

**M.Sc Thesis**

**ANALYSIS OF THE REGIM BEHAVIOUR OF LOWER GUGERA BRANCH  
CANAL AFTER REHABILITATION/REMOLDING OF THE SYSTEM**



**ADVISOR**

**DR. GHULAM NABI**

**Submitted By**

**ENGR SAJID MAHMOOD  
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**CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING**  
University of Engineering and Technology,  
Lahore-Pakistan

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## **ABSTRACT**

Pakistan has one of the world most effective irrigation systems which are comprised of canal network. These canals are mostly unlined and are designed mainly either on Lacey or Kennedy design methods. Irrigation canals essentially off-takes from a river and draw a fair share of silt moving in the river. Design of irrigation channel is based on the concept of non-silting and non-scouring approach. Such a channel is known as regime channel. The most common design methods based on this concept are of Kennedy method, Lacey regime and Simon & Albertson regime theory. In the second concept, the design of irrigation channel is based on the properties of boundary material in which the channel is flowing. The most important design method based on this concept is Tractive Force Method.

Irrigation canals take water mostly from rivers which contain silt of varying amount. If a canal system is not properly designed, the flowing water can cause scouring or deposition of silt thereby reducing the capacity of the canal. To maintain a canal system, heavy expenses are incurred to keep the canal system in good operating condition. It is desired that the canal system should be designed in such a way that hydraulic as well as sediment transportation aspects are covered in such a way that there is minimum problem of operation and maintenance. The present study is focused on the point that a stable canal system should be designed which conveys water and the associated silt. Different methods of design have been discussed and for some selected methods computer worksheets have been developed which are used for design of Lower Gugera Branch canal.

The Lower Gugera Branch Canal off-takes from the tail of Upper Gugera Branch canal at Head Buchiana near Jaranwala City. It is the part of Lower Chenab canal system. The Lower Chenab Canal (L.C.C.) Irrigation System is one of the oldest systems in the Punjab Province. It off-takes from Khanki Head Works located in Gujranwala District on the River Chenab. The study was carried out to evaluate the sedimentation problem and to re-evaluation of the design of the canal system, analysis of the sediment budget of the system and evaluation of sediment carrying capacity of designed channel by using different sediment transport functions.

The existing canal cross-sections were observed at site and also been obtained from the consultants of rehabilitation project of Lower Gugera Branch Canal for the data prior to rehabilitation to ascertain the changes in the regime. For suspended sediment/ bed sediment observation, the D-49 sediment sampler and BM-54 sediment sampler has been used for determination of existing sediment load at the specified sites. Sediment samples were analyzed by International Sediment Research Institute of Pakistan (ISRIP) of Water and Power Development Authority (WAPDA) laboratory.

The existing canal reaches of the selected channel show that bed of channel is scoured up to 0.61 m and the sides are also eroded at the downstream of fall structures. The scouring trend is significantly increasing towards the tail and water line has been depressed. Resultantly the off-taking channels and the outlets are suffering badly. The results of suspended sediment samples collected from the selected channels shows that sediment concentration is less than the permissible limits

in the LCC System so the system is sediment deficient i.e. sediment inflow is less than sediment carrying capacity.

The sediment data of Head Khanki reveals that sediment entry into the Lower Chenab Canal is not up-to permissible limits so the functioning of silt excluder and crest of the said channel should be analyzed. The irrigation channel should be designed by considering the sediment concentration in the system and silt carrying capacity should be checked by using the different sediment transport formulae. Periodic sediment measurement must be done during the course of whole year until the canal is in regime. Canal design/operational software should be introduced to facilitate the decision making authorities.