**IN THE HON'BLE NATIONAL GREEN TRIBUNAL,
PRINCIPAL BENCH, NEW DELHI**

**IN
ORIGINAL APPLICATION No. 1115/2024**

News Item titled "Rampant mining causes Joshimath-like crisis in Uttarakhand's Bageshwar" appearing in India Today dated 14.08.2024

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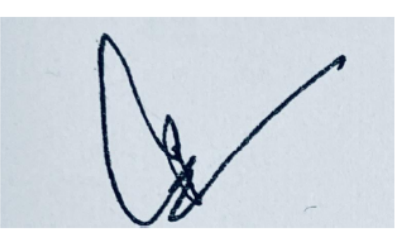

FILED BY:

**PRATYAKASH GUPTA,
(ADV. FOR RESPONDENT NO. 3)**

DEHRADUN:
DATED: 09/12/2024

**IN THE HON'BLE NATIONAL GREEN TRIBUNAL,
PRINCIPAL BENCH, NEW DELHI**

**IN
ORIGINAL APPLICATION No. 1115/2024**

News Item titled "Rampant mining causes Joshimath-like crisis in Uttarakhand's Bageshwar" appearing in India Today dated 14.08.2024

Affidavit on behalf of Respondent No. 3, Ministry of Environment, Forest & Climate Change, through its Regional Office, 25, Subhash Road, Dehradun-248001.

Affidavit of Vipin Gupta (Male) aged about 34 years S/o Shri Ved Prakash Gupta, presently posted as Scientist-C, in the Regional Office of the Ministry of Environment, Forests and Climate Change (MoEF&CC) at Dehradun.

(Deponent)

I, the deponent named above do hereby solemnly affirm and state as under:

1. That the deponent in his official capacity is conversant with the facts of the case and duly authorized by the competent authority to file the

present reply affidavit on behalf of respondent No. 3.

2. That the present original application is registered suo motu based on the news item appearing in India Today dated 14.08.2024 which relates to the rampant mining in Bageshwar District of Uttarakhand resulting in the Joshimath-like situation in the Kanda area, where cracks have appeared in homes, temples, fields, and roads. That taking cognizance of news article, the Hon'ble Tribunal vide order dated 30.08.2024 has impleaded this office as Respondent No. 3 and directed to file his response/reply by way of affidavit at least one week before the next date of hearing.

3. That in pursuance of the above order, the following response/reply by way of affidavit is being submitted by answering respondent for kind consideration of this Hon'ble Tribunal.

4. To ascertain the correct position, the truthfulness of the facts disclosed in the news article as mentioned in para- 2 above, a site visit was conducted by Ministry's Regional Office, Dehradun between 23.11.2024 and 26.11.2024. The Site Inspection Report is annexed herewith as **ANNEXURE-I** for kind perusal/consideration of this Hon'ble Tribunal.

5. It is therefore humbly requested to this Tribunal that the reply affidavit on behalf of answering respondent (Respondent No. 3) may kindly be taken on record.

NOTARY
Rajender Singh Negi
Advocate
Dehradun District
Reg.No.19(01)2002
GOVT. OF UTTARAKHAND (INDIA)

6. That the answering respondent reserves its right to file additional affidavit, if required, till pendente lite.

7. That in view of the foregoing submissions, this Hon'ble Tribunal may be pleased to pass such or further orders as it may deem fit in the given circumstances of the case.

DEPONENT

डॉ. विपिन गुप्ता / Dr. Vipin Gupta
वैज्ञानिक 'सी' / Scientist 'C'
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय / MoEF&CC
क्षेत्रीय कार्यालय / Regional Office
भारत सरकार / Government of India
25, सुभाष रोड, देहरादून / 25, Subhash Road, Dehradun

VERIFICATION:

Verified at Dehradun, Uttarakhand on this 09 day of December, 2024 that the contents of the above affidavit are true and correct to my knowledge and are based on official records, no part of it is false and nothing material is concealed there from.

Sr. No. 8048/2024
This affidavit is sworn before me by Shri Vipin Gupta who is identified by Shri Ram Singh Negi at Dehradun on 09/12/2024

NOTARY Rajender Singh Negi Advocate Dehradun District Reg.No.19(01)2002 GOVT. OF UTTARAKHAND (INDIA)

(Rajender Singh Negi)
Advocate & Notary, Dehradun

DEPONENT

डॉ. विपिन गुप्ता / Dr. Vipin Gupta
वैज्ञानिक 'सी' / Scientist 'C'
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय / MoEF&CC
क्षेत्रीय कार्यालय / Regional Office
भारत सरकार / Government of India
25, सुभाष रोड, देहरादून / 25, Subhash Road, Dehradun

File No.: NGT/14/2024
Government of India
Ministry of Environment Forest and Climate Change
Regional Office (NCZ)

SITE INSPECTION REPORT

Subject: Original Application No. 1115/2024 in respect of News Item titled "Rampant mining causes Joshimath-like crisis in Uttarakhand's Bageshwar" appearing in India Today dated 14.08.2024 before the Hon'ble National Green Tribunal, Principal Bench, New Delhi.

Reference: Hon'ble NGT's order dated 30.08.2024 in aforesaid matter wherein the Hon'ble NGT has taken *suo motu* cognizance based on the Indian Today's news regarding the rampant mining in Kanda area of Bageshwar District, Uttarakhand, reportedly resulting in cracks in homes, temples, fields and roads.

The Hon'ble NGT, while quoting the aforesaid news item, has further mentioned that a 1,000-year-old Kalika temple is also at risk due to nearby mining activities as the cracks have appeared in the temple premises, with locals attributing the damage to a open cast soapstone (Talc or Khadiaya) mine just 50 meters away. The article further claims that there has been no visible government effort to address the situation or help those affected. Hon'ble NGT in its order dated 30.08.2024 has correctly mentioned that the villagers initially supported talc mining for the jobs it provided. However, now they are worried for the safety of their homes and Kalika temple due to adjacent open cast soapstone (talc or khadiya) mine. It may however be noted that the District Administration vide order dated 01.06.2023 has closed the operations in all the mines within 50 m of existing CNG Godown, Aabadi Area and Motor Road including this particular mine. This open cast soapstone mine lease was allocated to Shri Kuldeep Singh Bisht.

Photo 1: Open Cast Soap Stone Mining at Kanda Tehsil, Bageshwar

2. The Hon'ble NGT, vide aforesaid order dated 30.08.2024, has impleaded the Ministry of Environment Forest and Climate Change (MoEF&CC), New Delhi (hereinafter referred to as the Ministry) through its Regional Office (NCZ), Dehradun, as one of the respondents and directed to file response/reply by way of affidavit.

3. In compliance to Hon'ble NGT's order dated 30.08.2024, the Ministry's Regional Office (NCZ), Dehradun carried out an inspection of the site at Kanda-Kaniyal village between 23.011.2024 and 26.11.2024 for verification of various issues raised by the India Today in its news item referred above. Kanda Kaniyal Village falls under the Kanda Tehsil of Bageshwar District, nestled in the Kumaon region. Kanda Tehsil is situated at 1500-1900m above sea level. Village is surrounded by mountains, terraced fields, and organic tea platforms. The coordinates of Kanda Tehsil are N 29° 49' 07.3011" and E 79° 52' 35.9969 E". The landscape boasts a rich ecology and biodiversity, with flora including Banjh (Oak) *Quercus leucotrichophora*, Buransh (Rhododendron) *Rhododendron arboreum*, Chir (Pine) *Pinus roxburghii*, Deodar (Cedar) *Cedrus deodara*, Surahi (Cypress) *Cupressus torulosa*, Pangar (Indian Horse Chestnut) *Aesculus indica*, Walnut *Juglans regia*, Tun (Toon) *Toona ciliata*, Semal (Silk Cotton Tree) *Bombax ceiba*, Angu (Date Palm) *Phoenix dactylifera*, Mehal (Pear Tree) *Pyrus pashia*, Angyar (Indian Birch) *Lyonia ovalifolia*, Ghingaru (Firethorn) *Pyracantha crenulata*, Utish (Alder) *Alnus nepalensis*, and Poplar *Populus deltoides*.

The local wildlife includes species such as the Leopard (*Panthera pardus*), Wild Boar (*Sus scrofa*), Fox (*Vulpes vulpes*), Barking Deer (*Muntiacus muntjak*), Indian Muntjac (*Muntiacus muntjak*), and Rabbit (*Oryctolagus cuniculus*). Bird species found in the area include the House Sparrow (*Passer domesticus*), Partridge (*Perdix perdix*), Jungle Fowl (*Gallus gallus*), Eagle (*Aquila chrysaetos*), Vulture (*Gyps bengalensis*), Crow (*Corvus splendens*), and Cuckoo (*Eudynamys scolopacea*).

The tehsil is also culturally significant with a strong tradition of folk music, dance, and handicrafts. Kanda's proximity to popular tourist spots like Bageshwar, known for the Bagnath Temple, also contributes to its cultural and religious importance. The total geographical area of Kanda-Kanyal village is 231.24 hectares.

4. The Kalika Temple in Kanda, located in the Bageshwar district of Uttarakhand, is a significant religious site believed to have been established in the 10th century It is known for its historical and cultural importance, particularly in the context of local beliefs regarding the protection against malevolent forces. villagers/Temple Committee Members were present during the site inspection The views of the villagers/members were also taken **(List of Committee members attached as an Annexure-I)**. In addition, the records of the District Administration and its Department of Geology and Mining at Bageshwar, Uttarakhand, were also reviewed during this period.

