REVETMENT WORKS - MUSKERS BEACH

Presented by:
Arvind Singh
Coordinator Infrastructure Projects, Livingstone Shire Council
Chris Lancaster
Geofabrics Australasia Pty. Ltd.
Presentation Topics

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3. Investigations and Design Methodology
4. Scope of Works
5. Design Approach
6. Design Criteria, parameters and method used
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10. Project After Completion - Photos
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Background

• Cyclone Dylan early in 2014.
• This has been a site issue since 2004.
• Muskers Beach Landholders Group (NMBLG)
• NMBLG engaged a consultant engineer
• Consultation with relevant State agencies and coastal specialists
• Geotextile revetment wall with a design-life of approximately 25 years.
Site Layout
Events Effect

No. 14 Reef St

No. 52 Reef St
Investigation & Design Methodology

• **Observed trend in vicinity of dwellings**
  – Beach Survey 2006 - 2014

• **Typical Coastal Management Options**:
  – Do nothing
  – Retreat
  – Beach Nourishment
  – Rock Revetment
  – Geotextile Revetment
Investigation & Design Methodology

Option Review

• Rock Wall
  – High energy impact structures
  – Produce beach changing dynamics
  – Design requirements result in deeper toe elevation; rock quantities >13,000 m³
  – Not preferred or supported by DILGP

• Sand-filled geotextile containers
  – The ELCOROCK® shoreline protection system
  – The geotextile containers are made from Texcel®, a durable staple fibre geotextile
  – Provides a cost-effective alternative to traditional coastal erosion
  – Supported by DILGP and EHP
Investigation & Design Methodology
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Preferred Option

• Combination of Geotextile Revetment & Nourishment
• Construct geotextile revetment adjacent to current dune scarp
• Natural beach with an engineered structure to resist major erosion during storm events
Investigation & Design Methodology

• **Pros**
  – Recognised best practice
  – Complements natural coastal processes
  – Beach aesthetics
  – Greatly extended geotextile product life

• **Cons**
  – Revetment may be exposed during storm events
  – Would require ongoing renourishment to resist vandalism & UV rays
Scope of works

Brief project scope of works:

1. Design and Certification of Revetment Wall
2. Earthworks
3. Revetment Wall - Geotextile bags and underlay
4. Sand for Revetment Wall Bag Fill
5. Revetment Wall Containers and Installation
6. Nourishment Works to Wall
7. Landscaping / Revegetation
8. Erosion & Sediment / Stormwater Control
Revetment Wall Design Approach

Design Considerations

• DILGP provisions close to the property boundary
• Alignment consistent with natural beach shape (DILGP)
• EHP requirement for protective structure support for softer sand fill containers, nourishment

Design Events

• Protection Act 1995 details seawalls are to be designed corresponding to 2% AEP

Design Certification

• Designed in-house (Stephen Linnane) and RPEQ certification by ICM
Design criteria, parameters and methods used

Design Life

• Adopted design life of approximately 25 years

Offshore Storm Characteristics for design events

• Datum – all reference to RL in this report is in metres above Australian Height Datum (AHD)
• Tides (Qld Tide Tables - Maritime Safety)
• Storm Tide, wave period and direction – Connell Wagner, 2003 adjusted for Mean High Water Springs (MHWS) since 2003
• Projected Sea Level Rise – adopted 0.3 m from Qld Coastal Plan
• Wave Height – J Piorewicz, 2013 - analysed wave data sourced from Emu Park buoy (Datawell Waverider)
• Duration – Capricorn Beaches BPA, 1979
Design criteria, parameters and methods ......

Determine Suitability of Seawall

- Coastal sediment transport (cross-shore & long-shore)
- Erosion / Accretion Patterns
- Alignment – consistent with natural beach shape
- End detail – revetment wall extended landwards from the active scarp
- Nourishment / beach scraping – nourishment to the revetment wall sourced from the intertidal zone below MHWS
- Site constraints – project requires Development Application /Approval
### Design criteria, parameters and methods ……

#### Storm Characteristics at Structure

<table>
<thead>
<tr>
<th>Description</th>
<th>2014 conditions</th>
<th>2050 conditions</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm surge (50yr ARI)</td>
<td>3.4 m AHD</td>
<td>3.6 m AHD</td>
<td>Connell Wagner, 2003 (Cawarral Ck)</td>
</tr>
<tr>
<td>Sea Level Rise</td>
<td>0</td>
<td>0.3 m AHD</td>
<td></td>
</tr>
<tr>
<td>Wave setup</td>
<td>0.5 m AHD</td>
<td>0.5 m AHD</td>
<td>S-Beach model</td>
</tr>
<tr>
<td>Local wind setup</td>
<td>0.2 m AHD</td>
<td>0.2 m AHD</td>
<td>S-Beach model</td>
</tr>
<tr>
<td>Wave runup</td>
<td>0.3 m AHD</td>
<td>0.4 m AHD</td>
<td>Empirical relationship</td>
</tr>
<tr>
<td>Overtopping (4.5m AHD at crest)</td>
<td>171 l/s/m</td>
<td>1626 l/s/m</td>
<td></td>
</tr>
<tr>
<td>Overtopping (4.5m AHD at 4m)</td>
<td>43 l/s/m</td>
<td>407 l/s/m</td>
<td>EurOTop (concrete slope with reduction factor 0.75)</td>
</tr>
<tr>
<td>Overtopping (5.0m AHD at crest)</td>
<td>39 l/s/m</td>
<td>835 l/s/m</td>
<td>Allowance for reduction by 75% for 4m from crest Limit for damage to grassed areas 50l/s/m Limit for pedestrian access 0.1 - 10l/s/m</td>
</tr>
<tr>
<td>Overtopping (5.0m AHD at 4m)</td>
<td>10 l/s/m</td>
<td>209 l/s/m</td>
<td></td>
</tr>
</tbody>
</table>
Design criteria, parameters and methods ......

