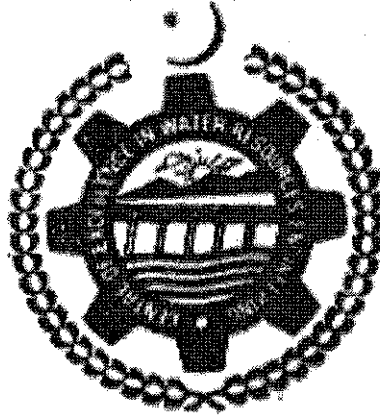


THESIS

**PREVENTION OF EXCESSIVE SEDIMENT LOAD IN WATERCOURSE
BY USE OF SEDIMENT TRAP/EXCLUSION DEVICES**



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ABSTRACT

The irrigation system of Pakistan is very vast. It comprises of three major reservoirs, 16 barrages, 2 head works, 2 siphons across major rivers, 12 inter river link canals, 44 canal systems and more than 107000 water courses. Sediment transport and deposition is a major issue in the design and operation of an irrigation system. Canal outlets supply water to watercourses for ultimate irrigation of fields to ensure due share of water and sediment. For excessive sediment load in the watercourse sediments are deposited causing rising of channel bed and inability of watercourse to carry its designed discharge and less water will be conveyed to the command area.

This study was done to study how to prevent the excessive sediment load in the watercourse by use of sediment trap/ exclusion devices. The study was carried out for a watercourse off taking from Depalpur canal for Mouza Jora (District Kasur) and having a discharge of 1.49 cusecs. The sediment and hydraulic measurements were done during September 2008. Suspended sediments and bed material samples were collected from the main channel. The samples were analyzed in the laboratory of Centre of Excellence in Water Resources Engineering University of Engineering and Technology Lahore. Sediment concentration, sediment load and sieve analysis was done which showed deposited pattern of different types of sediments in the watercourse. The watercourse has large sediment inflow of 4.57 tons/day causing severe sediment deposition in the upper 500 m section of the watercourse. A sand trap was constructed by the area farmers for trapping of excessive sediment load so that sediment free water would run in the watercourse. The farmers themselves constructed the dikes of the sand trap in 2007 having 45m length; 15m width and 2.5 m depth based on their judgment but were abandoned by the farmers due to incompleteness. The sand trap was completed in 2008 for this study in coordination with the farmers. The filling volume and deposited pattern of different sizes sediments

in the sediment trap were monitored for six months of irrigation season (March-October 2009). Sediment concentration of canal water entering and leaving the sand trap was measured. Hydrographic sounding method was used for determination of sediment deposited depth at different places. Measurements were made and deposited volume of sediments was assessed at every 15 days interval.

The sediment concentration of inflowing water was found as 1275 ppm on average basis. The sediment concentration of out flowing water varied from 72 ppm in the beginning of irrigation season (T=15 days) to 233 ppm at end of irrigation season (T=180 days). The sediments deposited in the sand trap on an average value of 1.55 m³ per day. Sediment depth at T=180 days was 1.01 m at head end, 0.41 m in the middle and 0.083 m at tail end of sand trap. The sediment trapping volume slightly decreased with time but still large sediment volume was getting deposited in the sand trap. The trap efficiency decreased from 95.05 % in the season start to about 89.73 % at end of irrigation season. During working of the sand trap no sand deposition was observed in the watercourse on volume basis. The prototype sand trap could trap all sediments of more than one irrigation season of six months. The prototype sand trap was found to be over designed in terms of length and width.

Considering the sediment load of 1275 ppm and gradation of incoming sediments the safe carrying capacity watercourse is 190 ppm ($d \leq 0.0625$ mm). Deposition of varying size particle in the sand trap was analyzed for sediment trap depth of 2.5 m, three different lengths of 10, 15 and 20 m and three different widths of 5, 10 and 15 m. Considering the performance of the prototype sand trap and theoretical analysis sand trap of 2.5×10×25 m (depth× width× length) is proposed. The proposed sediment trap is expected to perform satisfactorily for most sediment load conditions in terms of sediment trapping. The proposed size will allow removal of sediments once a year in no flow/ dry condition.