NOTARY Jitender Singh Negi Advocate Dehradun District Reg.No.19(1)2002 GOVT. OF UTTARAKHAND (INDIA)

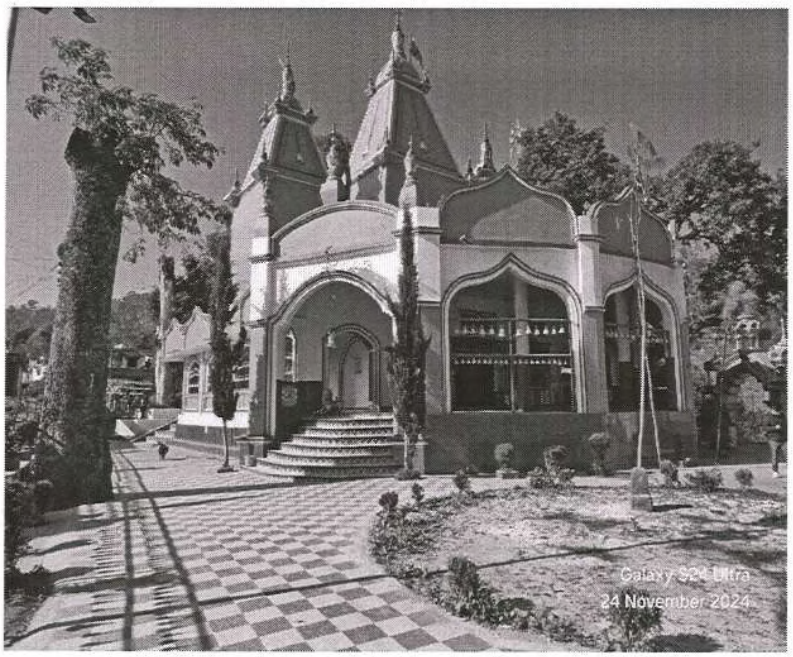

Photo 2: Kalika Temple in Kanda Tehsil

Photo 3- Cracks in flooring of Kalika Temple

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Advocate
Dehradun District
Reg.No.19(01)2002
GOVT. OF UTTARAKHAND (INDIA)

5. The Ministry's observations based on the site inspection, review of records of the District Administration/Department of Geology & Mining, Bageshwar and interaction with villagers/Temple Committee Members, are given below for kind consideration of the Hon'ble NGT:

(i) The villagers and temple committee members raised following issues:

- The cement flooring of an abandoned structure at the back side of the temple is sinking and developing cracks.
- The roof of an abandoned structure at the back side of the temple has subsided by 1 foot.
- The third dome of the temple appears tilted.
- Cracks and subsidence have at the front portion of the Dharamshala near temple.
- Tiles in the inner sanctum of the Kalika Temple are broken and the ground is sinking, causing displacement.
- Large cracks caused by heavy machinery mining were previously filled by the miner.

During the site visit, no mining was found operational near village and CNG Godown as it was closed by the District Administration on 01.06.2023. A few minor cracks were observed on the flooring inside the temple. Subsidence of roof and flooring at the backside of the temple were found unnoticeable through visual inspection. Architectural expertise would be required to assess the extent of subsidence. No major cracks were observed on the fields around temple as those cracks might have been previously filled by the Miner in compliance of orders by the District Administration.

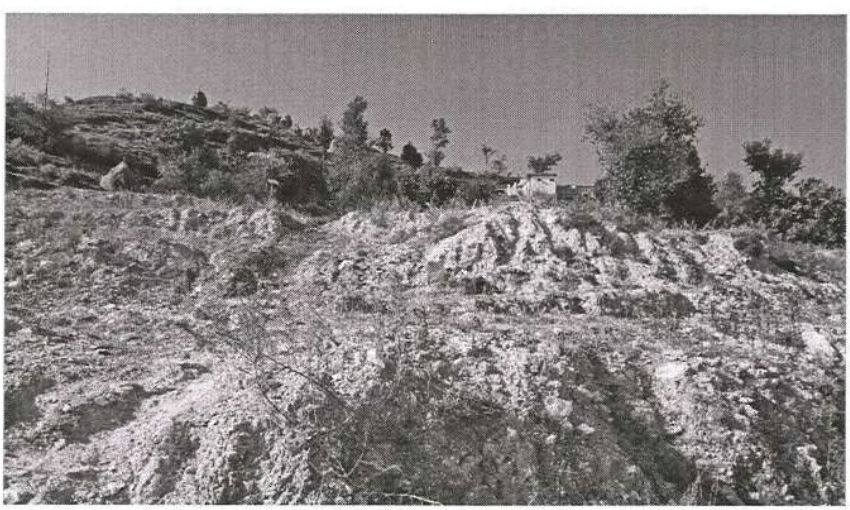

Photo 4: Abandoned Opencast Mine behind Kalika Temple

(ii) The villagers informed about occurrence of cracks in a house owned by Shri Hem Chandra Kandpal S/o Shri Prayag Dutt. As per report of the joint inspection carried on 03.09.2024 by the team comprising of the Naib Tehsildar, Kanda (Bageshwar), I/c Mining Officer, Bageshwar, Junior Engineer, PWD (Public Works Department) Bageshwar, Additional Assistant Engineer, PMGSY (Pradhan Mantri Gram Sadak Yojana) Bageshwar, and Assistant Geologist, Department of Geology and Mining, Bageshwar, the house of Shri Hem Chandra Kandpal had observed some cracks on the outer walls of the house and a crack (1 cm wide and 6 m long), which extended from floor to wall of the room inside house. This house is more than 95 years old. This joint inspection report also mentioned about occurrence of minor cracks and subsidence in five other houses of the village (**The detailed report is attached as an annexure II).**

The suggestions of Joint Committee also given below-:

- Structural/engineering deficiencies were found in building construction, such as the absence of beams and columns in most buildings.
- Adequate drainage systems were not observed at the site in question. Rainwater and household water are being discharged uncontrollably, which is saturating and weakening the ground surface.
- Weak rocks such as dolomite, limestone, and talc were observed in the area, which weather quickly when in contact with water.
- Exposed bedrock is not visible on the surface at the sites in question.

The joint committee also given following suggestions:

- Appropriately designed retaining walls or gabion walls should be constructed at designated levels.
- Cracks in the buildings should be repaired by filling them with suitable filling material.
- Proper drainage systems should be installed at the sites.
- Landslide-preventing grasses or plants should be planted at the aforementioned sites.

(iii) Subsequently, a team comprising of two Senior Geologists from the Geological Survey of India (GSI) visited the Bageshwar district for preliminary assessment of ground subsidence affected villages between 12.09.2024 and 14.09.2024. The GSI team, accompanied by the SDM, Kanda, Bageshwar and other local authorities visited Kanda Kaniyal village for investigation of cracks in two residential houses and Kalika temple.

The GSI team pointed out that House No. 1 at coordinates N 29^{0}49'42.01", E 79^0'53'31.48" was located in a natural depression with water seepage observed about 300 m upslope. The development of cracks was mainly due to its location, which acted as a conduit for subsurface waster as indicated by seasonal springs and

seepage. The Primary cause of cracks was due to gradual piping action (removal of fines) controlled by water seepage.

In case of House No. 2 at coordinates N 29^{0}49'38.79", E 79^0'53'32.04" the cracks at the outer edge of the porch were likely due to the defacing of a steep bench created downslope. Those cracks were not related to the open cast soapstone mine, which is located about 70 m south of the house.

In case of Kalika temple, approximately 40 m of the open cast mine, a curvilinear crack was observed on the floor of temple measuring 2-5 mm wide and 2-3 m long. Those cracks in the floor of temple prima facie appeared due to defacing of slope. The cracking patterns on the northern slope of the temple and house below were similar.

The GSI team concluded that the cracks and subsidence were mainly due to varying causes of ground instability, including water seepage, erosion, and mining activities, which would be necessitating the tailored recommendations for each site. In case of House No. 1, GSI team recommended to provide a deep lined trench with weep holes to the upslope of the house to collect and divert the subsurface water and establish proper drainage to direct the water downslope. This solution might address the current issue, but given the house's location in a natural depression, surface water flow during heavy rains could pose a risk. The cracks at the outer edge of the porch in House No. 2 could be mitigated by constructing a retention wall with weep holes to support the steep face of the bench, if required. The cracks in Kalika Temple prima facie appeared due to defacing of slope but the role of open cast soapstone mine cannot be denied. Therefore, GSI team recommended to collect photos and videos before backfilling of the mine to better understand its impact on the destabilization of areas present upslope to those mines **(The detailed GSI report is attached as an annexure III).**

6. Key observtions

Key Points emerged from the site inspection and review of records of District Administration and Geology and Mining Department, Bageshwar are as under:

1. Structural and drainage deficiencies, water seepage, and natural ground instability are key factors contributing to the observed damage.

2. The proximity of the open-cast soapstone mine may also be a contributing factor. The role of opencast mine could not be denied as the timeline of cracks in the temple and houses below with reference to mine development would be required to put proper light on the issue.
3. Cracks in the Kalika Temple and nearby residential houses indicate structural distress caused by subsurface erosion, slope defacing, and possibly past mining activities.
4. Construction of retaining or gabion walls, repairing of cracks and improvement of drainage systems is required to be improved.

NOTARY GOVT. OF UTTARAKHAND (INDIA) Rajender Singh Negi Advocate Dehradun Reg.No.19(

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5. To stabilize slopes, preserve structural integrity, and prevent erosion and ground saturation in Kanda-Kaniyal village, implementing retaining or gabion walls, repairing cracks, and enhancing drainage systems is essential.
6. Rainwater management is required to be improved through channels or culverts to mitigate erosion risks and support long-term structural stability.
7. Implement tailored recommendations for each site, focusing on water management and structural reinforcement are required to mitigate future risks.
8. Collaborative approach is required to involving geological experts, local authorities, and the community to safeguard structures and promote sustainable development.

7. Conclusion

Structural and drainage deficiencies, water seepage, and natural ground instability are key factors contributing to the observed damage. The proximity of the open-cast soapstone mine may also be a contributing factor. The role of opencast mine could not be denied as the timeline of cracks in the temple and houses below with reference to mine development would be required to put proper light on the issue. Cracks in the Kalika Temple and nearby residential houses indicate structural distress caused by subsurface erosion, slope defacing, and possibly past mining activities.

Department of Geology and Mining, Bageshwar was requested to provide information on the functional open-cast soapstone mines and status of Environmental Clearance granted in Kanda Tehsil- Bageshwar, The Information is still awaited.

