Tonkin+Taylor

Memo

To:	**Richard Saunders, Lisa Wheeler, David O'Malley**	**Job No:**	**27226.002**
From:	**Richard Reinen-Hamill**	**Date:**	**2 December 2015**
Subject:	**Ocean Beach - Hold the Line Remedial Work Options**		

1 Purpose

Ocean Beach has experienced winter storms that has resulted in dune and backshore erosion along the St Clair Seawall and Ocean Beach. The purpose of this memo is to present findings on the extent and scale of erosion, and to identify potential works that may be required to continue to "hold the line" and to compare observation with the coastal issues and options report T&T prepared in 2011.

2 Erosion observations

The general observation from discussions with Council and David O'Malley from Octa Associates Ltd is that over the last 8 to 10 years the beach levels have generally been elevated from the lows of 2007, although beach lowering started to be observed from around August 2014. Based on the results on monitoring carried out on 6 July 2015 (Craig Horne Surveyors, 7 July 2015) and a site visit carried out by me on 10 July 2015 it is evident that there are locations where the beach levels are significantly low, allowing the dune toe to erode. It was observed that beach levels were not consistently low along the beach from St Clair's seawall to the Surf Club, but there are locations where levels are close to historic lows, particularly:

- Immediately adjacent to the St Clair seawall extending all along the area where the geotube backshore wall is situated and a distance some 100 m to the east (*Photograph 1*).
- At the location of the reno mattress protection structure to the west of Moana Rua Road (*Photograph 2*).
- At the eastern end of the playing fields between Moana Rua Road and John Wilson Ocean Drive where there is an erosion scarp on the dune exposing construction debris and material on the dune face (*Photograph 3*).

We note that Craig Horne survey reports would benefit from including in their report and graphs the low beach levels recorded in 2007 to provide a basis of comparison relative to the previous extreme erosion event. We have BMAP profile data provided to us from Derek Todd that includes this information which we will provide to Council. However, we note there may be differences in Datum and or co-ordinate systems that may need to be resolved.

3 Geotube backshore wall

The geotube backshore wall is situated in Area 2 as identified in the T+T Options Report, Figure B1. The existing geotube backshore wall is around 220 m long, although the eastern 100 m was damaged during installation in 2007 and was not able to fully function as designed. While the original design included a scour apron and three fully filled tubes of 1 m diameter, the as built works comprises three partially filled 1.0 m diameter black geotextile tubes stacked on a steep slope

(0.5(H):1(V), with rock rubble on a steeply sloping upper beach (approx. 4(H):1(V)) providing some scour protection.

The western 100 m has performed to retain the position of the dune toe. However, there is evidence of wave overtopping and scour above the crest of the bags and there are significant areas of the bags that have begun to split or abraded. It is likely that they will not perform adequately if beach levels remain low and storms occur and these bags should also be replaced.

At the eastern end of the geotube there is accelerated erosion of the dune toe resulting in erosion of the dune face, including loss of vegetation from the dune slope. This is a common feature at the end of seawalls as there is both a deficit of sediment supply from the protected area of the dune and edge effects focussing wave energy.

In the long term the plan for this area is to look at a combination of partial seawall extension or equivalent erosion protection system and managed retreat (T&T, 2011), with a short term goal of continuing the holding pattern. The present erosion has removed the existing walkway access adjacent to the geotextile bags, but where the reserve width is wider, it may be possible to relocate access further landward from the original path. We recommend that the holding pattern should provide protection to the narrowest parts of the reserve to reduce the risk of dune erosion affecting any new walkway access that is located more landward than the original position. To extend protection along the foreshore where the width of the reserve is less than 40 m would require the restoration and rebuilding of around 130 m of the backstop wall. If the footpath was to be relocated the backstop wall could be installed as far landward as possible, with dune planting of the slope above the crest of the wall to improve sand rebuilding properties. It is noted however, that there is the potential of erosion of the dunes to the east but as the reserve width is sufficiently wide, for the medium term it is proposed not to protect the dune. This is consistent with the longer term strategy.

