

## MANAGING WATERLOGGING AND DRAINAGE CONGESTION

The term "Waterlogging" usually refers to the condition of very shallow groundwater table affecting the growth and yield of crops. It is customarily linked with balance of the sub-soil water table and the soil pores in the crop root zone. Accumulation of surface runoff and thereby stagnation of water over the depressed lands due to the restriction of natural passage of water, which may arise because of inadequate surface drainage or due to the higher water level elevation at the out-falls, also cause waterlogging which is termed here as surface waterlogging. In fact, there are hardly any separate definitions to define surface waterlogging. Waterlogging and drainage problems of such nature cause flooding of areas suitable for Kharif crops resulting in loss of productivity. Stagnation of water for a longer period, besides affecting agricultural activities of the area due to the rise of sub-soil water table, also affects the socio-economic aspects of the region.

In the lower Gangetic plains, because of the flat nature of the country, large scale topographical abnormalities and haphazard alignment of roads, railway lines and canals, large areas experience afflux of flood waters during rainy season

causing inundation and stagnation of water. On the right bank of the river Ganga in Central Bihar, a large area, locally known as "Mokama Tal", has been experiencing submergence of water every year, particularly during the monsoon period. The problem of surface waterlogging and drainage congestion over depressed land of 1062 km<sup>2</sup> in Mokama Tal area is a long-standing issue before the water resources planners in terms of management. A need was realised to find a scientific solution to this problem considering overall perspective of water management of all basins contributing water to the Mokama Group of Tals with objective to manage the incoming flows over time and space.

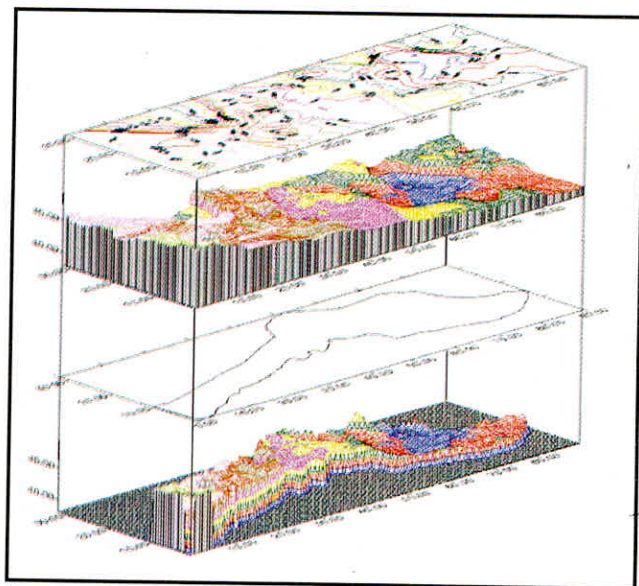


Figure - 1 Digital Terrain Model of Mokama Tal

The methodology developed for this specific problem takes into account the total water balance of the basin and optimal allocation of water resources to suit various agricultural demands. This methodology has a wide applicability in areas suffering from surface waterlogging and drainage congestion problems.

### **TECHNOLOGY**

Surface waterlogging in Mokama Group of Tals (Figure-1) is basically a problem of blockage of monsoon runoff originating from the upper catchment and its discharge to an area, which has a longer detention time to dispose off the incoming water. Alternately, the rate of inflow for a considerable period is much more than the rate of outflow resulting in higher rate of storage of water in the vicinity. Towards solution of the problem, a management approach intending to check inflows at the pace of need of water requirement for agriculture and with no risk of waterlogging at the downstream was considered to be the logical strategy.

The problem has been conceptualized as a management model considering that waterlogged area is acting as a storage reservoir whose drainage area is the total Kiul-Horahar River basin and during the monsoon period, upstream runoff is to be so regulated that the storage does not create any danger of flooding. Rather, the storage would be able to meet the irrigation water requirement in the Tal area and the upstream commands. A

non-linear optimisation model is formulated taking into account the crop factors, monthly reservoir storage values in the upstream catchment, and the area expected to be exposed in the Tals.

The objective of minimising the waterlogged area in the monsoon season is equivalent to maximising the cropped area in the Tal. This is possible by minimising the inflow into the Tal, ensuring at the same time that the water stored in the Tal meets the crop water requirements of the catchment. Again, minimising the inflow into the Tal area is equivalent to maximising the water stored in the upstream reaches which is to be subsequently used for meeting the crop water demands in the upstream reaches and the Tal area. The minimisation problem, thus, leads to maximisation of cropped area, both in the upstream reaches as well as in the Tal area.

Most of the area in our country, and specially Bihar, is suffering from surface waterlogging problem. The technology developed for the management of waterlogging and drainage congestion problems of Mokama group of Tals can be implemented to other problematic areas suffering from waterlogging and drainage congestion problems.

### **ENVIRONMENTAL IMPACT**

Utilisation of water in the upper catchment of the Kiul-Harohar basin will improve the land use and forest and, at

the same time, will reduce the surface waterlogging in the lower catchment. This will lead to a positive impact on overall environment of the river basin.

### **ECONOMICS**

By restricting the incoming flows, the irrigation potential in the upstream catchment of Kiul-Harohar River can be substantially increased. Similarly, this will have a direct impact on the reduction of surface waterlogged area in the Mokama Group of Tals. The increased irrigation potential will have positive boost in overall economic development of the area. Furthermore, the technology

may be utilised to decide on the cropping pattern, which may provide maximum benefit to the farmers.

### **BENEFICIARIES**

The direct beneficiaries of the technology include farmers of the region, State Water Resources Department and local administration.

### **INTELLECTUAL PROPERTY RIGHTS**

The methodology and the software have been developed at the National Institute of Hydrology, Roorkee. Therefore, the Institute owns the Intellectual Property Rights of this technology.