Submitted by

(Dr. Ashish Kumar)
Additional Director/Scientist-E

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ANNEXURE - I

Annexure-I

S. No	Name of Member	Father's Name	Residence
1	Raghubir Singh Majila	Bhawan Singh Majila	Village Pangchodha
2	Tej Singh Nagarkoti	Sakat Singh Nagarkoti	Village Kanda
3	Virendra Singh Nagarkoti	Former District Panchayat Member	Village Kanda
4	Mahesh Chandra Pant	Ramesh Chandra Pant	Village Kanda
5	Gopal Singh	Padam Singh	Village Kanda
6	Kedar Singh Majila	Trilok Singh Majila	Village Pangchodha
7	Ratan Singh Daphola	Trilok Singh Daphola	Village Dapholi

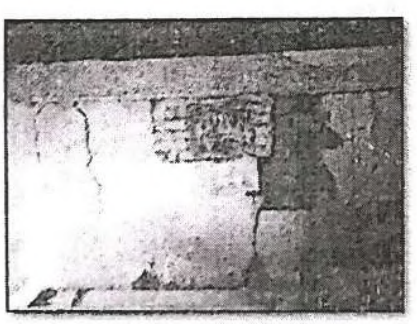
NOTARY (INDIA) Rajender Singh Negi Advocate District Dehradun Reg. 19/01/2002 GOVT. OF UTTARAKHAND

विषय–मॉ कालिका मन्दिर काण्डा पड़ाव एवं उसके आस–पास के क्षेत्रों में हो रहे भूधंसाव एवं भूगर्भीय सर्वेक्षण सम्बन्ध में।

प्रस्तावना–उपरोक्त विषयक उपजिलाधिकारी, काण्डा के पत्र संख्या 202/पी0ए0–विविध/2023–24 काण्डा दिनांक 02/09/2024 के माध्यम से अवगत कराया गया है कि उपरोक्त विषयक विभिन्न समाचार पत्रों/सोशियल मीडिया के माध्यम से संज्ञान में लाया गया है कि कालिका मन्दिर काण्डा पडाव एवं उसके आस–पास के क्षेत्रों में भूधसाव से ग्रामवासियों के मकानों में दरारें आ रही हैं। साथ ही आम जनमानस द्वारा सुरक्षात्मक उपाय किये जाने का अनुरोध किया जा रहा है। उक्त के सम्बन्ध में जिलाधिकारी महोदय बागेश्वर द्वारा दूरभाष पर तत्काल प्रश्नगत क्षेत्र का भूगर्भीय सर्वेक्षण करने तथा भूगर्भीय सर्वेक्षण में कार्यदायी संस्थाओं को भी उपस्थित रहने के निर्देश दिये गये हैं, जिससे क्षेत्र में निर्मित/निर्माणाधीन/प्रस्तावित निर्माण कार्यों की स्थिति भी स्पष्ट हो सके तथा सर्वेक्षण उपरान्त संयुक्त निरीक्षण आख्या उपलब्ध कराये जाने का उल्लेख किया गया है।प्रभावित स्थल का संयुक्त निरीक्षण तहसीदार काण्डा, प्रभारी जिला खान अधिकारी बागेश्वर,सहायक अभियन्ता लोनिवि बागेश्वर, अपर सहायक अभियन्ता पीएमजीएसवाई बागेश्वर तथा सहायक भूवैज्ञानिक बागेश्वर द्वारा दिनाक 03/09/2024 को भवन स्वामियोंएवं स्थानीय निवासियों की उपस्थिति में सम्पन्न किया गया, जिसकी संयुक्त निरीक्षण आख्या निम्नवत है।

स्थिति–प्रश्नगत स्थलजनपद बागेश्वर, जिला मुख्यालय से लगभग 30 किमी0 की दूरी पर काण्डा पडाव–भाकडपंत मोटर मार्ग पर हिल साईड में अवस्थित है।

स्थल 01–हेम चन्द्र काण्डपाल पुत्र श्री प्रयाग दत्त–आवासीय भवन की बाहर की दीवार पर दरारें है, भवन के अन्दर कमरे में लगभग 01 सेमी0 चौडी तथा 06 मी0 लम्बी दरार है, जोफर्श से दीवार तक जा रही है। किचन के फर्श पर दरारें व गीली अवस्था में है। भवन के दूसरे कमरेके दरवाजे खोलने–बन्द करने में अटकरहे है। फर्श तथा दीवारों पर हल्की दरारें है। आंगन में चाहर दीवारी की ओर हल्का धंसाव है। परिवार भवन में निवास कर रहा है। निरीक्षण के दौरान भवन स्वामी द्वारा अवगत कराया गया की भवन लगभग 95 वर्ष पुराना है जिसमें वर्ष 2016 से दरारें आना शुरू हो गयी थी।



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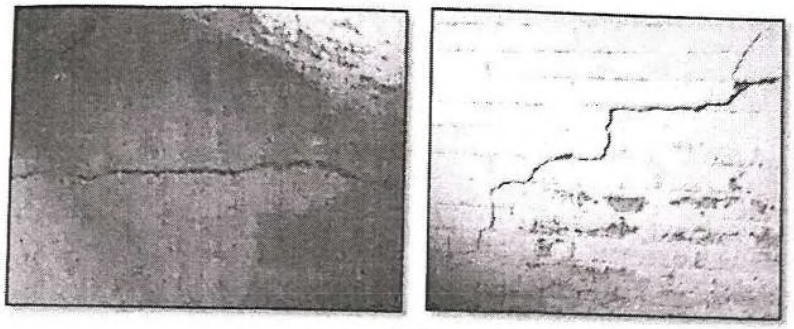
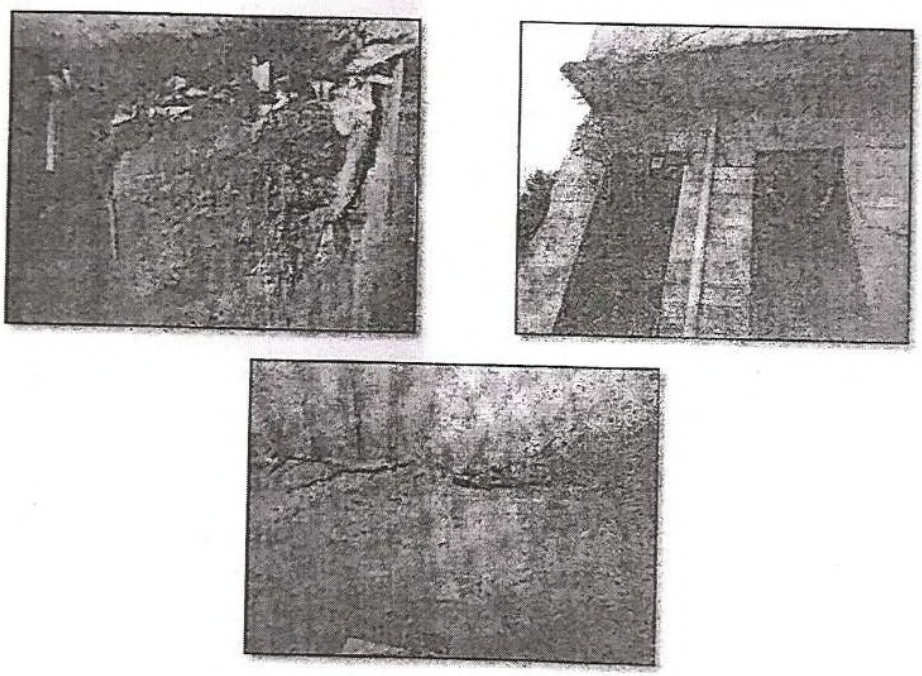


स्थल के चित्र

महेश चन्द्र काण्डपाल पुत्र श्री हरीश चन्द्र काण्डपाल–आवासीय भवन की बाहर तथा अन्दर की दीवारों पर अनवरत दरारें है, कमरें के दरवाजे तिरछे हो गये है। परिवार अन्यत्र निवास कर रहा है।आंगन में बायी ओर हल्का धंसाव है। निरीक्षण के दौरान हेम चन्द्र काण्डपाल द्वारा अवगत कराया गया कि भवन लगभग 05 वर्ष पुराना है।



स्थल के चित्र

निरीक्षण के दौरान अवगत कराया गया कि आवासीय भवनों के पीछे ढालदार भूभाग के अपस्लोप से पानी भवनों की ओर प्रवाहित होता है एवं वर्षा में अत्यधिक मात्रा में पानी आता है। वर्तमान में भवनों के पीछे नाली है जिसमें पानी प्रवाहित हो रहा है तथा आवासीय भवनों के बायें किनारें पानी प्रवाहित है। भवनों के पीछे ढालदार भूभाग जल प्रवाह क्षेत्र प्रतीत होता है। स्थल से खनन क्षेत्र की दूरी लगभग 110 मी0 है।

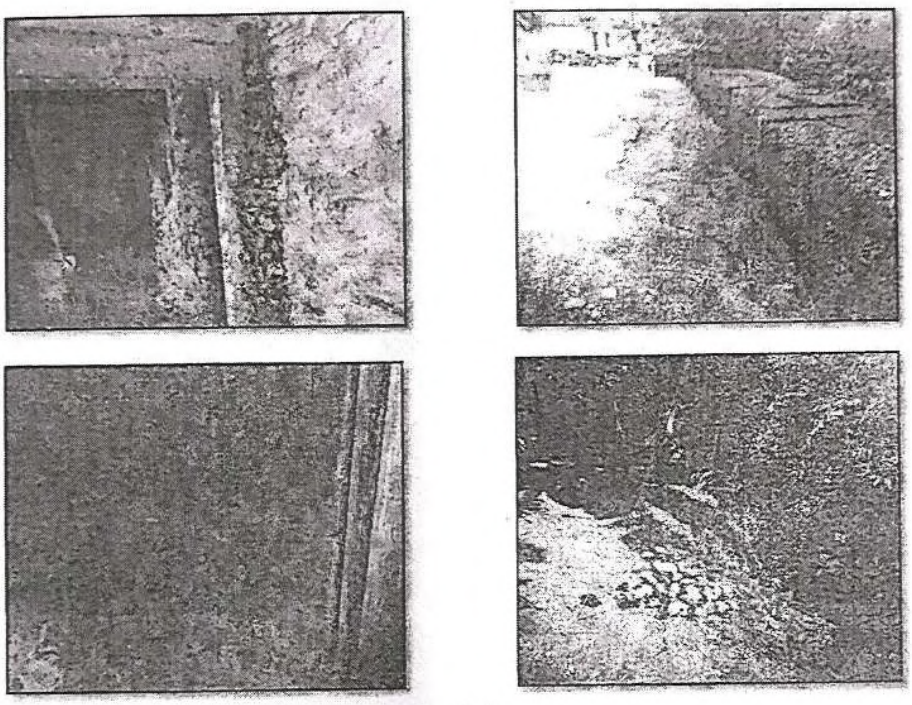
स्थल समुद्र तल से लगभग 1640 मीटर की ऊंचाई पर तथा निम्न अक्षासं व देशान्तर पर स्थित है:–

उत्तर 29° 49' 42.2" अक्षांश

पूरव 79° 53'31.3" देशान्तर

NOTARY GOVT. OF UTTARAKHAND (INDIA)

स्थल 02–साधू राम पुत्र श्री तिल राम–आवासीय भवन की बाहर व अन्दर की दीवार पर हल्की दरारें है जिनकी मरम्मत की गई है।आंगन के फर्श में चाहर दीवारीकी ओरदरारें है तथा हल्का धंसाव है। परिवार भवन में निवास कर रहा है। निरीक्षण के दौरान भवन स्वामी द्वारा अवगत कराया गया कि भवन लगभग 12 वर्ष पुराना है। शौचालय में हल्की दरारें है। अवगत कराया गया है कि 08/08/2024 को अतिवृष्टि से आंगन से लगभग 15 मी0 की दूरी पर नीचे की ओर खेत धंस गये है, वर्तमान में यह पौधों तथा घास से ढका है।स्थल से खनन क्षेत्र की दूरी लगभग 30 मी0 है।



