



CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING
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Dated: July 26, 2024

**Subject: PUBLIC DEFENCE/VIVA-VOCE EXAMINATION OF Ph.D THESIS
OF MR. AHMAD MUJTABA, 2018-Ph.D-WRE-01**

Name: AHMAD MUJTABA

Registration No. 2018-Ph.D-WRE-01

**Thesis Title: Development of Sustainable Water Management
Scenarios using Surface Water – Groundwater
Interaction Modeling (Copy of the abstract
enclosed)**

**Research Supervisor: Dr. Ghulam Nabi, Associate Professor, CEWRE,
UET., Lahore**

Public Defence Date: August 9, 2024 (Friday) at 03:00 p.m.

Venue: Computer Room, CEWRE, UET, Lahore

All interested faculty are cordially invited to attend the public defence. The students of 2nd and subsequent terms are mandatory to attend the public defence.

(Prof. Dr. M. Atiq Ur Rehman Tariq)
Director

Copy to:

- 1) Prof. Dr. Hamza Farooq Gabriel, Professor, School of Civil and Environmental Engineering (SCEE), National Univ. of Science & Technology (NUST), Islamabad
- 2) Dr. Muhammad Ashraf, Chairman (R), PCRWR, Islamabad
- 3) Prof. Dr. Khalid Farooq, Dean, Faculty of Civil Engg., & Research Supervisor, UET., Lahore
- 4) The S.V.C., UET, Lahore
- 5) The Controller of Examination, UET, Lahore
- 6) The Director Research, Innovation & Commercialization, UET, Lahore
- 7) The Chairmen of all teaching Departments, UET, Lahore
- 8) Notice Boards

Note: T.A./D.A. will be paid by the Centre as per rules.

ABSTRACT

Groundwater resources are depleting dramatically in Pakistan due to massive extraction, shifting cropping pattern and climate change vulnerability. In this study, water budget, spatio-temporal pattern of groundwater fluctuations, cropping pattern for sustainable aquifer, efficient water management and conservation options for sustainable agricultural production, and policy guidelines are formulated in Lower Chenab Canal (LCC) area. Climatic, groundwater levels, crops data were collected from Pakistan Meteorological Department (PMD), Water and Power Development Authority (WAPDA), Punjab Irrigation Department (PID) and Agricultural Department - Crop Reporting Services (CRS). Area under different crops for Rabi and Kharif season and Crop water requirements (CWR) for all crops were estimated for existing cropping pattern. Cropwat model was used to determine the evapotranspiration and crop water requirement. Using CWR, spatio-temporal patterns and different climatic scenarios, a new cropping pattern was proposed. By using the available surface water availability for meeting the CWR, water deficit was estimated.

The CWR for different crops ranges from 200mm to 1600mm in which sugarcane has evapotranspiration of 1600mm while the fodder has minimum CWR upto 200mm. Area under cultivation was decreased from 9300km² in 1995-96 to less than 8900km² and from 7700km² to less than 7200km² in Rabi and Kharif seasons respectively. Climate change scenarios developed by Global Change Impact Study Center Islamabad were used for estimating crop water requirements for major crops and deficit under different conditions.

The research concluded that the area under crop cultivation is decreasing. Due to increase in growing of high delta crops (rice and sugarcane), the increase in crop water demand also increased the stress to groundwater. Canal water supplies decreased from 7.75BCM to 4.88BCM (Kharif season) and 4.17BCM to 2.63BCM (Rabi season). The surface water availability is decreasing from 11.93BCM in 1995-96 to 7.51BCM in 2016. Average water deficit was about 4.31BCM for both Rabi and Kharif seasons. The net change in groundwater levels was 310mm/year approximately. The threat to the groundwater is also justified with the number of tubewells. During last decade, the number of tubewells has increased from 225,660 to 338,300 with an average increase of 11,264tubewell/year.

There are several efficient water management options available for adapting to climate change conditions, such as, improving water use efficiency, implementing Integrated Water Resources Management (IWRM), improving water infrastructure and increasing water storage capacity, water management strategies for reducing the effect of climate change. Capacity building workshops for groundwater management may be done by using interactive learning activities to explore different strategies and solutions for groundwater management. This study may help in improving the irrigated agriculture efficiency and save irrigation system from disasters.