PROJECT PERFORMANCE AND MONITORING OF A REVETMENT
COCOS BAY, EAST TRINIDAD

Charmaine O'Brien-Delpesh [1], Candice Gray-Bernard [2], Marisha Tang Kai [3]

[1,3] Department of Civil and Environmental Engineering, University of the West Indies, St. Augustine Campus, St. Augustine, Trinidad

[2] Ministry of Food Production and Marine Affairs, St. Clair Circle, St. Clair, Trinidad

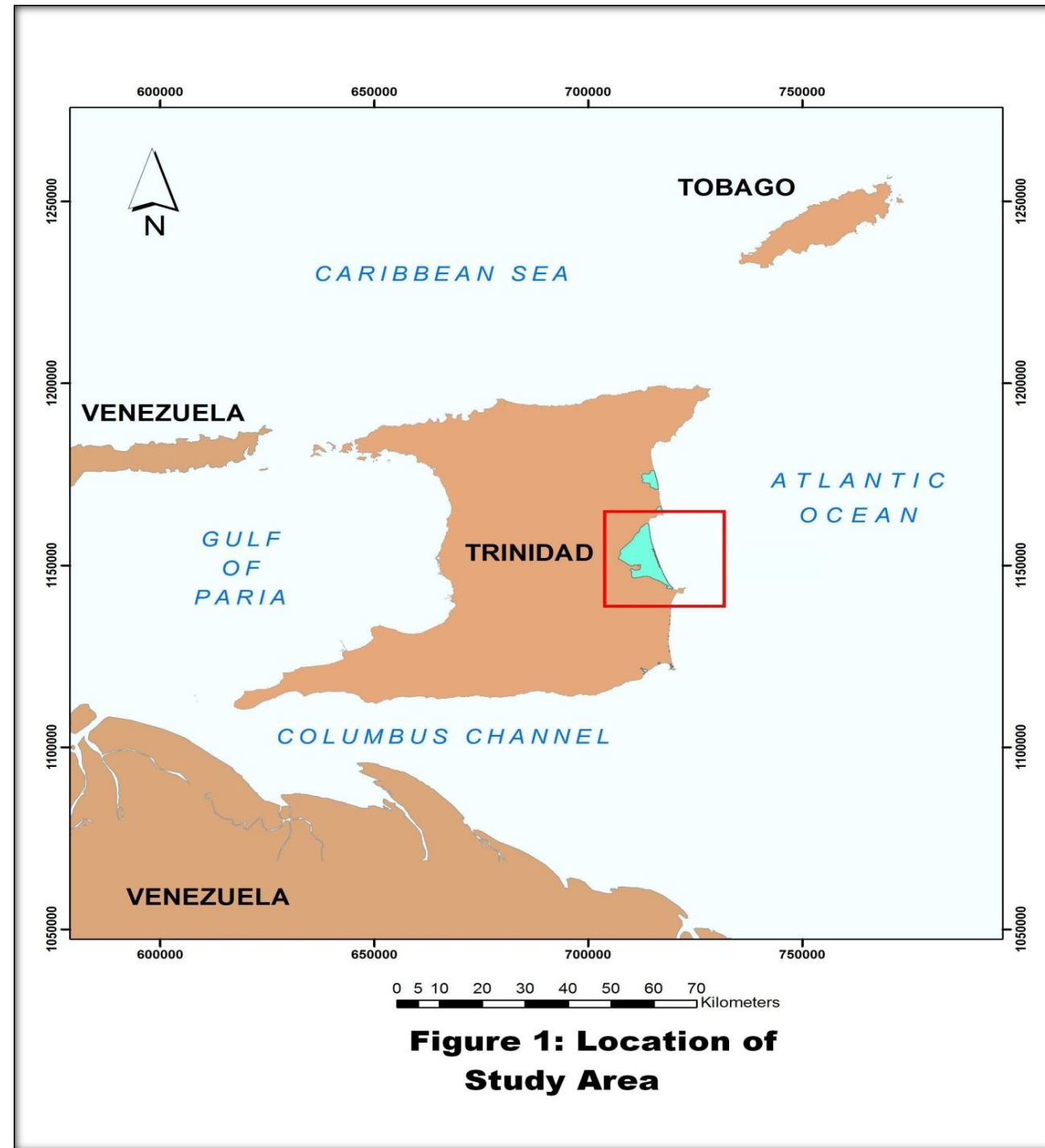Charmaine.O'Brien-Delpesh@sta.uwi.edu cgraybernard@fplma.gov.tt Marisha.Tang-Kai@sta.uwi.edu

