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Govt. of Uttarakhand

Letter No. 104 **/ 32 / ULMMC / 2025-26** **Dated** 19 **May, 2025**

सेवा में

अधीक्षण अभियन्ता,
सिंचाई कार्यमण्डल,
उत्तरकाशी।

विषयः– **जनपद उत्तरकाशी में भागीरथी नदी के दाएं किनारे स्थित चडेथी एवं भटवाड़ी नाम स्थान पर भूस्खलन की सुरक्षात्मक कार्य हेतु भू–वैज्ञानिक सर्वेक्षण कराये के सम्बन्ध में।**

महोदय,

उपरोक्त विषयक अपने कार्यालय पत्र संख्या 3542/सि.का.मं.उ./दिनांक 30 दिसम्बर, 2024 का संदर्भ ग्रहण करने का कष्ट करें, जिसके द्वारा जनपद उत्तरकाशी में भागीरथी नदी के दाएं किनारे स्थित चडेथी एवं भटवाड़ी नाम स्थान पर भूस्खलन के कारण संवेदनशील/अतिसंवेदनशील स्थल बने हुए है, जिसके कारण वहां पर स्थानीय निवासियों को कठिनाईयों का सामना करना पड़ रहा है। उक्त स्थल पर सुरक्षात्मक कार्य कराये जाने हेतु स्थानीय जनप्रतिनिधियों एवं स्थानीय निवासियों द्वारा लगातार मांग की जा रही है। परन्तु सुरक्षात्मक कार्य कराये जाने से पूर्व संबंधित स्थल (लम्बाई लगभग 2.00 किमी) का भू–वैज्ञानिक सर्वेक्षण कराया जाना अतिआवश्यक है, जिस हेतु उक्त का स्थलीय निरीक्षण करते हुए तद्नुसार अपना प्रस्ताव अध्ययन/सर्वे एवं दरों सहित कार्यालय को उपलब्ध कराने की अपेक्षा की गयी है, ताकि प्रकरण में अग्रिम आवश्यक कार्यवाही की जा सके।

2. उक्त के क्रम में उक्त क्षेत्र का स्थलीय निरीक्षण कर लिया गया है, जिसकी आख्या इस पत्र के साथ संलग्न कर यथावश्यक कार्यवाही हेतु प्रेषित की जा रही है।

3. उक्त के अतिरिक्त विभिन्न कार्यों के संपादन हेतु इस केन्द्र द्वारा परामर्श शुल्क का निर्धारण किया गया है, जो निम्नानुसार हैः–

Projects	ULMMC Charges
Project Management Consultancy (PMC) Supervision Consultancy Design and Supervision consultancy Comprehensive Supervision Consultancy	Based on scope of work 1.0% of total project cost 1.5% of total project cost 2.0% of total project cost
Evaluation of DPR	0.25% of total project cost
Topographic Survey	Rs. 30,000@per hectare
Geophysical Survey	Rs. 400 per meter + charges for labour, travel etc.
DPR Preparation	Upto Rs. 5.00 Cr: 1.0% of Total Project Cost Rs. 5.00 – 50.00 Cr: 0.75% of Total Project Cost Above Rs. 50.00 Cr: 0.50% of Total Project Cost Specific investigations charges extra

4. अतः उक्तानुसार यथावश्यक कार्यवाही करने का कष्ट करें।

भवदीय

19/5/25

(डॉ0 शान्तनु सरकार)
निदेशक

संख्या एवं तिथि तदैव।

प्रतिलिपि–

1. महानिदेशक, उत्तराखण्ड भूस्खलन न्यूनीकरण एवं प्रबंधन केन्द्र, देहरादून।
2. अपर महानिदेशक, उत्तराखण्ड भूस्खलन न्यूनीकरण एवं प्रबंधन केन्द्र, देहरादून।
3. वित्त नियंत्रक, उत्तराखण्ड भूस्खलन न्यूनीकरण एवं प्रबंधन केन्द्र, देहरादून।

निदेशक

Preliminary visit to Chadethi (Bhatwari) landslide zone along right bank of the River Bhagirathi, Uttarkashi

उत्तराखण्ड राज्य

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1. INTRODUCTIONS

In reference to Letter No. 84/32/ULMMC/2024-25 dated 6th May 2025, a field visit was carried out to assess the Chadethi (Bhatwari) landslide zone between 8th and 9th May 2025. The site visit was undertaken by a team comprising Dr. Raghuveer Negi (Geologist) and Er. Pankaj Uniyal (Design Engineer). This visit was initiated following a request received from the Irrigation Department, Uttarkashi Division, Government of Uttarakhand.

