

THESIS

IMPACTS OF IRRIGATION INTENSIFICATION ON THE  
GROUNDWATER REGIME IN BANNU PLAIN



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Submitted By

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## ABSTRACT

Bannu plain comprises a large area (GA 76000 ha, CCA 66000 ha, canal irrigated 43000 ha + barani/inundation 23000 ha). The area is irrigated by a number of civil canals taking water from Kurram River mostly at Kurram Garhi headworks. The canals withdrawals fluctuate considerably with river flows. Riway-e-Aabpashi is followed that allows water allowance of 7.3, 5.75, 4.63 cfs/1000 Ac for upper (A), middle (B) and lower (C) zones of command areas respectively. Due to emergence of waterlogging in the past SCARP irrigation-drainage tubewells were installed in 1976 to 1983. A number of private tubewells are also installed to augment the irrigation supplies. Present cropping intensity in the area is 150, 70 and 45 % in zones A, B and C respectively. At present the groundwater is in a state of dynamic equilibrium and fluctuate with irrigation supplies, rainfall and pumping. At present 6.57% of GA is water logged (DWT <1.5m) and 6.32 % is under waterlogging threat (DWT 1.5-3 m).

A water resources development project is planned in terms of constructing Kurram Tangi dam upstream of Kurram-Garhi Headworks, improving canal system of civil canals and bringing other areas under irrigated agriculture in Marwat and Tahl plain. Project envisage reconstruction and lining of main and distributaries under civil canal command improving irrigation system efficiency from present 40% to 57.4% and regularizing canal supplies and assuring historic canal flow volumes. However no clear future water diversion is spelled out due to sensitivity of water rights and many alternative situations could arise depending upon socio-political maneuvering of all



stakeholders. Present study describe future groundwater regime and extent of waterlogging in the Bannu plain under alternate canal supply options as under

- (1) Canal run at design capacity of 665 cfs (56800 ha-m/year) and water allowance is as per existing water rights in different zones.
- (2) Canal supplies are as per historic withdrawals (40,535 ha-m/year) and zone wise water allowance is proportional to designed future cropping intensity of 165, 110, 85% in A, B, C zones.
- (3) Canal supplies are increased by 12% above historic withdrawals to 45,000 ha-m/year and water allowance is made proportional to planned cropping intensity of 165, 118, 100% respectively.

These alternatives were compared with future without project conditions with average recharge and pumping as average of 9 years (1991-2000). A groundwater flow model was prepared using MODFLOW program. The model was calibrated for the 1991-2000 period. Calibrated model was used to evaluate groundwater regime under alternate scenarios.

The results indicate that waterlogged area is likely to increase by 5.42%, 0% and 0.66% of GA (3700, 0, 500 ha) respectively for above scenarios in comparison to that existing now. The improved irrigation system efficiency is expected to help in avoiding further increase in waterlogged area by 3-5%.

Readjustment of water rights is helpful in limiting extent of waterlogging. The areas likely to be most affected are those located along the middle reaches of Kurram River, near the confluence of Baran and Tochi Rivers, Tahkt Khel and near Sarai Gambila etc. It is recommended that efforts be made to ensure present level of pumping by STW and PTWs and to encourage further PTWs in those areas that are likely to become waterlogged after project operations. Field and watercourse level water conservation and management measures will also be needed in these areas.