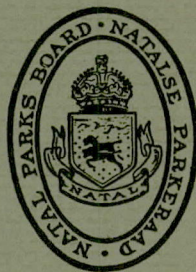


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NATAL PARKS BOARD

Reclamation

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REPORT ON

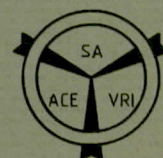
Stabilisation and protection of the
north bank of the estuary

at

ST. LUCIA

A.A. LOUDON & PARTNERS
Consulting Engineers

SEPTEMBER 1984



NATAL PARKS BOARD

REPORT ON
STABILISATION AND PROTECTION OF THE
NORTH BANK OF THE ESTUARY
AT ST. LUCIA

1. INTRODUCTION

Cyclone Demoina was active over the Umfolozi catchment between 29 January and 1 February 1984.

ND
A total of 728,9mm of rain was recorded at Cape St. Lucia and flood waters in the Estuary rose to an elevation of about 4,1m above mean sea level. Considerable damage was done to the roads, parking areas, slipways and banks on the north bank of the Estuary.

On 3 July 1984, Mr. Brent the Chief Coastal Resorts Officer of the Recreation Division asked us to prepare a report, with an estimate of costs, on the rehabilitation and repair of the damaged facilities.

We visited the site on 11 July when Mr. Brent and Mr. Gous pointed out the necessary repair work.

2. STABILISATION OF THE NORTH BANK OF THE ESTUARY

2.1 Extent

We were asked to report on the stabilisation of the north bank of the Estuary between the Natal Parks Board workshop area to the west and the stream about 300m east of the entrance to the Sugar Load Camp to the east.

2.2 Present Condition

The length of the bank under consideration is about 1600m, and can be subdivided into the following sections:-

2.2

Present Condition (contd)

- i) Natal Parks Board boat locker and workshop area. This is about 200m long and as can be seen from the cross section OA to 150A an almost vertical unstable earth bank about 2,5m high extends over this length. The developed area is at an elevation of about 3,0 with a high water level of 1,09 and a low water level of -0,92 above or below mean sea level.

The slipway was washed away and will have to be replaced.

The unstable earth bank will have to be protected to prevent further erosion and the destruction of the N.P.B. facilities in this area.

- ii) Research area. This is about 200m long with stable vegetation covered banks or sandy beaches. No protection works are envisaged along this length. This area will provide easy access for hippo and crocodiles.
- iii) Public boat launching and parking area. This area is about 150m long and cross sections 970, 1000 and 1050 show a vertical unstable earth wall between 1m and 1,5m high which will have to be protected to prevent erosion of the car park area.
- iv) Swamp. The length of the swamp is about 100m and needs no protection.
- v) Picnic area. This area extends over about 400m and cross section 450 - 800 show the nature of the area. An unstable nearly vertical bank about 1m high rises from a generally steep unstable inter-tidal zone. This bank needs protection.

Additionally the area is subject to flooding at high tide.

- vi) Beach area. The area extends over the remaining 500m of the estuary bank under discussion.

The upstream 250m of this area is at an elevation between 4 and 5m above MSL and consequently has a 2 to 3m high unstable bank at the water edge.

This length will have to be stabilised.

The downstream 250m of this section has stabilised to an attractive sandy beach at a slope of about 11°. A bank about 1m high against the Casurina trees is being eroded at high tide and threatening the parking area. Protection of this bank may be necessary.

1) General Introduction

A variety of stabilisation methods has been considered:-

- 1) gabion and reno mattress protection
- 2) reinforced earth
- 3) rock berm
- 4) steel sheet piling
- 5) concrete sheet piling
- 6) creosoted timber walling
- 7) cement/sand bag walls

A comparison of the qualities of these different methods is tabulated in Annexure 1.

We have analysed method 6 - creosoted pole walling in fair detail and have considered the costs of steel and precast concrete sheet piling. The other methods have been rejected for one reason or another as detailed in Annexure 1.

2) Description of the methods investigated

a) Sheet piling - steel and precast concrete.

Boreholes were drilled at two sites to determine the nature of the material in the banks and below water level. The results of these boreholes are shown in Annexure II.

Annexure III is a summary of the lengths and thicknesses of the steel sheet piling needed for the various heights of wall.

We estimate the cost of steel sheet piling as R952 500 for the whole job or R843 per lineal metre average.

Concrete sheet piling will cost R1 681 500 for the whole job or R1488 per lineal metre average.

An expected life of at least 20 years can be expected for the steel sheet piling. The Armco piling is galvanised and in addition could be bitumen painted.

Continuous maintenance of the exposed estuary face would however be necessary.

The concrete sheet piling is extremely durable with an expected life in excess of 20 years and minimal maintenance.

Both systems are environmentally incompatible. The concrete sheet piling is aesthetically more acceptable than the steel sheet piling.

