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Coastal erosion and accretion in Kuwait – Problems and management strategies

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ABSTRACT

Kuwait is a coastal country with 496 km coast. It is located in the Arabian Peninsula, at the north-western part of Arabian Gulf. Many coastal infrastructures are close to high water line and hence attract erosion, especially in the south. The northern part is significantly dominated by sedimentation. Remote sensing is used to identify the hot spot of erosion and accretion. Kuwait does not have good quality natural stones and needs to be imported from other countries for any coastal structure project and is expensive. Hence innovative coastal protection solutions, which are cost competitive, environment friendly, easy to fabricate, install and reorient, are needed. Geo-bags, filled with sand are field tested. New type of floating breakwaters are developed which has reduced width compared to conventional pontoon breakwaters, by introducing skirt walls at the keel of the floating breakwater. It is found that material saving of more than 60%–75% is possible when compared to rubble mound offshore breakwaters. Many coastal infrastructures in the northern part of Kuwait are suffering due to sedimentation. Detailed field, lab and numerical modeling studies were carried out to understand the sedimentation problem and for providing solutions to reduce the degree of accretion in the marinas and seawater intake structures. Work is in progress for rolling out the Integrated Coastal Zone Management Plan for Kuwait.

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1. Introduction

More than 50% of the world's population is living within 60 km of the coastline on the earth and would rise to almost 75% by 2020 (Anon, 1992). The coasts are very dynamic and undergo significant changes due to natural and manmade influences. A proper understanding of the coastal morphological changes is very essential for integrated management and sustainable development of the coastal zone. Kuwait is a coastal country. The country is situated on the northeastern corner of the Arabian Peninsula. Kuwait covers an area of about 17,800 km², extending between Latitude 28° 30' N and 30° 05' N and Longitudes 46° 3' E and 48° 35' E (Fig. 1). Kuwait is bordered by Arabian Gulf in the eastern side, Saudi Arabia in the south and south-west and by Iraq in north and north-west. An Amiri Decree issued on 17 December 1967 defined the boundaries of Kuwait's territorial waters: both the mainland and islands as 12 miles (22.32 km). The area of Kuwaiti territorial waters is estimated at about 2200 square miles (7611 km²). They can be divided into two parts: the shallow northern area, which is less than 5 m deep in

most places with a muddy bed, and the relatively deep southern area, which has a bed of sand and silica deposits. The north-eastern part of Kuwait (for example Boubyan Island, see Fig. 1) is less inhabited and the coast is mostly evolving by natural processes, whereas the south-eastern part of Kuwait and the southern part of Kuwait Bay is thickly populated and the coast is evolving mainly due to man-made process like construction of marinas, ports and harbors, seawater intakes, Jetties, seawalls, moles, slipways for boats, private and public Chalets etc. Sustainable and holistic development of all coastal engineering activities in Kuwait is essential for meeting the future requirements of increased population. Kuwaiti coastal area has some of the very vital activities such as:

- Power and desalination plants built on the coastal area for ease of drawing seawater for cooling and desalination.
- Navigation, which is one of the lifeline activities in Kuwait, since import and export of most of the cargoes are made via sea transports.
- Some of the prominent housing schemes for the present and future population are located on the coast (e.g. Sabah Al-Ahmad sea city in Al-Khiran, see Fig. 2).

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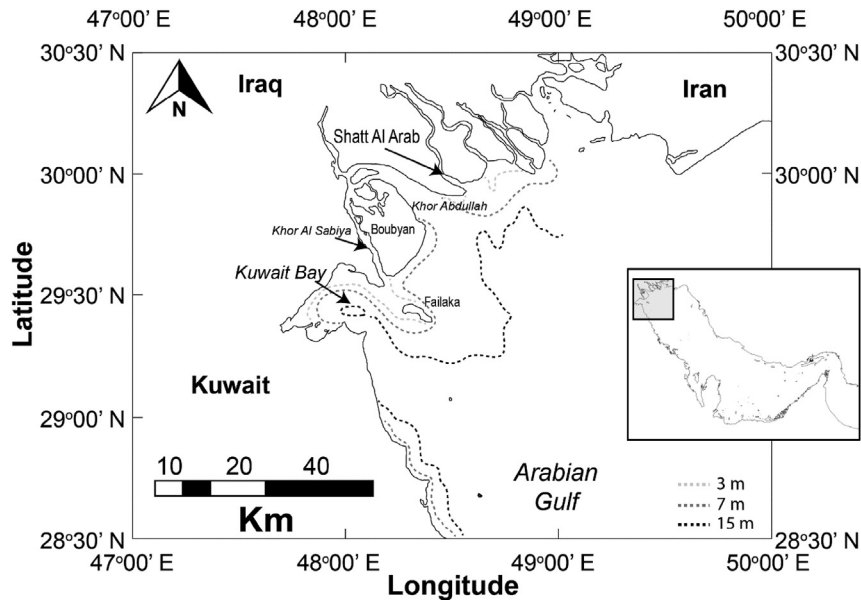