Design (Refer table)

- Size of Sandfill Geotextile Containers Units for stability – 2.5 m³/5T
- Recommended Crest: 4.5 m AHD
- S-Beach – storm induced beach change model analysis used
- Recommended Toe: 1.3 m AHD (or lower)
State Agency Approval Process

- Development Application (DA) for prescribed tidal works in a coastal management district
- Concurrence Agencies – DGLIP, EHP & DNRM
- Marine Parks Act 2004
- Native Title & Cultural Heritage
Project Budget

Project Budget: $1.50 million
Project Completion Cost: $1.45 million
• Construction: 96%
• Design: 3%
• Project Management: 1%
Geofabrics Australasia Pty. Ltd.

• Who are we – a supplier & manufacturer of geosynthetic products – various range of products featuring in most construction field segments – Roads, Rail, Mining, Buildings & Ports/Coastal Protection even Golf & Sports!!
• The Elcorock & Texcel range of geotextile material is a staple fibre – either a polyester or a polypropylene or a combination of both.
• With 2 manufacturing plants in Australia, with ElcoRock & Texcel made at Ormeau on the Gold Coast.
• Our Bidim range of geotextiles is manufactured in Albury.
Geofabrics Australasia Pty. Ltd.

• Who are we –
• Geofabrics are the largest manufacturer and supplier throughout Australasia of geotextiles.
• Established in Australia 1977.
• April 2015 – GA merged with Maccaferri Australia & NZ
• Currently employ approx. 220 people.
• International presence.
So what is ELCOROCK –

ELCOROCK® is a shoreline protection system utilising robust geotextile containers designed to be filled with sand (or other infill material), that are then placed to form a stable, durable structure.

The versatility and durability of the ELCOROCK® containers allow construction of a wide variety of coastal structures – including groynes, walls, reef structures and other applications for marine and inland waterways.
So what is ELCOROCK –

ELCOROCK® is a world-leading system, with structures built on open beaches over 20 years ago surviving Australia’s harsh coastal environment. The ELCOROCK® system is supported by extensive research, including design methods, durability reports and environmental analysis.

The ELCOROCK® shoreline protection system is an alternative building material to traditional coastal methods such as concrete, rock armour, steel or timber. Geofabrics supports the ELCOROCK® system with research, specialist installation equipment and design assistance.
So what is ELCOROCK –

Geosynthetic Sand Containers – various sizes
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• So how do we design ELCOROCK –
• GA can offer “design suggestions”.
• GA can put you in touch with design engineers.
• GA will support you if you wish to design your own wall or groyne.
• GA offer on site assistance to you or your contractor.
• Most design suggestions come at “no cost” incl. the support & on site assistance.
So what would a standard design ELCOROCK wall look like?

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![Diagram of ELCOROCK wall dimensions and sections](image-url)
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- So onto Musker's Beach @ Zilzie (Emu Park)
- We got involved in this project some ten years ago.
- We were approached by some local land owners back then.
- We assisted council with design.
- Located a RPEQ for the council – ICM
- In late 2015 Hall Contracting was awarded this project.
- Some 600m long - 5 bags deep / high wall.
Pre-Construction -
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Pre-Construction -
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Construction -
Construction -
Geofabrics Australasia Pty. Ltd.

Construction -
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Construction -
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Construction -
Construction -

Geofabrics Australasia Pty. Ltd.

[Image of construction equipment and workers]
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Construction -
Construction -
Geofabrics Australasia Pty. Ltd.

Construction -
Geofabrics Australasia Pty. Ltd.

Construction -
Construction Completed

Thick Jute Mat placed over the site along with cube stock & a watering system.
• Construction Issues –
• Sand supply issue – not a “free draining material”??
• So what is “free draining”?
• A material should allow water to pass through the sand & out through the bag whilst filling – allows very good compaction of the sand within the container bag.
• The original material had a very fine silt component that caused “clogging”.
• Solution: new material was sourced – coarser sand.
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- Construction issues –
- Had some issues with the containers as well
- Draw strings sewn into the containers
- Solution: GA replaced draw strings at no cost
- Some containers were “incomplete” with sewing
- Solution: GA replaced the 2 containers at no cost
- Livingstone SC required that jute mat cover steel pins not be used, was not specified though
- Solution: GA & Halls replaced the standard jute steel pins with biodegradable pins at no extra cost
Construction Issues

• Complaint from local residents regarding sand blown
• Stormwater drainage
• Operations on days when persistent on-shore wind conditions are experienced
• Seawall return profile
• Community consultation
Construction Issues and Solutions
Questions??