Impact of Growing Islands on the Flood Capacity of Tigris River in Baghdad City

Ammar A. Ali, Nadhir A. Al-Ansari, Sven Knutsson
Department of Civil, Environmental and Natural Resources Engineering, Lulea University of Technology, Sweden
Emails: ammar.ali@ltu.se, nadhir.alansari@ltu.se, sven.knutsson@ltu.se

INTRODUCTION

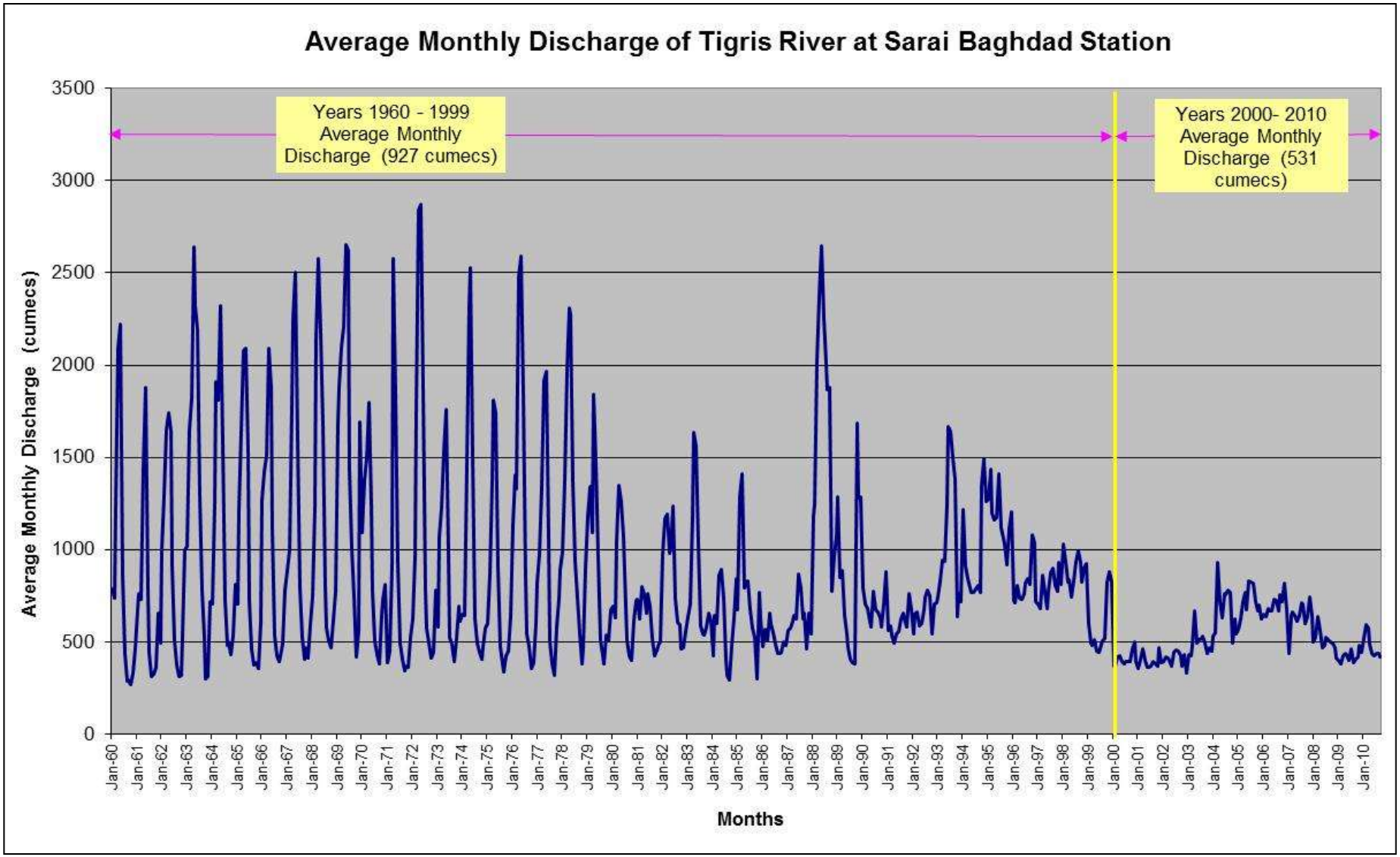
In recent years, substantial changes have occurred in the morphology of the Tigris River within Baghdad City. Although huge volumes of sediment are being trapped in recently constructed headwater reservoirs, the number of islands in the Tigris at Baghdad is increasing.