Figure 1 Showing the likely extent of the proposed geotube wall and the possible location of a relocated pathway

Detailed design will need to be undertaken for the replacement of the existing geotube wall. This would include the requirement for additional survey to confirm levels of the existing foreshore and extent of rock debris. We note the geotubes originally used are no longer readily available and if it is determined to replace like with like these would need to be specially made. Two alternative

geotextile products that are better suited for the purpose of coastal protection are available: 2.5 m^3 Elcorock geobags and mega containers. Mega containers are large geotextile tubes (in the order of 3.2 to 3.8 m wide and 1.7 m to 1.9 m high and 20 m long). Both products are made from heavy duty staple-fibre polyester and polyester/polypropylene blends which are reasonably abrasion resistant and should provide at least 10 years of service, provided they are not vandalised or ruptured by construction debris or sharp quarried rock.

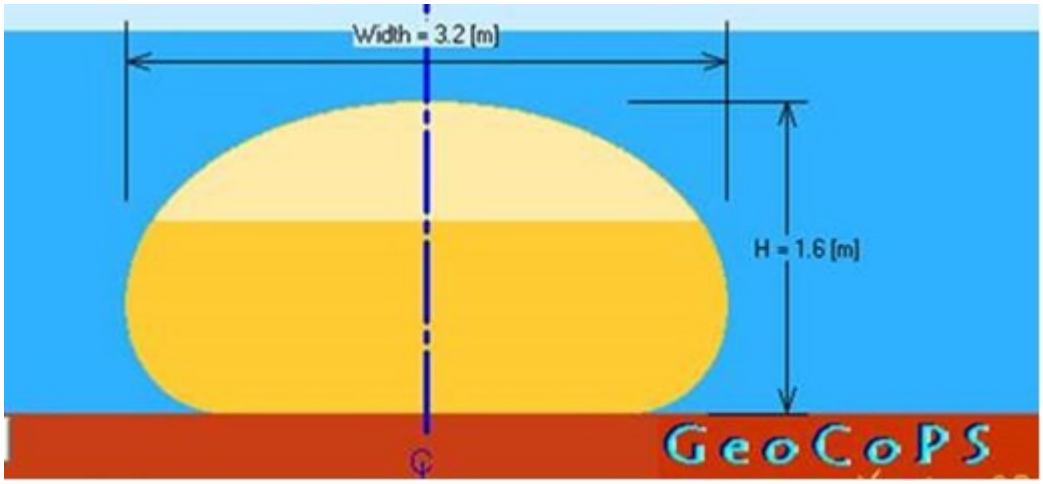

Figure 2 Typical dimensions of T1 Mega Container

Based on the available stability data, the 2.5 m^3 geobag (dimensions 2.4 m x 1.6 m x 0.6 m) is only marginally stable for the design wave conditions and they are not recommended. While there is no specific design guidance for the mega bag, given the greater mass, it is likely that these structures will be more stable than the smaller geobags. This may also be acceptable as a backstop wall option. Additional rock armour either appropriately sized cobbles will be required seaward of the geobags to provide enhanced scour protection. This is likely to augment the existing rock situated on the foreshore. A typical section and plan based on the original layout plan is attached with this memo. This structure would extend along 130 m of the shoreline with the remaining 10 m length providing a return landward at that point. This length is sufficient to protect the reserve area where it is less than 40 m from the existing geobag wall. A shorter length of wall could be considered, just replacing the existing functioning geotube wall. However, this would continue to exacerbated end effect erosion that is occurring at this location. It is unlikely that this erosion will extend to private property over the next 10 years, but is likely to result in ongoing erosion and slumping of the vegetation and may also affect access along the existing trails and pathways along the dune crest.

The mega container require special lifting and filling tools and some specialist supervision by the bag suppliers. However, there is a reasonable lead time (in the order of 6 to 8 weeks) for the containers to be fabricated and supplied in NZ as there is only limited stock (Geofabrics, pers. Comm.).

Indicative costings based on advice from Geofabrics and base data from Rawlinsons indicate the cost of the proposed wall to be in the order of $460,000 as detailed in the table below.

