project staff;
- A description of the methodology proposed for the study; and
- A proposed fee and project schedule.

1.2 Company and Contact Details

TRADING NAME:	Water Technology Pty Ltd
ABN/ACN:	60 093 377 283
ADDRESS:	Level 3, 43 Peel Street South Brisbane, QLD, 4101
CONTACT PERSON:	not relevant
CONTACT DETAILS:	not relevant NR @watertech.com.au not relevant (07) 3105 1460 Level 3, 43 Peel Street South Brisbane, QLD, 4101

2. PROJECT APPRECIATION

The Department of Transport and Main Roads (DTMR) recently commissioned Water Technology to undertake an *Alternative Options Analysis*[1] with regard to sand management practices presently being implemented on Nelly Bay Beach on Magnetic Island. Currently mechanical clearance of accumulated sand occurs annually to reinstate tidal flows beneath the breakwater bridge at the northern end of Nelly Bay Beach. The *Alternative Options Analysis* identified ways to better manage this accumulation and subsequent clearance of sand from beneath the breakwater bridge.

The strategy of reinstating the bund that existed beneath the bridge prior to 2003 and then allowing sand to naturally accrete against this bund (and the southern harbour breakwater) was recommended by the *Alternative Options Analysis*. This would no longer require heavy earthmoving equipment to be deployed on this important and much-valued Magnetic Island foreshore to undertake annual campaigns of sand relocation.

Compared to a training wall option (as proposed by the *Shoreline Erosion Management Plan* completed in 2010), this results in less disruption to the natural coastal processes on the adjacent intertidal reef platform, as well as less disruption to natural processes currently sustaining the northern end of Nelly Bay Beach. Sand on Nelly Bay Beach would be able to adopt its naturally preferred orientation alongside the flank of the southern breakwater. Under this strategy there would also be no permanent "footprint" of a training wall on the crest of a natural low ridge on the intertidal reef platform, nor would there be complex flow patterns imposed on the intertidal reef platform.

As a consequence of these findings, DTMR wishes to implement the strategy of reinstating the bund beneath the breakwater bridge. This proposal presents our intended methodology and our fees for undertaking investigations and preliminary designs for works associated with the construction of the bund beneath the bridge and the placement of beach sand fill against this structure.

Since the bund and sand fillet will alter the way in which tidal waters naturally enter and flush the south-western corner of Nelly Bay Harbour basin, Water Technology has also been requested to provide a proposal for numerical modelling services that will identify any implications to tidal flushing of the harbour basin as a consequence of closing the "gap" beneath the breakwater bridge.

[1] "*Nelly Bay Alternative Options Analysis*". Water Technology report number 4231-01_R01v02 dated 12th February 2016.

3. PROJECT TEAM

3.1 Water Technology – Company Profile

Since 2000, Water Technology has developed a reputation for delivering technically excellent and practical based services to Australia's water, coastal and environmental sectors. From a foundation of advanced numerical modelling capability, we have developed a broad profile of specialised skills across all areas of water, coastal and environmental management. Our services cover a broad range, incorporating virtually every situation in which surface water interacts with the natural or built environment.

The expertise of our Coast and Environment Team has recently been supplemented by the joining of the specialist consulting firm Coastal Engineering Solutions with Water Technology. Our nominated Project Manager, not relevant was a Director of that specialised coastal engineering consultancy.

3.2 Team Structure

Our proposed team structure is shown below:

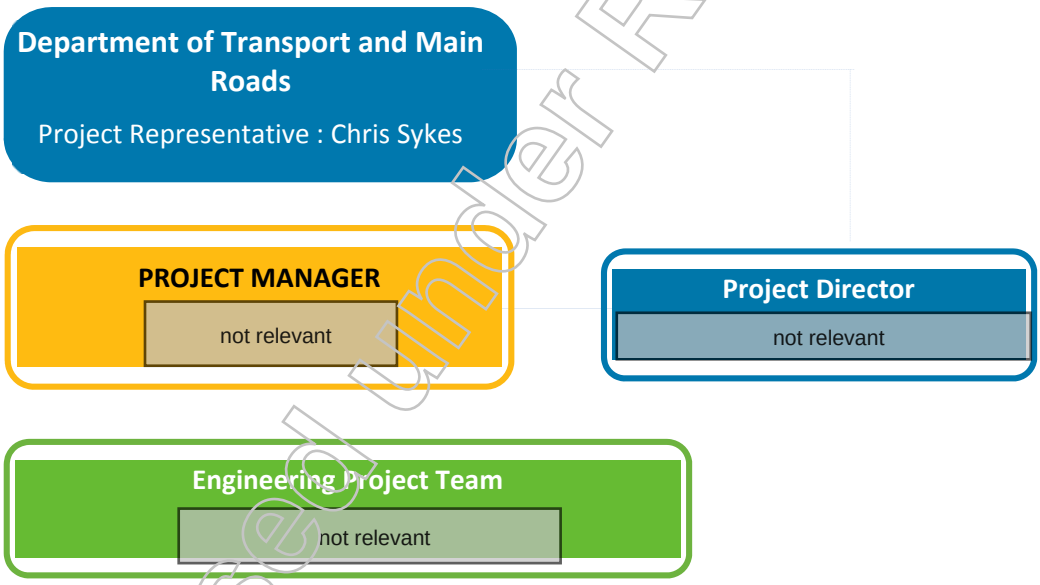

Figure 3-1 Team Structure

NR is nominated as the Project Manager for this commission and will be responsible for the day to day management of our team and for project delivery. NR recently managed our services to DTMR for the *Alternative Options Analysis*, and was the Study Manager for Coastal Engineering Solutions' preparation of the SEMP for Nelly Bay Beach in 2010. He will be the primary point of contact with DTMR throughout the course of the project.

NR will be undertaking and directing the technical work on the project, supported as required by not relevant - with review and oversight from NR here appropriate. We guarantee that the engineers we nominate will actually be those who do the work, so that DTMR can have confidence in the people who are delivering the project.

not relevant is the proposed Project Director for this study. NR will also provide technical input and will technical review the overall project. As Project Director she will engage regularly with NR to assess progress and provide support and guidance. This will provide an accountability measure for the Project Manager. NR will also act as an independent point of contact for DTMR.

3.3 Key People

not relevant **Senior Principal Engineer**

not relevant s a Senior Principal Coastal Engineer with more than 30 years' experience in the planning, design and supervision of coastal engineering projects throughout Australia, Asia and the Pacific Region.

NR has recently joined the Water Technology team and brings extensive design, construction and re-constructive experience, carrying out the design and construction management duties on a number of post cyclone recovery projects in northern Queensland. This provides an extensive understanding of the practical application of state-of-the-art techniques and systems of foreshore protection and maritime engineering design in tropical and sub-tropical regions. Since many of these applications are in coastal areas having significant environmental, cultural, social and commercial values, NR skills therefore incorporate extensive experience of developing appropriately sensitive solutions.

not relevant **Senior Principal Engineer – Project Director**

As a Civil Engineer with over 15 years of experience in river, estuary and coastal engineering, not relevant is the Senior Principal Engineer at Water Technology. NR joined Water Technology in 2008 and has worked on a range of water related projects, focusing on the analysis of river systems, estuaries and coasts. Recently NR as been involved with coastal process and vulnerability (inundation and erosion) assessments for 90 Mile Beach and the Gippsland Lakes, Western Port Bay, and Phillip Island, as well as studies of the Kolan River estuary, Snowy River estuary, the Latrobe River estuary, and Anglesea estuary.

Prior to joining the ranks of Water Technology, NR undertook a post-doctoral fellowship at the Technical University in Delft, followed by 8 years working on a selection of research and consultancy projects, ranging from bridge scour and stream instability assessment through to dam spillway design, and stormwater system studies.

not relevant **enior Engineer**

NR has 10 years' experience as a coastal engineer having worked in both Australia and overseas. NR has an Honours Degree in Environmental Engineering and a post graduate certificate in Coastal Engineering. NR completed her engineering degree thesis on sediment transport and mitigation options and dredging feasibility within Sandringham Harbour in Victoria.

NR has carried out detailed coastal processes assessments and design work for major marine projects at Wyndham Harbour, Mornington Harbour, Port Bellarine and Martha Cove. As part of the Martha Cove and Wyndham Harbour projects, NR as been involved in design of coastal structures from concept stage through to detailed design and physical testing.

NR was also the coastal engineer for the investigation and design of coastal protection at Miara Caravan Park for the Bundaberg City Council.

4. PROPOSED METHODOLOGY

4.1 Preliminary Design of Closure Bund & Sand Fill

The Department's *Development Application* submission will need to include details as to the extent, nature and form of the bund which will close the gap in the southern harbour breakwater beneath the bridge. It will also require details as to the sand fill to create the beach fillet against this bund.