The debris of bridges destroyed in the wars of 1991 and 2003 and their subsequent reconstruction have enhanced the development of these islands. As a consequence the ability of the river to carry the peaks of flood waters has been reduced. This has led to potential increase of flooding in parts of the city.

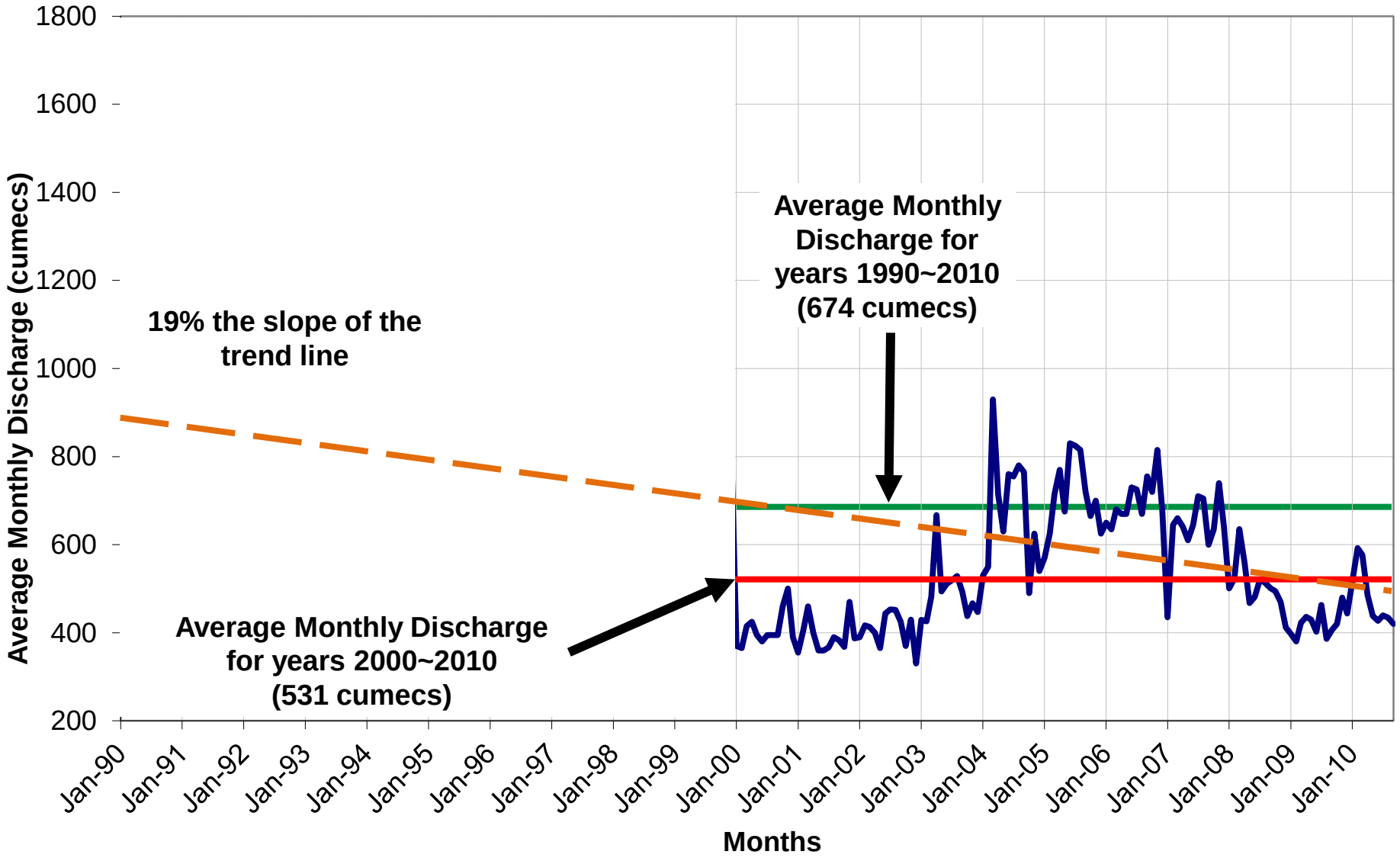
Map of Iraq showing the Tigris and Euphrates Rivers.

