HYDROLOGICAL APPROACH TO ENVIRONMENTAL IMPACT ASSESSMENT IN HIMALAYAN RIVERS: A CASE STUDY OF THE KHIMTI RIVER IN NEPAL

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INTRODUCTION

Water is Nepal's greatest natural resource. In a drive to utilise this resource, the 60MW Khimti Hydropower Project is being constructed. Khimti basin (area 443sq.km.) has a biologically diverse and rich ecosystem, including some endangered species. Construction of any major hydropower projects could significantly affect this special ecosystem. With this in mind, low flow studies were initiated in 1992.

The primary objective of the low flow studies has been to identify the problems which might arise in the Khimti *Khola* following the diversion of water at the proposed intake site and to suggest measures that would mitigate the negative impacts.

The 60MW Khimti Hydropower Project will be of the run-of-the-river type, and a 2m-high diversion weir at the intake site will divert Khimti's water for power generation.

INVESTIGATION AND RESULTS

Figure 1 shows the mean monthly hydrograph. The flows have a tendency to increase in April and May due to snowmelt and premonsoon rains. In June, the flows increase rapidly with the onset of the monsoon. The design flow of 10.6m^3/s is available for only about six months during the monsoon period and this has been taken into consideration when designing the scheme.

Spanning over two years, the field investigations concentrated on low flow hydrology, fisheries, and water users.

It was important to establish a design curve which would give a fair indication of how much water would be available below the proposed intake in a typical dry year and to use this Design Curve as a basis to examine the various environmental impact considerations associated with the diversion of Khimti at the proposed intake site.

The February 1994 field programme offered the best data set of low flows. In February 1994 Khimti was gauged at the proposed intake site. The flow (4 m^3/s) was corresponding to a low flow return period of four years in the Low Flow Frequency Curve, similar to the return period of the rainfall recorded at that time.

Though February 1994 was in fact a month drier than average, a design return period had to be selected which would represent a relatively dry year, yet not an extreme. Therefore, a 10 year return period low flow was selected to establish the Design Curve. The February 1994 data were used to derive the Accumulated Flow Curve. The curve is drawn with straight lines between measured points. Figure 2 shows the accumulated flow curve. The curve gives us a clear picture of the accumulated flows resulting from the various tributaries. The February 1994 accumulated flows then had to be adjusted accordingly to produce a 10-year Design Curve.

This design curve gives a basis for analysing different low flow project operation scenarios. We chose two sets of flow scenarios.

Figures 3 and 4 show two low flow scenarios. Scenario No.1 (Fig. 3) shows the negative effect on the downstream water users, especially on fisheries in zones 3 and 4. Flow scenario No.2 (Fig. 4) shows that a compensation release of 500l/s will have less negative effect. Fishes in zones 3 to 5 will have water from the release and the tributary inflow. Mitigation measures include compensation release, monitoring programmes, control of water pollution, and other measures.

Figure 1. Mean Monthly Hydrograph

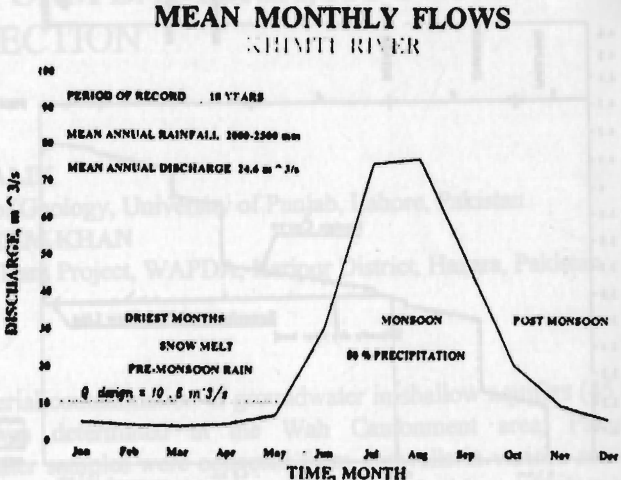

Figure 2. Accumulated Flow Curve

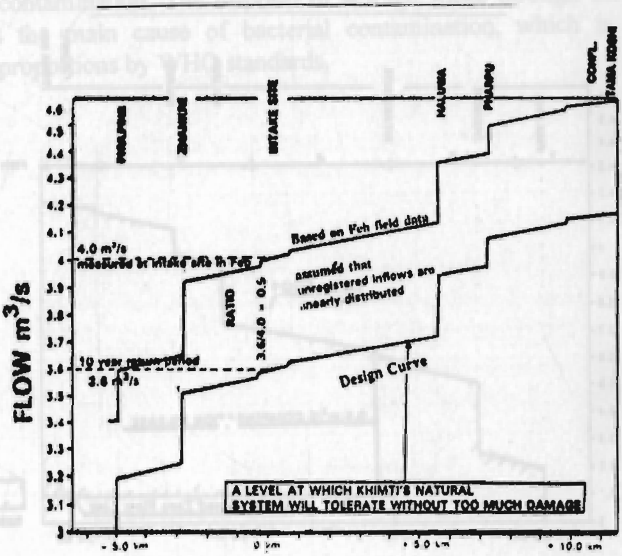

Figure 3. Low Flow Scenario No. 1

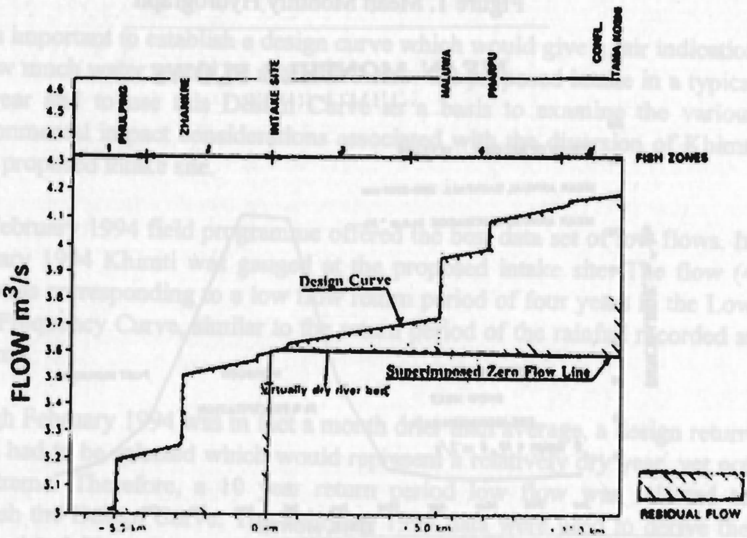

Figure 4. Low Flow Scenario No. 2