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# Scour Protection for Gbaran Terminal at NUN River (Nigeria)

in cooperation with HYCON (Hydraulic & Coastal Engineers)

**Client:** Bilfinger & Berger Nigeria GmbH

**Location:** Nun River, Nigeria

**Construction:** Gbaran Terminal

**Scope of Work:** Setup of a 3D numerical model, simulation of scour

**Methodology:** Numerical 3D model

## INTRODUCTION

At the NUN River, the main branch in the delta of River Niger in the Southeast of Nigeria, the Gbaran Terminal (Fig. 1) was planned at an outer river bend. Because of the anticipated lateral shift of river banks, calculations of scours were recommended.

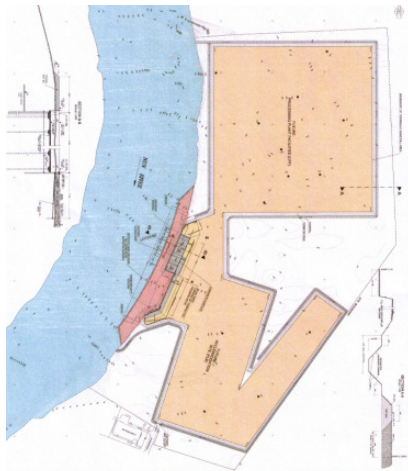


Figure 1: Setup of Gbaran Terminal at Nun River

## METHODOLOGY

No data on discharges and flow velocities were available. Thus, ADCP-measurements, water levels and echo soundings were done to determine variation of flow velocities and discharges, correlate with upstream ABOH Gauge and calibrate a 3D numerical Model (Fig. 2). Bathymetry was setup with a grid spacing of  $\Delta x/\Delta y=10\text{m}$  and a vertical spacing of  $\Delta z=0.5\text{m}$ .

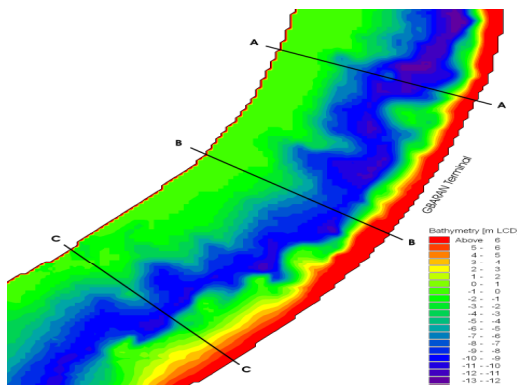


Figure 2: Bathymetry of 3D hydrodynamic Model

## RESULTS

Fig. 3 shows flow velocities at Gbaran Terminal at High Waters.

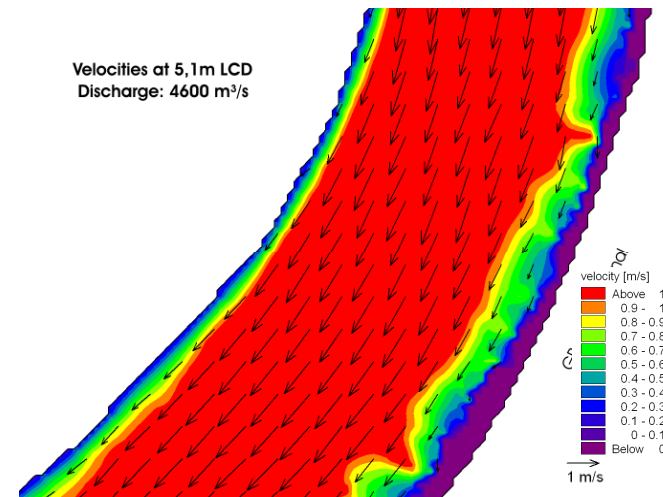


Figure 3: Velocities in the River Bend at High Waters

According model results there is a continuing strong erosion of the outer river bank during higher discharges of Niger and NUN River each year.

Scours estimated by formula (ZIMMERMANN & KENNEDY, 1978) can reach depths of -17 m up to -23 m LCD.

## CONCLUSIONS

It was recommended to prevent erosion of the outer bend and protect terminal foundations at the east bank through a layer of 0.5 m stones or gravel (> 3.5 cm).

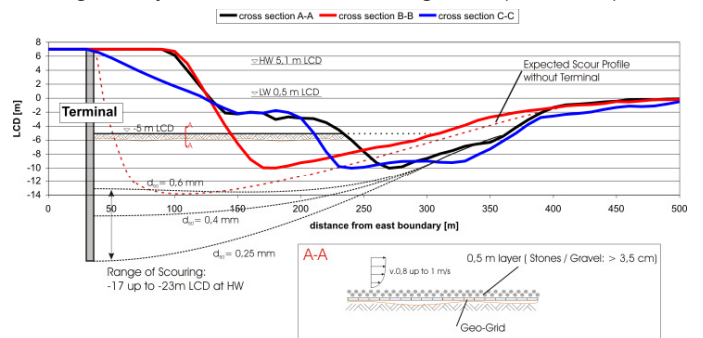


Figure 4: Expected scour profile at Gbaran Terminal

Underneath the gravel there should be a layer of geotextiles (Fig 4).