Water Technology's coastal engineering team will produce the Preliminary Design for these works. We will also prepare cost estimates for the proposed bund and sand fill. The Preliminary Design will include engineering drawings showing cross sections and plans of the closure bund and beach fill.

Given that the primary purpose of the bund is to contain sand against its southern flank, appropriate armouring of its exposed side slope will be necessary. This armouring could be achieved by placing sand-filled geotextile containers (similar to that at the entrance to Mundy Creek at Rowes Bay). However at this stage we suggest that the armouring units be rocks - sourced from the quarry on Magnetic Island. The outcome would be similar to that shown in Figure 4-1 below.

Figure 4-1 Bund preventing tidal flow beneath bridge (circa 2002)

Rock armouring will provide a more robust and enduring structure than sand-filled geotextile bags. It will require careful design of the under-layers between the sand and primary armour rocks. The SEMP completed in 2010 suggested that such foreshore works could utilise some precast concrete blocks that are currently stockpiled at one of Council's Magnetic Island depots. We would investigate this option for the closure bund as part of the Preliminary Design for the works.

When preparing the Preliminary Design we would rely on details of the survey (of foreshore and nearshore areas) recently provided to us for the *Alternative Options Assessment*.

However when undertaking that earlier work, it became apparent that the supplied Townsville City Council's survey drawings incorporated the results of two separate surveys – one of the beach and nearshore intertidal areas; and the other covering the area in the vicinity of the gap beneath the breakwater bridge. These appear to have been undertaken at different times and there are inconsistencies of levels and contours at the junction of those two surveys. These would need to be resolved by Council's survey team in order for us to utilise the survey details for Preliminary Design and for setting up of our hydrodynamic and tidal flushing models.

We assume that the following survey data can be provided to us in a format suitable for our purposes, namely:

- Detailed existing bathymetry within and around the harbour – including on Nelly Bay Beach and the intertidal flats immediately offshore, provided as xyz points;
- Digital drawings of harbour development plan, with the correct spatial referencing.

4.2 Hydrodynamics & Tidal Flushing

If commissioned for the investigations, Water Technology would develop a detailed numerical hydrodynamic model of Cleveland Bay – extending from Townsville to Magnetic Island using the industry standard software package MIKEFM developed by DHI.

The model would utilise a flexible mesh modelling system which allows the detail of Nelly Bay Harbour and the nearshore environment of Nelly Bay Beach to be sufficiently resolved and modelled within the whole of the Cleveland Bay. This ensures that the entire hydrodynamic movement of waters within the harbour is resolved.

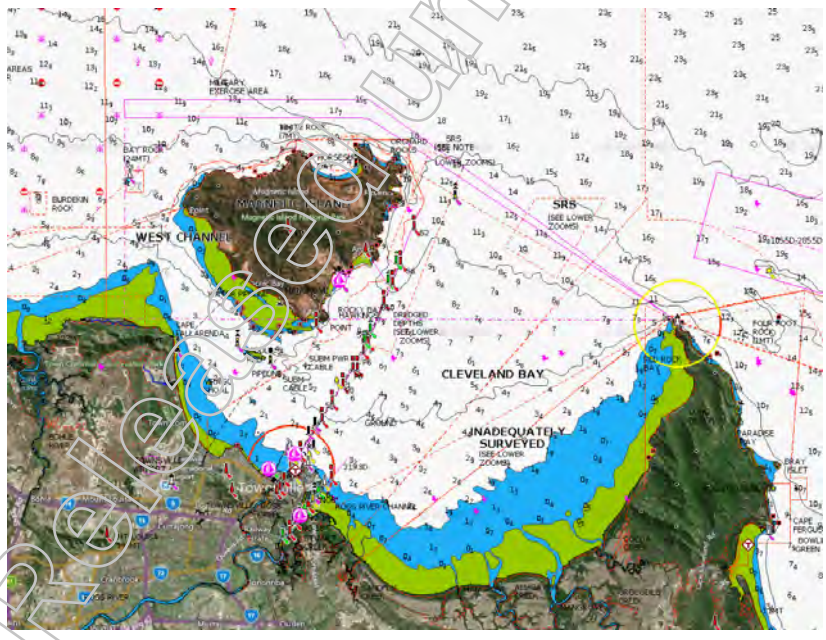

Figure 4-2 Nautical Chart Data for Cleveland Bay (Navionics)

4.2.1 Model Development

The model mesh will be developed based on available Nautical Chart data, supplemented with local bathymetric survey of the harbour and adjacent Nelly Bay areas.

Other relevant data sets used to replicate the local bathymetry include:

- Geoscience Australia Australian Waters DEM (250m grid);
- Project 3DGBR: a high-resolution depth model for the Great Barrier Reef and Coral Sea (Reef and Rainforest Research Centre, 2010).

The model mesh resolution will be scoped to ensure that the hydrodynamic processes in Cleveland Bay are adequately resolved, along with the bathymetric detail in the vicinity of the harbour.

An example of the flexible grid used for such modelling is shown below in Figure 4-3. That grid arrangement was used in recent investigations we undertook when investigating the implications to water quality of alternative breakwater openings for a harbour project in Victoria.

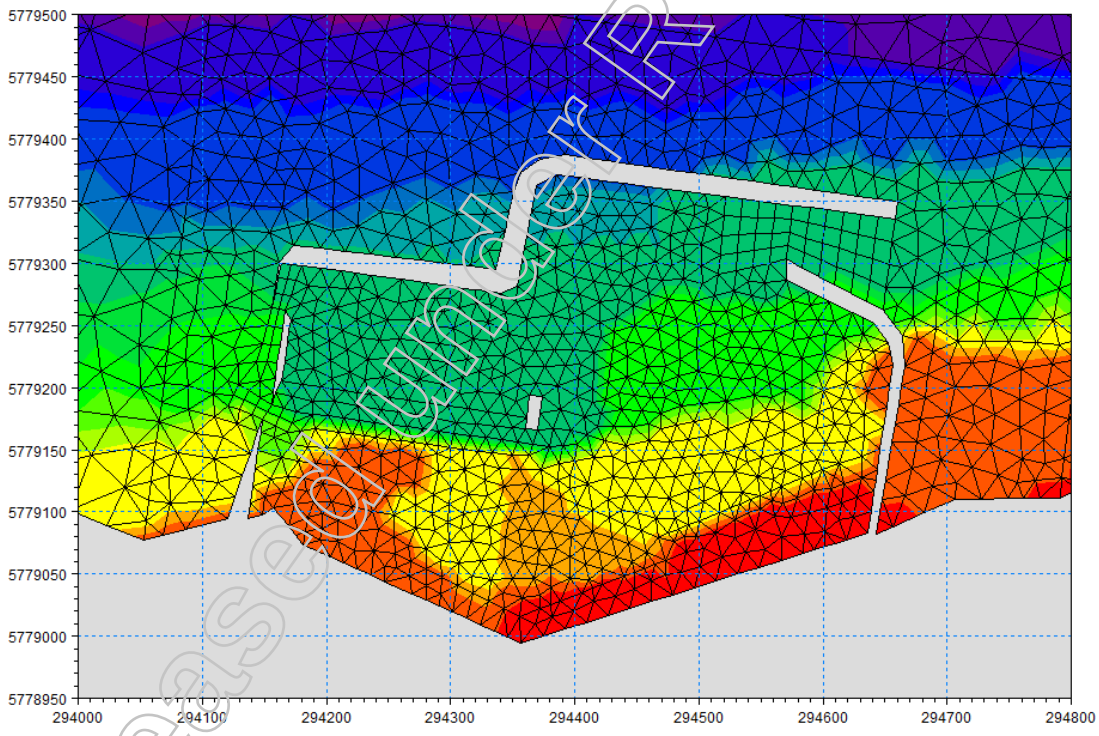

Figure 4-3 Example of model mesh of a harbour layout for an impact assessment

4.2.2 Model Calibration

The model will be calibrated to astronomical tidal conditions within Cleveland Bay. A tidal station for which data is available is located at Townville; and another slightly further away at Cape Ferguson. There are also a number of supplementary stations offshore.

4.2.3 Representative Conditions

The circulation and mixing of waters within Cleveland Bay is predominantly driven by tide-driven water level changes and surface winds. The relatively shallow waters of Cleveland Bay mean that surface winds can have a significant impact on water movement and the direction of currents along local shorelines.

To determine wind conditions representative of conditions within Cleveland Bay, the climate data recorded at a number of anemometer stations operated by the Bureau of Meteorology in the Townville region will be sourced, assessed and analysed as appropriate. Several months of representative wind conditions will be identified and then be used in the water quality and flushing modelling.