स्थल के चित्र

स्थल समुद्र तल से लगभग 1630 मीटर की ऊंचाई पर तथा निम्न अक्षासं व देशान्तर पर स्थित है:–

उत्तर 29° 49' 38.8" अक्षांश

पूरब 79° 53'32.2" देशान्तर

स्थल 03–किशन राम पुत्र श्री दौलत राम, पूरन राम पुत्र श्री दौलत राम, प्रेम राम पुत्र श्री दौलत राम– आवासीय भवन की बाहर की दीवार पर हल्की दरार है। आंगन में हल्का धंसाव व हल्की दरार है। आंगन के बाये किनारें पर हल्का धंसाव हो रहा है।परिवार भवन में निवास कर रहें है। निरीक्षण के दौरान भवन स्वामी द्वारा अवगत कराया गया की भवन लगभग 25–30 वर्ष पुराना है। भवन से लगभग 20मी0 की दूरी पर मोटर मार्ग है। स्थल से खनन क्षेत्र की दूरी लगभग 25–30 मी0 है।

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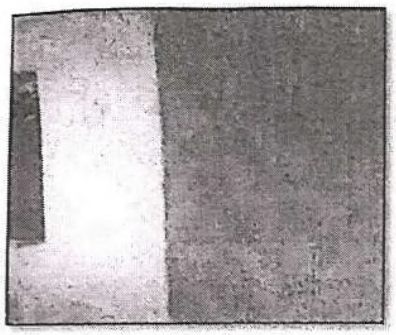


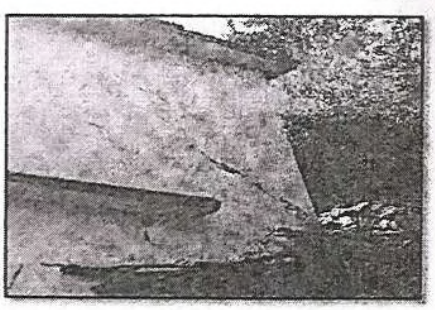
स्थल के चित्र

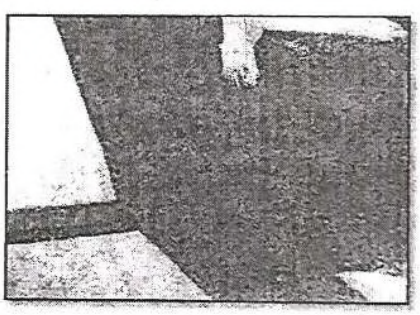
स्थल समुद्र तल से लगभग 1630 मीटर की ऊंचाई पर तथा निम्न अक्षासं व देशान्तर पर स्थित है:–

उत्तर 29° 49' 39.2" अक्षांश

पूरब 79° 53'32.4" देशान्तर

स्थल 04–हरीश राम पुत्र श्री कुवर राम–आवासीय भवन के बाहर किनारे की दीवार पर हल्की दरार है। परिवार भवन में निवास कर रहा है। निरीक्षण के दौरान भवन स्वामी द्वारा अवगत कराया गया कि भवन लगभग 30 वर्ष पुराना है। स्थल से खनन क्षेत्र की दूरी लगभग 45 मी0 है।





स्थल के चित्र

स्थल समुद्र तल से लगभग 1640 मीटर की ऊंचाई पर तथा निम्न अक्षासं व देशान्तर पर स्थित है:–

उत्तर 29° 49' 39.1" अक्षांश

पूरब 79° 53'31.2" देशान्तर

स्थल 05–दिनेश वर्मा पुत्र श्री गिरीश लाल वर्मा–निरीक्षण के दौरान भवन स्वामी द्वारा अवगत कराया गया किभवन/दुकानके पीछे उत्तर–पूरब दिशा में लगभग 30 मी0 की दूरी पर धंसाव हो रहा है, वर्तमान में यह क्षेत्र घास तथा पौधों से ढका है। स्थल से खनन क्षेत्र की दूरी लगभग 50–60 मी0 उत्तर–पूरब दिशा में है।

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Vim Gupta

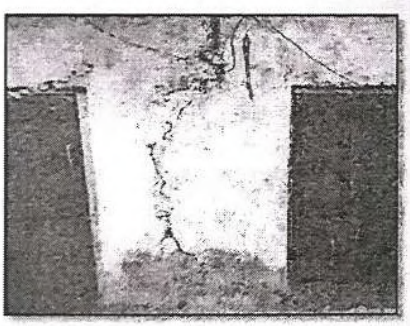
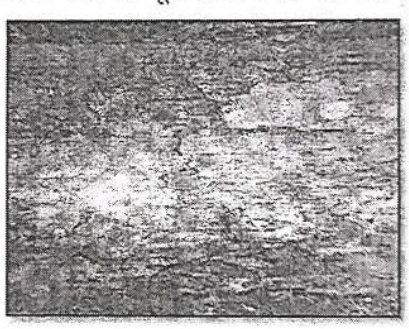

स्थल के चित्र

स्थल समुद्र तल से लगभग 1650 मीटर की ऊंचाई पर तथा निम्न अक्षासं व देशान्तर पर स्थित है:–

उत्तर 29° 49' 32.6" अक्षांश

पूरब 79° 53'29.7" देशान्तर

स्थल 06–जोगा राम पुत्र श्री लछम राम–निरीक्षण के दौरान भवन स्वामी द्वारा अवगत कराया गया की भवन के अन्दर कमरे में दरार थी जिनकी मरम्मत की गई है।भवन के किचन में सीलन है। शौचालय में हल्की दरारें है।गौशाला की बाहर तथा अन्दर की दीवारों परदरारें है। परिवार भवन में निवास कर रहा है। निरीक्षण के दौरान भवन स्वामी द्वारा अवगत कराया गया की भवन लगभग 12 वर्ष पुराना है। आवास से लगभग 20–25 मी0 दूरी पर दक्षिण–पूरब दिशा में प्राकृतिक जल स्रोत तथा मोटर मार्ग है। अवगत कराया गया है कि जल स्रोत में वर्ष भर पानी रहता है। स्थल से खनन क्षेत्र की दूरी लगभग 50–60 मी0 है।

स्थल के चित्र

स्थल समुद्र तल से लगभग 1630 मीटर की ऊंचाई पर तथा निम्न अक्षासं व देशान्तर पर स्थित है:–

उत्तर 29° 49' 41.9" अक्षांश

पूरब 79° 53'33.3" देशान्तर

क्षेत्रीय एवं स्थानीय भूगर्भीय संरचना–

जनपद बागेश्वर का सम्पूर्ण क्षेत्र मुख्यतः लेसर हिमालय और मध्य हिमालय में अवस्थित चट्टानों की उत्पत्ति से निर्मित है। क्षेत्र में उत्पत्ति कई चक्रों में हुई विभिन्न टैक्टोनिक मूवमैन्ट के कारण क्षेत्र की भूवैज्ञानिक संरचना अत्यधिक जटिलता लिये हुए है। जनपद बागेश्वर में विभिन्न स्थानान्तर्गत Current Bedded Quartzite, Micatalc Schist, Limestone, Conglomerate, Slate, Quartzite,

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का उत्तरी भाग जो अधिकांशतः हिमाच्छादित है, कायान्तरित चट्टानों से निर्मित है जो कि मध्य हिमालय का भाग है। मध्य हिमालय जोन का सेन्ट्रल क्रिस्टलाइन भाग थ्रस्ट की तरह प्रदर्शित है जो कि विभिन्न टैक्टोनिक सैटिंग अवधियों के दौरान लेसर हिमालय जोन की MetasedimentaryवSedimentary चट्टानों के ऊपर अवस्थित है। सेन्ट्रल क्रिस्टलाईन जोन में मुख्यतः मिग्मेटाइट, माइका नाइस, कैल्क नाइस, क्वार्टजाईट, मार्बल, माइका शिस्ट तथा एम्फीवोलाईट चट्टानें पायी जाती हैं। जनपद बागेश्वर का अधिकांश भाग Geotectonic Zone के अन्तर्गत आता है जिसे लेसर हिमालय कहा जाता है। लेसर हिमालय के अन्तर्गत मुख्यतः अवसादी शैल, मेटा अवसादी शैल, अन्तः संस्तरीय आग्नेय चट्टानों से निर्मित है। जहां भू–संरचनात्मक रूप से क्रमशः बेरीनाग एवं मुनस्यारी थ्रस्ट क्षेत्र के अन्तर्गत पूरब से पश्चिम दिशा में विस्तारित है।

पूर्व में भू–वैज्ञानिकों द्वारा किये गये भूगर्भीय अध्ययनों के अनुसार क्षेत्र का लिथोयूनिट निम्नवत् हैः–

अल्मोड़ा समूह	मुनस्यारी फोरमेशन
~~मुनस्यारी थ्रस्ट~~~~~~~~~~~~~~~~~~~~	
जौनसार समूह	बेरीनाग फोरमेशन
~~बेरीनाग थ्रस्ट~~~~~~~~~~~~~~~~~~~~	
तेजम समूह	मन्धाली फोरमेशन
गंगोलीहाट फोरमेशन	
दामथा समूह	रोथगढ़ फोरमेशन

प्रश्नगत स्थल लघु हिमालय पर्वत श्रृंखला के विकसित सोपानों के मध्य तेजम समूह के देवबन गंगोलीहाट फोरमेशन,मन्धाली फोरमेशन के मध्य अवस्थित है। स्थल एवं आसपास का क्षेत्र मृदा के आवरण से ढका है। स्थल एवं स्थल के निकटवर्ती क्षेत्रों में सतह पर भूरे रंग की महीन एवं मोटे कणों वाली मृदा के साथ चट्टानों के छोटे कोणीय टुकड़ों के मिश्रण का आवरण है। प्रश्नगत स्थल डोलोमिटिक लाइमस्टोन, टॉल्क प्रकार की चट्टानों के अन्तर्गत आता है।

<u>भूधंसाव/दरारों के सम्भावित कारणः–</u>

प्रश्नगत स्थल काण्डा पड़ाव,ग्राम काण्डेकन्याल, तहसील काण्डा में निरीक्षण के समय पाये गये तथ्यों के अनुसार क्षेत्र में होने वाले भूधंसाव/दरारों के सम्भावित कारण निम्नलिखित हैः–

1. भवनों के निर्माण में अभियान्त्रिकी/संरचनात्मक कमियॉ पायी गयी, जैसे– अधिकांश भवनों में बीम एवं कॉलम का अभाव आदि।
2. प्रश्नगत स्थलों के अन्तर्गत जल निकासी की पर्याप्त व्यवस्था नही पायी गयी। वर्षा जल तथा आवासीय भवनो में प्रयुक्त होने वाले जल को अनियन्त्रित रूप से प्रवाहित किया जा रहा है जो स्थल की भूसतह को जल संतृप्त कर कमजोर कर रहा है।
3. प्रश्नगत स्थलों के अन्तर्गत डोलोमाईट, लाईम स्टोन, टॉल्क प्रकृति की कमजोर चट्टानें अवलोकित की गयी हैं, जो जल के सम्पर्क में आकर शीघ्र अपक्षयित होती है।
4. प्रश्नगत स्थलों पर भूसतह पर स्वस्थाने चट्टाने दृष्टिगोचर नहीं होती हैं।