INTRODUCTION

- Cocos Bay is located on the east coast of Trinidad, exposed to the Atlantic Ocean (Figure 1).
- Three rivers, the L'Ebranche, Nariva and Ortoire dissect the beach and discharge into Atlantic Ocean.
- The Manzanilla - Mayaro Road which runs parallel to the shoreline is inundated during extreme wave events (Figure 2).
- Waves approach from the east and at the shore, transform into rows of spilling breakers ranging between 0.5 and 1.0 m in height.
- The beach is an important nesting site for the leather back turtle.
- In the early 1990s the section of the shoreline between the Nariva and Ortoire Rivers, was eroding at a rate of 1.7 m per annum threatening the stability of the road.
- To combat erosion and flooding the Ministry of Works, Drainage Division undertook emergency intervention by constructing a 2.3 km revetment which consists of two rubble mound structures spaced 900 m apart (Figure 2).
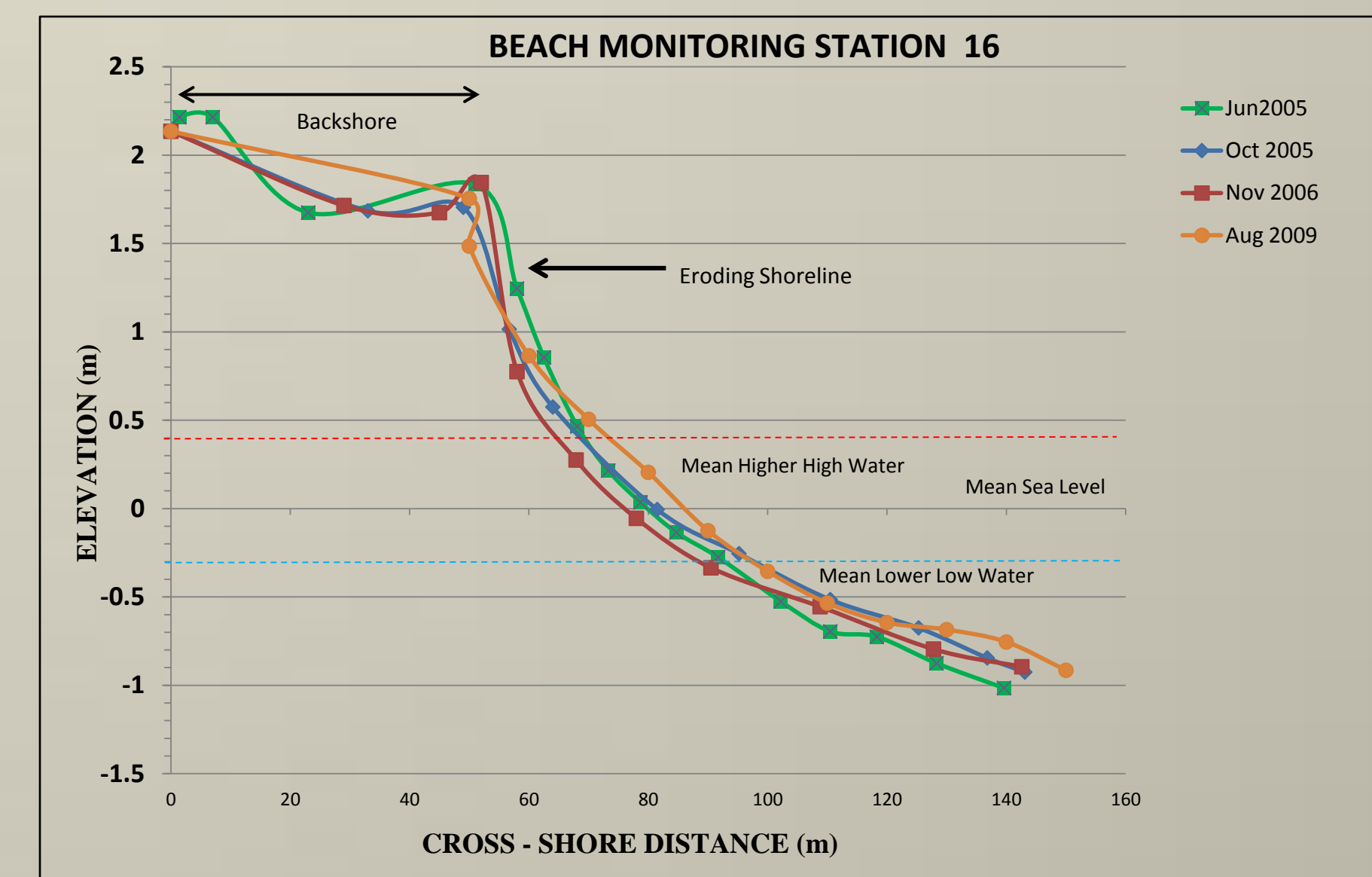- The construction was started in March 2005 and was completed in January 2008 at a cost of TT$18.8M (USD 3M).

