

# **Engineering Geological Site Investigation Report of the Chitrehanjyang Electric Pump Water Supply Project**

## **Reference:**

- A. Sub-Contract Agreement between Ramboll Finland Oy and Narayan Gurung, dated 20 January 2011

## **1. INTRODUCTION**

The proposed Chitrehanjyang Electric Pump Water Supply Scheme site was visited by me as the Consultant Geo-technical Engineer to assess the geological feasibility of the site over the period from 23 to 24 January 2011 as per the sub-contract vide at Ref A.

The proposed Chitrehanjyang Electric Pump Water Supply Scheme is located in Chitrehanjyang VDC of Syangja district. The site has been proposed for the Electric Pump Water Supply Scheme (Lift System) by the District Development Syangja under the Rural Water Supply and Sanitation Project –Western Nepal.

## **2. GEOLOGICAL OBSERVATION**

After assessing the site, following Geological observations were made.

**Geological Stability:** The proposed site for the Reservoir Tank was found to be geologically good and there is no sign of any geological instabilities that may occur in the future.

**Geological Instabilities:** Following geological instabilities were observed at the following locations.

- A. Geological Instability at the source and proposed Pump House location
- B. Geological Instability along the proposed Delivery pipe alignment from the source to the proposed Reservoir Tank

Details of Geological Instabilities and their Remedial Measures are as follows.

### **2.A Geological Instability at the proposed Intake and Pump House Site**

The proposed Intake site (Source) and Pump House of Chitrehanjyang Scheme was found to be geologically infeasible as both the intake and pump house site are prone to flooding and landslide. The source is a stream source and lies on the waterway of the stream, hence flooding is obvious. Deposition of huge boulders at the source area shows the proof of previous flooding. Besides, slope of the left bank of the stream along the proposed pump house area is prone to landslides. Any structure built in such area will be vulnerable and may either get damaged beyond repair or completely washed away. (See Photos 1- 3, Page 1- 2, Annex A)

### **2.B Geological Instability along the proposed Delivery Pipe Line**

The proposed alignment for the delivery pipe line was found to be geologically not feasible as the alignment passes not only through the rivulet (Kholosa) and valley area but also through the landslided slope and sheer rock cliff. (See Photos 4, 5 Page 3, 4 at Annex A). As the surface run off always follows the valley and there will be often flash flood in rivulets, structures like delivery pipe may easily be damaged or washed

away. Further it will be quite difficult to work along the sheer cliff at the time of construction and for any future repair work if necessary.

### **2.C Alternative Site**

Due to the Geological Instabilities **along the proposed Intake, Pump House and Delivery Pipe line**, the alternative sites were looked at and in the end, new sites both for the Pump House and Delivery pipe alignment have been selected and proposed for. The lifting has been proposed at two stages as the head is quite high.

#### **In consequence;**

- The total lift head is slightly increased than the previous. Total head now is 496 m.
- A suspended river crossing (approx. 25 m span) requires to be built for the Delivery pipe over the stream.

(See Photos 6- 8, Page 5- 8, Annex A)

### **3. DESIGN OF THE SYSTEM**

Since the total lift head of Chitrehanjyang Scheme is more than 350 m, two stage lifting is required. The relevant Reduced Level (RL) of the proposed prominent locations are as follows.

- RL of the proposed site (Dhaukhani Danda) for Pump House and Collection Tank for the 1st Stage Lift = 988 m
- RL of the proposed site for Pump House and Collection Tank for the 2nd Stage Lift = 1183 m
- RL of the proposed site for the Reservoir Tank = 1484 m

Hence the **first stage lift** head would be **195 m** and the **2nd stage lift** head would be **301 m**. The **total head** to be lifted thus would be **496 m** for the proposed Chitrehanjyang Electric Pump Water Supply Scheme.

### **4. CONCLUSIONS AND RECOMMENDATIONS**

The proposed Chitrehanjyang Electric Pump Water Supply Scheme is **geo-technically feasible** at the proposed new locations **less the Gravity system**. The consultant has not assessed the gravity system nor has assessed the overall feasibility of the Scheme in socio-economic aspect as these do not fall under the scope of contract work of the consultant and the relevant organisations are sole responsible for this.

However following points must be noted regarding to the Lift System of Chitrehanjyang.

- a. Intake must be built robust with RCC Cover and Gabion protection works and still there is no guarantee that it can be made permanent as it lies on the water way of stream (Kholā). It is likely that Intake needs to be repaired periodically,

especially after every monsoon and the Villagers must be in no doubt that this may be the case !

- b. The Pump House and the Collection Tank (Photo 7, Page 6, Annex A ) for the 1st Stage Lifting must be built by embedding it into the rock strata. The rock is quartzite mixed Phyllite and medium to hard type. It may take bit longer time for manual excavation.
- c. Generally crossings are avoided in the lifting system as it consists of right angled bends ultimately reducing the efficiency of pumps. But it does not mean that one should not use the crossing. In the case of Chitrebhanjyang, there is no other option except for the crossing. This would lead increase in number of pumps in the design.

## **5. ACKNOWLEDGEMENTS**

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