2) a) Sheet piling - steel and precast concrete (contd)

These methods were not investigated further, mainly because of the high cost, but also because we felt they were incompatible with the environment.

b) Creosoted pole walling

Drawing CS/399 shows our proposals in this regard.

We estimate the cost of providing this type of protection at R338 000 or R300 per lineal metre.

Piles used to construct the two existing jetties are creosoted Clusiana or Paniculata gum poles and after five years exposure to the marine environment are in very good condition apart from some splitting of the tops.

Adjacent to the public jetty are the remains of old wooden piles which are full of borer holes and have virtually disintegrated. The age of these poles is not known neither is the type of treatment.

The National Timber Research Institute has no practical experience of treated poles in this environment but suggest that if they were treated with Copper Chrome Arsenate and a double treatment of creosote then a life expectancy of at least 15 years could be expected.

This wall is technologically simple. Vertical poles could be replaced using a hand operated sliding hammer. Horizontal poles could be replaced by sliding new ones into position.

It is aesthetically pleasing and will blend into the environment far better than any other type of protection considered.

The wall will remain stable even if partial scouring of the base takes place. Such scouring is easily repaired.

3) Recommendation

We recommend that creosoted pole walling be used to protect the banks as:-

- a) the initial cost is low;
- b) maintenance is easy;
- c) it is environmentally compatible.

NATAL PARKS BOARD
ST LUCIA ESTUARY
ESTIMATED SCHEDULE OF QUANTITIES

Report Ref.	Description	Unit	Quantity	Rate	Amount
2	BANK STABILISATION : CREOSOTED TIMBER WALL				
1	Supply creosoted poles :				
	125mm min tip by 5,4m long	no	170	16,81	2 857,70
	125mm 4,2	no	590	11,95	3 513,30
	50mm 3,0	no	6048	2,05	12 398,40
	75mm 3,0	no	3024	3,67	11 098,08
	100 mm 3,0	no	2646	5,57	14 738,22
	125mm 3,0	no	1890	8,08	15 252,30
	150mm 3,0	no	3024	11,03	33 354,72
	175mm 3,0	no	504	14,45	7 282,80
			Sub total		104 008,82
2	Contractors charge on cost of creosoted poles	%	104008,82	10	10 400,82
3	Transporting poles to site ⁺ 55km	ton	457	17,20	7 860,40
4	Anchor plates	no	380	20,00	7 600,00
5	Cables	m	10100	2,00	20 200,00
6	Concrete to "dead men"	m ³	563	90,00	50 670,00
7	Excavation				
	"dead men"	m ³	1279	2,00	2 558,00
	cable trenches	m ³	13739	3,00	41 217,00
	cut off trench	m ³	3390	3,00	10 170,00
8	Backfill	m ³	16955	2,50	42 388,00
9	Driving uprights and placing horizontal poles				
	4m vertical poles	m	250	36,00	9 000,00
	3m horizontal poles	m	880	27,00	23 760,00
10	Placing geofabric behind poles	m ²	4000	2,00	8 000,00
			TOTAL		337 833,04

ANNEXURES

ANNEXURE 1

BANK STABILISATION METHODS
A COMPARISON OF THE QUALITIES OF THE DIFFERENT METHODS CONSIDERED

Method	Cost	Durability	Aesthetics	Technology	Stability	Usage	Convenience of Public	Environmental Compatibility	Remarks
1 Gabion and Reno mattresses	high	poor	low	low	Good if extended below scour depth	extensive	low	low	No locally available rock. Corrosion of baskets.
2 Reinforced earth	high	very good	high	high	Good if extended below scour depth	extensive overseas	high	low	
3 Rock berms	high	good	low	low	good	extensive	low	medium	
4 Steel sheet piling	high	medium	low	high	good	extensive	high	low	Corrosion even if protected
5 Concrete sheet piling	high	very good	high	high	good	extensive	high	low	
6 Creosoted pole walling	low	medium	high	low	good	minor	high	medium	Borer attack. Minimal information
7 Cement sand bag walling	low	good	medium	low	Poor unless extended below scour depth	locally extensive	high	medium	Destroyed by Cyclone Demoina

BOREHOLE LOG

ANNEXURE II

De LEUW, CATHER LOUDON INC.	Project: St. Lucia Estuary Site: Parks Board Boat Area Job No.: 035 Logged By: A.H. Cook Date: '84.08.02	Hole No.: 1 Sheet: 1 Location: See plan
	Contractor: McLaren & Eger Driller: Jeremiah	Machine: Pilcon Wayfarer Drilling Started: 84.07.19 Completed:

