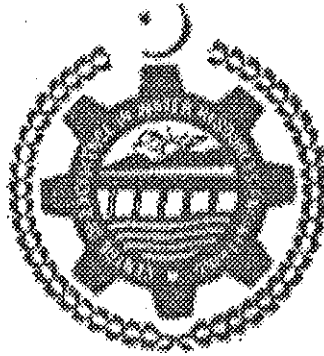


THESIS

**PERFORMANCE EVALUATION OF ON-FARM DRAINS**



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(99-PG-WRM-02)

For the Degree of

**MASTER OF SCIENCE**

**IN**

**WATER RESOURCES MANAGEMENT**

**CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING**  
University of Engineering and Technology, Lahore, Pakistan.

**2002**

## ABSTRACT

Inadequate and poor drainage of canal irrigated areas is a serious problem in Pakistan. Every year extensive tracts of land are prone to frequent and prolonged flooding. The need for drainage becomes most critical from irrigated lands during the monsoon, when heavy rains combined with surplus irrigation water cause severe ponding and flooding of large areas. Prolonged flooding particularly of the Kharif rice crop delays harvesting and makes it difficult to cultivate the land quickly enough to obtain a second Rabi crop. Prolonged ponding of rainfall runoff must be removed from cropped area within 2 to 3 days to avoid damage to crops. The surface runoff may be removed from the area through a network of natural or man made surface disposal drains (main, branch and sub-drains). Adequate on-farm surface drainage network (i.e. small surface drains at chak and moraba level) are also essential for providing effective drainage of surface runoff from all fields in flat canal irrigated areas.

On-Farm Water Management wing of Punjab Agriculture Department has initiated construction of on farm surface drains since last decade and completed two such projects. These on-farm drainage schemes were constructed by adopting a uniform drainage coefficient of 1 liter per second per hectare. All these drains were completed with the participation and cost sharing (approximated 38%) by the farmers through Drainage Beneficiary Groups (DBGs). No monitoring of such OFDs were undertaken in past. This study was conducted to evaluate performance and design criteria of on-farm drains and the role of DBGs in O&M of these on-farm drains. The study was conducted for the Kot Nazir-II on-farm drain located in District, Sheikhpura. It drains out rainfall excess from its catchment area of 287 ha into Deg Nala. Rainfall and runoff data was

collected from the field for the period July to September, 2001. The runoff data was analyzed in terms of runoff volume, runoff, depth, time to peak flow, peak flow rate, base time. Different relationships were used to relate rainfall and runoff data.

The runoff was found to be drastically different from cropped areas and fallow areas. The flow from fallow area reached its peak in 4 to 6 hours in comparison to 22 to 50 hrs from to cropped area. The total flow time (base time) was 20 to 28 hrs for abandoned area and 32 to 146 hrs for cropped area. The initial abstraction was found as 7 mm for abandoned area and 10 mm for cropped areas. The average SCS curve number was found as 87 for abandoned area and 78 for cropped area. The peak flow rate was found as 0.088 to 0.27 lps/ha/mm for abandoned area and as 0.017 to 0.06 lps/ha/mm rain for cropped area. The peak flow rate was found to be related directly with rainfall depth and intensity in abandoned area. For cropped areas the peak flow rate increased linearly with rainfall depth only.

Kot Nazir-II drain was found to be useful to remove rainfall runoff and surplus irrigation water from the area. It evacuated 101517 m<sup>3</sup> of surface runoff in 6 rainfall events (peak flow 471 lps). Kot Nazir-II drain also evacuated 42205 m<sup>3</sup> of surplus irrigation water (average flow rate 0.012 lps). Thus in the absence of drain apart from loss of Kharif and Rabi crops, this water would have caused a rise in ground water levels in the area.

The drain satisfactorily catered for largest rain event during the season. The drain for its present discharge capacity (design drainage coefficient of 1 lps/ha actual drainage coefficient of 2 lps/ha) is considered to be adequate for providing on-farm surface drainage to the area for a rainfall storm of 5- years recurrence interval. The evaluation of alternate drainage flow capacity showed that the drain, if designed for a drainage

coefficient of 0.5 lps/ha, could provide acceptable surface drainage to the area with partial restriction to entry of runoff from fields to the drain for 24 to 30 hours. This alternate design would result in savings by 40% or more in land area, and excavation cost, making the construction of on-farm drains more acceptable and affordable to the farmers.

The DBG was found to be non-functional for maintenance of drain due to non-presence and binding role of OFWM. It is proposed that on-farm drain (chak drain and moraba drain) be provided for all irrigated area for drainage coefficient of 0.5 lps/ha (in Northern Punjab areas) with active participation of DBG. It is also considered essential that the OFWM department should have a continuous and authoritarian role in monitoring the performance of DBGs and ensuring maintenance of on-farm drains. Further field research is also needed to firm up the design and operation of on-farm drains.