सूझावः–

NOTARY Rajender Singh Negi Advocate Dehradun District GOVT. OF UTTARAKHAND (INDIA)

1. स्थल 01,02,03,04 पर स्थित आवासीय भवन के ऑगन के नीचे सीढीनुमा खेतों में निर्धारित स्तरों पर उपयुक्त रूप से डिजाईन की गयी सुरक्षा दीवार/गैबियन दीवार का निर्माण किया जाना होगा।
2. स्थल 05 पर स्थित भवन/दुकान के पीछे उत्तर–पूरब दिशा में उपयुक्त निर्धारित स्तरों पर उपयुक्त रूप से डिजाईन की गयी सुरक्षा दीवार/गैबियन दीवार का निर्माण किया जाना होगा।
3. भवनों की दरारें को उपयुक्त फिलिंग मटीरियल द्वारा भर कर मरम्मत की जानी होगी।
4. उपरोक्त प्रश्नगत स्थलों पर जल निकासी हेतु उचित व्यवस्था की जानी होगी।
5. उपरोक्त प्रश्नगत स्थलों पर भूस्खलन को रोकने वाली घास/पौंधों का रोपड़ किया जाना होगा।

निष्कर्ष–

प्रश्नगत स्थलों को सुरक्षा प्रदान करने की दृष्टि से उपरोक्त सुझावों की पालना की जानी होगी अन्यथा प्रश्नगत स्थलों को भविष्य मे खतरा उत्पन्न होने की संभावना से इंकार नही किया जा सकता है तथा स्थल 01 के 02 परिवारों,हेम चन्द्र काण्डपाल पुत्र श्री प्रयाग दत्त एवं महेश चन्द्र काण्डपाल पुत्र श्री हरीश चन्द्र काण्डपालको अन्यत्र सुरक्षित स्थान पर विस्थापित किया जाना सुरक्षा के दृष्टिकोण से उचितप्रतीत होगा।

उक्त के अतिरिक्त अवगत कराना है कि श्री कुलदीप सिंह बिष्ट के पक्ष में स्वीकृत सोपस्टोन खनन पट्टा वर्तमान में असंचालित है।

एन0के0 जोशी
अपर सहायक अभियन्ता पी0एम0जी0एस0वाई0
बागेश्वर।

निरज कुमार
कनिष्ठ अभियन्ता
लो0नि0वि0 बागेश्वर।

सुनील दत्त
सहायक भूवैज्ञानिक, भूतत्व एवं
खनिकर्म विभाग,जनपद बागेश्वर।

जिज्ञासा बिष्ट
प्रभारी जिला खान अधिकारी
भूतत्व एवं खनिकर्म विभाग,
जनपद बागेश्वर।

रितु गोस्वामी
ना० तहसीलदार काण्डा।

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ANNEXURE - III 20

NOTE ON PRELIMINARY ASSESSMENT OF GROUND SUBSIDENCE SITUATION IN BAGESHWAR DISTRICT, UTTARAKHAND

By

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Geological Survey of India, SU: Uttarakhand, Dehradun

DMO

In pursuance to the office order no. D-26013/2/93/COS from the Geological Survey of India, State Unit: Uttarakhand, Dehradun, a team comprised of Yogendra Singh, Sr. Geologist and Tahir Mushtaq, Sr. Geologist visited the Bageshwar District for preliminary assessment of ground subsidence affected villages as reported by the Press Information Bureau on 05.09.2024. The GSI team made site visit to affected villages from 12th to 14th September, 2024. Prior to site visit GSI team had discussions with the District Magistrate and the District Disaster Management officials on 12/09/2024. The district administration informed that the rehabilitation cases for reported eleven villages are not recent ones and provided a list of the affected villages, as shown in Table 1. The location of these villages over geological map of Bahgeshwar district is shown in Fig. 1.

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Table 1: Table showing the list of villages and number of houses rehabilitated or are in progress.

No	Tehsil	Village	Latitude	Longitude	Number of families	Year of rehabilitation	Status of rehabilitation
1.	Kapkot	Badeth	N29°59'30"	E79°55'51"	12	2017	Completed
2.		Dobarh	N30°12'23"	E79°53'17"	12	2013	Under progress
3.		Kuwari	N30°05'09"	E79°47'51"	11	2013	Completed
4.		Phullai	N29°55'35"	E79°54'20"	03	2017	Completed
5.		Malladesh	N29°57'19"	E79°57'12"	04	2017	Completed
6.		Badiyakot	N30°06'46"	E79°50'17"	07	2017	In progress
7.		Naukuri	N29°59'29.6"	E80°00'33.5"	01	2017	Completed
8.		Karmi	N30°02'51"	E79°53'23"	06	2022	Under progress
9	Kanda	Seri	N29°51'25.7"	E79°57'26.3"	08	2017	Under progress
10		Simgarhi	--	--	02	2017	Completed
11	Garur	Jakh	N29°55'08.9"	E79°43'56.9"	02	2018	Completed

As it is clear from the Table-1 that the rehabilitation cases of individual villages dates back up to 2013, it was necessary to prioritise the villages, where recent ground cracks have been developed or need immediate attention for geological survey by GSI. In view of this, the team met with local administration at tehsil level to find out the priority villages and the detailed description is as follows.

1. **Kanda Tehsil:** The team met with Sh. Anurag Aarya, SDM, Kanda Tehsil on 12/09/2024 and discussed about the ground situation of Seri and Simgarhi Villages under the jurisdiction of Kanda Tehsil. In this meeting, it was informed that ground crack have not been reported from Simgarhi village and the rehabilitation of two houses have been already done and there is no need for geological survey at present. The team was requested to visit Seri and Kanda Kaniyal village as

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new cases of house cracks have been reported from these two villages of Kanda Tehsil. The preliminary assessment of these individual villages is discussed below:

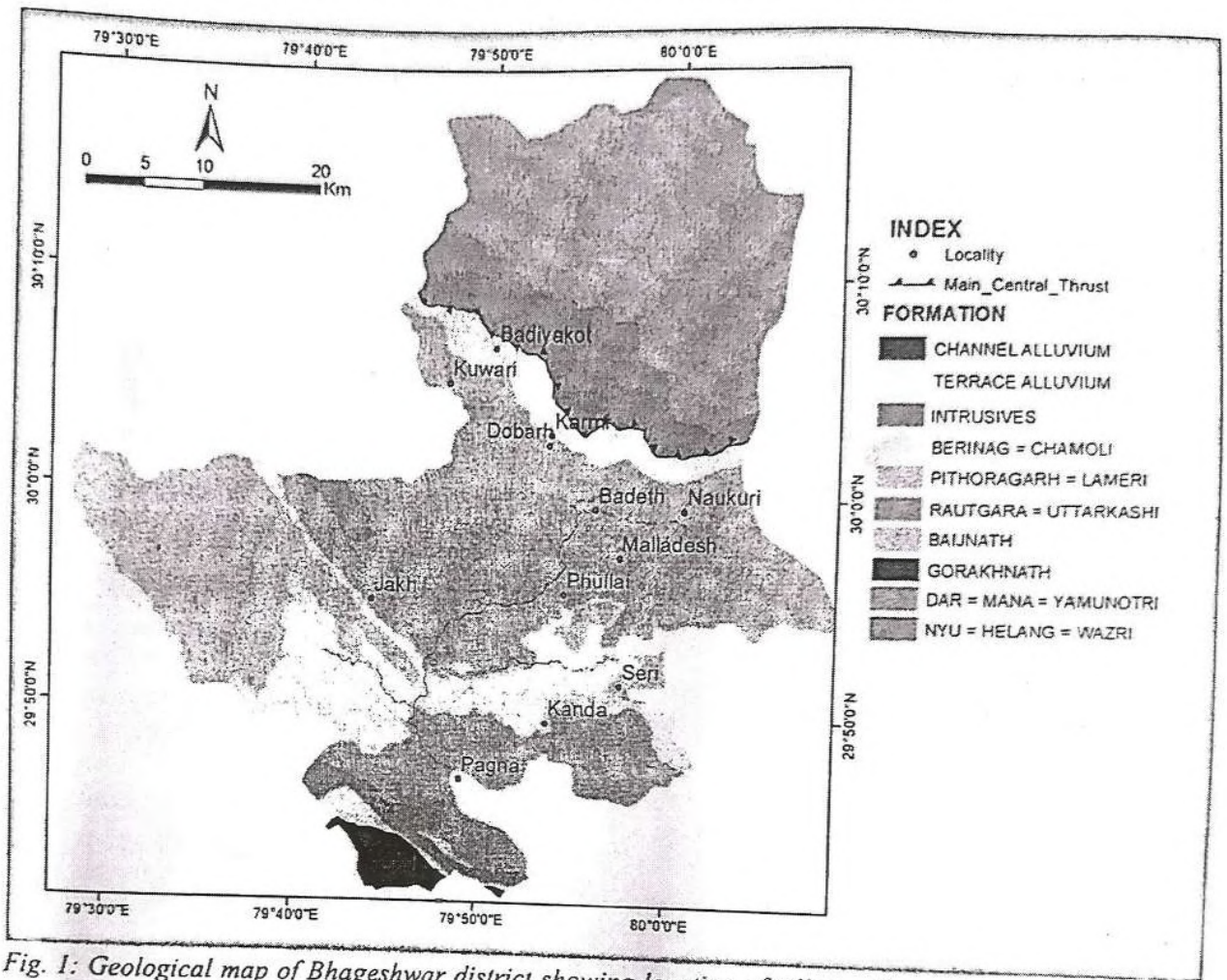

Fig. 1: Geological map of Bhageshwar district showing location of villages from where rehabilitation of houses has been done.

a) Kanda Kaniyal Village: The GSI team, accompanied by Sh. Anurag Aarya, SDM, Smt. Ritu Goswami, Naib Tehsildar, and other local authorities, visited Kanda Kaniyal village. The Tehsil administration prioritized the investigation of cracks in two residential houses and the Kalika Temple. The location of these investigated sites in Kanda Kaniyal village is shown in Fig. 2. The observations and suggestions for individual site are discussed below:

House-1: During the field inspection, multiple cracks were observed in the walls and floor of the house (Fig. 3) at coordinates N 29°49'42.01", E 79°53'31.48" but no ground crack were found. The house is located in a natural depression, with water seepage observed about 30 meters upslope. The development of cracks is mainly due to its location, which acts as a conduit for subsurface water, as indicated by seasonal springs and seepage. Although a channel was built to manage the seepage, its lining is damaged, causing water to flow underneath the house. This water movement saturates the slope material beneath,

gradually leading to ground settlement. While the house is situated in an unsuitable area, the primary cause of cracks in the house is due to gradual piping action (removal of fines) controlled by water seepage. The suitable remedial measures are given under conclusion and recommendations heading.