Figure 1: Location of Study Area
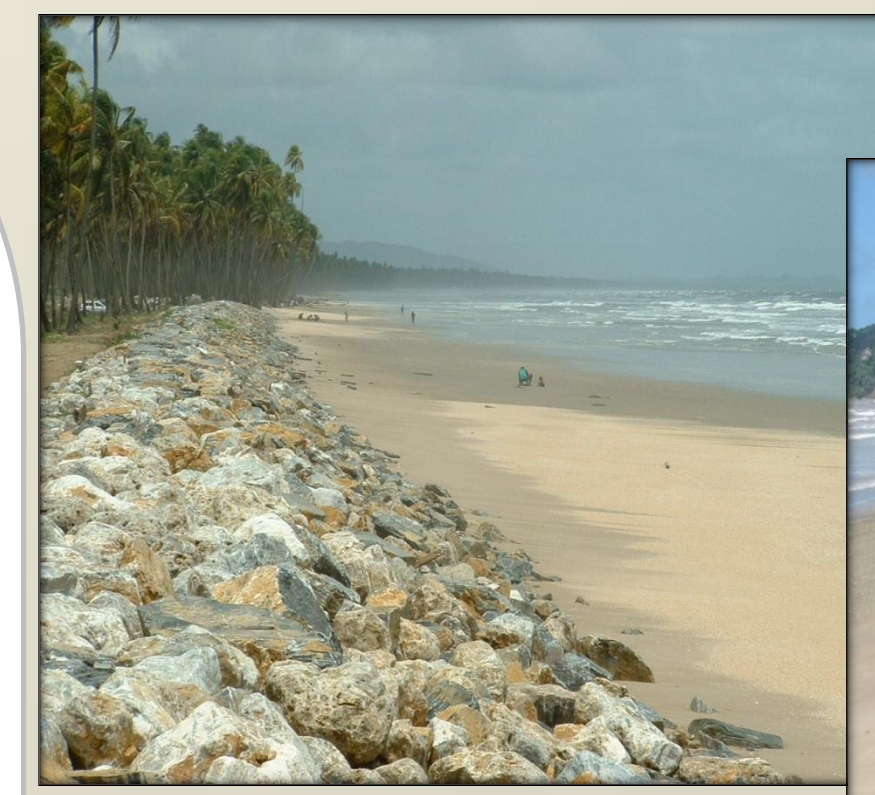
Revetment 1 year after completion

Revetment 6 years after completion

BEACH MONITORING STATION 16

METHODOLOGY

- 19 beach profiles were established along the revetments and were measured quarterly from 2005 to 2009 using standard surveying techniques (level and staff) .
- Beach widths were extracted from the data using Shoreline Analysis Data System (SANDS).
- Generalized Model for Simulating Shoreline Change (GENESIS) was used to generate shoreline simulations for 5,10 and 25 year periods.

