Seasonal changes in the suspended sediment concentration and bathymetry of the NWW, the impact of low and high river discharge on sediment transport and sedimentation

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Introduction: The EU INTERREG NWE project SURICATES stands for Sediment Uses as Resources In Circular And Territorial EconomieS. One sediment application is the reallocation of sediment on the NWW to enhance the river bank sedimentation for a neighbouring constructed wetland (Groene Poort). Monitoring of the impact of the sediment reallocation also involved extensive monitoring of the suspended sediment concentration (SSC) of and the bathymetry of the NWW at the reallocation site.

The reallocation period was 6 months (May to November 2019), with extra monitoring in February 2019 and February 2020. During this one year we observed shifts in the SSC and bathymetry profiles in different cross sections of the NWW during periods with different river discharges.

Understanding variation in the seasonal sediment transport and sedimentation can help in understanding the impact of climate change on harbor sediment management. Does a low river discharge during a dry summer with less suspended sediment in the river and a lower discharge (but with more salt water intrusion) result in a net increase in sedimentation in the port? Or does the winter period with a higher river discharge and a higher SSC (gross increase in sediment load) has the highest sedimentation rate? SURICATES tries to give insight in these processes since they influence the sediment use strategies in ports.

Methods: For the spatial SSC profiles the backscatter of an Acoustic Doppler Current Profiler was used [1]. Local checks where done with Optical Backscatter (OBS) and Niskin bottle on a profiler frame. SSCs were validated in the lab by weight and grain size distribution (Malvern Mastersizer 2000). The NWW bathymetry was surveyed with the Surveyor two vessel from Port of Rotterdam, using a multi beam echo sounder with a digital terrain model (DTM).

Results: We observed that the suspended sediment flume due to the sediment reallocation on the pilot site location was mainly transported along the Northern riverbank during spring/summer (low river discharge) (Fig. 1) and shifted towards the southern bank in august/winter (high river discharge).

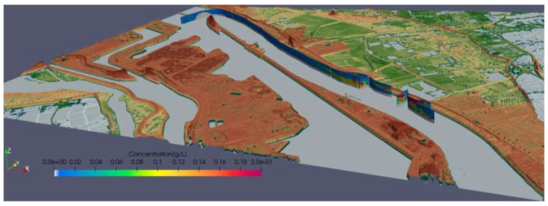

Fig. 1: Suspended sediment flume due to sediment reallocation in the pilot area, profile northern bank

The shift in sediment transport from the northern to the southern bank is also reflected in the sediment core samples, the sediment layer on the North and South banks varies in thickness. The local bathymetry of the area was also impacted due to the reallocation (Fig. 2).

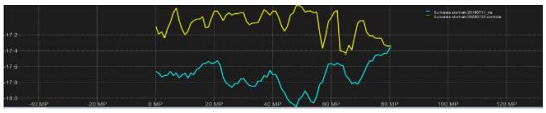

Fig. 2: Impact of sediment reallocation, yellow line before reallocation, blue line after reallocation

Discussion: We observe a strong seasonal shift in the SSC between the northern and southern river bank, impacting the sedimentation and erosion rate in the river. This shift is not predicted by the numerical simulation software (not presented here). Translating this to climate change scenario's, a change in river discharge in periods of drought or during floods will impact the sedimentation and erosion in a river on a local scale. It is too early to conclude if the net sedimentation increases or decreases during dry periods or floods.

References: INTERREG project SURICATES.

[1] J.F.Hoitink et al, Observations of suspended sediment from ADCP and OBS measurements in a mud-dominated environment, Coastal Engineering Volume 52, Issue 2, February 2005, Pages 103-118