Heading: Climate, environment and social aspects

Topic: Environmental and social aspects

Title: Geological mapping to assess social and environmental impact of possible slopes instabilities along the Karuma HPP reservoir, Uganda.

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The impounding of reservoirs can have major social and environmental impacts that are not necessarily limited to the flooded area but can in some cases also extend to the surrounding areas. Geological mapping of reservoirs is often done mainly to assess their water tightness or the presence of landslides that could affect the safety of the dam or the population. To assess all social and environmental possible impacts, a more detailed mapping focusing for example on very small landslides or on water springs can instead be necessary.

The example of the Karuma dam located along the Nile River near Karuma village in Uganda is discussed here. The Karuma HPP run-off river scheme consists of a 14 m high dam, an underground powerhouse and a 9 km long tailrace tunnel. The Karuma reservoir is about 60 km long with a storage capacity of about 80 million m^3. The impounding-related water level increase in the Karuma reservoir is limited to a few meters but depending on the geological conditions even such small water level changes can affect the shore stability.

In Karuma where many small settlements, living from agriculture, are found along the Nile shores, even small losses of land could strongly impact the local population.

For this reason, a detailed geological risk assessment along the reservoir shore was requested by UEGCL with the scope to define:

- Hazards and risk
- Need to buy additional land or to compensate land losses
- Need of mitigations measures / monitoring systems

The field work was carried out within a short period. The site activities were planned using aerial photographs and maps to look for access to the shores and define paths. Representatives of the local community were involved in the planning and during the field work itself. Giving the topographical conditions, with flat topography and locally high vegetation, orientation in the field was very difficult and for this reason the field work was carried out following pre-defined paths saved on a GPS device and adapted, when necessary, to local conditions. This system allowed to move quickly through the area and map the whole reservoir rim within a short amount of time.

The gained geological information was than combined with other information gained from the aerial photographs and during the survey as:

- land usage
- presence of buildings
- type of building

As result of the geological mapping and of the land usage survey a risk matrix was produced highlighting:

- Type and location of geological hazard
- Risks and risk level (e.g. impact on agricultural area or buildings)
- Possible mitigation measures

Such geological mapping focusing on E&S aspects and the development of a risk matrix allow to identify possible risk areas, to focus attention on these area during impounding and operation, and eventually, if needed, to compensate or mitigate social or environmental impacts caused by the impounding of the reservoir. In the case of Karuma HPP, despite the very favourable topographical and geological conditions, which generally guarantee good slope stability, the study allowed to identify some risk areas along the reservoir shores that need to be monitored during impounding and plant operation.

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Dr Stefano CERIANI holds a M.Sc. and Ph.D. from the Geological-Paleontological Institute, University of Basel (Switzerland). He has over 15 years of professional experience as geologist in worldwide hydropower infrastructure projects. His main field of expertise are: geology, field investigations, engineering geology and tunneling, natural hazards, hydropower schemes, infrastructures, project management. Beside his countless project missions to foreign countries all over the globe, he gathered experience working in multi-disciplinary teams with hydraulic, dam and geotechnical engineers.

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