Aerial photo of Baghdad City

DISCHARGES OF TIGRIS RIVER FOR THE PERIOD 1960-2010



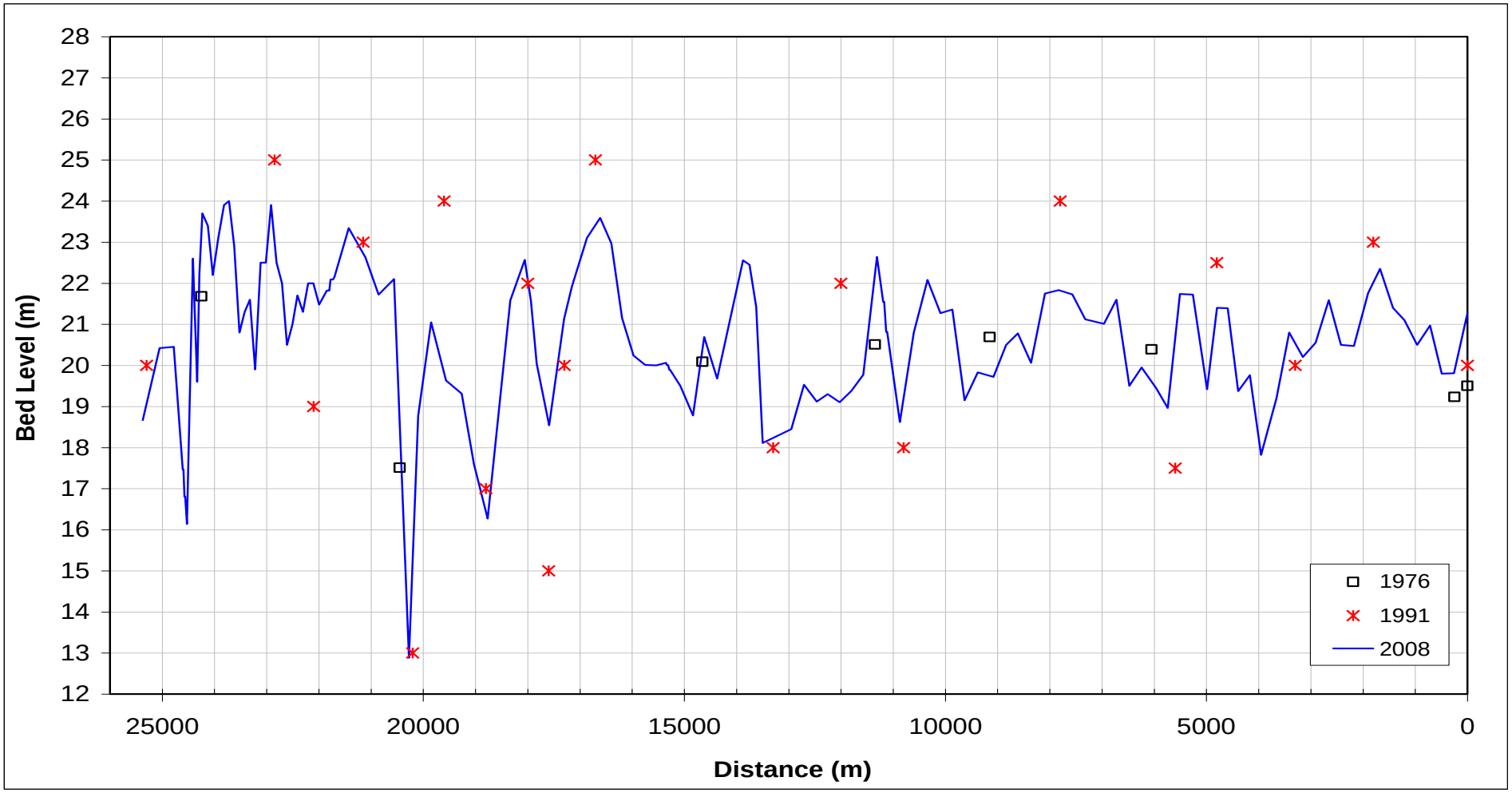
DISCHARGE OF TIGRIS RIVER FOR THE PERIOD 1990-2010



