

## PROBLEMS OF IRRIGATION SYSTEMS IN NILE DELTA OF EGYPT

S.A.Kantoush<sup>1</sup>, H.M.Nagy<sup>2</sup>, and K.Watanabe<sup>3</sup>

<sup>1</sup>Student, Dept. of Civil Engineering, Saga University, Saga, Japan.

<sup>2</sup>Associate prof, Dept. of Civil Engineering, Alexandria University, Alexandria, Egypt.

<sup>3</sup>Professor, Dept. of Civil Engineering, Saga University, Saga, Japan.

### 1-INTRODUCTION

Nile Delta, is located in northern Egypt as shown in Fig.1. Water resources in Egypt are becoming scarce, because rapidly growing population and limited quantity of water. Historically, the performance of surface irrigation systems has been low, particularly in areas with a long history of surface irrigation like the Nile Delta of Egypt. This poor performance often leads to problems with soil salinity management, the increase of salts in the sewage water, salt water intrusion, water managements and in some cases, water lost to further reuse. Improving the performance of surface irrigation systems has been difficult, partially because of local tradition, but also due to technical limitations. This paper demonstrates that application of modern surface irrigation methods in Egypt are responsive to the needs of the end users. This paper suggest for obtaining uniformities and efficiencies for surface irrigation system, Improvement Project includes reconstruction of secondary and tertiary system based on new design. The paper demonstrates that computer models can be used for design of improved surface irrigation systems.

### 2-NILE IRRIGATION SYSTEM

#### 2-1-General description

Every bit of Egyptian water conveyance system is man - made. The irrigation system is tremendous in size and complexity. It consists of two storage dams at Aswan, seven main barrages, 31,000 km of irrigation canals, 17,000 km of public drains, 80,000 km of private canals (Meskas) and farm drains, 450,000 private water-lifting devices (sakias or pumps), 22,000 public water - control structures, and 670 large public pumping stations for irrigation. Through out this system, approximately 59 billion m<sup>3</sup> of water are distributed annually, not only for cultivated land, but also for municipal and industrial use, for generation of hydro-electricity and for the navigation of freighters and tourist boats on the Nile. The canals deliver water into "Meskas", which are channels serving 420,000 to 2,100,000 m<sup>2</sup>. Meskas, in turn, feed "Marwas", which are farm ditches serving 42,000 to 420,000 m<sup>2</sup>. the Meska and Marwa systems are, operated and maintained by farmers.

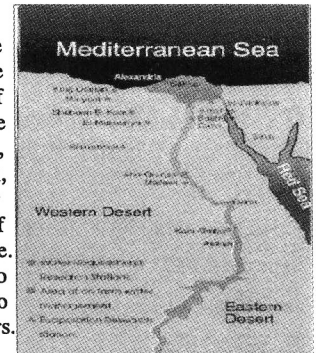


Fig. 1 Map of Nile River

#### 2-2- Existing irrigation system

The key feature of old irrigation systems in the Nile Valley and the Delta is that the irrigation channels are below field level and farmers have had to pump water to their fields. The main canals are operated under continuous flow and upstream control. The secondary and tertiary canals are operated on a seasonably adjusted rotation schedule.

#### 2-3-Irrigation constrains

The most pressing problems confronting the irrigation system are the limited control provided by canal structures, many of which are only partially functional, inadequate systems operations, water shortage, and inequitable distribution of water at the tertiary level with 70 percent of farmers at the tail-ends receiving very little water.

#### 2-4- Strategy for improving existing water supply system

An importance strategy to improve and achieve safety to water system is to :

(a) improve operation practices to provide more reliable, predictable and equitable water deliveries to users, (b) sustain a preventive maintenance program that avoid need for rehabilitation, and improve irrigation water management on farms.

### 3- COMPONENTS OF IMPROVEMENT PROJECT :

#### (a)Improvement of Main and Secondary Canal Delivery System by provision of:

- (i) concrete lining and slope stabilization, using stone masonry and pitching in the unstable portions covering about 70km of main canals and 680km of secondary canals as shown in Fig. 2.
- (ii) replacement of deteriorated old structures, particularly bridges, in addition to cross regulators which would be replaced by structures with modular gates and escapes.

