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THE EFFECT OF CASPIAN SEA WATER LEVEL CHANGES ON NOWSHAHR HARBOR SEDIMENTATION

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Key Words: Noushahr Harbor Sedimentation, Caspian Sea Water Level Change.

Introduction

Harbor sedimentation is an important problem to be addressed, especially within the access channel. Noushahr harbor (from 1939) had no sedimentation problem until 1988. Then dredging became necessary at the harbor entrance. The dredging rate was about 100'000 to 120'000 m³/year for several years. However, it has been increased to about 200'000 m³/y in the last three years.

The sedimentation problem of Nowshahr harbor has been investigated in the present research. Several factors have been studied including the sea level change, modifications in the harbor layout, and the effect of road construction along Chaloos river near the harbor.

History of the Harbor

The harbor has been constructed during the years 1930 to 1939. The harbor layout has been modified during the years 1993 to 1997 by increasing the length of the main breakwater and shifting the eastern shoreline towards the sea. The shoreline has been shifted further recently. The harbor entrance had no sedimentation problem until 1986. The dredging rate after that has been illustrated in Fig. (1). The dredging value has been increased within the recent years. The net littoral drift at the shoreline is from the west to east.

The mean sea level has been changed considerably during the last century. This phenomenon affects: the water depth at the breakwater head, the sedimentation capacity at the upstream shoreline, and the distance between the shoreline and the harbor entrance. The Caspian Sea water level has been decreased by 1.5m during the harbor construction (from -25.3 to -27.0m). The decreasing trend continued until 1977 when the sea level was -28.5m (-3.2m after harbor construction). Then the sea level increased continuously until 1995 when it was -26.0m (+2.5m in 19 years). Then the water level decreased slightly until 2001 (-26.5m). The Caspian Sea level has been nearly stable after that, except for the seasonal changes.

Study Results

Several factors were investigated in order to find the main cause of introducing sedimentation problems after 1988 (not before or after that) and the recent noticeable increase in the dredging rate. The shoreline changes immediately after the harbor construction have been studied (the effect of sea level change has been filtered). It shows that the net littoral drift is about 170'000 m³/year eastward. Apart from the sea level rise, the natural sediment storage at the western

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shoreline of the harbor would not be able to delay harbor-entrance sedimentation until 1988. The sea level rise has been 0.13m per year during 1976 to 1995. It means adding 100'000m³ more capacity for the sediment storage at the upstream shoreline per year. This fact delayed sediment bypassing for several years. Then the sea level has been decreased during 1995 to 2001 by 0.08m per year. This is equal to 60'000m³ decrease in the upstream sediment storage per year. This factor had the potential to increase the harbor entrance sedimentation rapidly. However, the length of the main breakwater has been added at the same time for a different reason (completed at 1997) which added the upstream sediment storage and delayed high sediment bypassing again.

Dredging rate has been increase during the last three years. The annual hydrographies after 1999 have been compared in this regard. The comparison showed that the access channel has been deflected slightly by sedimentation during the last decade (dredging was less than necessary). The dredgers have tried to re-adjust the channed direction during the recent years. In fact part of the dredged material is due to sedimentation in the previous years.

Long-term numerical simulation of the morphology (1D) and short-term simulations of the wave, current and sediment transport (2D) during and after selected storms have been executed. The simulation results support the mentioned findings.

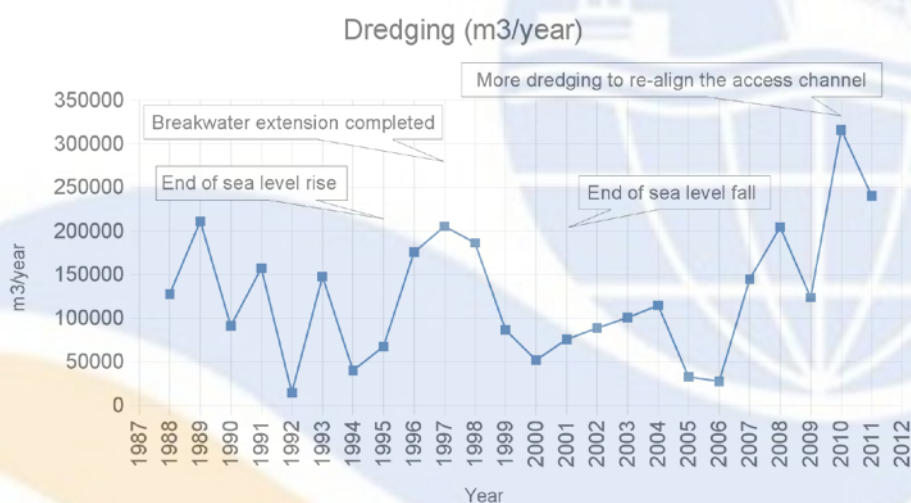


Fig. 1) Annual dredging rate, Nowshahr harbor

Conclusion

The sediment budget calculations and the numerical simulations of the morphology show that the sedimentation problem of Nowshahr harbor is a natural process which has not been accelerated by the harbour layout modifications.

References

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