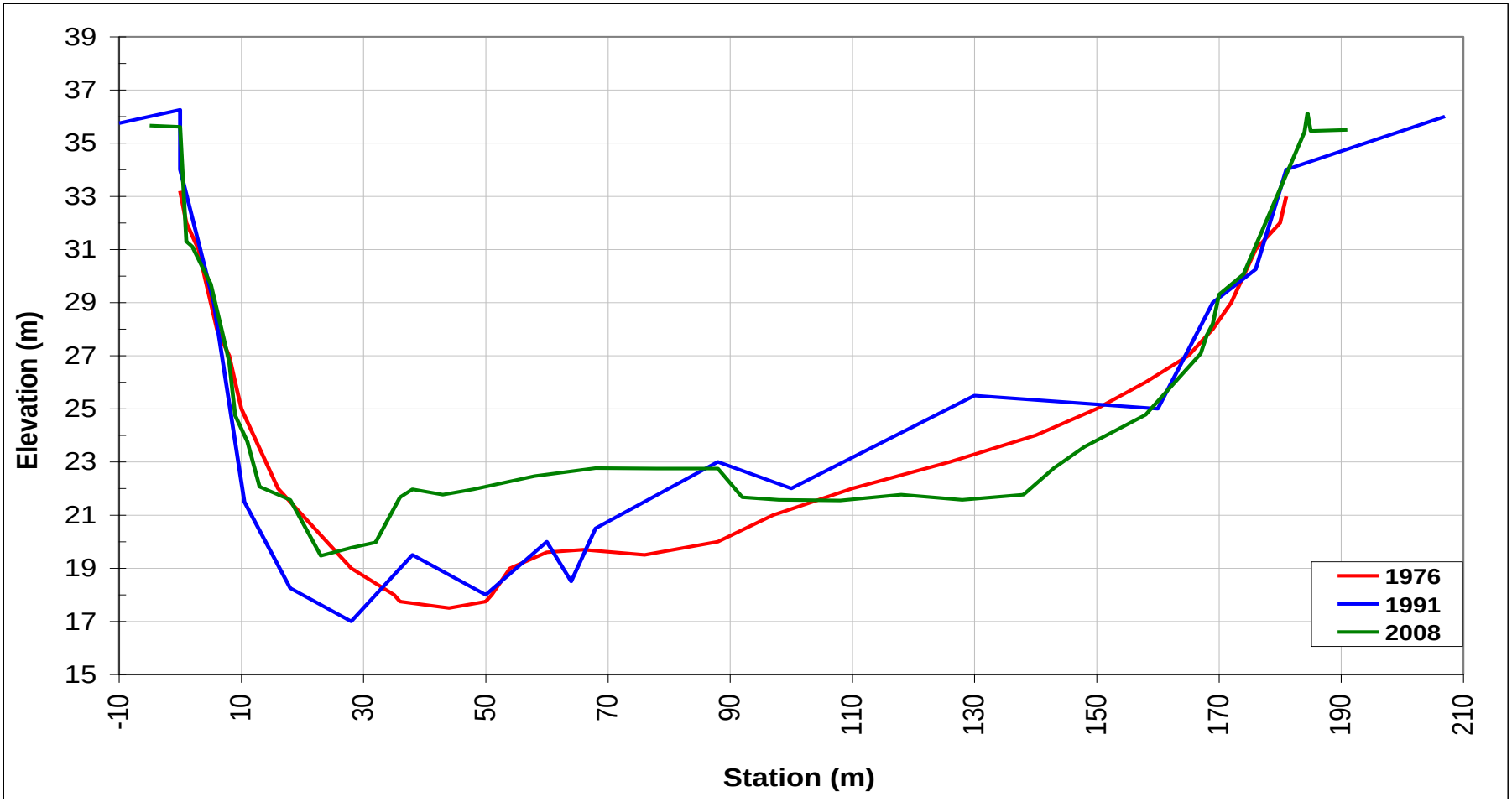
CONTROL STRUCTURES UPSTREAM BAGHDAD CITY