4.2.4 Existing Conditions

The representative wind conditions will be used in conjunction with predicted astronomical tides to drive water movement within the Cleveland Bay model. The results will be used to determine the existing current conditions in the vicinity of Nelly Bay Harbour and within the harbour basin itself.

To determine the existing mixing conditions within the harbour, a transport module will be coupled to the hydrodynamic model. The transport module calculates the dilution and dispersion of materials based on the flow conditions determined by the hydrodynamic modelling. For water quality within the harbour, mixing of ocean waters only will be considered. If inflows from Gustav Creek need to be considered a separate cost estimate can be provided. An example of our recent modelling of water quality from a stormwater discharge for the Wyndham Harbour EES, is shown in Figure 4-4.

The transport model will be simulated for up to 6 tide and wind condition combinations.

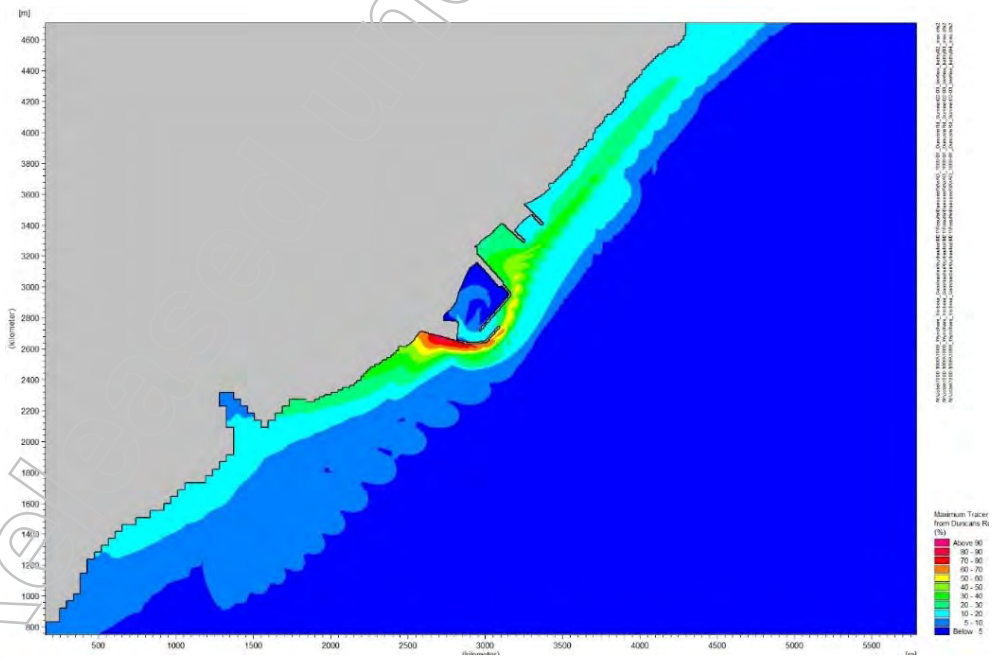

Figure 4-4 Example of Modelling the Flushing of Wyndham Harbour in Port Phillip Bay (by Water Technology, 2014)

4.2.5 Impact Assessment

To assess the impact of closing the gap beneath the breakwater bridge opposite Kelly Street, the model mesh will be modified to include this change. The existing conditions scenarios will then be re-run for the modified mesh; and a comparison between resulting hydrodynamics, mixing and residence times will then be undertaken.

Hydrodynamics

The model result with and without the breakwater bridge opening will be compared to assess the impact of the opening on the current regime - both within the harbour basin and in the surrounding waters off Nelly Bay Beach.

Residence Times

"Residence time" is a means to determine water quality and flushing within the harbour. Residence time can be used to assess pollution spills, poor water quality due to surface runoff entering the harbour, or the mixing of water outside of the harbour with that within it. To determine the residence time, the harbour basin represented within the model will be filled with a model tracer representing a pollutant source. The time taken for this pollutant to disperse, as well as the extent of pollutant dispersion and dilution will be established for the representative conditions. This will be modelled for both scenarios - with and without the breakwater bridge opening.

An example of this type of residence time modelling, and the comparisons we made of different breakwater opening arrangements is illustrated below in Figure 4-5 for the Portarlington project in Victoria.

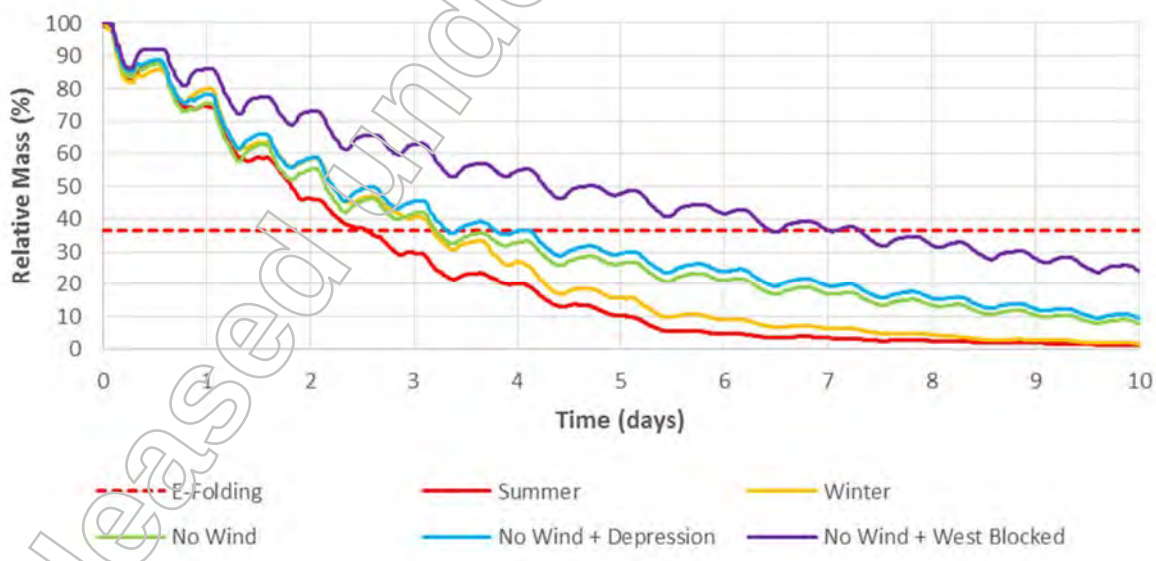

Figure 4-5 Example - Comparison of Flushing Times in Portarlington Harbour for Various Breakwater Scenarios

5. PROJECT FEES AND TIMING

5.1 Project Fees

Water Technology proposes a lump sum fee for the work. The lump sum fee for the services outlined in our preceding discussion of methodology is not relevant A breakdown of this fee is shown below in Table 1.

We believe this represents excellent value for money given the high level of experience and skill of the study team members, and the required deliverables of the study.

Table 1: Project Fee Structure

ITEM	DESCRIPTION	LUMP SUM FEE EX. GST
1	Preliminary Design of Closure Bund & Sand Fill	$ not relevant
2	Modelling of Hydrodynamics and Tidal Flushing	$
	Total (excluding GST)	**$**

In the event of a variation to our nominated services, Table 2 below outlines Water Technology's standard rates for our nominated project staff.

Table 2: Rates for senior staff

TEAM MEMBER	COST (EX. GST)
not relevant	not relevant

The following assumptions have been made when preparing the fees to undertake activities nominated in our methodology:

- All survey information relating to Nelly Bay Beach, the adjacent intertidal reef platform, the gap beneath the breakwater bridge and Nelly Bay Harbour basin will be provided digitally to Water Technology free of charge and appropriately geo-referenced with xyz coordinates.
- The Preliminary Design nominated within our scope does not include detailed structural or geotechnical design components. It is envisaged that further design services will be required to bring the Preliminary Design to a Final Design standard suitable for tendering and/or construction. Such extra design activities will involve establishing the set-out details for the works, as well as a Technical Specification for the supply and placement of rocks and sand.

- No site visit has been allowed for by Water Technology staff; since the site visit in late December 2015 by our Project Manager for the *Alternative Options Assessment* is sufficient to inform our nominated scope of work.
- We have not allowed for any meetings in Townsville with DTMR, Council, or the Great Barrier Reef Marine Park Authority in our services. Should such meetings be required, we suggest these be undertaken as variations to the scope of services outlined herein at the rates nominated above in Table 2. Expenses incurred as part of any variations will be at cost plus 10%. Vehicular travel will be charged at $0.85/km (ex GST).
- One revision of the Draft Report has been allowed for in our fees. Further revisions of the report will be charged at either a rates basis or by a lump sum fee to be negotiated.
- The Preliminary Design drawings and Final Report presenting outcomes of our numerical modelling will be provided as electronic copies.