GSC Revetment Option

Item		Description	Quantity	Unit	Rate excl. GST	Amount excl. GST
1		**Earthworks and GSC Seawall Works**				
1.	1	Hire and transport of specialist GSC filling equipment from supplier and transport bags to site:	1	Item	$15,000.00	$15,000.00
		T2 bags	7	Item	$5,974.88	$41,824.16
		T1 bags	7	Item	$4,599.16	$32,194.12
1.	2	Import sand for filling, stockpile	1421	m3	$35.00	$49,735.00
1.	3	Remove existing foreshore geobags and construction debris	1	Item	$20,000.00	$20,000.00
1.	4	Excavate foundation seawall construction. Use excavated gravel and cobbles to form a contruction mound to be reshaped after completion	600	cu.m	$30.00	$18,000.00
1.	5	Installation assuming hopper, pump, crane assembly and 2 bags per day filled (using Rawlinson pump concrete rate)	1421	m3	$80.00	$113,680.00
1.	6	Supply and place ElcoMax 600R geotextile, or similar approved, naturtal ground and seawall, including overlap and fixings	840	sq.m	$7.00	$5,880.00
1.	7	Regrade upper beach and project completion	1	Item	$10,000.00	$10,000.00
Total for GSC Seawall and Related Works						**$306,313.28**
				P&G	20%	$61,262.66
				Contingency	**30%**	**$91,893.98**
				Total (rounded)		$460,000.00
		cost per m2 (based on 140 m length and 2.4 m wall height)				$ 1,400.00

4 Reno mattress

The geotube backshore wall is situated in Area 3 as identified in the T+T Options Report, Figure B1. The reno mattress toe protection has experienced overtopping and end scour and has many elements that are damaged. At this location the long term option was either a buried backstop wall or managed retreat or a combination of both. In the short term it was the continuation of the holding pattern.

We note that the suppliers of reno mattresses do not recommend this structure at this location for more than a temporary structure (design life of 1 to 5 years – pers.comms. with Simon Moran, Geofabrics) and we have similar concerns if this structure was perceived to be anything but a short term response.

If the reno mattress is required it will require a rebuild of this structure to continue to provide toe protection to the dune, although it is possible that the graded rock used may be able to be salvaged to refill the new baskets. We recommend a slightly more landward location of the structure be implemented to limit its extension into the beach system to improve its longevity by reducing its exposure. In addition, to improve the performance of the structure there should be a tie in detail comprising a landward return of the structure and at the crest the reno baskets should be returned landward at least 2 m and preferably 4 m to reduce overtopping scour.

A concept plan and typical section is included in Attachment 2 and rough order costs included below:

Reno Mattress

Item		Description	Quantity	Unit	Rate excl. GST	Amount excl. GST
1		**Earthworks and Reno Mattress Works**				
1.	1	Remove existing reno mattress and stockpile existing rocks on upper foreshore (assume 20% of required volume)	1	Item	$15,000.00	$15,000.00
1.	2	Supply of reno mattresses	56	No.	$290.00	$16,240.00
1.	3	Supply of gabions	40	No.	$83.00	$3,320.00
1.	4	Supply of geotextile	800	m2	$5.13	$4,104.00
1.	5	Double twist additional mesh	800	m2	$10.00	$8,000.00
1.	6	Additional rock (assume 80%)	256	cu.m	$40.00	$10,240.00
1.	7	Form subgrade, place and fill bags	1	Item	$22,000.00	$22,000.00
Total for GSC Seawall and Related Works						**$78,904.00**
				P&G	20%	$15,780.80
				Contingency	**30%**	**$23,671.20**
				Total (rounded)		$120,000.00
						$ 400.00

5 Construction debris on dune face

There are localised areas where construction debris is being eroded from the dune face. We recommend ongoing regular inspections and management of the debris, removing it from the upper part of the beach as it falls from the dune to the beach.

