THESIS

HYDROLOGICAL ANALYSIS OF FLAT CANAL IRRIGATED AGRICULTURAL AREAS: CASE STUDY OF QAISER DRAIN

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ABSTRACT

HYDROLOGICAL ANALYSIS OF FLAT CANAL IRRIGATED AGRICULTURAL AREAS: CASE STUDY OF QAISER DRAIN

Drainage and evacuation of surface runoff generated from severe and intense rainstorm is essential for prevention of crop damages. Surface drains are occasionally provided for this purpose. The discharge capacity of surface drain need to be based on the thorough study of the rainfall-runoff relationship for any area. Sufficient knowledge of rainfall-runoff relationship is usually not available for flat canal irrigated areas of pakistan. Surface drains are conventionally based on drainage coefficient of 2 to 4 cusecs per mile of catchment area.

Qaiser drain (a branch of Awagat drain of Sumundri Drainage System in Faisalabad region) was constructed to drain an area of 5.2 sq. mile with a drainage coefficient of 3 cfs/sq. mile. Present study was undertaken to evaluate the rainfall-runoff relationship of the Qaiser drain for various frequency storms to understand runoff process in flat irrigated areas. Variability of runoff contributing area was also assessed. In addition the performance of the drain to timely evacuate the rain water was also studied.

Seven rainfall events spread over 1993 to 1996 for which corresponding drain stage height data was available were selected for analysis. The discharge was obtained from the stage record for a measuring flume installed at outfall (RD 0+000) of the Qaiser drain. The rating curve was developed by using a computer program. The

recorded data for stage height was missing at early and late time. The corresponding hydrograph was thus completed by extrapolation. Direct runoff hydrograph was derived by subtracting a baseflow of 2 cusecs.

Numerous kacha/pucca roads, field dikes, watercourses obstructed the flow of rain runoff to reach the drain from areas/fields located farther from the drain thus limiting the runoff contributing area. Actual runoff contributing area was assessed by field surveys and by interviews of local farmers. The area was found to vary with rainfall depth. Most of the runoff was found to be contributed by barren area and kacha/pucca road surface located adjacent and connected to the drain. Area of the villages also contributed significant runoff to the drain. The cropped area contribution to runoff was very small. Fields with high water delta crops (sugarcane and rice) detained large water. Water could not be evacuated effectively from the cropped areas due to numerous physical obstructions coupled with absence of field drains.

The runoff details in terms of base time, time to peak, peak flow rate, runoff volume, runoff depth were determined. Relationship for runoff volume, runoff depth, time to peak, curve number and peak flow rate was evaluated in relation to rainfall depth. Relationship for time to peak and peak discharge was also evaluated in relation to runoff depth.

It was noted that runoff volume increases as the rainfall depth increases. A good relationship was observed between rainfall and runoff volume following a smooth curve. The relation between rainfall and runoff depth also follow a smooth curve. The relationship between time to peak and rainfall showed that time to peak value decreases

as the rainfall value increases. The relationship for runoff depth and time to peak showed that time to peak decreases as the runoff depth increases. An average time to peak was determined as 6.5 hrs. The relationship for runoff depth and peak discharge showed that peak discharge increases linearly as the runoff depth increases. A curve number of 70 was determined as median for all storms.