5.2 Project Timing

As shown below in Table 3, we anticipate that we would complete the scope of services for the Preliminary Design and for modelling of hydrodynamics and tidal flushing within 10 weeks of being commissioned and receiving survey information.

Table 3: Project Timing – shown in weeks

ITEM	DESCRIPTION	1	2	3	4	5	6	7	8	9	10
1	Preliminary Design of Closure Bund and Sand Fill										
2	Modelling of Hydrodynamics and Tidal Flushing										

5.3 Project's Contract Terms

We propose that our services be provided under the terms set out in the following standard ACEA contract conditions. It would form an integral part of any agreement/ contract for Water Technology to provide our nominated services to DTMR.

Page 16 redacted for the following reason:
- - - - - - - - - - - - - - - - - - - -
not relevant - unsigned contact - Water Techn

NELLY BAY BEACH - GEOTEXTILE CONTAINER TRAINING WALL

	DRAWING NUMBER	DRAWING TITLE
·	5208-01_D02V01_001	Cover Page
·	5208-01_D02V01_002	Survey Layout
·	5208-01_D02V01_003	Setout Detail
·	5208-01_D02V01_004	Training Wall Section Detail
·	5208-01_D02V01_005	Training Wall Layer Detail
·	5208-01_D02V01_006	Sand Nourishment Detail

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CLIENT:
Queensland Department of Transport and Main Roads

Queensland Government

CONSULTANT:
Water Technology Pty Ltd
ABN: 60 093 377 283
Brisbane T +61 7 3105 1460

WATER TECHNOLOGY

Designed	not relevant	MARCH 2018
Drawn		MARCH 2018
Checked		MARCH 2018

NELLY BAY BEACH
GEOTEXTILE CONTAINER TRAINING WALL
COVER PAGE
JOB NO. J5208-01
SHEET 1 of 6

Drawing No. 5208-01_D02V01_001 SCALE: N/A
Rev No. V01
A3

NOTE
1. This drawing and layout is based on the survey undertaken by Townsville City Council in August 2015 and reported on "August 2015 Nelly Bay X-Sections contours."
2. Beach and foreshore levels shown are approximate only and represent those determined by survey in August 2015. Such levels vary on the Nelly Bay Beach foreshore in response to seasonal weather and wave conditions.

△STN13 – 3x2 Peg

△STN14 – Screw in kerb

△STN14A – Screw in Kerb

Erosion Line August 2015

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NELLY BAY BEACH
GEOTEXTILE CONTAINER TRAINING WALL
SURVEY LAYOUT
JOB NO. J5208-01
SHEET 2 of 6

Drawing No. 5208-01_D02V01_002 SCALE: 1:500
Rev No. V01 A3

DESIGN SETOUT LINE TABLE - SOL A (TRAINING WALL)

	CHAINAGE (metres)	SOP COORDINATES (metres)	
SOP No.	along SOL	EASTING	NORTHING
01	0.0	484 315.0	7 881 425.7
02	50.4	484 354.0	7 881 393.8

DESIGN SETOUT LINE TABLE - SOL B (BEACH NOURISHMENT)

	CHAINAGE (metres)	SOP COORDINATES (metres)	
SOP No.	along SOL	EASTING	NORTHING
03	0.0	484 351.9	7 881 392.1
04	89.6	484 282.6	7 881 335.2

NOTE

GEOTEXTILE CONTAINERS

1. Geotextile containers are to be ELCOROCK or equivalent manufactured of Composite ER250V ELCOROCK Containers (appropriately treated to be vandal deterrent) and standard ER250 ELCOROCK Container. The different container types are to be located as shown on drawing 5208-01_D02V01_005.
2. All containers are to be 2.5 cu. m size. Drawings have been prepared on the basis that the filled dimensions of containers are 2.4m long x 1.8m wide x 0.65m deep, weighing approximately 4.5 tonnes.
3. The natural sand surface on which the structure is to be levelled immediately prior to container placement; and cleared of all rocks, debris or other such foreign content that may cause puncture or settlement of individual containers.
4. The placement of individual containers in the structure is to be such that all the seams that have been sewn to close the container are not exposed on the outer surface of the training wall structure.
5. Sand used to fill all containers is to be sourced solely from Gustav Creek at the Sooning Street sedimentation basin, as part of the sedimentation basin clearing process. Locations for all sand extraction and container filling activities will be directed by the Superintendent.
6. Sand used to fill all comtainers is to be clean and completely free of any clays, large particles, organic matter or other such material.
7. The construction of the training wall is to be immediately followed by beach nourishment activities that will result in the rapid construction of the adjoining fillet. Any delay in the completion of beach nourishment can result in adverse erosion of nearby foreshores.
8. The supply, storage, filling, handling, placement and repairs of geotextile containers are at all times to be in accordance with the manufacturer's recommendations.
9. The bend in the training wall is to be achieved by sewing and removing one corner of the geotextile bag to achieve the desired bag angle.

BEACH NOURISHMENT

10. Sand placed to create the beach fillet alongside the training wall is to be sourced from Gustav Creek at the Sooning Street sedimentation basin.
11. Sand excavated from the beach above the founding level of the new training wall (to facilitate construction of the wall) must be used as beach nourishment, not to fill the geotextile containers.
12. Sand that has been excavated and subsequently placed as fill for beach nourishment shall be clean, naturally-occurring marine sand. All contaminents and foreign materials such as rocks or rock fragments, brush, sticks, trash and other debris shall be removed prior to its placement in the beach fillet.
13. The line defining the seaward edge of the beach slope (ie setout line B) shall be within 0.5 metres of its indicated plan position.
14. The crest level of the beach shall not be below that shown on these drawings, nor greater than 0.5 metres above. The slope of the initially constructed beach shall not vary by more than 1.0 units horizontally from the specified grade.

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Queensland Department of Transport and Main Roads

Queensland Government

CONSULTANT:
Water Technology Pty Ltd
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Brisbane T +61 7 3105 1460

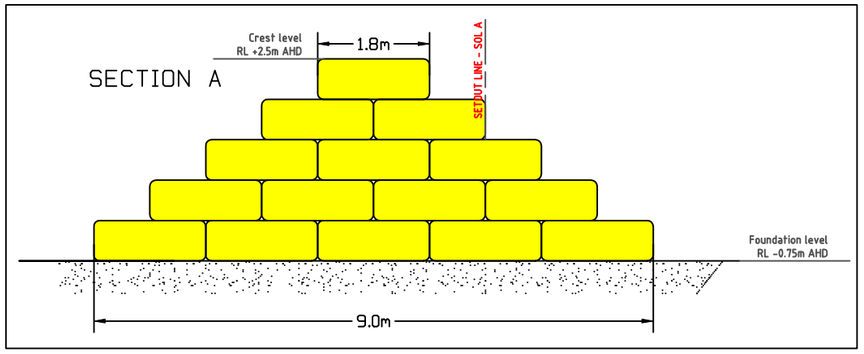
WATER TECHNOLOGY

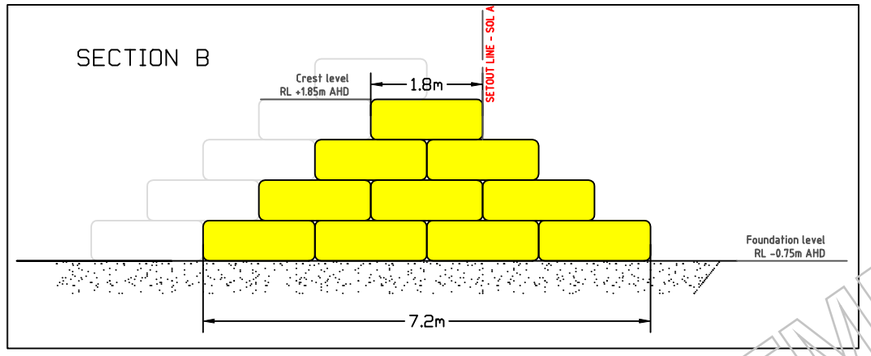
Designed	not relevant	MARCH 2018
Drawn		MARCH 2018
Checked		MARCH 2018