6 Applicability

This memo has been prepared for the benefit of Dunedin City Council with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

2-Dec-15
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Attachment 1: Site photographs

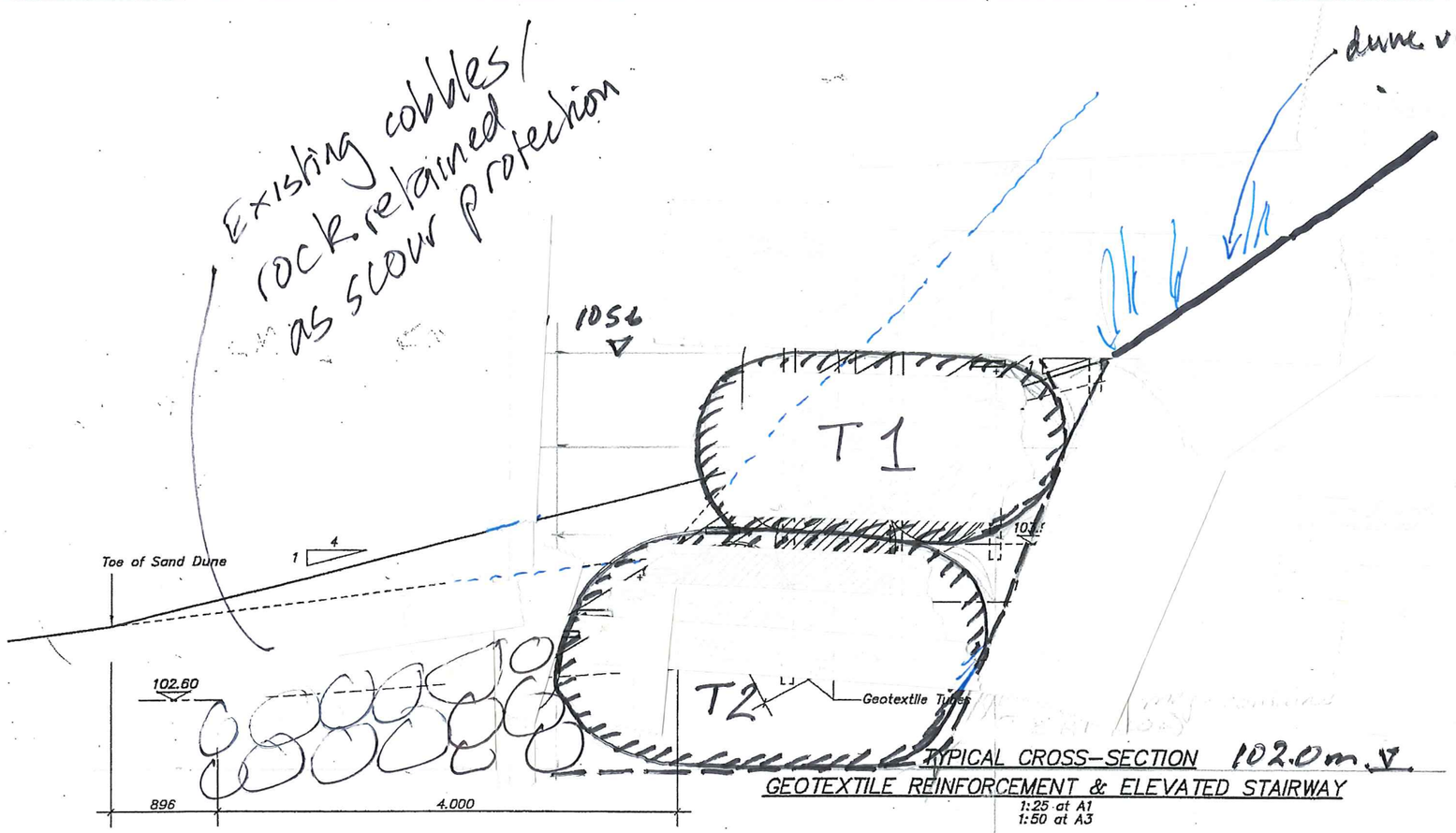
Photograph 1 Geotube backstop wall

Photograph 2 Reno mattress toe

Photograph 3 Construction debris on eroded dune face

Photograph 4 Erosion of the dune face to the east of the geotube wall

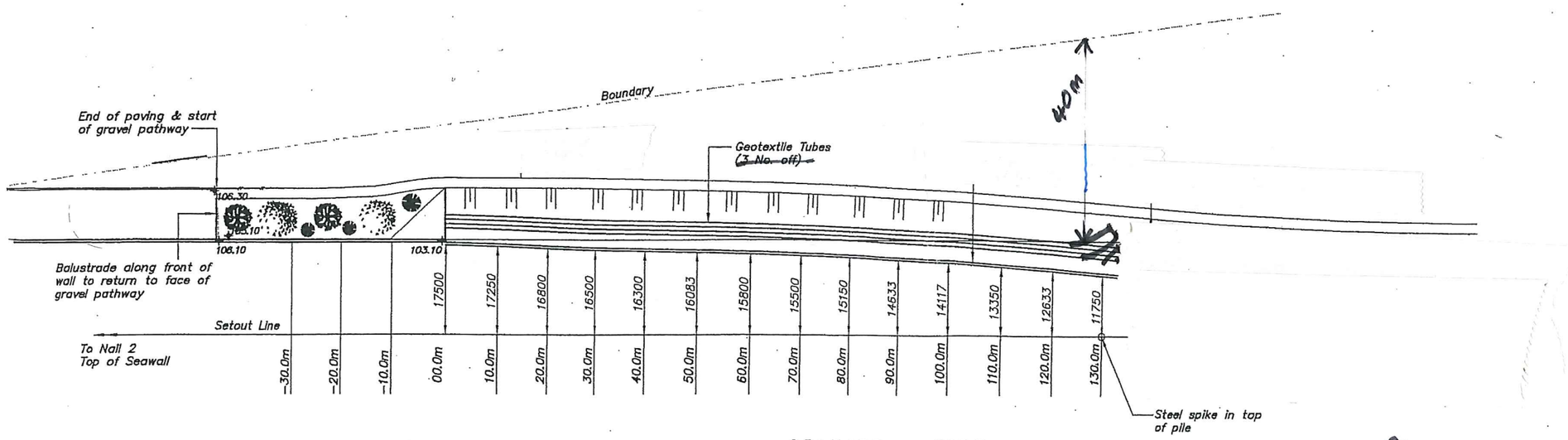
Attachment 2: Concept sketches



TYPICAL CROSS-SECTION 102.0m V.

GEOTEXTILE REINFORCEMENT & ELEVATED STAIRWAY

1:25 at A1
1:50 at A3



SEAWARD SIDE

LAYOUT PLAN – GEOTEXTILE TUBES

1:500 at A1
1:1000 at A3

NOTE: Geotextile Scour Mat placed under tubes – Refer to Section

Prelim. Draft
Tonkin & Taylor
27226.005
Richard R-H 6/8/15

PRELIMINARY ONLY
NOT FOR CONSTRUCTION
28/02/03

No.	Revisions	Date	Appvd

Designed	N.Knowles	Date	Print Date