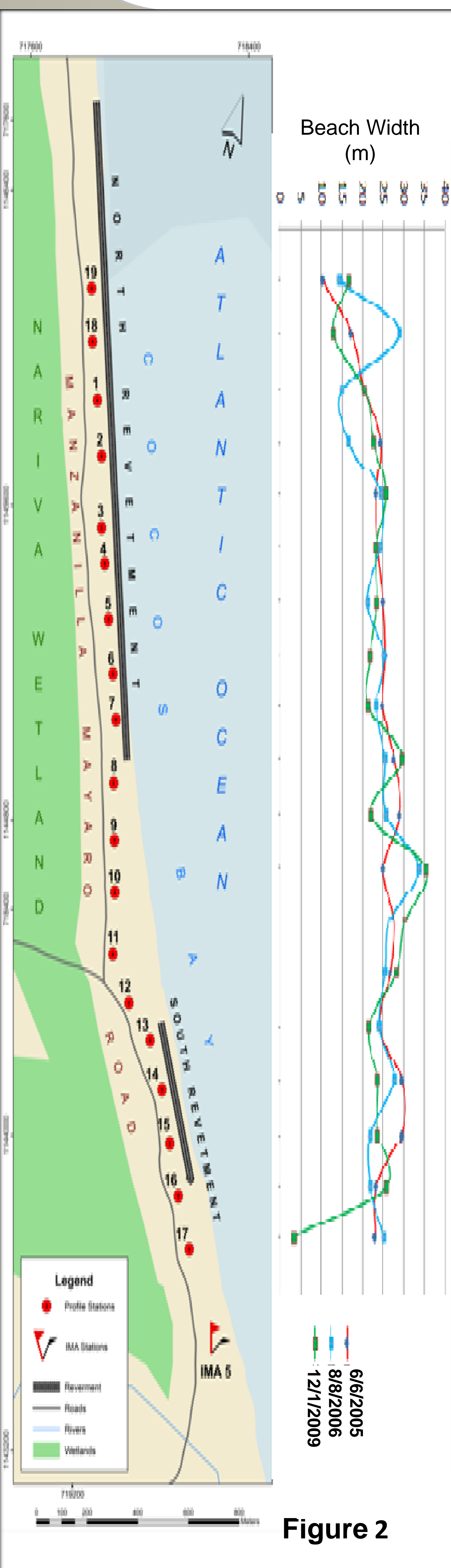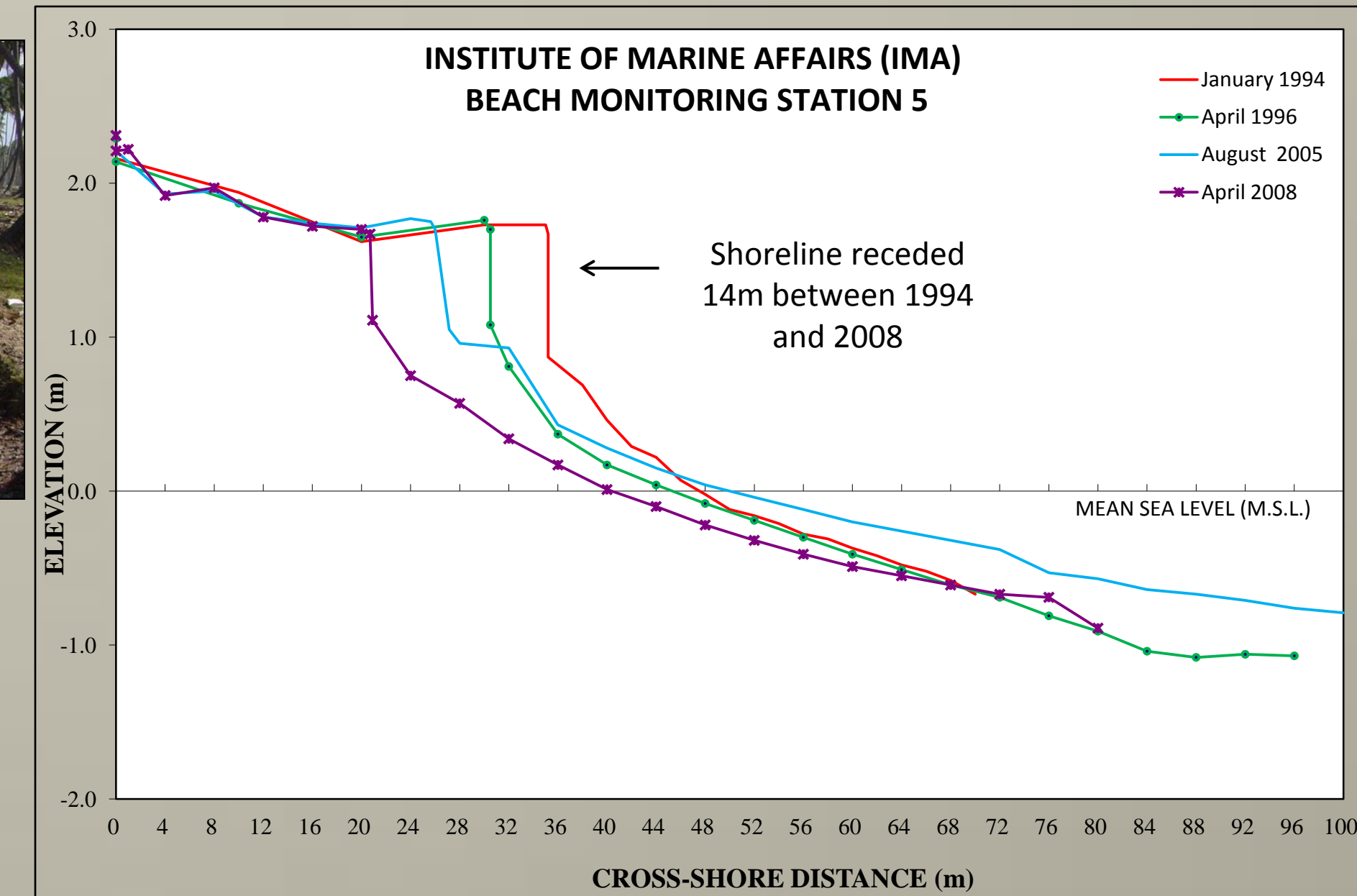Erosion north of Ortoire River prior to construction of revetment (2000)