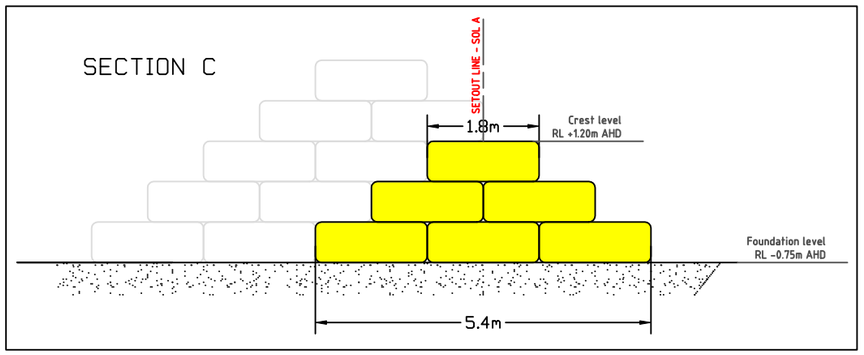
NELLY BAY BEACH
GEOTEXTILE CONTAINER TRAINING WALL
SETOUT DETAIL - OPTION B

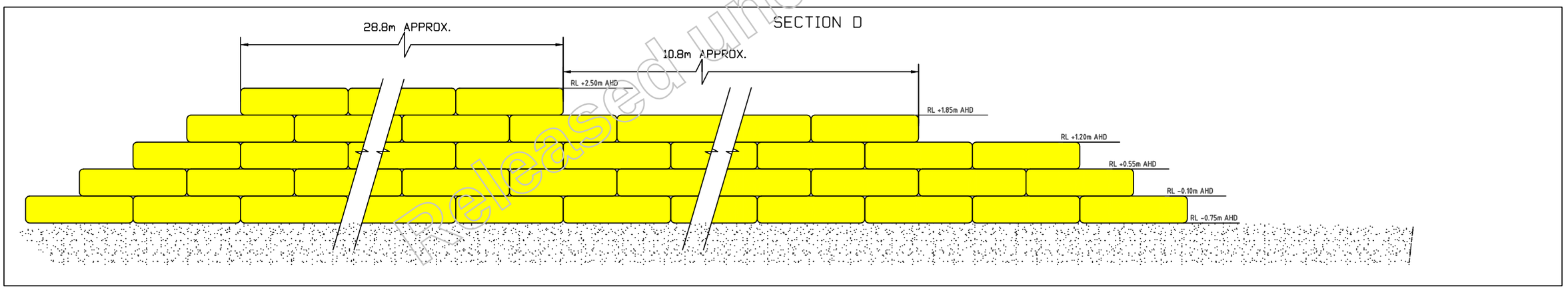
JOB NO. J5208-01
SHEET 3 of 6

Drawing No. 5208-01_D02V01_003 SCALE: 1:500
Rev No. V01
A3









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CONSULTANT:
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ABN: 60 093 377 283
Brisbane T +61 7 3105 1460

WATER TECHNOLOGY

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Drawn		MARCH 2018
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NELLY BAY BEACH
GEOTEXTILE CONTAINER TRAINING WALL
TRAINING WALL SECTION DETAIL
JOB NO. J5208-01
SHEET 4 of 6

Drawing No. 4231-02_D02V01_004 SCALE: 1:100
Rev No. V01
A3

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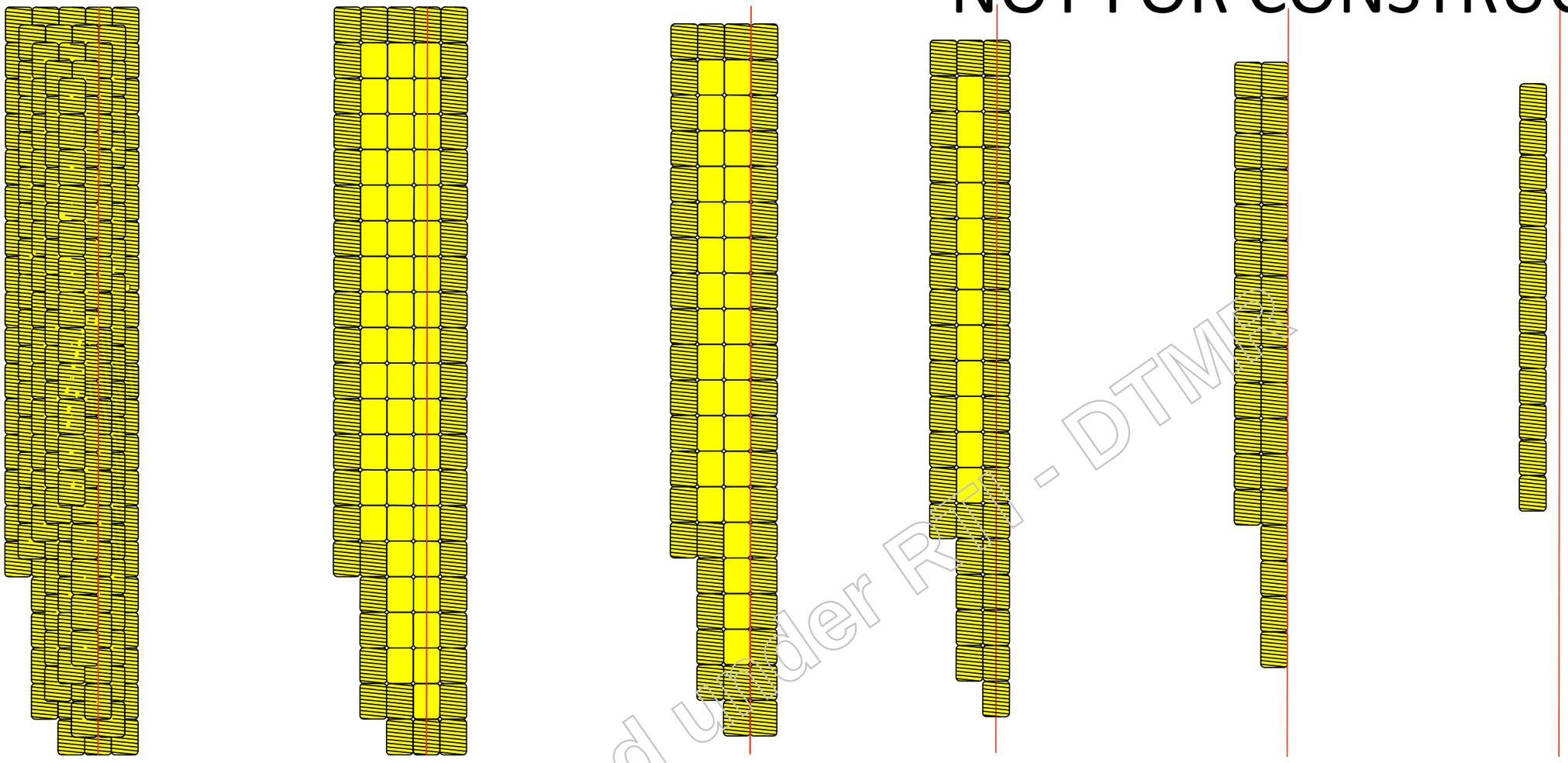

TOTALS FOR TRAINING WALL
173 No. Vandal Deterrent Containers PLUS 93 No. Standard Containers.

266 CONTAINERS IN TOTAL.

TOTALS FOR TRAINING WALL BOTTOM LAYER
48 No. Vandal Deterrent Containers PLUS 51 No. Standard Containers.

99 CONTAINERS IN TOTAL.

TOTALS FOR TRAINING WALL SECOND LAYER
44 No. Vandal Deterrent Containers PLUS 30 No. Standard Containers.

74 CONTAINERS IN TOTAL

TOTALS FOR TRAINING WALL THIRD LAYER
39 No. Vandal Deterrent Containers PLUS 12 No. Standard Containers.

51 CONTAINERS IN TOTAL.

TOTALS FOR TRAINING WALL FOURTH LAYER
30 No. Vandal Deterrent Containers.

30 CONTAINERS IN TOTAL.

TOTALS FOR TRAINING WALL TOP LAYER
12 No. Vandal Deterrent Container.