Fig. 1. North-western region of the Arabian Gulf with Kuwait and its sea front.

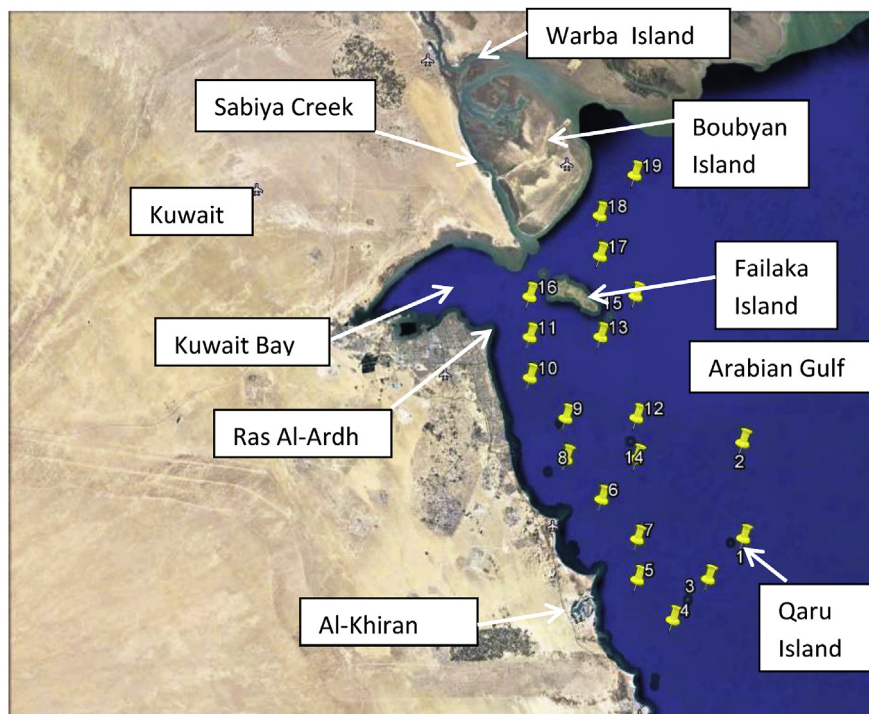


Fig. 2. Locations for the study of extreme wave climate in Kuwait. (The hindcasted wave data is based on the marine wind speed from 1.1.1993 to 31.12.2004). (Source: Google earth).

- Tourism and recreation activities are gaining momentum in recent times.
- Environmentally friendly methods of disposal of treated sewage from residential areas and effluent from industry into deeper Arabian Gulf waters for better dispersal.
- New mega port construction at Boubyan Island (see Fig. 2) to meet the future demands of this region.
- Developing Failaka Island (see Fig. 2) as a tourism hub.

Certain coastal areas in Kuwait are undergoing coastal erosion

due to natural and anthropogenic effects. This happens mainly in the southern part of Kuwait. Some coastal areas are experiencing with significant sedimentation and are dominant in the northern part of Kuwaiti coast. The coastal erosion is mainly due to the fact that the infrastructures were built very near to the high water level, without giving due attention for sea level rise and its effect. Sedimentation in the coastal infrastructure is due to the presence of high suspended sediments in the seawaters in the northern part of Kuwait. This paper discusses about the various studies carried out to understand the erosion and accretion problems in Kuwait,

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