- (iii) installation of downstream control gates in secondary canals (branches and sub-branches) and elementary system on the head and cross regulators of the main canals to activate gate operations through a centralized remote control system .
- (iv) installation of pumps on selective locations for the reuse of controlled quantities of drainage effluent and water supplies from rice fields to meet the water deficit.

**(b) Improvement of Tertiary System by provision of:**

(i) single lift pumping stations at the intakes of about 2,700 tertiary laterals as shown in fig.3 . having an average lift of 2 to 3 meters to deliver water to the raised tertiary laterals. (ii) construction of about 1,000 km of lined territories (Meska ) and 1,500 km of covered PVC piped tertiary laterals.



**Fig.2 Concrete lining for canals**

**(c) Environmental Assessment and Management of :**

(i) monitoring of water quality, particularly of reused agricultural drainage effluent and of soil salinity at the tail-end of each system.

**(d) On-farm Irrigation Management Demonstration Program of :**

- (i) demonstration on about 50 selected farms to improve irrigation application efficiency and irrigation scheduling.
- (ii) application of land levelling, selective soil amendments and other more efficient water use techniques.

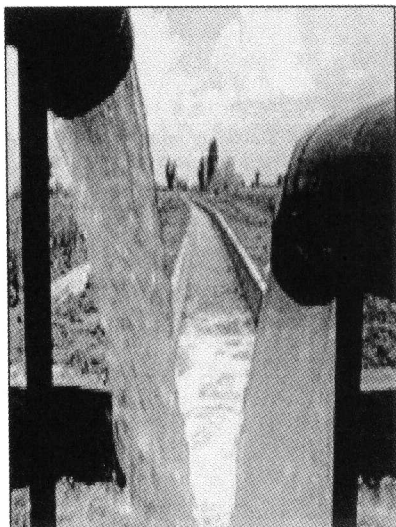
**4-COMPUTER MODELS CAN BE USED FOR DESIGN OF IMPROVED SURFACE IRRIGATION SYSTEMS**

For optimization purposes a numerical analysis is proposed for the estimation of the hydraulics properties (depth & discharge) for all the project network as shown in Fig.4. Also, it is suggested to compute water surface profiles , after construction of such hydraulic structures. One of the seeking goals is the determinate of the safe and optimum operation of the structures.

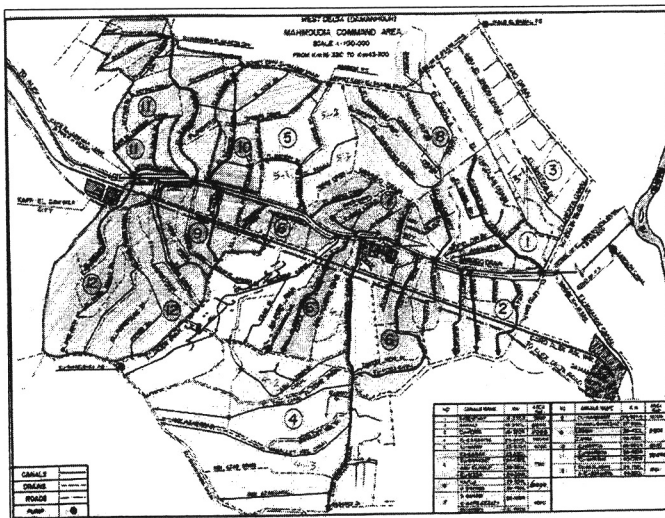
**5- SUMMARY**

This study has provided evidence that:

- 1- Farmer water control is vastly improved, (a) - well functioning continuous flow is of utmost importance
  - 2- sizable reduction in irrigation cost was found, (a) - pumping cost decreased, (b) decrease in the time used to irrigate
  - 3- Improved farm income; a - a change to new crops was expected by 35 per cent of the farmers .
- The overall objectives of the project are to , (a) increase agriculture production and farm incomes by improving the irrigation infrastructure, facilitating a more equitable distribution of water and improving irrigation management. (b) improve the long-term sustainability of irrigation, through take- over of the operation and maintenance for the tertiary level irrigation system by the farmers. (c) environmental assessment and management.



**Fig.3 Secondary canals after improving**



**Fig.4. Map for improved network irrigation system.**