12 CONTAINERS IN TOTAL.

LEGEND
- STANDAR D CONTAINER
- VANDAL DETERRENT CONTAINER

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Queensland Government

CONSULTANT:
Water Technology Pty Ltd
ABN: 60 093 377 283
Brisbane T +61 7 3105 1460

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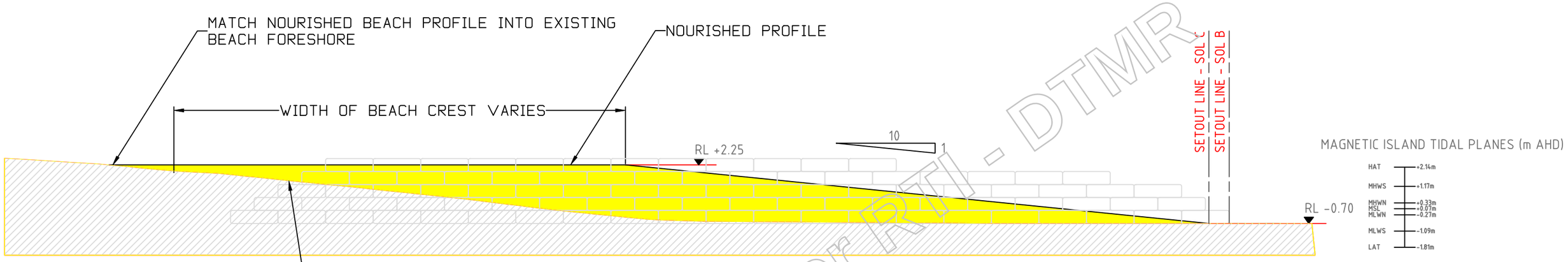
Drawn		MARCH 2018
Checked		MARCH 2018

NELLY BAY BEACH
GEOTEXTILE CONTAINER TRAINING WALL
TRAINING WALL LAYER DETAIL

JOB NO. J5208-01
SHEET 5 of 6

Drawing No. 5208-01_D02V01_005 SCALE: 1:325
Rev No. V01
A3



SECTION E

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REVISIONS			
REV.	DESCRIPTION	DATE	INIT.
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Queensland Department of Transport and Main Roads
Townsville City Council

Queensland Government

SUPPORTED BY City of Townsville

CONSULTANT:
Water Technology Pty Ltd
ABN: 60 093 377 283
Brisbane T +61 7 3105 1460

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Designed	not relevant	MARCH 2018
Drawn		MARCH 2018
Checked		MARCH 2018

NELLY BAY BEACH
GEOTEXTILE CONTAINER TRAINING WALL
SAND NOURISHMENT DETAIL
JOB NO. J5208-01
SHEET 6 of 6

Drawing No. 5208-01_D02V01_006 SCALE: 1:200
Rev No. V01
A3

NELLY BAY BEACH - GEOTEXTILE CONTAINER TRAINING WALL

	DRAWING NUMBER	DRAWING TITLE
·	5208-01_D01V01_001	Cover Page
·	5208-01_D01V01_002	Survey Layout
·	5208-01_D01V01_003	Setout Detail
·	5208-01_D01V01_004	Training Wall Section Detail
·	5208-01_D01V01_005	Training Wall Layer Detail
·	5208-01_D01V01_006	Angled Geotextile Container Detail
·	5208-01_D01V01_007	Sand Nourishment Detail

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REVISIONS			
REV.	DESCRIPTION	DATE	INIT.
01	INITIAL RELEASE	22/06/2017	POB

CLIENT:
Queensland Department of Transport and Main Roads

Queensland Government

CONSULTANT:
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WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Designed	not relevant	JUNE 2017
Drawn		JUNE 2017
Checked		JUNE 2017

NELLY BAY BEACH
GEOTEXTILE CONTAINER TRAINING WALL
COVER PAGE
JOB NO. J5208-01
SHEET 1 of 7

Drawing No. 5208-01_D01V01_001 SCALE: N/A
Rev No. V01
A3

NOTE

1. This drawing and layout is based on the survey undertaken by Townsville City Council in August 2015 and reported on "August 2015 Nelly Bay X-Sections contours."
2. Beach and foreshore levels shown are approximate only and represent those determined by survey in August 2015. Such levels vary on the Nelly Bay Beach foreshore in response to seasonal weather and wave conditions.

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01	INITIAL RELEASE	22/06/2017	POB

CLIENT:
Queensland Department of Transport and Main Roads

Queensland Government

CONSULTANT:
Water Technology Pty Ltd
ABN: 60 093 377 283
Brisbane T +61 7 3105 1460

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NELLY BAY BEACH
GEOTEXTILE CONTAINER TRAINING WALL
SURVEY LAYOUT

JOB NO. J5208-01
SHEET 2 of 7

Drawing No. 5208-01_D01V01_002 SCALE: 1:500
Rev No. V01 A3

DESIGN SETOUT LINE TABLE - SOL A (TRAINING WALL)

	CHAINAGE (metres)	SOP COORDINATES (metres)	
SOP No.	along SOL	EASTING	NORTHING
01	0.000	484 315.0	7 881 425.7
02	50.9	484 354.4	7 881 393.5
03	64.4	484 359.3	7 881 380.9

DESIGN SETOUT LINE TABLE - SOL B (BEACH NOURISHMENT)

	CHAINAGE (metres)	SOP COORDINATES (metres)	
SOP No.	along SOL	EASTING	NORTHING
04	0.0	484 357.0	7 881 386.2
05	90.1	484 282.6	7 881 335.2

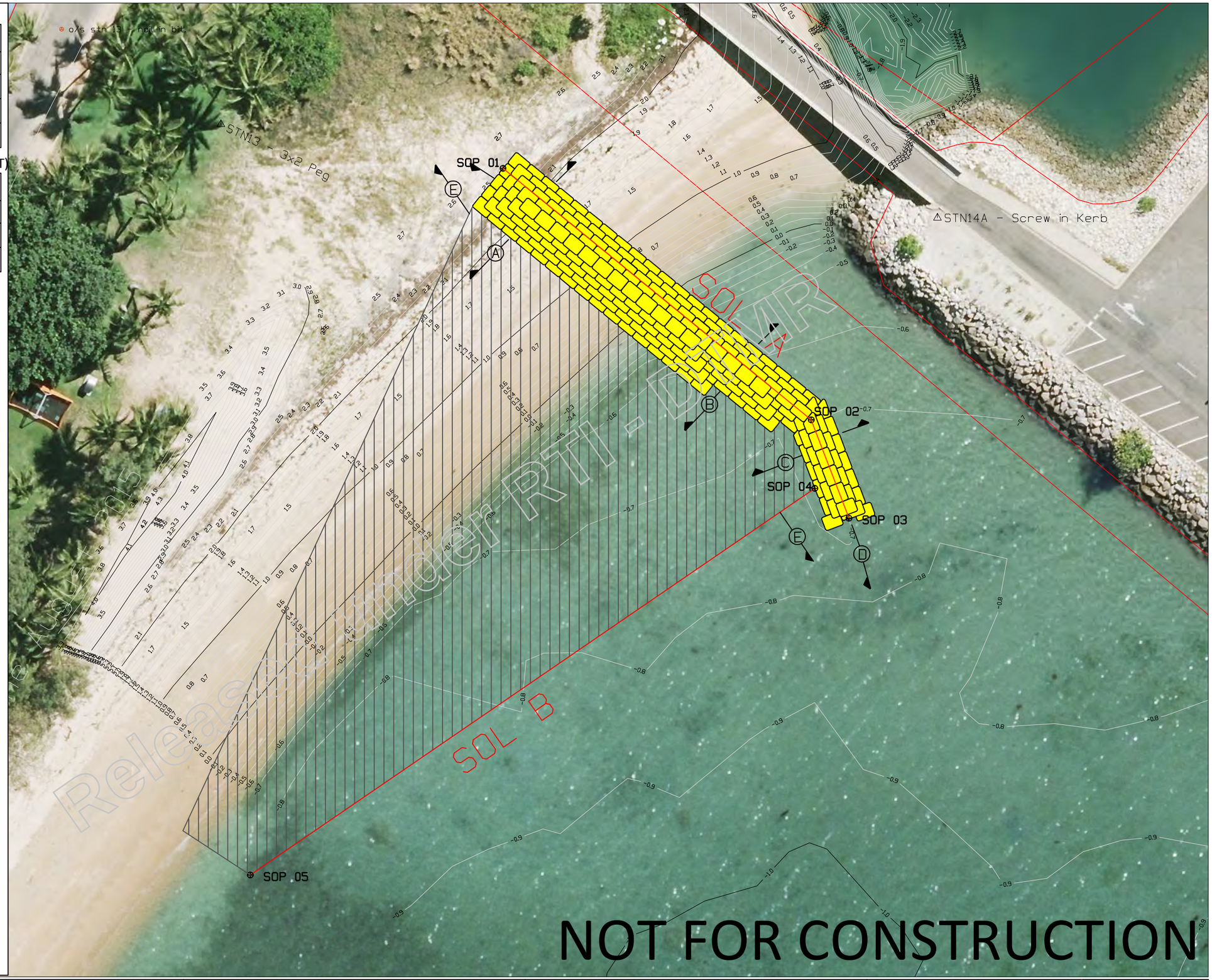
NOTE

GEOTEXTILE CONTAINERS

1. Geotextile containers are to be ELCOROCK or equivalent manufactured of Composite ER250V ELCOROCK Containers (appropriately treated to be vandal deterrent) and standard ER250 ELCOROCK Container. The different container types are to be located as shown on drawing 5208-01_D01V01_005.
2. All containers are to be 2.5 cu. m size. Drawings have been prepared on the basis that the filled dimensions of containers are 2.4m long x 1.8m wide x 0.65m deep, weighing approximately 4.5 tonnes.
3. The natural sand surface on which the structure is to be levelled immediately prior to container placement; and cleared of all rocks, debris or other such foreign content that may cause puncture or settlement of individual containers.
4. The placement of individual containers in the structure is to be such that all the seams that have been sewn to close the container are not exposed on the outer surface of the training wall structure.
5. Sand used to fill all containers is to be sourced solely from Gustav Creek at the Sooning Street sedimentation basin, as part of the sedimentation basin clearing process. Locations for all sand extraction and container filling activities will be directed by the Superintendent.
6. Sand used to fill all comtainers is to be clean and completely free of any clays, large particles, organic matter or other such material.
7. The construction of the training wall is to be immediately followed by beach nourishment activities that will result in the rapid construction of the adjoining fillet. Any delay in the completion of beach nourishment can result in adverse erosion of nearby foreshores.
8. The supply, storage, filling, handling, placement and repairs of geotextile containers are at all times to be in accordance with the manufacturer's recommendations.
9. The bend in the training wall is to be achieved by sewing and removing one corner of the geotextile bag to achieve the desired bag angle.