Drilling Method & Size	% Core Recovery	R.Q.D. %	Fracture Frequency	Test or Sample	Value	Depth Metres	Legend	Description
Washboring, BX size 				N	5	1	●	Moist, dark brown, loose, intact <u>Silty Clay</u>
				N	6	3	●	Moist, dark brown, loose, intact, fine <u>Sandy Clay</u>
				N	7	4	●	Wet, Olive/dark grey loose, fine <u>silty sand</u> .
				N	4	6	●	Wet, Dark grey <u>soft clay</u>
				N	25	7	●	Wet, yellow brown with some grey clay lenses, <u>Stiff sandy clay</u> becoming more sandy with depth.
				N	25	8	●	End of borehole

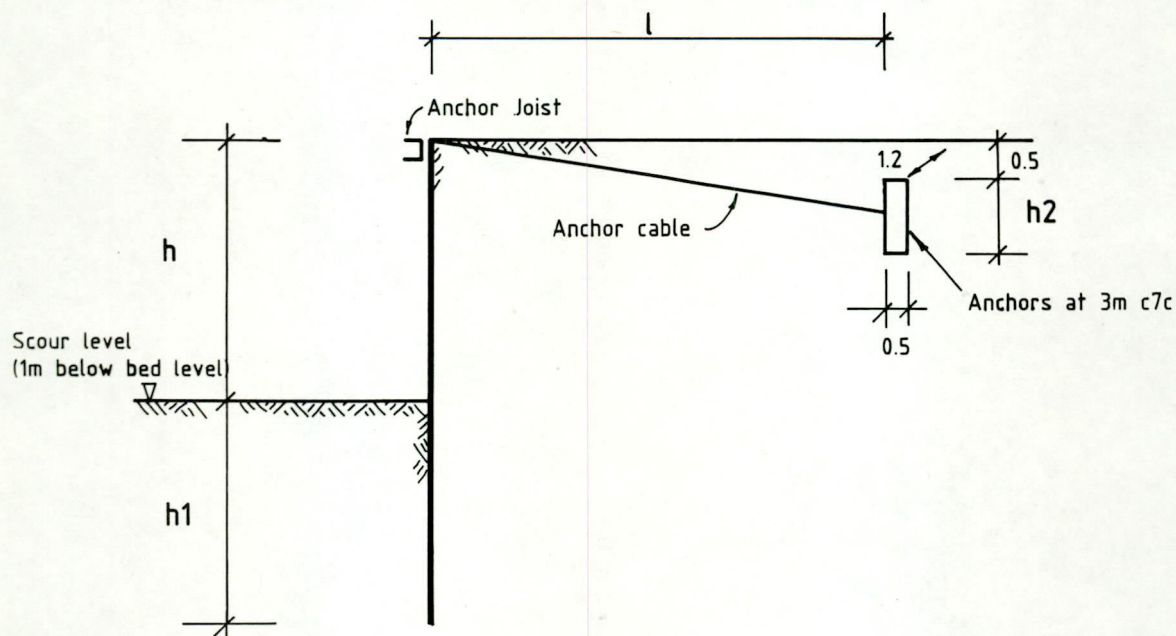
Standard Penetration Test Water Level Approximate Material Changes	Permeability Test Disturbed Sample Undisturbed Sample	N S.P.T. Result I Classification Test S Strength Test C Consolidation Test	REMARKS: Logged from SPT samples
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BOREHOLE LOG

De LEUW, CATHER LOUDON INC.	Project: St. Lucia Estuary	Hole No.: 2
	Site: Picnic site	Sheet: 1
Contractor McLaren & Eger	Job No.: 035	Location: See plan
Driller Jeremiah	Logged By: A.H. Cook Date '84.08.02	Elevation:
	Machine: Pilcon Wayfarer	Orientation: Vertical
	Drilling Started: '84.07.19 Completed:	

Drilling Method & Size	% Core Recovery	R.O.D. %	Fracture Frequency	Test or Sample	Value	Depth Metres	Legend	Description	
↑ Washing, BX size ↓				N	3	1	●	Very moist, dark grey, loose intact silty sand 	
				N	17	3	●		Wet, Light grey, medium dense, intact fine sand
					N	5	4	●	Wet light grey, intact loose fine sand.
					N	2	6	●	Wet light grey, intact, loose fine sand.
								End of borehole.	

↓ Standard Penetration Test ▽ Water Level - - - - - Approximate Material Changes	[Permeability Test ● Disturbed Sample ■ Undisturbed Sample	N S.P.T. Result I Classification Test S Strength Test C Consolidation Test	REMARKS: Logged from SPT samples.
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h	h1	l	h2	Anchor Joist	Sheet Piling	Remarks
2	2	2.8	0.5	100x50 C	Armco 2.8 mm	h - height includes for 1m scour
3	2.5	3.9	0.75	178x54 C	Armco 4 mm	
4	3.5	5.2	1.25	200x75 C	Armco 7 mm	
5	4	6.4	1.5	240x85 C	Frodingham 2N	

Concrete sheet piling requires some anchorages

SUMMARY