Drawn	A.R.B/A.D.I	Oct 01	
Checked			
Approved			
File		Ref	cSTEP-P3

Client: DCC

Project: ST CLAIR SEAWALL

Sheet Title: SECTION SHOWING ELEVATED TIMBER STAIRWAY

Job No.	Sheet No.	Revision
57292	S22 of sht's	

Duffill Watts & Davis Ltd
CONSULTING ENGINEERS
CIVIL AND MARINE

Duffill Watts & King Ltd
CONSULTING ENGINEERS

Rugby Field

Ch0.00 Section A

Ch0.00 Section B

Ch0.00 Section C

fence

gate

light

L 15

10

12.5

7.5

5

2.5

14m 42m

16m

gabion basket

reno mattress

20°

Beach

4 No. 6×2×0.5 gabion mattress

3.72 3.0

4

1

1N° 1×1 gabion basket

1:5

0.5

geotextile terrafel 600R or similar approved

Section A-A (scale 1:100 A3)

concept plan & details.

Tonkin & Taylor Ltd
27226.002
11 August 2015
R. Rivers-Mansill

CRAIG HORNE
Registered Surveyor

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Topographic Detail - Ocean Beach
Existing Reno Mattress

Ref: DCC K44

SHEET 1 OF

Drawn	Checked	A3 SCALE
Traced	Date 10 AUG 2015	1:300

NTS