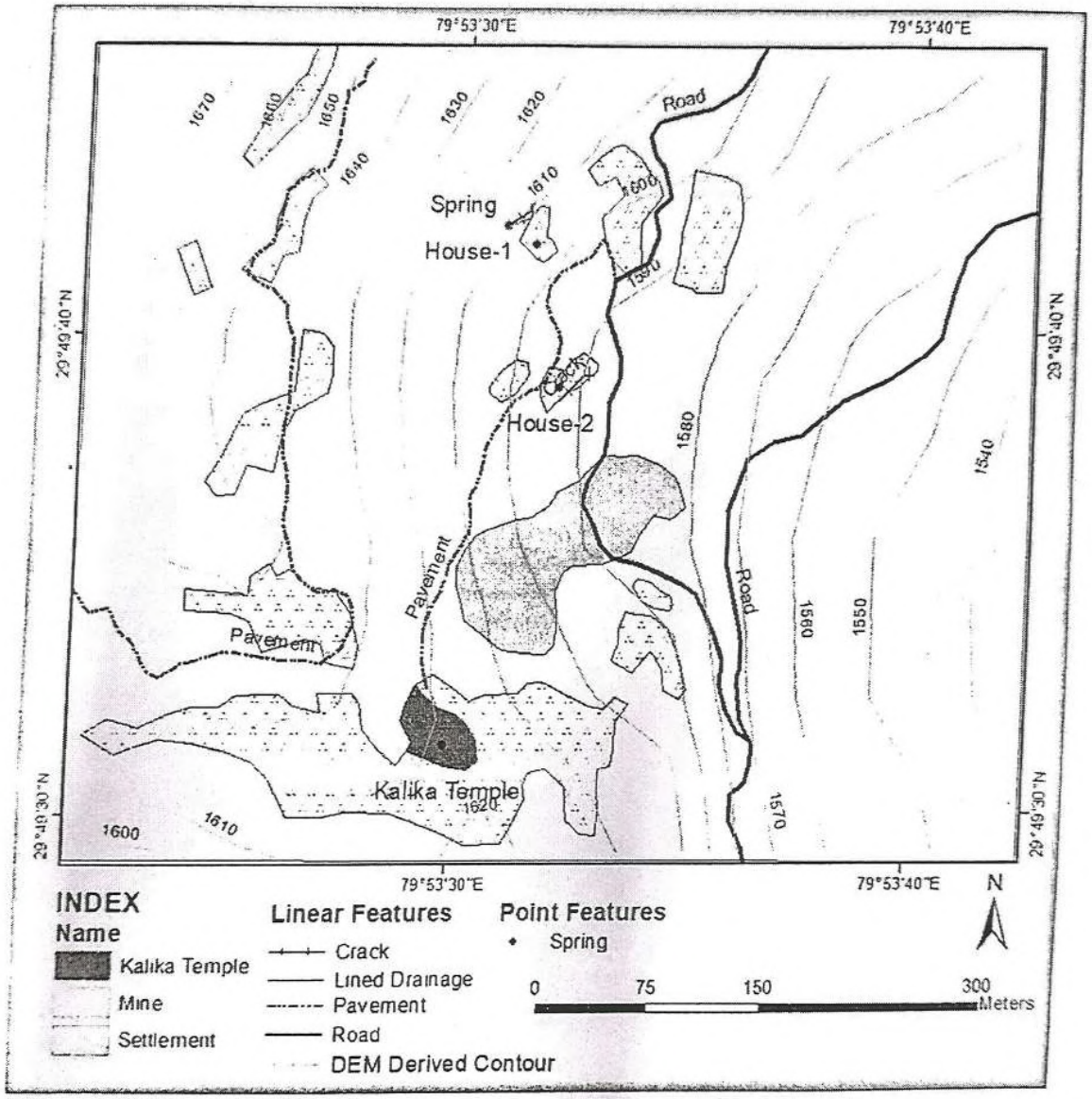

Fig. 2: Map showing the location of visited sites in Kanda Kaniyal village.

House-2: During the field inspection, a linear crack was observed near the outer boundary of the house porch at coordinates N 29°49'38.79", E 79°53'32.04" (Fig. 4). No cracks were found in the walls or ceiling of the house. The cracks at the outer edge of the porch are likely due to the defacing of a steep bench created downslope. The concrete slab is not provided with any reinforcement and it is usual to develop such cracks in outer part. These cracks are not related to the open cast mine soapstone mine, which is situated about 70 meters south of the house.

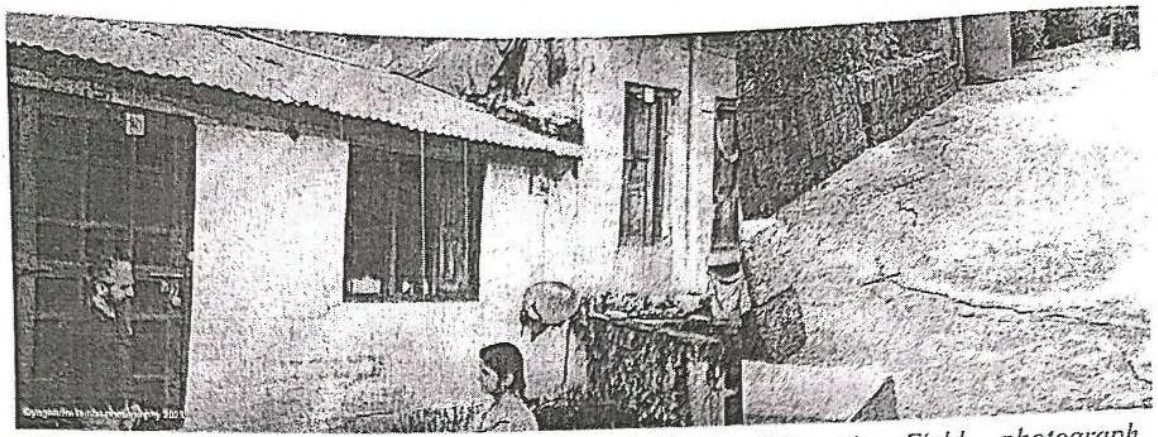

Fig. 3: Field photograph showing cracks in House-1 of Kanda Kaniyal Village.

Fig. 4: Field photograph showing cracks in the porch of House-2 of Kanda Kaniyal Village.

Kalika Temple: The temple is located at coordinates N 29°49'31.72", E 79°53'29.53" on a small ridge trending NW-SE, approximately 40 meters southwest of the open-cast mine. A curvilinear minor crack was observed on the floor of temple complex, measuring 2mm-5mm in width and extending 2-3 meters in length. The steep cutting for road construction has been observed just below the floor where cracks are developed. These cracks in the floor of temple primafacie appear to result from defacing of slope. However, several cracks have been reported in two houses situated on the slope below the temple complex. The cracking patterns on the northern slope of the temple and the houses below are similar, oriented in a NW-SE direction with the open face toward the NE. These cracks prima facie appear to result from defacing of slope but the role of open cast soapstone mine cannot be simply denied as the timeline of cracks with reference to mine development can put proper light on the issue. At present, the excavated part has been backfilled with waste material, due to which the steepness of the excavated slope could not be observed.

b) **Seri village:** The GSI team, accompanied by Smt. Ritu Goswami, Naib Tehsildar, and other local authorities, visited Seri village. The team examined six damaged houses, some of which had been rehabilitated in 2016-17 and 2019-20, with new cracks appearing in two of them. Additionally, several seepages, paleo subsidence scars, and sinkhole locations reported by local villagers were also noted down. The field photograph of one of the damaged house are shown in Fig. 5. The residents of this house have been rehabilitated by administration.

Analysis of Google Earth imagery indicates that Seri village is situated on a cone-shaped paleo slide material, sloping to the west (Fig. 6). This material is deposited over Augen Gneiss from the Proterozoic Baijnath Formation. The overburden is unsorted and contains large granite gneiss boulders embedded in a fine-grained matrix. The northern edge of the cone is defined by an unlined first-order nala fed by a spring located upslope to the east

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(Fig. 6). According to a 1963 SOI toposheet, this nala used to merge with another first-order nala, but they no longer connect, and the springs have appeared.

