

BRIEF SUMMARY OF PROJECTS CARRIED OUT
BY
THE HYDRAULICS RESEARCH INSTITUTE
Coastal hydraulics & marine structures

1- Karon Lake

Consultant : HRI

Period : 1987 - 1989

The study objective was to check the reason of the increase in water level of the lake. A sedimentation problem was predicted and had to be evaluated.

The study comprised field investigations, data collection, bathymetric surveys and desk study to review previous assignments.

2- The Hydrographic Survey of Moot Pond *El-Dakhla- El-Wadi El-Gadeed*

Consultant : HRI

Period : 1997 – 1998
1999 – 2000
2000 - 2001
2001 – 2002

The study objective was the hydrographic survey and finding the optimal solution for the lake bank stability.

The study was conducted by hydrographic survey of Moot Pond with area of 580 feddan and also two additional ponds with total area of 33.44 feddan. Bed samples were taken, 60 cross-sections were configured and bed contour mapping were studied. The study in 1999 showed that dredging amount reached one 1358492 cubic meter.

The study of 2000 recommended the periodical following and stated that dredging at level of 101.0 m amounted 2090559 cubic meter.

3- Construction Borolos Fishing Harbour

Consultant : HRI

Period : 2001 -2002

The main study objectives were to search effects of constructing the suggested fishing harbour on shoreline balance, to study the optimal solution for shoreline safety, and also to find the optimal solution to preserve the protection wall of Borolos City.

The study comprised of comprehensive hydrographic survey, water level measurements, bed and suspended samples analysis, and data collection. 1-D mathematical model (UNIBEST) was applied for studying the different alternatives and suggestions to reach the most suitable solutions.

4- Karon Lake

Consultant :HRI

Period : 1987 – 1989

The study objective was to find out why the water level increases in the lake. A sedimentation problem was predicted and had to be evaluated.

The study comprised field investigation; data collection, bathymetric surveys, and desk work.

5- Morphological Studies for Palm Beach

Consultant : Six October Society

Period : 1996-1997

The study objective was to investigate the effect of constructing an offshore breakwater in front of Palm Beach to provide safety for the swimmers by reducing the wave height; on the morphology and stability of the beach.

The study comprised field investigations, data collection, bathymetric surveys of 4 km long, and desk study using the 1-D Mathematical Model (UNIBEST).

6 – Rip Currents Investigation at El-Zohour Village

Consultant : HRI and Ministry of Housing

Period : 2002 – 2003

The study aimed at inspecting the rip currents generation at the beach of El-Zohour Village (ZV) so as to create better and safe swimming conditions.

To investigate the rip currents, the bathymetric survey was conducted to produce the bed levels contour map. The wave climate at ZV location was analyzed to introduce the wave conditions at the boundaries of the modeled area. The numerical models utilized in this study were: a two dimensional horizontal model (Delft3D) and one-line model (Unibest). The study was conducted in two main parts. The first part was to investigate the hydrodynamic effect of the proposed alternative to diminish or decrease the rip currents around the village. The second part was to examine the morphological evolution of the optimal proposed alternative.

It was concluded that the best solution is to establish warning signs at rip current locations. Furthermore, this solution fits well the environmental and swimming safety requirements. The floating warning signs are located at a water depth of 5 m and composed of 10 concrete units with dimensions of 4 m width by 20 m length each.

7 –Integrated Development of Egypt’s Northern Coastal Zone

Consultant : HRI

Period : 2002 – 2003

The main objective of the study was to evaluate and predict the effect of the proposed measures for protecting the shore against the rip currents as well as to create safe areas for swimming entertainment and sea sports.

To achieve the aforementioned objective a physical model was constructed at the HRI Coastal Experimental Hall to better understand the phenomenon under consideration. Two different protection schemes were tested. The first scheme was perched beach, it could be described as long submerged breakwater with two groins at both ends and it is perpendicular to the shore. The second protection scheme was detached breakwater.