BEACH NOURISHMENT

10. Sand placed to create the beach fillet alongside the training wall is to be sourced from Gustav Creek at the Sooning Street sedimentation basin.
11. Sand excavated from the beach above the founding level of the new training wall (to facilitate construction of the wall) must be used as beach nourishment, not to fill the geotextile containers.
12. Sand that has been excavated and subsequently placed as fill for beach nourishment shall be clean, naturally-occurring marine sand. All contaminents and foreign materials such as rocks or rock fragments, brush, sticks, trash and other debris shall be removed prior to its placement in the beach fillet.
13. The line defining the seaward edge of the beach slope (ie setout line B) shall be within 0.5 metres of its indicated plan position.
14. The crest level of the beach shall not be below that shown on these drawings, nor greater than 0.5 metres above. The slope of the initially constructed beach shall not vary by more than 1.0 units horizontally from the specified grade.



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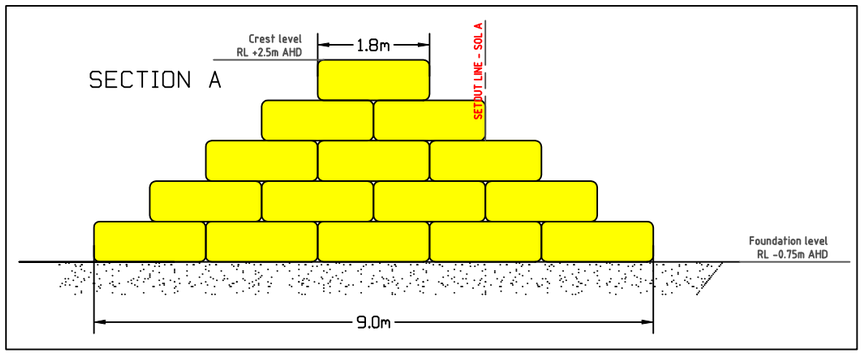
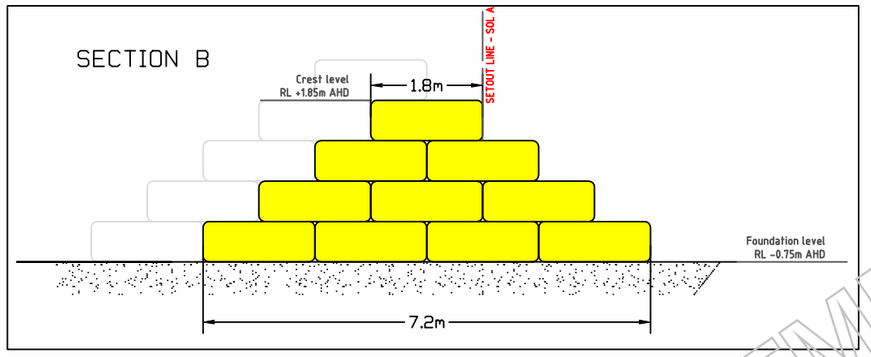
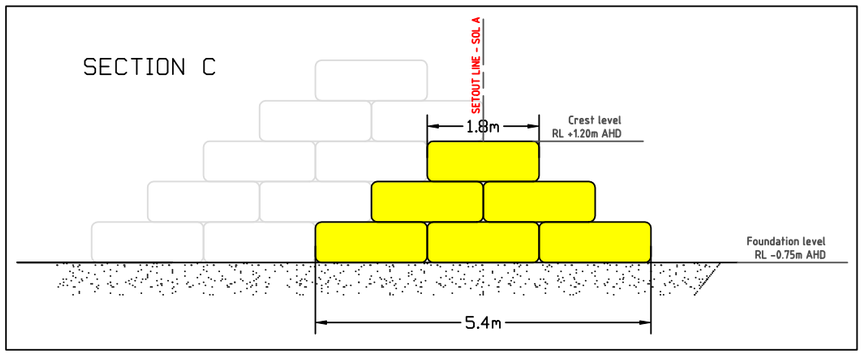
NELLY BAY BEACH
GEOTEXTILE CONTAINER TRAINING WALL
SETOUT DETAIL

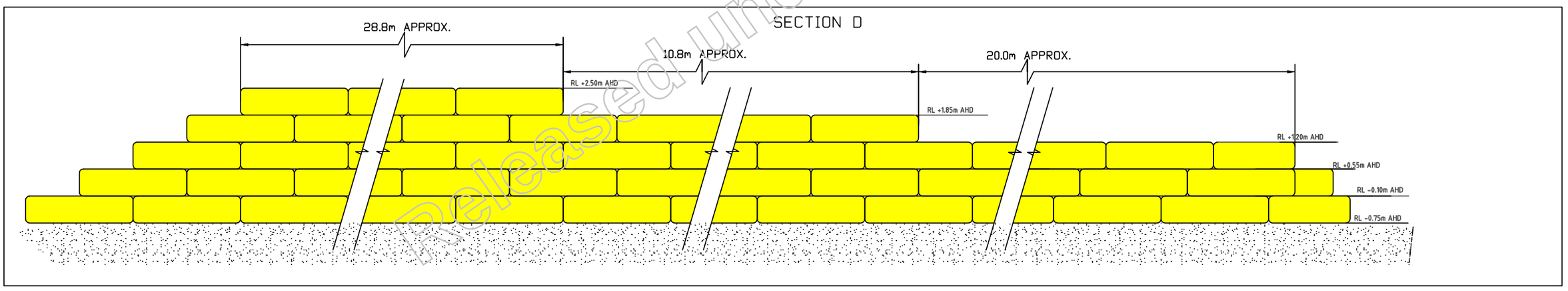
JOB NO. J5208-01
SHEET 3 of 7

Drawing No. 5208-01_D01V01_003 SCALE: 1:500
Rev No. V01 A3









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NELLY BAY BEACH
GEOTEXTILE CONTAINER TRAINING WALL
TRAINING WALL SECTION DETAIL
JOB NO. J5208-01
SHEET 4 of 7