INSTITUTE OF MARINE AFFAIRS (IMA) BEACH MONITORING STATION 5

Shoreline receded 14m between 1994 and 2008

Beach Width (m)

Figure 2

POST CONSTRUCTION RESULTS

- There was an immediate change both positive and negative in the beach width.
- With the exception of the two most northerly stations, there has been a general reduction in the width of the beach of 3 to 4 m along the northern revetment.
- The shoreline between the two structures continues to recede at an average rate of 0.8 m per year.
- At the southern revetment there has been an increase in beach width of 1.0 m.
- There is continuous erosion between station 16, and Ortoire River mouth; at IMA Station 5 the shoreline receded 8 m within 3 years which is more than during the pre construction period.
- Incorrect placement of the armour units have resulted in large spaces in the armour.
- Local "blue" limestone rocks used by the contractor have shown signs of disintegration and weathering.
- Vegetative growth has occurred on top of the revetment including coconut palm trees within the structure.
- Public access to the beach has become difficult due to the structural failure of the public access steps.
- The simulated shoreline generated by GENESIS for 2009 shows similarities to the beach profile data: erosion primarily along the northern revetment and within the gap and accretion along the southern revetment.
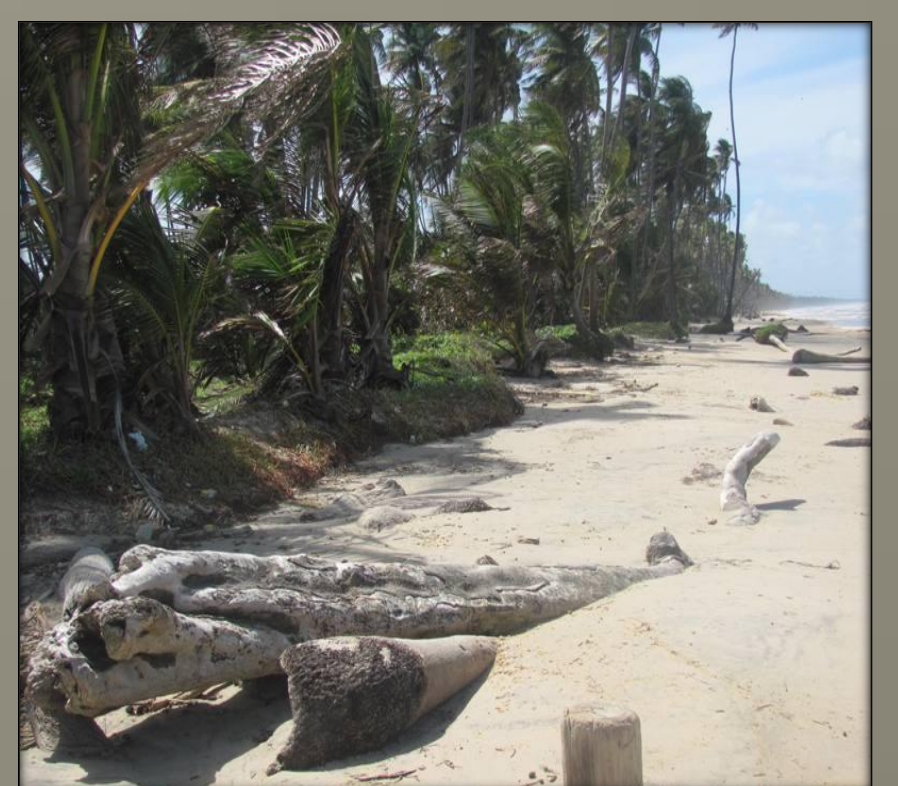

Ortoire River

Erosion between station 16 and the Ortoire River (2012)

Flanking on northern end of north revetment

Failing Steps

Exposed Geotextile

Weathering of the local "Blue "Limestone used to construct the revetment

Erosion between the two revetments.

RECOMMENDATIONS

- Immediately design and implement an Operation and Maintenance Program: routine structural inspection, control vegetative growth and replace armour units.
- Develop and implement a shoreline management policy to address the erosion that is continuing to occur both south and north of the revetment.