The results of the mid-depth flow velocities for the first scheme revealed that the perched beach with open ends has higher velocities for Areas 3 and 4 than those of the one with submerged groins, while for Areas 1 and 2, the submerged groins recorded higher values than those of the perched beach with open ends. On the other hand, the submerged groins alternative revealed lower velocity values for Area 1 compared to those of the detached breakwater with open ends.

8 – Shoreline Erosion at Rosetta Area

Consultant : HRI

Period : 2002 – 2003

Due to the socio-economic importance of the area and the need for providing an appropriate environment for summer recreational activities, the protection of the shoreline from erosion needs no emphasis. The main objective of the study was to examine the possible alternatives for protecting the shoreline at Rossetta Area from erosion, while maintaining the western barrier of Rosetta Estuary.

The study comprised field investigations, data collection, and bathymetric survey. A three-dimensional numerical model "Delft 3D" model was employed to test the proposed solutions. The following modules were used: Wave Module (HISWA); Currents Module (TRISULA); Sediment Transport Module; and Bed Levels Change Module.

Three different solutions were explored and the study revealed that the best solution is to construct 9 coastal groins perpendicular to the shoreline for a distance of 5 km west of the western barrier of Rossetta Area.

9– Field Measurements for Al-Burullus Fishing Port

Consultant : HRI

Period : 2005-2006

The study aimed at investigating the impact of constructing the port on the adjacent area. The survey covered 4 km, of which 2 km lie west of the estuary.

The survey revealed that the bed levels at the western side raised by 1 m to 2.5 m due to the construction of breakwater, while at the eastern side the bed levels remained constant.

10 – Physical Model Stability Study of Double Protection System Using Groins and Revetment

Consultant : HRI

Period : 2005-2006

The project aimed at constructing a series of groins and revetment to protect the shore against wave attack. There is a need to carry out stability tests for the groins and the revetment to assure that the armor layer is stable with the extreme wave conditions and water levels.

The proposed physical model will have undistorted scale; the model scale will be designed according to the available data of the project and the area to be simulated. The details of the revetment and the groins will be presented in the model. Model bed bathymetry will be formed from sand, cement mortar or movable material. Measurements will cover stability of armor units in the head portion, including observation of rocking of armor units along with overtopping and measurements of wave climate, as specified.

The test facility of HRI is a 30x30 m basin equipped with a 25 m long hydraulically driven wave generation machine. The machine is suitable for generating prescribed regular and random waves up to a significant wave height of 0.18 m. The wave generator is built-in wave dissipating system to minimize the reflected wave effect and dissipate reflected energy from the basin boundary.

11- Towards the Improvement of Flow Circulation in the Montaza Bay and Beach Stabilization

Consultant : HRI

Period : 2005-2006

Because of the limited water exchange between the bay and the open sea, the bay undergoes critical water quality problem represented visually by black-colored seawater that is observed during the moderate wave condition in the summer season. In the winter season, with storm

conditions, the problem of water quality disappear but another problem exists. This problem is due to the shoreline erosion. The study main goal was to determine the optimum solution of both problems in a delicate way in order not to induce any environmental impacts or worsening the coastal problems.

The problems were investigated by physical and mathematical models after data collections. The present situation was hydrodynamically and morphologically simulated. The hydrodynamic simulations results revealed that the water is relatively stagnant during the moderate wave condition, while the morphological simulations for one year showed severe erosion of the shoreline.

The proposed solution involved:

- Removing or modifying the diving tower;
- Adding sand nourishment to the narrow beach to extend it to 10 m wide with a slope of 20:1. The sand utilized in the sand nourishment should have a median diameter (D_{50}) which should vary between 0.5mm and 1.2 mm; and
- Dredging under the Island Bridge.

12- Improving the Swimming Conditions at the Ghazala Village Beach

Consultant : HRI

Period : 2005-2006

This study aimed at creating sandy beach in front of Ghazala Village (GV) to create better swimming conditions. Having understood the sediment transport phenomenon, some alternatives are introduced to create and maintain the sandy beach. Bathymetric survey was conducted to produce the bed levels contour map. After constructing the breakwater in front of the hotel two survey missions were conducted to investigate the beach changes due to the breakwater construction. Six hundred meters along the water line and the breakwater were surveyed. The bathymetric survey covered an area of 7.5 km length parallel to the shoreline and 2 km normal to the shoreline.