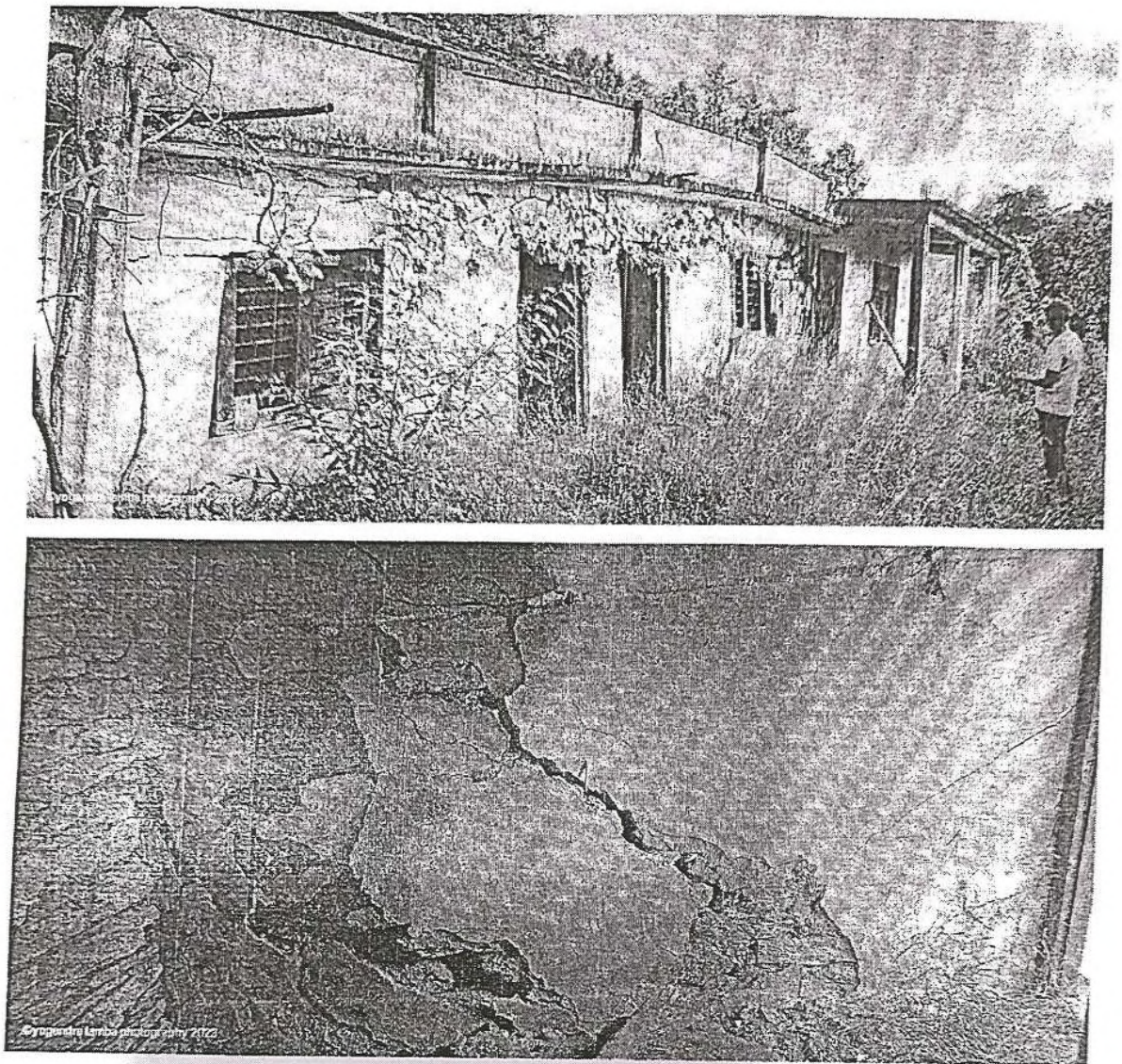

Fig. 5: Severely damaged house with inside photograph from Seri village.

Over time, new springs have formed, feeding the cone's crown and causing water to seep down its slopes (Fig. 6). This subsurface water percolation through the overburden material washes away finer particles, leading to sinkholes near the crown and subsidence in the mid-section. The spring-fed nala has also contributed to the slow undercutting of the slide material, causing instability along its flank, evident from the tilted trees.

Multi-temporal Google Earth Imagery shows that houses previously built near the crown, periphery, and toe of the paleo slide were repeatedly constructed but could not withstand the ground instability. The majority of rehabilitated houses were also in these areas as evident from the comparison of houses in 2009 and houses present today (Fig. 6). Recently, cracks have started to appear in homes located in the middle part of the village. Numerous

paleo-subsidence and landslide scars have been observed in the lower agricultural lands below the village, with villagers reporting similar subsidence issues there. The imagery also indicates the emergence of circular depressions in the agricultural fields.

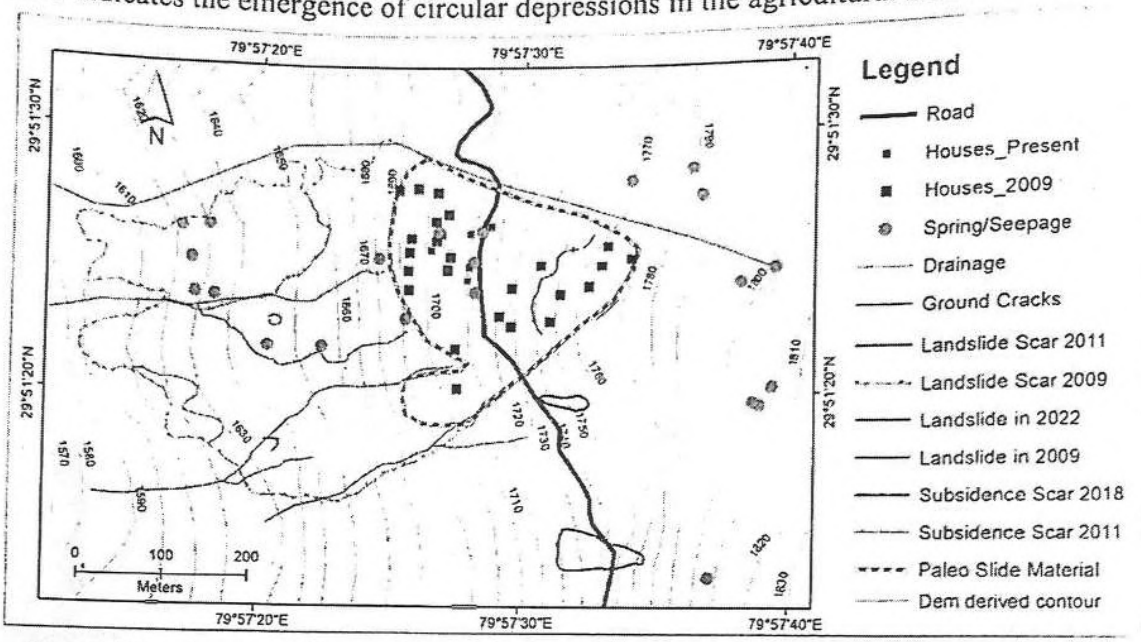

Fig. 6: Map showing different ground deformation and hydrological features of Seri Village.

2. Kapkot Tehsil: Kapkot Tehsil is one of the most severely affected areas in Bageshwar District, where a total of fifty-six families have been impacted by cracks in their homes under various conditions. The District Administration has facilitated their timely relocation to safer areas, taking into account geological studies and recommendations from the Department of Geology and Mining, Uttarakhand. These studies assessed cracks in houses and identified suitable rehabilitation sites for eight villages: Kuwari, Naukuri, Badeth, Malladesh, Phullai, Dobarh, Badiyakot, and Karmi, as indicated on SOI Toposheet nos. 53N/16, 53O/09, and 53C/01. Currently, rehabilitation has been completed for thirty-one families in five villagesKuwari, Naukuri, Badeth, Malladesh, and Phullaiwhile efforts for twenty-five families in three villagesDobarh, Badiyakot, and Karmiare ongoing. According to the administration, there are no recent or old ground cracks in these villages and the rehabilitation was based solely on the observed cracks in the houses. Details regarding these villages, including their locations, number of families affected, year of rehabilitation, and current rehabilitation status, are provided in Table 1. Since there are no recent ground cracks, the administration did not require a site visit for further geological investigation by GSI but a brief discussions cum Bhumisamvad was held at Tehsil office on 12/09/2024 and 15/09/2024. In this discussion SDM along with Naib Tehsildar and Patwari of different villages participated. The aim of this discussion was to aware the administration about how to access and use of National Landslide Susceptibility Map (NLSM) map of GSI. The discussion was also aimed to emphasize about the ground conditions in which GSI should be contacted for assessment of ground situation.

3. **Garur Tehsil:** The Garur Tehsil is located in the west of Bageshwar district and two houses have been rehabilitated from Jakh village of Garur Tehsil. To understand the ground condition of Jakh village, the GSI team visited the Garur Tehsil office on 13/09/2024 and met with Smt Nisha Rani, Tehsildar, Garur. She apprised about the problem of rehabilitation of two houses in Jakh village and informed that the problem was related to breaking of water pipeline and these are no recent ground cracks in the village but apprehend to visit the site for confirmation.In view of this the team visited Jakh village on 14/09/2024 and the observation are as follows:
The area falls under.

a) **Jakh village:** The Jakh village falls in SOI Toposheet no. 53O/09, with the rehabilitated homes situated at coordinates N 29°55'8.01", E 79°43'56.59". During the field visit, GSI team was accompanied by Sh. Yuvraj Goswami, Revenue Sub Inspector. He informed that an issue began in September 2020 when a water pipeline above the homes of Sh. Rajendar Singh and Surinder Singh (Narain Singh's son) ruptured in night on a rainy day. This led to a sudden flow of water that saturated the slope, causing cracks to develop in the north side of the above mentioned houses. The location of houses and water pipeline are shown in Fig. 7.

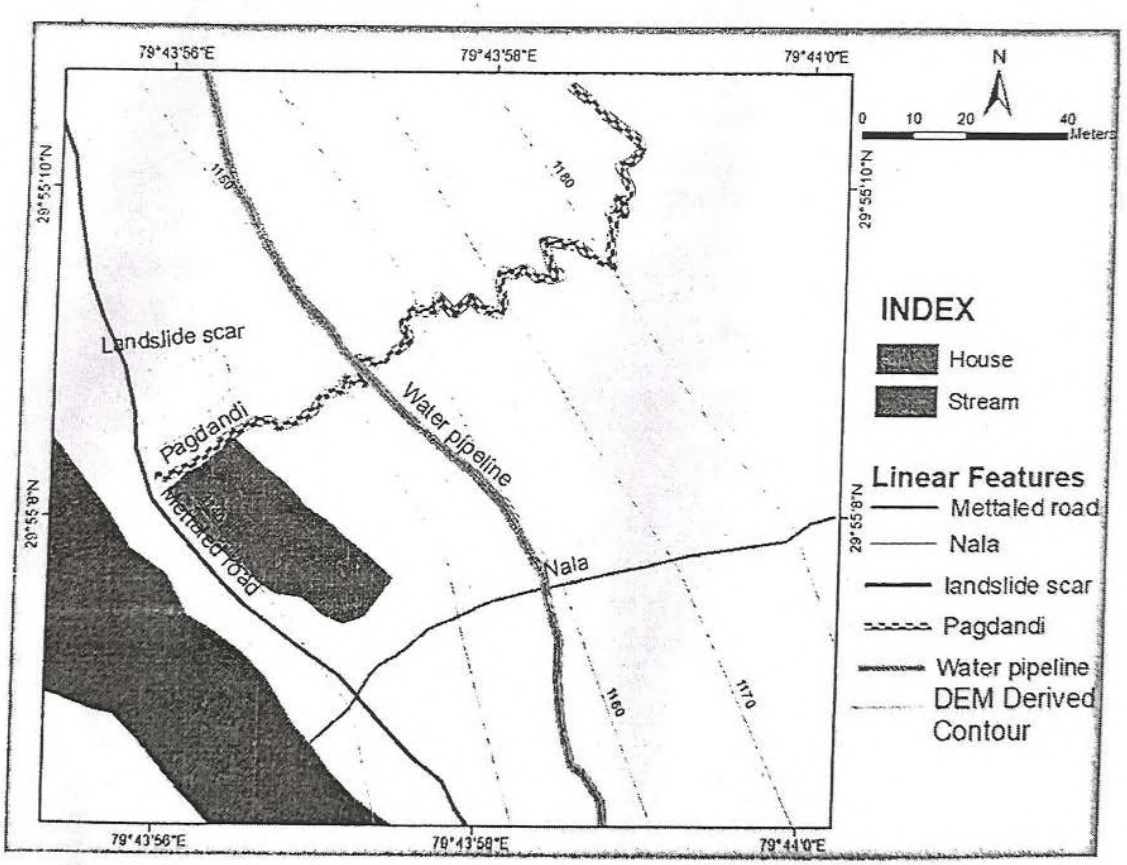

Fig. 7: Map showing ground features of affected area in Jakh village.