09/02/2006

CHANGES IN TIGRIS RIVER BED ELEVATIONS DURING 1976, 1991 AND 2008



CHANGES IN GEOMETRY SHAPE OF SARAI BAGHDAD GAUGING STATION



HYDRAULIC MODEL

- A one-dimensional steady-flow hydraulic model using HEC-RAS was used to predict the maximum flood capacity for the river.
- The upstream condition was the average daily discharge in Baghdad for the past ten years.
- The downstream condition was the updated rating curve at Diyala River confluence.

METHODOLOGY

River geometry

- The survey conducted in ***2008***
- ***105*** cross sections at average intervals of ***250m***.
- The length of the reach ***26*** km, starts from ***Suspension*** Bridge at u/s till the ***confluence*** with ***Diyala*** River at d/s.

METHODOLOGY

Model calibration

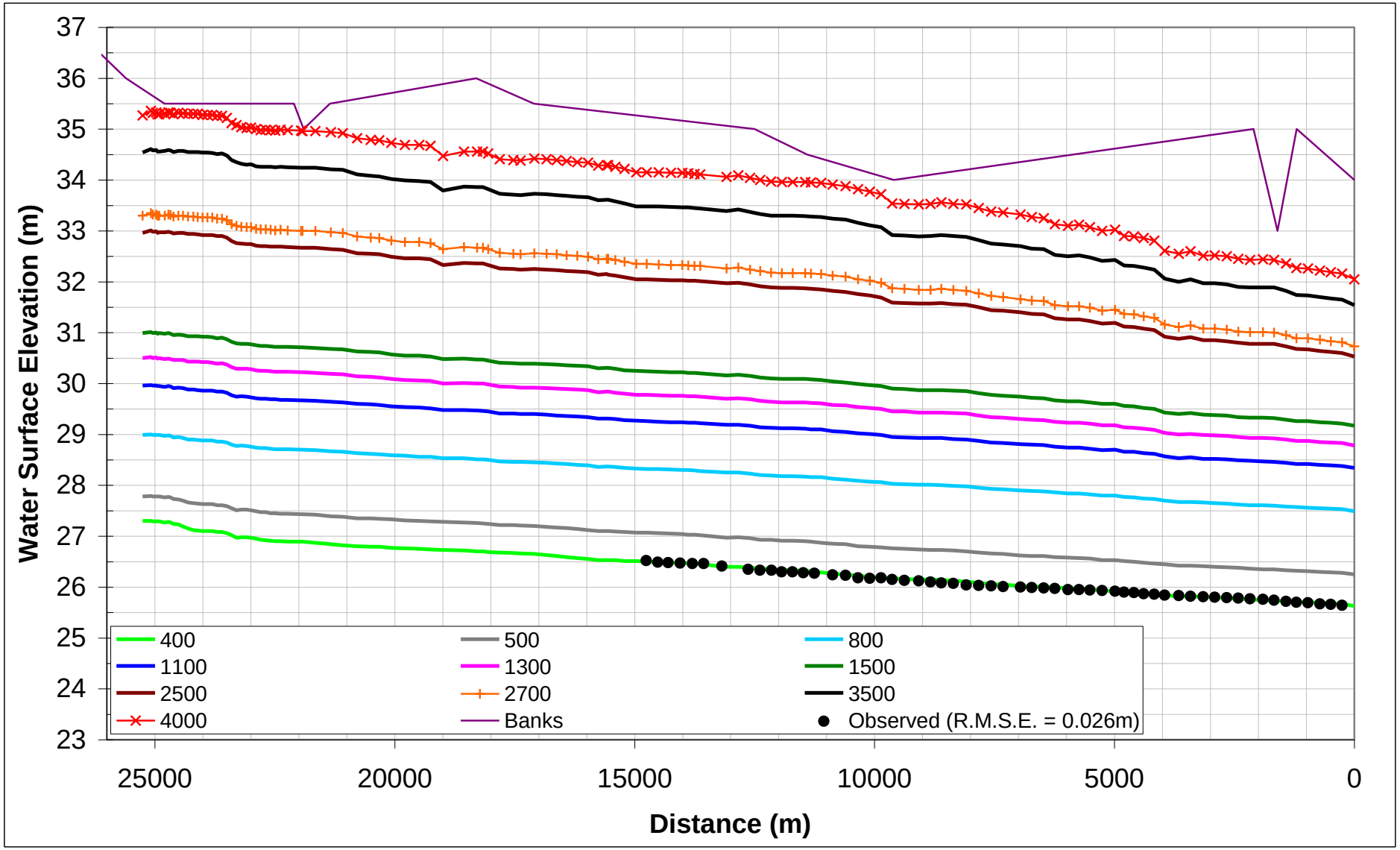
- 59 observation points for water levels along last 15 km of the reach were used to calibrate the model. These observations were recorded at the same day for a discharge of 400 m^3/s.
- Modification for Manning's 'n' for the main channel and the floodplain was included to achieve coincidences between computed water surfaces and observed one.
- Minimum R.M.S.E. (0.026m) was achieved for Manning's 'n' as 0.0285 for the main channel and 0.042 for floodplains.
- 5 m^3/s discharge for Diyala River was considered as lateral inflow.
- No precise data available for water consumption along the reach.

METHODOLOGY

Model application

- To find out the critical discharge that can cause inundation, a set of discharges starting from the average daily discharge for the past ten years were used in model as u/s condition with the updated rating curve at d/s.
- Most of these discharges were examined for the same area in previous studies (Geohydraulique in 1977 and University of Technology-Baghdad in 1992).

Observed water surface elevations with the computed for different discharges of Tigris River and 5m^3/s discharge of Diyala River.



RESULTS AND CONCLUSIONS

- The critical elevation for inundation is 35m at station 22+000m
- The inundation could take place along approximately 3 km reach of the Tigris River for discharges greater than 4000 m^3/s.
- No significant effect found for more three lateral inflow values (25, 50 and 100 m^3/s) for Diyala River on the water surface elevations in Tigris River with highest discharges.

RESULTS AND CONCLUSIONS

- Since the water is eroding below the protected banks now, this will lead to the collapse of parts of these protecting banks in future.
- The bed levels fluctuation was the minimum according to the 2008 survey relative to those of 1976 and 1991.
- The average slope of the river bed became higher in 2008 compared with previous surveys.