

TERMS OF REFERENCE

For

Consultancy Services for Determining Flood Warning and Danger

Level Thresholds of Banra River and Doda River

1. Background

Kanchanpur District in Sudurpashchim Province is one of Nepal's highly flood-prone areas. Its flat Terai landscape, intense monsoon rainfall, and the unpredictable behavior of rivers flowing from the Siwalik and Churia hills make many communities vulnerable to flooding. The Doda River, in particular, poses a serious risk to downstream settlements during the monsoon season. However, the lack of scientifically defined flood warning and danger levels weakens the effectiveness of early warning systems, often delaying response efforts and increasing the exposure of local communities to flood impacts.

Two hydrological stations under the judiciary of Office of Hydrology and Meteorology Attariya (OHMA)—Banra River at the E-W Highway Bridge and Doda River at Nandgaun, Laljhandi—need scientifically established Warning and Danger Level thresholds. These thresholds are essential for providing timely early warnings to downstream communities at risk. Once established, they will support DHM's Flood Early Warning System (FEWS) by guiding flood warnings and danger alerts for local governments, disaster management authorities, and communities. This will help improve preparedness, support timely evacuation decisions, and strengthen disaster response. The information generated through this study will also be valuable for water resource planners, researchers, and disaster management institutions at local, provincial, and national levels.

To address this need, the Climate Resilience Programme, implemented by Practical Action and PESWAN Kanchanpur in coordination with the Office of Hydrology and Meteorology Attariya, intends to procure consultancy services for hydrological surveys, data analysis, and flood threshold determination at the two selected stations in Kanchanpur District. The consultancy will generate reliable hydrological evidence and analysis required to establish scientifically validated Warning and Danger Levels. This will contribute to stronger flood early warning information and support more effective water resource management and disaster preparedness in Sudurpashchim Province.

2. Objective

The overall objective of the study is to develop Warning Level and Danger Level thresholds at Banra River at E-W Highway Bridge and Doda River at Nandgaun, Laljhandi stations in Kanchanpur District.

The specific objectives are to:

1. To estimate peak flood discharges for various return periods using empirical hydrological methods;
2. To develop a stage-discharge rating curve for the both gauge station;
3. To simulate flood inundation extents, depths, and velocities using hydraulic modeling;
4. To produce flood hazard maps for multiple return period scenarios;
5. To Determine Warning Level and Danger Level thresholds at each station.
6. To validate established thresholds against historical flood events and community Level.

3. Scope of Work

The consultant shall undertake the following tasks:

3.1 Literature Review and Data Collection

1. Collect and review gauge and discharge data of Banra River at E-W Highway Bridge and Doda River at Nandgaun, Laljhandi.
2. Collect and review rainfall data from nearest meteorological stations.
3. Collect supplementary data including satellite-derived rainfall estimates, Digital Elevation Models (DEMs), and watershed characteristics.
4. Review institutional literature including DHM and WECS guidelines to ensure methodological consistency.
5. Prepare a map of hydrological and meteorological stations within the Banra River and Doda River Basin.

3.2 Cross-Section Survey and Rating Curve Development

1. Conduct a detailed cross-sectional river survey at the Banra River and Doda River gauge station at gauging site and at a minimum of two additional 100m upstream and 100m downstream sections.
2. Develop a preliminary stage-discharge rating curve using available discharge measurement and field survey-based cross-sectional data.
3. Document critical infrastructure (roads, bridges), nearby settlements, and flood marks along the river corridor. Conduct informal community interviews to gather local flood knowledge.

3.3 Flood Estimation Using Empirical Methods

Apply the following empirical flood estimation methods to estimate peak discharges for return periods of 2, 5, 10, 20, 25, 50, and 100 years:

1. WECS/DHM Method (1990): Based on regional physiography and catchment characteristics.
2. Modified Dickens Formula: For ungauged or data-scarce basins.
3. MHSP/CIWEC Regional Equations (1997): Calibrated for Nepal's physiographic zones.
4. Regional Analysis Method: Regional regression equations for extreme flood estimation.

