Flushing Process within Perched Beaches

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ABSTRACT:

Coastal zones in many countries suffer from strong offshore direct rip currents. Rip currents regularly lead to hazardous situations, and at some beaches swimming is prohibited for a considerable time of the year especially during summer storm. Also, the swimming may be prohibited at beaches where the wave height is too high. Saski et al (1975) concluded that breaker heights smaller than 0.6m and current velocities smaller than 0.2m/s are considered as comfortable swimming conditions, but it is hard to swim against a rip current of 0.5m/s and breaker height greater than 2.0m even for good swimmers. So, there is an essential need to construct suitable coastal structure in order to secure safe conditions for swimmers.

There are several plans and investigations for improvement of the swimming conditions. The use of coastal structures is the tool in many cases and, hence, the impact of their construction becomes of great interest. The impact of marine structures on shoreline changes and water quality under various waves, current and site conditions is of great interest to engineers and scientists. The present study has been recommended the use of perched beach as a possible alternative for safe swimming conditions. So, water quality within perched beach basin must be considered, and it is particularly important for health and environmental quality, especially in warmer climates where biological processes are accelerated. Successful control of water quality is usually dependent upon periodic exchange of the basin water with the sea water of the open sea. RMA model was applied to investigate various configurations of the perched beach including submergence ratio of the breakwater, groin with/without gap, the gap width/location and emerged/submerged groins. These configurations have been compared from the point of view of flushing rates to develop general guidelines for the design of similar constructions.

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It has been found that the perched beach could be a reliable solution for protecting swimmers along the coast with minimum impact on the shoreline while preserving acceptable water quality within the perched beach. Good flushing rates can be achieved if the crest level of the submerged breakwater and groins is at least 0.5m below M.S.L. and the groin at the up drift side has a gap located near its offshore end, while the groin at the down drift side has a gap close to the shoreline. To allow water flow along the shoreline, it is recommended to have the up drift gap wider than the down drift one.

Keywords: *Water quality, Perched beach; coastal hydro-dynamics; Numerical models; Flushing rates; Environmental impacts.*

1. INTRODUCTION:

Due to the increasing demand for safe swimming conditions with minimum impact on the shoreline and keeping acceptable water quality, new studies have been conducted to meet these requirements using appropriate coastal structures. Several resorts constructed some types of countermeasures to protect their shoreline and develop a safe swimming area using either soft or hard measures. The challenge is always to introduce protected areas with minimum impact on environment including shoreline, currents, eddies and water quality. Among the negative impacts experienced at different coastal villages was excessive scour at the down drift side, stagnation zones, lake of circulation and flushing...etc. The latter drawbacks could be due to constructing improper structures, lack of database, non-professional studies…etc.

Understanding the site characteristics and water hydrodynamics in addition to the characteristics of the proposed countermeasure are key factors in selecting the best protection structures/configurations to match site existing conditions with minimum negative impacts on the shoreline and water quality. The Shore Protection Authority of Egypt (SPA) conducted a study in (2002) for the development of the North-West coast of Egypt and recommended the use of perched beach as a possible alternative for safe swimming conditions along El-Arab bay zone, located from El-Agamy at Km 21 to El-Alamin city at Km 120 (along Alexandira-Matrouh road).

The perched beach consists of two bounding groins and shore parallel breakwater at groin ends enclosing a sheltered basin. The top level of the offshore part of the submerged breakwater is close to the sea water surface level to ensure water flow from open sea to the basin and not to obstruct sea view; i.e. minimal visual impact. Basins enclosed by submerged breakwaters are existing naturally; i.e. rocky submerged shoal enclosing a shelter basin such as in Stanley beach at Alexandria named "El Bahr El Sagir" and artificially or semi-artificially such as in Sela beach at Bat-Yam, as illustrated in (Figure 1).

The enclosed basin at Sela beach is 400 meters alongshore by 175 meters perpendicular to the shoreline.