THESIS

ALTERNATE DESIGN OF PAHARANG DRAINAGE SYSTEM TO ADMIT FREE DISCHARGE OF S- II-C SUB-SURFACE DRAINAGE UNIT OF FOURTH DRAINAGE PROJECT

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2010-PG-WRM-47

For the Degree of

MASTER OF SCIENCE

IN

WATER RESOURCES MANAGEMENT

CENTER OF EXCELLENCE IN WATER RESOURCES ENGINEERING
University of Engineering and Technology Lahore, Pakistan

2013

ABSTRACT

Waterlogging of agriculture land affects the crop productivity and causes environmental pollution and diseases in the public. Subsurface pipe drains are provided to eradicate waterlogging and manage high watertable. This study deals with disposal of sub-surface drainage effluent of S- II-C unit of FDP. At present the sub-surface pipe drains discharge drainage effluent through pipe collector into a sump, from where water is pumped and carried through shallow surface disposal channel and ultimately outfalls into Paharang surface drainage system. The disposal pump sumps have become dis-functional due to social, financial and law and order constraints in the area. The present study evaluates the alternate design of the Paharang drainage system that could permit discharge of sub-surface drainage system under gravity flow and to determine the additional design requirements for the surface drain. This gravity outflow could be achieved by deepening the bed level of surface drains below the collector outfall level.

For the study data of subsurface and surface drains (layout, profile, L-section, X-section and discharge etc.) was obtained from Punjab Irrigation Department, Faisalabad. Collector outfall levels are well below the bed level of existing surface drains. Collector was extended to the surface drain and required elevation of extended collector at the surface drain was calculated. The modified bed level of surface drain was set below the collector, also ensuring that collector remains above about 0.3m to the water level at low flow condition viz. collective subsurface effluent of all pump sumps.

Lowering of bed level of Paharang main drain was achieved by decreasing the bed slope over a drain reach near the outfall end. Interconnected worksheets were

developed for design of drain profile (L-section, X- section) of main and tributary drains. Drain cross section was done using manning's formula. The design was completed after many successive trials in term of lowering the bed level and decreasing the channel bed slope until a suitable design was achieved. Design continuity of drainage system was achieved by ensuring that the bed and water levels of receiving drain be lower that outfalling drain.

The drain cross section was set within the present ROW with few changes on service road side. Side slope of the channel was unchanged at 1:1.5 and spoil bank inner and outer bank slopes was kept as 1:2 for the whole design. Additional ROW, if needed, was determined for the each remodeled reach. Earthwork was calculated in term of excavation for lowering the bed level and increasing the drain section and to place the excavated materials in specific manner. Modification/ stability of the existing structures (siphon, bridges etc) was studied.

The study showed that modification in design of Paharang main drain and its branch/tributary drains in terms of lowering the drain bed levels well below the collector level to admit free drainage of sub-surface drainage effluent for all sumps is technically admissible. Free drainage is ensured by lowering the bed level/low flow water level of surface drain below the collector level. Lowered bed level can be achieved by decreasing the bed slope of surface drain over some length of the drain. This will allow continuous discharge of subsurface drainage effluent from the area.

It is recommended that the redesign of Paharang main drain to admit free flow may be adopted after economic and structural analysis. All future sub-surface drainage projects should be designed to ensure gravity outflow into surface drains by deepening the flow section of surface drains.