Drawing No. 4231-02_D01V01_004 SCALE: 1:100
Rev No. V01
A3

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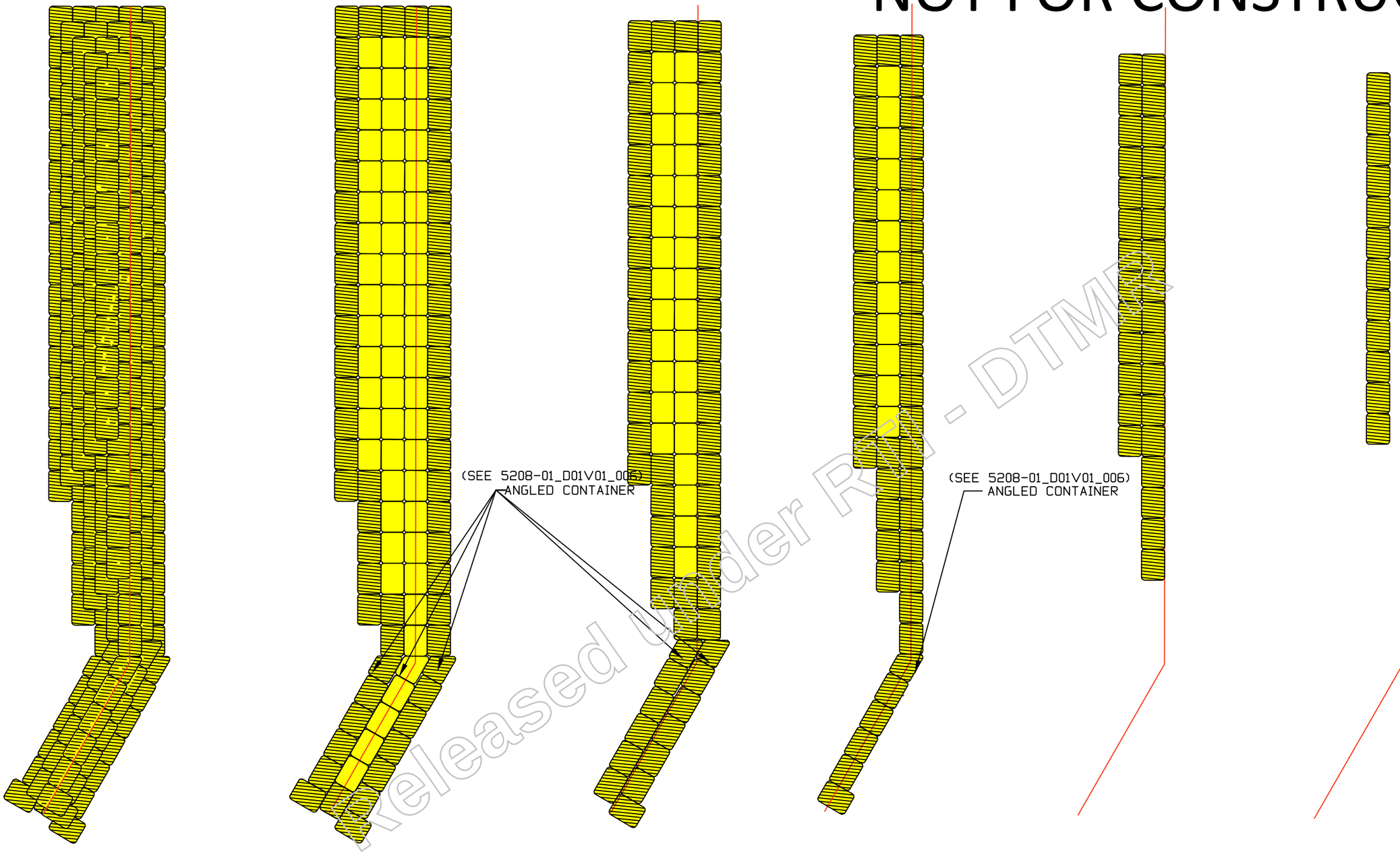

TOTALS FOR TRAINING WALL
206 No. Vandal Deterrent Containers (5 to be modified for angle as per detail in Drawing 5208-01_V01D01_006) PLUS 99 No. Standard Containers (1 to be modified for angle as per detail in Drawing 5208-01_V01D01_006).

305 CONTAINERS IN TOTAL.

TOTALS FOR TRAINING WALL BOTTOM LAYER
61 No. Vandal Deterrent Containers (2 to be modified for angle as per detail in Drawing 5208-01_V01D01_006) PLUS 57 No. Standard Containers (1 to be modified for angle as per detail in Drawing 5208-01_V01D01_006).

118 CONTAINERS IN TOTAL.

TOTALS FOR TRAINING WALL SECOND LAYER
57 No. Vandal Deterrent Containers (2 to be modified for angle as per detail in Drawing 5208-01_V01D01_006) PLUS 30 No. Standard Containers.

87 CONTAINERS IN TOTAL

TOTALS FOR TRAINING WALL THIRD LAYER
46 No. Vandal Deterrent Containers (1 to be modified for angle as per detail in Drawing 5208-01_V01D01_006) PLUS 12 No. Standard Containers.

58 CONTAINERS IN TOTAL.

TOTALS FOR TRAINING WALL FOURTH LAYER
30 No. Vandal Deterrent Containers.

30 CONTAINERS IN TOTAL.

TOTALS FOR TRAINING WALL TOP LAYER
12 No. Vandal Deterrent Container.

12 CONTAINERS IN TOTAL.

LEGEND
- STANDAR D CONTAINER
- VANDAL DETERRENT CONTAINER
- ANGLED CONTAINER (SEE DRAWING 5208-01_D01V01_006)

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NELLY BAY BEACH

GEOTEXTILE CONTAINER TRAINING WALL
TRAINING WALL LAYER DETAIL

JOB NO. J5208-01
SHEET 5 of 7

Drawing No. 5208-01_D01V01_005 SCALE: 1:325
Rev No. V01
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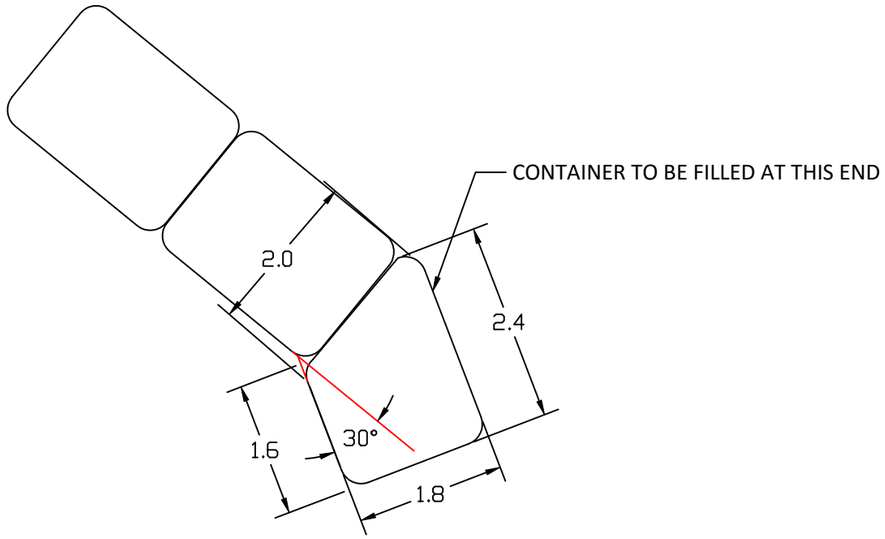

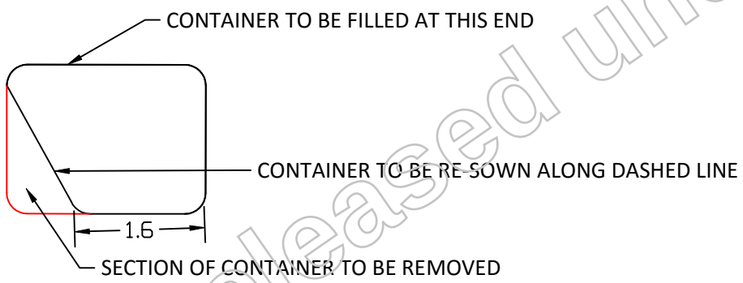

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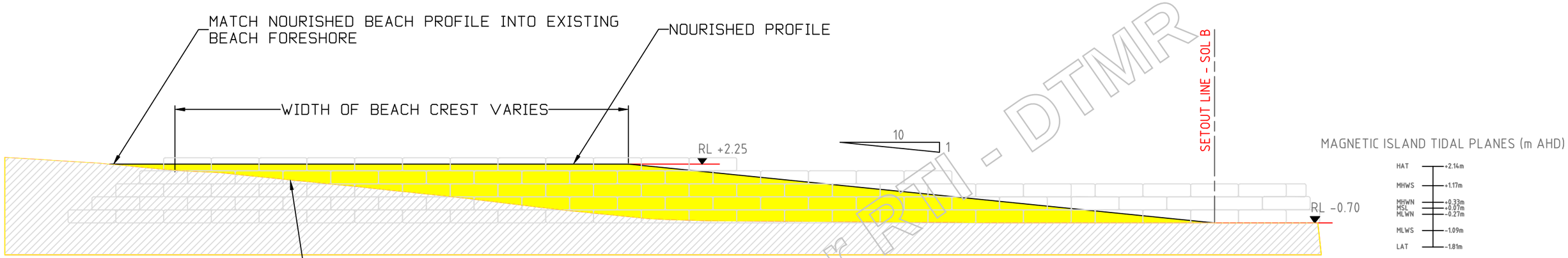
NELLY BAY BEACH
GEOTEXTILE CONTAINER TRAINING WALL
ANGLED GEOTEXTILE CONTAINER DETAIL
JOB NO. J5208-01
SHEET 6 of 7

Drawing No. 5208-01_D01V01_006 SCALE: 1:75
Rev No. V01
A3



SECTION E

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CLIENT:
Queensland Department of Transport and Main Roads
Townsville City Council

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SUPPORTED BY City of Townsville

CONSULTANT:
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Brisbane T +61 7 3105 1460

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NELLY BAY BEACH
GEOTEXTILE CONTAINER TRAINING WALL
SAND NOURISHMENT DETAIL
JOB NO. J5208-01
SHEET 7 of 7

Drawing No. 5208-01_D01V01_007 SCALE: 1:200
Rev No. V01
A3