

Hydrodynamic and morphological effects of dredging a navigation channel in the Corantijn River, Suriname

Background

The Corantijn is one of the major rivers in Suriname with a catchment area of 69.000 km². The river is relatively shallow and tidal water level fluctuations are present up to 240 km upstream from the river mouth. The physics of the flow and sediment transport in the Corantijn River is complex. It is an area where fresh and salt waters meet and where the in and out going tide is quite strong. In addition, the river discharge varies throughout the year and also from year to year. The sediment transport is characterised by a fine silt fraction in the lower reach of the river mainly originating from the sea (Amazon River) and sand further upstream. Alkyon set up a measurement campaign to determine the spatial variation in sediment type and size.

Within the framework of the Bakhuis project, BHP Billiton investigates the feasibility of operating a bauxite mining plant near Apoera, which is about 150 km from the river mouth. Barges will transport the mineral from Apoera Dock downstream over the Corantijn River. However, the river depth is not sufficient at a number of stretches. Therefore, dredging is required as well as a manoeuvring area near the future Apoera jetty.

Objective

The main objective of this study is to quantify the effects of deepening the navigation channel in terms of current velocity magnitudes and sedimentation rates (maintenance dredging).

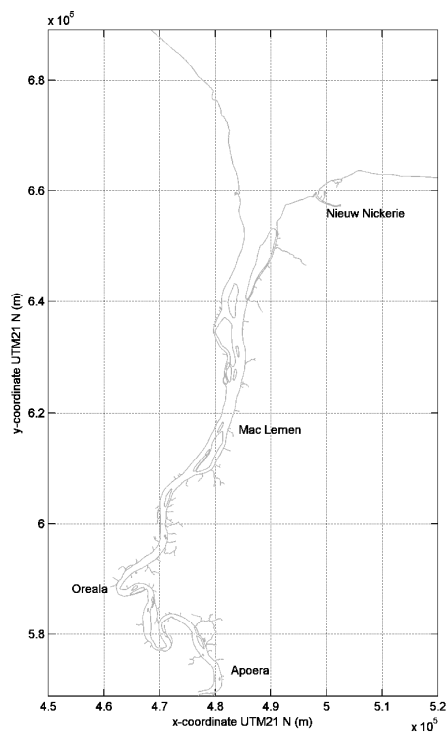
Type of project	Hydrodynamic and morphological effect study
Location	Suriname
Client	BHP Billiton
Period	2007



Launching the boat



Checking measurement locations



The Corantijn River, Suriname

Hydrodynamic study

Alkyon's hydrodynamic experts set up a numerical flow and wave model to predict the current velocities and wave heights along and across the river under different river discharges and various tidal conditions and to quantify the effect of deepening the navigation channel in the Corantijn River for different scenarios. One of the main challenges was to accurately simulate the water level variations and flow velocities in a relatively large estuary like the Corantijn with sufficient spatial and temporal resolution and also keeping the computation time within acceptable limits. Optimizing this, the calibrated and validated model predictions of the water level at different stations along the Corantijn River and predicted flow discharges at one station showed encouraging agreement with historical observations.

Nautical study

Alkyon's nautical and morphological experts defined the dimensions (depth, width and bank slopes) of the navigation channel along different trajectories based on the manoeuvring behaviour of the ships, the present bathymetry and the expected flow velocities as predicted with the flow model. In addition, our nautical experts designed the dimensions of a manoeuvring area (turning circle) near the location where the ships will be loaded.

Barge transport study

Alkyon's transport system experts set up a barge transport model to predict and optimize the number of tugs and barges required to reach the transport capacity requested by the client. In addition, Alkyon presented a sensitivity analysis to reveal the effects of varying the loading capacity or ships draft.

Sedimentation study

Alkyon's specialists on sediment transport and maintenance dredging set up a morphological model based on the available flow and wave model. Challenge herein was to reflect the relatively strong spatial variations in sediment type in the model schematization.

Alkyon carefully maintains its valuable relationships with world famous experts on sediment transport and morphology from various universities. In the framework of the Corantijn sedimentation study we held expert meetings with prof. dr. L.C. van Rijn and prof. dr. G.J.F. Augustinus who reflected on the adopted methods and results. This approach ensures reliable and robust answers to the clients' requests.

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