Catchment parameters (area, slope, land use, rainfall intensity) shall be derived from GIS analysis and remote sensing data. The recommended design discharges shall be translated into gauge heights using the developed rating curve.

3.4 Historical Flood Impact Assessment and Stakeholder Consultations

1. Collect anecdotal flood information from local residents, municipalities, and media records.
2. Identify flood-prone areas, historical inundation zones, and community-level risk perceptions.
3. Conduct structured stakeholder consultations to explore local experience with flood triggers, including water levels associated with road closures or evacuations.

3.5 Flood Hazard Modeling Using HEC-RAS

1. Develop and run a HEC-RAS 2D hydraulic model using field-surveyed cross-sections and discharges from empirical methods.
2. Simulate flood scenarios for return periods of 2, 5, 10, 20, 50, and 100 years.
3. Generate outputs including flood depths, inundation extents, and flow velocities.
4. Validate the model qualitatively using terrain data, flood marks (if any), and community feedback.

3.6 Flood Hazard Mapping

1. Produce detailed flood inundation maps for each simulated return period scenario.
2. Identify vulnerable settlements, agricultural lands, and critical infrastructure within flood hazard zones.

3.7 Determination of Flood Thresholds

Determine scientifically based flood threshold levels in accordance with DHM's standard practices. Thresholds shall be cross-verified through community consultations and aligned with topography and land use analysis.

3.8 Validation of Results

1. Validate results through hydrological modeling, terrain analysis, and stakeholder insights.
2. Document assumptions and limitations due to the absence of long-term observational data.
3. Coordinate with Department of Hydrology and Meteorology (DHM), Nepal for final result output

4. Description of Study Area

The study covers two hydrological stations located in Kanchanpur District, Sudurpashchim Province, within the river basins of the Terai region:

Table 1: Proposed Stations for Warning and Danger Level Determination

River Name	Location	Latitude	Longitude
Banra River	E-W Highway Bridge	28°53'20.06"N	80°23'42.69"E
Doda River	Nandgaun, Laljhandi, Kanchanpur	28°45'36.36"N	80°23'36.32"E



5. Methodology

The consultant shall adopt a comprehensive, multi-method approach combining:

1. Empirical flood estimation (WECS/DHM, Modified Dickens, MHSP/CIWEC, Regional Analysis methods).
2. Field-based cross-sectional surveys and rating curve development.
3. HEC-RAS 2D hydraulic modeling for flood simulation.
4. GIS-based flood hazard mapping.
5. Stakeholder consultations and community-based data collection.

6. Schedule of Work/Timeline

The assignment is expected to be completed within **1 and half months** from the date of commencement.

Activities	June		July			
	W3	W4	W1	W2	W3	W4
Inception Report						
Draft Report (after field work and modelling)						
Final Report (with threshold)						

7. Budget

The maximum budget available for this assignment is NPR 7, 50, 000.00 (seven lakh fifty thousand -including VAT/TAX). The consultant is responsible for their travel, food, accommodation, and insurance expenses.

The payment of fees shall be processed upon fulfilment of the following requirements:

- 30% upon approval of the inception report.
- 40% upon receipt of the draft report
- 30% upon approval of the final report

8. EVALUATION CRITERIA

All proposals received shall be reviewed under the following different indicators. These will be but not limited to sound understanding of the assignment, proposition of competent methodology, team members' capacity, commitment, experience of working on similar assignments particularly in this region (Kanchanpur), and efficient budget planning.

Apart from the above, submission of the following will be taken into account during the selection process:

1. Technical proposal along with financial breakdown of proposed methodology
2. A copy of company registration, VAT registration (for firms), and TAX clearance for the latest fiscal year.

3. A cover letter and updated CV of team member/s.
4. Similar works experience documents copies
5. The organisation may request additional documents, if deemed necessary.

For More Detail

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