The wave climate at GV location was analyzed to introduce the wave conditions at boundaries of the modeled area. The physical model was constructed in the wave basin in HRI. The numerical model utilized in this study are a two dimensional horizontal model (Delft3D). The models were reasonably calibrated. The study was conducted in two main parts. The first part was to investigate the hydrodynamic effect of the proposed alternative in creating sandy beach in front of GV. The second part was to investigate the morphological evolution of the optimal proposed alternative.

Comparison of the Delft3D simulations and the physical model showed a considerable agreement, since the velocities and flow pattern at the nearshore regions are almost identical in both simulations. Three alternatives were investigated from the hydrodynamic computations

point of view. Some of them somewhat improved the swimming conditions and created sandy beaches. Alternative HRI 3 (two groins and detached breakwater with length of 70 m having crest level of +3 m above MSL was found to create sandy beach in front of GV.

13- Hydrographic Survey for Sahl Hashish, Red Sea, Egypt

Consultant : HRI

Period : 2006-2007

The main objective of this study was to carry out bathymetric and hydrometric surveys at Sahl Hashish, some 20 Km south of Hurgada, the Red Sea, Egypt. The survey is considered a main part of the proposed hydraulic studies for the design stage of Serrenia beach side and the marina in Lot 38.

The bathymetric and hydrometric required field data included:

- A detailed bathymetric survey for an area of 5 Km further southwards Lot 38, which is extended into the Sea till a water depth of some 40 m.
- Simultaneous tidal level and tidal flow measurements at a point opposite to Lot 38 at a water depth of 8 to 10 m for one month.
- Collection of bed material samples.

14- Field Measurements for Jeddah Corniche Project

Consultant : HRI

Period : 2006-2007

The objectives of this survey is to determine Sea bed levels and contours, shoreline measurements, collection of information pertaining to currents, wind, water temperature, salinity, turbidity and water surface elevations, ecological survey and eventually reporting.

The consultants will perform field works to cover the coastal region of the project site; such survey will consist of the following:

- Topographic survey;
- Bathymetric survey;
- Hydrographic survey; and
- Ecological survey.

The final draft report will include:

- Survey report on the topographic, bathymetric, hydrographic, and ecological surveys.
- General site plan at an approximate scale to indicate the limits of the survey area, survey control stations and all other relevant information.

- Map the survey results in AutoCAD with a scale of 1:2000. The computer files will be build-up in separate layers for each of the following aspects:
 - Grid points at 100 m distance and benchmarks
 - Topographic features (building, road edges, services, etc)
 - Depth contours at intervals of 1 m

15– Marina Project: Proposal for Hydraulic and Morphological Investigation

Consultant : HRI

Period : 2006-2007

The objectives of the study are to:

- Propose an urgent action to mitigate the sedimentation problem and temporary improve the water circulation;
- Investigate the stagnant zones inside the inland lakes;
- Evaluate the water circulation within the lakes;
- Propose a suitable and feasible measure to improve the water exchange; and
- Investigate the impact of the proposed shoreline protection at Al-Ahlam Resort.

In order to achieve the above-mentioned objectives, data collection, field investigations, and modeling are required. The survey area is 14 x 5 km². The alongshore distance of 14 km shall cover the shoreline of Marina Resort, shoreline of Al-Ahlam Resort, including additional 1 km at the western and eastern sides. The distance offshore is determined whichever is closer, 5 km distance offshore or 12 m water depth. Cross-shore profiles are to be surveyed with an interval of 50 m around the lake's openings and 100 m further away. The inland lake of Marina should be covered in details with a grid of not less than 20 m x 20 m.

Numerical model simulations with shoreline model (Unibest) and 2-D hydrodynamic model using Delft 3D will be carried out. The two-dimensional model (Delft3D) is to investigate and satisfy the objectives of the Project. The data required for mathematical modeling studies including wave data, current data, recent bathymetric, topographic and hydrographic surveys and Admiralty charts. These data will be collected or measured as explained above.