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Modelling of flood flushing in a tributary constrained by barrages

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Abstract

Purpose – Flood flushing is one natural cleansing capability of a natural river channel to wash away in-stream pollutants and debris. The purpose of this paper is to explore the flood flushing restriction in a tributary due to its regulated main river channel between two barrages.

Design/methodology/approach – In the absence of detailed data, a concerted effort of computer river modelling is conceptualized to represent possible flushing conditions.

Findings – Regulation schemes of barrages are deduced to interrupt the natural tidal and river flow interaction zones and thus impede river flushing capability.

Practical implications – Modelling of barrages' operating modes suggested that though the man-made structures are unable to replicate natural flood flushing, proper operations offer a secondary option to achieving the desired water quality objective in a constrained tributary.

Originality/value – Studies on minor tributary of modified main-stem river are few. The attended tributary-trunk relationships carry the credibility of this paper.

Keywords River pollution, Hydrodynamics, Water retention and flow works, Pollutant transport, Regulation, River channel, Tidal fluctuation, Water quality, Modelling

Paper type Conceptual paper

1. Background

Maong River is one of the tributaries of Sarawak River in the southwestern parts of Kuching City, Sarawak State, Malaysia. The river has two tributaries, namely Maong Kiri and Maong Kanan rivers. It is the largest sub-catchment draining the city into Sarawak River that vivid from an aerial map (Figure 1). Maong River confluences with Sarawak River at about 18 km upstream of Kuching Barrage, where tidal flushing is significant in removing pollutants from the river system naturally (Jenny *et al.*, 2007). Kuching Bay is subjected to spring tides as high as 6-6.5 m (Memon and Murtedza, 1999). Annual rainfall within the catchment is typically around 4,000 mm (Department of Irrigation and Drainage (DID), 2003). Therefore, the city is at risk to fluvial and tidal flooding events.

In 1998 under the Sarawak River Regulation Scheme (KTA Consulting Engineers, 1994), Sarawak State Government established Kuching Barrage with gate systems to control the floodwater level especially in front of the city centre (Sharp and Lim, 2000). The barrage is the only outlet of the river basin, while the other two exits are blocked. Another 8-km-long and 10-m-deep flood bypass channel with a barrage would be in full operation by 2015 to divert floodwater from Kpg Paroh to Salak River (Jurutera Jasa Consulting Engineers, 2006). The new barrage is termed here as Second Barrage. The facilities are intended to complement the existing Kuching Barrage. These two barrages would discontinue Sarawak River and particularly the Lower Sarawak River appears to have the most significant changed from natural. The tributary Maong River would be restricted between the barrages. This paper is initiated to investigate the conditions by means of utilizing a hydrodynamic model to simulate Sarawak-Maong Rivers-Barrage operation interactions.

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