The Bhatwari Landslide Zone is located near Bhatwari township in Uttarkashi district, Uttarakhand, along NH-34 (formerly NH-108), which connects to Gangotri. This region is known for its active and recurrent landslides, especially during the monsoon season. The zone is geologically situated in the Higher Himalayas and is strongly influenced by the tectonic activity of the Main Central Thrust (MCT) (Naithani, 2020).

Figure 1: *Field photograph of the affected zone impacted by landslide/subsidence activity along NH 34.*

2. GEOLOGICAL SETUP

The area comprises high-grade metamorphic rocks such as schist, gneiss, and quartzite. These are extensively jointed and sheared, making the slope highly unstable. The proximity to tectonic features like the MCT contributes significantly to the region's instability (Rawat et al., 2020).

3. OBSERVATIONS

The landslides in the Bhatwari area exhibit a combination of rotational and translational failure mechanisms, contributing to frequent mass wasting events, including debris flows, rockfalls, and toe erosion induced by the Bhagirathi River. These slope movements have caused repeated damage to National Highway 34 (NH-34) and pose a significant threat to nearby settlements (Pant et al., 2015). Both natural factors (geological, geomorphological, and hydrological) and anthropogenic influences (construction, road cutting, etc.) are responsible for slope instability in this region. The following observations were made during the site investigation:

1. The settlements are at risk due to ongoing and potential slope movements include Bhatwari, Raithal, Kyara, Bandrani, and Natin may also be studied if any surface deformation observed and correlated with the subsidence zone.
2. The Bhagirathi River flows approximately north-south (005°–185°N) but exhibits a pronounced bend near a local temple, changing course to 050°–230°N. The road alignment closely follows the river's course, which may exacerbate erosion and destabilize the toe of the slope (Figure 2).

Figure 2: *Field photograph showing of river shifting and adjacent human settlements.*

3. The right bank slopes (eastern side) predominantly dip eastward, while the left bank slopes dip westward (~270°N), indicating divergent slope geometries across the river channel.
4. The affected area exhibits characteristics of a paleo-landslide, with Bhatwari town largely situated on reactivated landslide debris. The average slope gradient in the area ranges between 30° and 50°, predominantly dipping towards the east.
5. The slope material consists primarily of colluvial deposits—a heterogeneous matrix of debris and boulders derived from crystalline rocks, specifically schists and gneisses of the Higher Himalayan Crystalline Zone.
6. Structural cracks have been observed in several key structures, including the Patwari Chauki, LIU office, and Tehsil building, indicating active ground deformation. Additionally, numerous hotels, residential buildings, and shops in the area show signs of distress (Figure 3).

Figure 3: *Cracks observed in building structures during field inspection, suggesting potential differential settlement or ground movement.*

7. Some buildings exhibit tilting towards the upslope direction, suggesting the development of rotational slip surfaces within the debris- and boulder-rich material, indicative of circular (rotational) failure mechanisms (Figure 4).
8. The Baldev Market area shows visible ground cracks and displacement trending towards 350°N, further indicating slope movement in a northwest direction.

Figure 4: *Structural cracks observed in buildings at Baldev Market, highlighting signs of damage possibly due to subsidence or geotechnical failure*

4. SUGGESTIONS

The area is undergoing subsidence and creep movements, with the affected zone extending over a ~2 km stretch of the road and surrounding regions. Based on preliminary field investigations, the following recommendations are proposed:

1. The slope material is primarily composed of colluvial debris and boulders of varying sizes, making it difficult to ascertain the depth to bedrock. Therefore, geophysical investigations (e.g., Electrical Resistivity Tomography, Seismic Refraction) and borehole drilling are suggested to understand the subsurface stratigraphy and determine the depth and nature of the underlying bedrock.

2. A detailed geotechnical investigation is essential to evaluate the geotechnical properties and behavior of the debris and any encountered bedrock. This should include laboratory and in-situ testing for parameters such as shear strength, permeability, density, and Atterberg limits.
3. If grain size analysis indicates a clay content of approximately 10% or more, it is recommended to perform clay mineralogical analysis (e.g., X-ray Diffraction) to identify expansive or hydrophilic clay minerals that may influence slope stability.
4. A high-resolution topographic survey (e.g., through Drone, LiDAR or differential GPS/Total Station methods) should be conducted to map slope geometry, surface deformation features, drainage patterns, and potential zones of instability.
5. Detailed geological, engineering geological, and geotechnical mapping should be carried out to document lithology, structural features, discontinuities, and soil/rock interfaces relevant to slope stability assessment.
6. Based on the integrated findings from geological, geotechnical, geophysical, drilling, and topographical investigations, site-specific mitigation measures should be designed. These may include slope regrading, drainage improvement, retaining structures, or ground reinforcement depending on the local conditions and failure mechanisms identified.

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Other field photograph