The presence of an old landslide scar located north of the rehabilitated homes was observed during field visit with the slope material consists of calcrete. The study of Google Earth

Imagery revealed that a landslide was triggered in 2012 during road construction. As per the information from local people a gabion wall was installed for support to this landslide. However, the 2020 water surge reactivated the landslide, increasing the risk of calcrete boulders rolling down and threatening the safety of residents. To mitigate this risk, the administration relocated the affected families to a safer location. The old scars of ground cracks were observed in agricultural land present above the landslide scar indicating its retrogressive nature.

4. **Pagna-Sakteshwar Road Subsidence:** A meeting was conducted with Shri Ashish Kumar Bhatgain, the District Magistrate of Bageshwar, to discuss the observations made by the GSI team in various localities. During this meeting, he highlighted significant subsidence that occurred on the Pagna-Sakteshwar road on September 13, 2024. In response, the GSI team, accompanied by Sh. Bijendra Singh Mehra, Assistant Engineer from PWD, Bageshwar, visited the site of the road subsidence at coordinates N 29°46'54.91", E 79°48'58.45". This subsidence disrupted the connection between Sakteshwar and Bageshwar, and the Pagna-Sakteshwar road has experienced step-like subsidence at the specified location (see Fig. 8). Ground features in and around the subsidence area are depicted in Fig. 8.

The road subsidence caused due to landslide measures approximately 90 meters in length, 60 meters in width, and 4 meters in depth, with a downslope movement of 1 to 2 meters. A soapstone mine is located just beneath the subsidence area (see Fig. 8). The landslide was triggered by the removal of toe support for soapstone extraction. The failed material consists mainly of weathered soapstone-bearing rock and overburden, categorizing it as a shallow translational failure. The landslide may continue to retrogress until it reaches the overlying competent bedrock, which is dolomitic limestone. A 42-geoparametric data sheet can be found in Annexure-1.

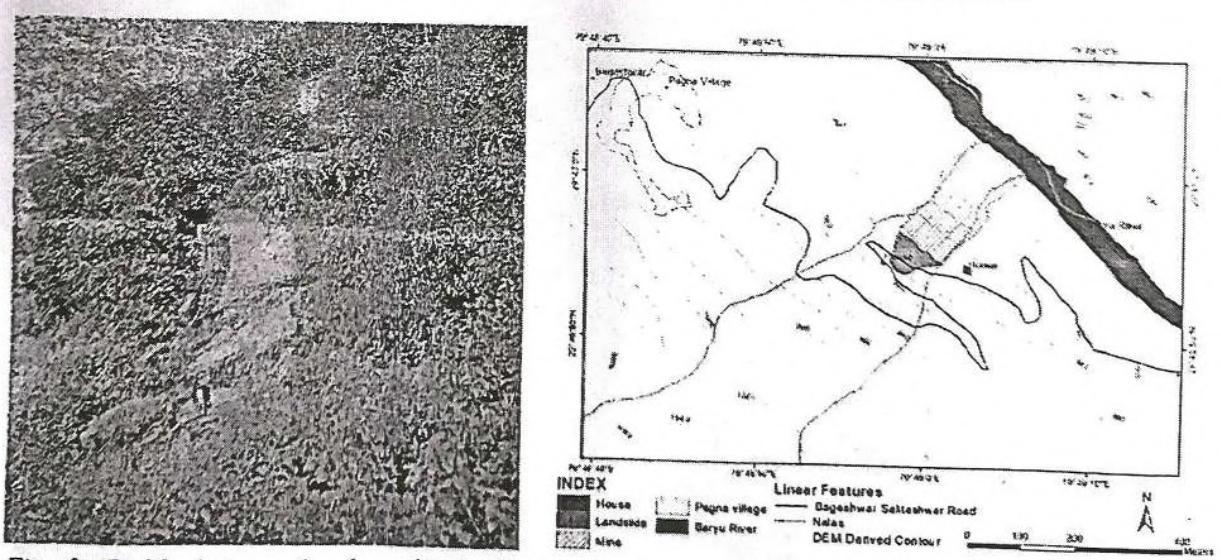

Fig. 8: Field photograph of road subsidence along with map showing ground features of Pagna-Sakteshwar road subsidence location.

Conclusion and Recommendations: The preliminary assessment of ground subsidence in Bageshwar District suggest that many interventions date back several years, highlighting the necessity to prioritize locations with recent subsidence issues, if any. Key findings underscore the varying causes of ground instability, including water seepage, erosion, and mining activities, necessitating tailored recommendations for each site.

1. **Kanda Kaniyal Village:** The House-1 is located in a natural depression and a seasonal spring/seepage is present behind the house. It is recommended to provide a deep lined trench with weep holes to the upslope of the house to collect and divert the subsurface water and establish proper drainage to direct the water downslope. This solution may address the current issue, but given the house's location in a natural depression, surface water flow during heavy rains could still pose a risk. The cracks at the outer edge of the porch in House-2 can be mitigated by constructing a retention wall with weep holes to support the steep face of the bench, if required. The cracks in Kalika Temple prima facies appear to result from defacing of slope but the role of open cast soapstone mine cannot be denied. Therefore, it is recommended to collect photos and videos before backfilling of the mine to better understand its impact on the destabilization of areas present upslope to these mines.

2. **Seri village:** The ground subsidence problem in Seri village primarily stems from the free flow of spring water at the crown of the paleo slide and erosion along the nala flank. Based on these preliminary findings, it is recommended to establish controlled drainage for the spring water originated upslope of Seri village and to line the nalas on the northern and southern side of Seri village. The detailed study of the village will be helpful in developing a proper slope management plan.

3. **Jakh Village:** The landslide present on the road section is retrogressive in nature as suggested by ground cracks in the agricultural land. In view of this, it is recommended to place a retaining wall with weep holes instead of gabion wall at the toe of the landslide to mitigate the risk in future.

4. **Pagna-Sakteshwar Road Subsidence:** Geological assessments indicates that mining activities in the downslope of the affected area have already compromised the natural stability of the material. Currently, the excavated area of the mine has been backfilled, making it difficult to assess changes in the natural slope profile. As a result, it is recommended to document the excavated slope through photos and videos before backfilling in the future. This documentation will provide valuable information on the potential impact on the stability of upslope areas if any ground instability issues arise. Restoring the natural stability of the material appears unlikely, as engineering solutions may not economically prevent the already triggered landslide, especially considering that the bedrock beneath is soft soapstone. The landslide is expected to retrograde uphill, and it is suggested that the recently constructed house near the crown of the landslide be

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relocated. A detailed study is also recommended to evaluate the area's suitability for restoring the existing road.

Addressing these recommendations across different locations is essential to mitigate risks, enhance community safety, and prevent future damage. Prompt action will not only protect existing structures but also inform future planning and development in subsidence-prone areas. The collaboration between geological experts and local administration is crucial to ensure the effective implementation of these measures.

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Annexure-1

No	Field	Description
1	Slide No	01
2	State	Uttarakhand
3	District	Bageshwar
4	Toposheet	53O13
5	Name of the slide	Pagna Landslide
6	NH/SH/Locality	Bageshwar-Pagna-Sakteshwar road
7	Latitude	29° 46' 54.91"
8	Longitude	79° 48' 58.45"
9	Length	90 m
10	Width	60 m
11	Height	65 m
12	Area	5400 sq. m
13	Depth	4 m
14	Volume	21600 cube m
15	Run Out Distance	NIL
16	Type of material	Soil
17	Type of movement	Slide
18	Rate of movement	Rapid
19	Activity	Active
20	Distribution	Confined
21	Style	Single
22	Failure mechanism	Shallow planer failure
23	History	13.09.2024
24	Geomorphology	Valley
25	Geology	Dolomitic limestone.
26	Structure	S0//S1:Variable due to fold closure , S2: 030/75SE
27	Landuse/ landcover	Mine (Open cast soapstone mine)
28	Hydrological condition	Damp
29	Triggering factor	Rainfall
30	Death of person	NIL
31	People affected	NIL
32	Livestock loss	NIL
33	Communication	Bageshwar-Pagna-Sakteshwar road
34	Infrastructure	NIL
35	Agriculture/Forest/Barren	Agricultural land on lease for mining of soapstone.
36	Geo-scientific causes	Removal of toe support during excavation for soapstone.
37	Remedial measures	Rehabilitation of newly constructed house along with detailed study is recommended for restoring the existing road.
38	Remarks	

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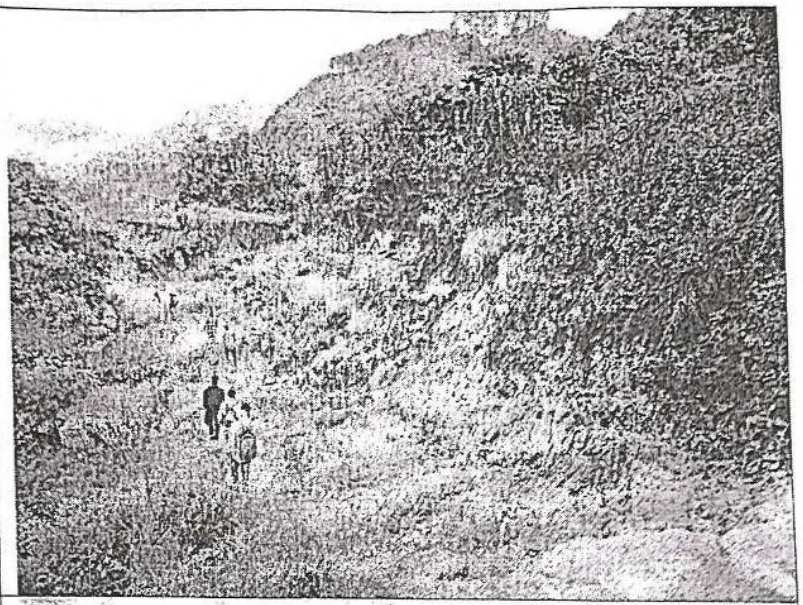
39	Photos/ Sketches/Sections	
		
40	Summary/Abstract	
41	PDF	
42	Landslide category	II

This affidavit is sworn before me by
Shri Vipin Gupta
who is identified by Shri Ram Singh Bisht
at Dehradun on 09/12/2024

(Rajender Singh Negi)
Advocate & Notary, Dehradun

NOTARY (INDIA) Rajender Singh Negi Advocate Dehradun District Reg.No.19/01/2002 GOVT. OF UTTARAKHAND